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**COMPARISON OF THE ESTIMATED ITEM
PARAMETERS OF SHIBA'S WORD/PHRASE
COMPREHENSION TESTS OBTAINED BY LOGIST
5 AND THOSE BY THE TETRACHORIC METHOD**

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↳ Stimulated by Lord's suggestion that LOGIST 5 can be used for equating even when the number of linking items is small, it was tested on Shiba's Word/Phrase Comprehension Test data. Combinations of four tests and two tests, and also a single test with different numbers of examinees, were chosen, for which LOGIST 5 was applied. The resultant estimated item parameters were compared with those obtained by the tetrachoric method. Some consistency was found in the results of certain tests in preference to those of certain other tests.

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COMPARISON OF THE ESTIMATED ITEM PARAMETERS
OF SHIBA'S WORD/PHRASE COMPREHENSION TESTS OBTAINED BY
LOGIST 5 AND THOSE BY THE TETRACHORIC METHOD

ABSTRACT

Stimulated by Lord's suggestion that Logist 5 can be used for equating even when the number of linking items is small, it was tested on Shiba's Word/Phrase Comprehension Test data. Combinations of four tests and two tests, and also a single test with different numbers of examinees, were chosen, for which Logist 5 was applied. The resultant estimated item parameters were compared with those obtained by the tetrachoric method. Some consistency was found in the results of certain tests in preference to those of certain other tests.

The research was conducted at the principal investigator's laboratory, 405 Austin Peay Hall, Department of Psychology, University of Tennessee, Knoxville, Tennessee. Those who worked for her as assistants include Paul S. Changas, Lisa Lambert, Richard Strouse, and Alecia P. Long

I. Introduction

In applying latent trait theory, or item response theory, perhaps two of the most frequently used models for binary test items are Rasch model (Rasch, 1960) and three-parameter logistic model (Birnbaum, 1968). In particular, three-parameter logistic model has become more and more popular in the past decade because of the availability of computer programs for estimating the three item parameters which are represented by Logist 5 (Wingersky, Barton and Lord, 1982).

This computer program, Logist 5, can be used not only for the item parameter estimation in the three-parameter logistic model, but also in the (two-parameter) logistic model, by setting the third parameter equal to zero. It is well known (Birnbaum, 1968) that (two-parameter) logistic model provides us with a good approximation to the normal ogive model if we set the scaling factor D equal to 1.7.

In the present study, using empirical data for which normal ogive model was originally assumed, comparison was made between the estimated item parameters obtained by assuming the normal ogive model and those obtained by Logist 5 assuming the (two-parameter) logistic model. In some cases, item parameter estimation was also made by Logist 5 assuming the three-parameter logistic model, and comparison was extended to those results also.

Empirical data adopted here were taken from the test data provided by the courtesy of Professor Sukeyori Shiba of the University of Tokyo. They are based upon the performance of fifth through ninth

graders in Japan who took separate tests of Shiba's Word/Phrase Comprehension Tests.*

II. Three-Parameter Logistic Model and Logist 5

Let θ be the latent trait, or ability, and $P_g(\theta)$ be the item characteristic function of the multiple-choice test item g , or the conditional probability with which the examinee answers item g correctly, given ability θ . In the three-parameter logistic model, this item characteristic function is given by

$$(2.1) \quad P_g(\theta) = c_g + (1-c_g) \psi_g(\theta) ,$$

where $\psi_g(\theta)$ is the item characteristic function in the (two-parameter) logistic model, for which we can write

$$(2.2) \quad \psi_g(\theta) = [1 + \exp\{-Da_g(\theta-b_g)\}]^{-1} ,$$

with $a_g (> 0)$ and b_g as the item discrimination and difficulty parameters, respectively, and D as the scaling factor which is usually set equal to 1.7. The third parameter, c_g , in (2.1) is the guessing parameter, which is originally defined as unity divided by the number of alternative answers presented with the multiple-

* The author is obliged to Dr. Hiroyuki Noguchi of Tokyo Gakugei University as well as Professor Shiba for providing her with these data.

choice test item g . The model was originated from the assumption that the examinee either knows the answer to the question, or guesses randomly. Thus $P_g(\theta)$, or the operating characteristic of the binary item score $u_g = 1$, given θ , is greater than $\Psi_g(\theta)$, which represents the conditional probability for the "knowledge." The discrepancy between the two functions is also a function of θ , i.e., $[1 - \Psi_g(\theta)]$ divided by the number of alternatives.

Lord started calling this third parameter, c_g , pseudo-guessing parameter, after he had discovered that for many multiple-choice test items the estimated guessing parameter, c_g , substantially differs from unity divided by the number of alternatives, when the three-parameter logistic model was adopted for those items (Lord, 1968). This fact itself seems to be enough evidence to invalidate the three-parameter logistic model with respect to those specific multiple-choice test items. Researchers who adopt this model claim, however, that there should not be any harm as long as the curve is used as an approximation to the true item characteristic function.

It should be noted that Samejima has pointed out (Samejima, 1973) that, unlike the normal ogive and the logistic models, three-parameter logistic model does not satisfy the unique maximum condition (Samejima, 1969, 1972), which indicates that, for some response patterns the likelihood function $L_V(\theta)$, i.e., the operating characteristic of the response pattern, V , may not have a unique maximum. This fact implies that the third parameter, c_g , can be a

real nuisance, in the mathematical aspect of theory.

The item characteristic function in the normal ogive model is given by

$$(2.3) \quad \phi_g(\theta) = (2\pi)^{-1/2} \int_{-\infty}^{a_g(\theta-b_g)} \exp(-t^2/2) dt ,$$

where $a_g (> 0)$ and b_g are the item discrimination and the item difficulty parameters, respectively. When the same values of parameters a_g and b_g are used in (2.2) with $D = 1.7$, the curve represented by (2.2) is very close to the one represented by (2.3) for the entire range of θ (Birnbaum, 1968).

Logist 5 is a computer program developed by Lord and others (Wingersky, Barton and Lord, 1982) for the purpose of estimating the item discrimination parameter a_g , the item difficulty parameter b_g and the guessing parameter c_g of each test item g ($=1,2,\dots,n$) following the three-parameter logistic model, as well as the individual ability parameter θ_s of each examinee s ($=1,2,\dots,N$). The method is based upon the maximum likelihood estimation, with the likelihood function,

$$(2.4) \quad L(U|\theta,A,B,C) = \prod_{s=1}^N \prod_{g=1}^n P_g(\theta_s)^{u_{gs}} \{1-P_g(\theta_s)\}^{1-u_{gs}},$$

where u_{gs} is a binary item score of the examinee s for item g , U is an $(n \times N)$ matrix of the binary item scores u_{gs} , θ is the vector of order N of the individual parameter θ_s , A , B and C

are the vectors of order n of the item parameters a_g , b_g and c_g , respectively. Those $(3n+N)$ parameters are estimated iteratively through the four sets of likelihood equations, with programming devices for efficiency in their convergence.

III. Empirical Data Based upon Shiba's Word/Phrase Comprehension Tests

Shiba's research on the measurement of word/phrase comprehension has been introduced earlier (Samejima, 1980). The battery of tests used for the construction of Shiba's word/phrase comprehension scale consists of thirteen tests, AP1, AP2, A1, A2, A3, A4, A5, A6, J1, J2, S1, S2 and U. Each of these thirteen tests contains thirty to sixty multiple-choice items, each of which has a set of five alternatives. These tests differ in difficulty, and each is designed for a different age group of subjects, ranging from four years of age to the ages of college students. There are subsets of items included in two tests, which are adjacent to each other in difficulty. For example, items 37 through 56 of Test J1 are also items 1 through 20 of Test J2. There are 480 test items in total, and their participation in different tests are shown in Table 3-1. The number of examinees used for the ability scale construction varies between 219 preschoolers for Test AP1 and 924 second graders of senior high schools for Test S1.

In the present study, four tests were chosen out of these thirteen tests, i.e., A5, A6, J1 and J2. The examinees who took these four tests in Shiba's original data are as follows.

TABLE 3-1 (Continued)

Item No.	Tests												
	AP1	AP2	A1	A2	A3	A4	A5	A6	J1	J2	S1	S2	U2
196	0	0	0	0	0	0	0	0	0	0	0	0	0
197	0	0	0	0	0	0	0	0	0	0	0	0	0
198	0	0	0	0	0	0	0	0	0	0	0	0	0
199	0	0	0	0	0	0	0	0	0	0	0	0	0
200	0	0	0	0	0	0	0	0	0	0	0	0	0
201	0	0	0	0	0	0	0	0	0	0	0	0	0
202	0	0	0	0	0	0	0	0	0	0	0	0	0
203	0	0	0	0	0	0	0	0	0	0	0	0	0
204	0	0	0	0	0	0	0	0	0	0	0	0	0
205	0	0	0	0	0	0	0	0	0	0	0	0	0
206	0	0	0	0	0	0	0	0	0	0	0	0	0
207	0	0	0	0	0	0	0	0	0	0	0	0	0
208	0	0	0	0	0	0	0	0	0	0	0	0	0
209	0	0	0	0	0	0	0	0	0	0	0	0	0
210	0	0	0	0	0	0	0	0	0	0	0	0	0
211	0	0	0	0	0	0	31	1	0	0	0	0	0
212	0	0	0	0	0	0	32	2	0	0	0	0	0
213	0	0	0	0	0	0	33	3	0	0	0	0	0
214	0	0	0	0	0	0	34	4	0	0	0	0	0
215	0	0	0	0	0	0	35	5	0	0	0	0	0
216	0	0	0	0	0	0	36	6	0	0	0	0	0
217	0	0	0	0	0	0	37	7	0	0	0	0	0
218	0	0	0	0	0	0	38	8	0	0	0	0	0
219	0	0	0	0	0	0	39	9	0	0	0	0	0
220	0	0	0	0	0	0	40	10	0	0	0	0	0
221	0	0	0	0	0	0	41	11	0	0	0	0	0
222	0	0	0	0	0	0	42	12	0	0	0	0	0
223	0	0	0	0	0	0	43	13	0	0	0	0	0
224	0	0	0	0	0	0	44	14	0	0	0	0	0
225	0	0	0	0	0	0	45	15	0	0	0	0	0
226	0	0	0	0	0	0	46	16	0	0	0	0	0
227	0	0	0	0	0	0	47	17	0	0	0	0	0
228	0	0	0	0	0	0	48	18	0	0	0	0	0
229	0	0	0	0	0	0	49	19	0	0	0	0	0
230	0	0	0	0	0	0	50	20	0	0	0	0	0
231	0	0	0	0	0	0	51	21	0	0	0	0	0
232	0	0	0	0	0	0	52	22	0	0	0	0	0
233	0	0	0	0	0	0	53	23	0	0	0	0	0
234	0	0	0	0	0	0	54	24	0	0	0	0	0
235	0	0	0	0	0	0	55	25	0	0	0	0	0
236	0	0	0	0	0	0	56	26	0	0	0	0	0
237	0	0	0	0	0	0	57	27	0	0	0	0	0
238	0	0	0	0	0	0	58	28	0	0	0	0	0
239	0	0	0	0	0	0	59	29	0	0	0	0	0
240	0	0	0	0	0	0	60	30	0	0	0	0	0
241	0	0	0	0	0	0	61	31	0	0	0	0	0
242	0	0	0	0	0	0	62	32	0	0	0	0	0
243	0	0	0	0	0	0	63	33	0	0	0	0	0
244	0	0	0	0	0	0	64	34	0	0	0	0	0
245	0	0	0	0	0	0	65	35	0	0	0	0	0
246	0	0	0	0	0	0	66	36	0	0	0	0	0
247	0	0	0	0	0	0	67	37	0	0	0	0	0
248	0	0	0	0	0	0	68	38	0	0	0	0	0
249	0	0	0	0	0	0	69	39	0	0	0	0	0
250	0	0	0	0	0	0	70	40	0	0	0	0	0
251	0	0	0	0	0	0	71	41	1	0	0	0	0
252	0	0	0	0	0	0	72	42	2	0	0	0	0
253	0	0	0	0	0	0	73	43	3	0	0	0	0
254	0	0	0	0	0	0	74	44	4	0	0	0	0
255	0	0	0	0	0	0	75	45	5	0	0	0	0
256	0	0	0	0	0	0	76	46	6	0	0	0	0
257	0	0	0	0	0	0	77	47	7	0	0	0	0
258	0	0	0	0	0	0	78	48	8	0	0	0	0
259	0	0	0	0	0	0	79	49	9	0	0	0	0
260	0	0	0	0	0	0	80	50	10	0	0	0	0
261	0	0	0	0	0	0	81	51	11	0	0	0	0

TABLE 3-1 (Continued)

Item No.	Tests												
	AP1	AP2	A1	A2	A3	A4	A5	A6	J1	J2	S1	S2	U2
262	0	0	0	0	0	0	0	52	12	0	0	0	0
263	0	0	0	0	0	0	0	53	13	0	0	0	0
264	0	0	0	0	0	0	0	54	14	0	0	0	0
265	0	0	0	0	0	0	0	55	15	0	0	0	0
266	0	0	0	0	0	0	0	56	16	0	0	0	0
267	0	0	0	0	0	0	0	0	17	0	0	0	0
268	0	0	0	0	0	0	0	0	18	0	0	0	0
269	0	0	0	0	0	0	0	0	19	0	0	0	0
270	0	0	0	0	0	0	0	0	20	0	0	0	0
271	0	0	0	0	0	0	0	0	21	0	0	0	0
272	0	0	0	0	0	0	0	0	22	0	0	0	0
273	0	0	0	0	0	0	0	0	23	0	0	0	0
274	0	0	0	0	0	0	0	0	24	0	0	0	0
275	0	0	0	0	0	0	0	0	25	0	0	0	0
276	0	0	0	0	0	0	0	0	26	0	0	0	0
277	0	0	0	0	0	0	0	0	27	0	0	0	0
278	0	0	0	0	0	0	0	0	28	0	0	0	0
279	0	0	0	0	0	0	0	0	29	0	0	0	0
280	0	0	0	0	0	0	0	0	30	0	0	0	0
281	0	0	0	0	0	0	0	0	31	0	0	0	0
282	0	0	0	0	0	0	0	0	32	0	0	0	0
283	0	0	0	0	0	0	0	0	33	0	0	0	0
284	0	0	0	0	0	0	0	0	34	0	0	0	0
285	0	0	0	0	0	0	0	0	35	0	0	0	0
286	0	0	0	0	0	0	0	0	36	0	0	0	0
287	0	0	0	0	0	0	0	0	37	1	0	0	0
288	0	0	0	0	0	0	0	0	38	2	0	0	0
289	0	0	0	0	0	0	0	0	39	3	0	0	0
290	0	0	0	0	0	0	0	0	40	4	0	0	0
291	0	0	0	0	0	0	0	0	41	5	0	0	0
292	0	0	0	0	0	0	0	0	42	6	0	0	0
293	0	0	0	0	0	0	0	0	43	7	0	0	0
294	0	0	0	0	0	0	0	0	44	8	0	0	0
295	0	0	0	0	0	0	0	0	45	9	0	0	0
296	0	0	0	0	0	0	0	0	46	10	0	0	0
297	0	0	0	0	0	0	0	0	47	11	0	0	0
298	0	0	0	0	0	0	0	0	48	12	0	0	0
299	0	0	0	0	0	0	0	0	49	13	0	0	0
300	0	0	0	0	0	0	0	0	50	14	0	0	0
301	0	0	0	0	0	0	0	0	51	15	0	0	0
302	0	0	0	0	0	0	0	0	52	16	0	0	0
303	0	0	0	0	0	0	0	0	53	17	0	0	0
304	0	0	0	0	0	0	0	0	54	18	0	0	0
305	0	0	0	0	0	0	0	0	55	19	0	0	0
306	0	0	0	0	0	0	0	0	56	20	0	0	0
307	0	0	0	0	0	0	0	0	0	21	0	0	0
308	0	0	0	0	0	0	0	0	0	22	0	0	0
309	0	0	0	0	0	0	0	0	0	23	0	0	0
310	0	0	0	0	0	0	0	0	0	24	0	0	0
311	0	0	0	0	0	0	0	0	0	25	0	0	0
312	0	0	0	0	0	0	0	0	0	26	0	0	0
313	0	0	0	0	0	0	0	0	0	27	0	0	0
314	0	0	0	0	0	0	0	0	0	28	0	0	0
315	0	0	0	0	0	0	0	0	0	29	0	0	0
316	0	0	0	0	0	0	0	0	0	30	0	0	0
317	0	0	0	0	0	0	0	0	0	31	0	0	0
318	0	0	0	0	0	0	0	0	0	32	0	0	0
319	0	0	0	0	0	0	0	0	0	33	0	0	0
320	0	0	0	0	0	0	0	0	0	34	0	0	0
321	0	0	0	0	0	0	0	0	0	35	0	0	0
322	0	0	0	0	0	0	0	0	0	36	0	0	0
323	0	0	0	0	0	0	0	0	0	37	0	0	0
324	0	0	0	0	0	0	0	0	0	38	0	0	0
325	0	0	0	0	0	0	0	0	0	39	0	0	0
326	0	0	0	0	0	0	0	0	0	40	0	0	0
327	0	0	0	0	0	0	0	0	0	41	1	0	0

TABLE 3-1 (Continued)

Item No.	Tests												
	AP1	AP2	A1	A2	A3	A4	A5	A6	J1	J2	S1	S2	U2
328	0	0	0	0	0	0	0	0	0	42	2	0	0
329	0	0	0	0	0	0	0	0	0	43	3	0	0
330	0	0	0	0	0	0	0	0	0	44	4	0	0
331	0	0	0	0	0	0	0	0	0	45	5	0	0
332	0	0	0	0	0	0	0	0	0	46	6	0	0
333	0	0	0	0	0	0	0	0	0	47	7	0	0
334	0	0	0	0	0	0	0	0	0	48	8	0	0
335	0	0	0	0	0	0	0	0	0	49	9	0	0
336	0	0	0	0	0	0	0	0	0	50	10	0	0
337	0	0	0	0	0	0	0	0	0	51	11	0	0
338	0	0	0	0	0	0	0	0	0	52	12	0	0
339	0	0	0	0	0	0	0	0	0	53	13	0	0
340	0	0	0	0	0	0	0	0	0	54	14	0	0
341	0	0	0	0	0	0	0	0	0	55	15	0	0
342	0	0	0	0	0	0	0	0	0	56	16	0	0
343	0	0	0	0	0	0	0	0	0	57	17	0	0
344	0	0	0	0	0	0	0	0	0	58	18	0	0
345	0	0	0	0	0	0	0	0	0	59	19	0	0
346	0	0	0	0	0	0	0	0	0	60	20	0	0
347	0	0	0	0	0	0	0	0	0	0	0	0	0
348	0	0	0	0	0	0	0	0	0	0	0	0	0
349	0	0	0	0	0	0	0	0	0	0	0	0	0
350	0	0	0	0	0	0	0	0	0	0	0	0	0
351	0	0	0	0	0	0	0	0	0	0	0	0	0
352	0	0	0	0	0	0	0	0	0	0	0	0	0
353	0	0	0	0	0	0	0	0	0	0	0	0	0
354	0	0	0	0	0	0	0	0	0	0	0	0	0
355	0	0	0	0	0	0	0	0	0	0	0	0	0
356	0	0	0	0	0	0	0	0	0	0	0	0	0
357	0	0	0	0	0	0	0	0	0	0	0	0	0
358	0	0	0	0	0	0	0	0	0	0	0	0	0
359	0	0	0	0	0	0	0	0	0	0	0	0	0
360	0	0	0	0	0	0	0	0	0	0	0	0	0
361	0	0	0	0	0	0	0	0	0	0	21	0	0
362	0	0	0	0	0	0	0	0	0	0	22	0	0
363	0	0	0	0	0	0	0	0	0	0	23	0	0
364	0	0	0	0	0	0	0	0	0	0	24	0	0
365	0	0	0	0	0	0	0	0	0	0	25	0	0
366	0	0	0	0	0	0	0	0	0	0	26	0	0
367	0	0	0	0	0	0	0	0	0	0	27	0	0
368	0	0	0	0	0	0	0	0	0	0	28	0	0
369	0	0	0	0	0	0	0	0	0	0	29	0	0
370	0	0	0	0	0	0	0	0	0	0	30	0	0
371	0	0	0	0	0	0	0	0	0	0	31	0	0
372	0	0	0	0	0	0	0	0	0	0	32	0	0
373	0	0	0	0	0	0	0	0	0	0	33	0	0
374	0	0	0	0	0	0	0	0	0	0	34	0	0
375	0	0	0	0	0	0	0	0	0	0	35	0	0
376	0	0	0	0	0	0	0	0	0	0	36	0	0
377	0	0	0	0	0	0	0	0	0	0	37	0	0
378	0	0	0	0	0	0	0	0	0	0	38	0	0
379	0	0	0	0	0	0	0	0	0	0	39	0	0
380	0	0	0	0	0	0	0	0	0	0	40	0	0
381	0	0	0	0	0	0	0	0	0	0	41	1	0
382	0	0	0	0	0	0	0	0	0	0	42	2	0
383	0	0	0	0	0	0	0	0	0	0	43	3	0
384	0	0	0	0	0	0	0	0	0	0	44	4	0
385	0	0	0	0	0	0	0	0	0	0	45	5	0
386	0	0	0	0	0	0	0	0	0	0	46	6	0
387	0	0	0	0	0	0	0	0	0	0	47	7	0
388	0	0	0	0	0	0	0	0	0	0	48	8	0
389	0	0	0	0	0	0	0	0	0	0	49	9	0
390	0	0	0	0	0	0	0	0	0	0	50	10	0
391	0	0	0	0	0	0	0	0	0	0	51	11	0
392	0	0	0	0	0	0	0	0	0	0	52	12	0
393	0	0	0	0	0	0	0	0	0	0	53	13	0

Test A5: 599 fifth graders in elementary schools
Test A6: 412 sixth graders in elementary schools
Test J1: 614 first graders in junior high schools
Test J2: 758 third graders in junior high schools

For convenience, hereafter, we shall call these groups of examinees and their performances A5/0599 Case, A6/0412 Case, J1/0614 Case and J2/0758 Case, respectively. There are also 461 second graders in junior high school who took Test J1 in Shiba's original data. In order to increase the number of examinees, this group of 461 subjects and their performances were added to the J1/0614 Case, to provide us with the J1/1075 Case. This case was further joined by an additional group of 1,184 students of four different junior high schools in Tokyo, to whom Test J1 was administered in some other research of Shiba's. We shall call this large group of examinees and their performances J1/2259 Case. Thus we have six cases in total, with three of them partly overlapping.

When the item parameter estimation was made by Logist 5, in some cases two or more tests and the corresponding samples of examinees were combined, in order to increase the number of test items and hence to improve the accuracy of estimation. Table 3-2 presents the resulting combinations of tests and the numbers of examinees, as well as other additional information. Since there are overlapping test items between two adjacent tests, such as Tests A5 and A6, for example, the total number of items is less than the sum of the numbers of items in the separate tests, when two or more tests are combined. As for the numbers of examinees, in all the combined cases they are the direct sums of the separate cases. Thus when Tests A5 and A6 are

TABLE 3-2

Tests, Numbers of Items, Numbers of Examinees And Other Information for Thirteen Different Cases.

Method	Test(s)	No. of Examinees	Original No. of Items	Excluded Items	No. of Items Included	
Tetrachoric Method (Shiba)	A5	599	48	3,13,17	45	
	A6	412	56	--	56	
	J1	614	56	38	55	
	J2	758	60	2	59	
Tetrachoric Method (Samejima)	J1	1,074	56	38	55	
	J1	2,259	56	38	55	
Logist 5	0.0	A5,A6	1,011	88	--	88
	0.0	J1,J2	1,833	96	--	96
	c_g : 0.0	A5,A6,J1,J2	2,844	168	--	168
	0.0	J1	1,075	56	38	55
	free	J1	1,075	56	38	55
	0.0	J1	2,259	56	38	55
	free	J1	2,259	56	38	55

combined, the 1,011 examinees are the sum of the two subject groups of 599 and 412 examinees in the A5/0599 and A6/412 Cases; when Tests J1 and J2 are combined, the 1,833 examinees are the sum of the two subject groups of 1,075 and 758 examinees in the J1/1075 and J2/758 Cases; and, when Tests A5, A6, J1 and J2 are combined, the 2,844 subjects are the sum of the four subject groups of 599, 412, 1,075 and 758 examinees in the A5/599, A6/412, J1/1075 and J2/758 Cases.

IV. Tetrachoric Method

It has been observed that, when the group of subjects is an unselected sample from, say, an age group of subjects, in a certain geographical area, normal assumption tends to fit well for the joint distribution of response tendencies (e.g., Samejima, ONR/RR-84-1). Thus we can use the (nxn) tetrachoric correlation matrix based upon the response tendencies behind the n test items and factor analyze the result to confirm the unidimensionality of the underlying latent trait. If it is confirmed, then the estimates of the item discrimination and item difficulty parameters, a_g and b_g , in the normal ogive model will be given by

$$(4.1) \quad \hat{a}_g = \rho_g (1 - \rho_g^2)^{-1/2}$$

and

$$(4.2) \quad \hat{b}_g = \hat{\gamma}_g \rho_g^{-1},$$

where ρ_g is the factor loading of item g on the first common

factor and $\hat{\gamma}_g$ is the normal deviate corresponding to the proportion-correct \hat{p}_g of item g , or we can write

$$(4.3) \quad \hat{\gamma}_g = \phi^{-1}(1-\hat{p}_g)$$

with ϕ^{-1} representing the inverse function of the standard normal distribution function.

For brevity, we shall call this method for estimating the item parameters a_g and b_g in the normal ogive model Tetrachoric Method. It has been shown (Samejima, ONR/RR-84-1) that this method can be used in selecting Old Test items in the non-parametric estimation of the operating characteristics, with additional procedures for validating the normal assumption and so forth.

V. Estimated Item Parameters Based upon the Tetrachoric Method

In his original research (Shiba, 1978) Shiba used the Tetrachoric Method in estimating the item parameters. Tables 5-1 through 5-4 present the estimated item parameters of each test item of Tests A5, A6, J1 and J2 obtained by Shiba. Those values were based upon the four separate scales of θ , whose origins and units are adjusted to the means and standard deviations of the separate ability distributions of the A5/0599, A6/0412, J1/0614 and J2/0758 Cases, respectively. In these tables and throughout the rest of the paper, in order to avoid confusion, each item number is preceded by the name of the test. Thus item A501 indicates item 1 of Test A5, item A604

TABLE 5-1

Estimated Item Discrimination Parameter \hat{a}_g And Difficulty Parameter \hat{b}_g of Each of the 48 Items of Test A5 Obtained by the Tetrachoric Method. (Results Provided by the Courtesy of Professor Shiba.)

Item g	\hat{a}_g	\hat{b}_g	Item g	\hat{a}_g	\hat{b}_g
A501	0.643	-1.737	A541	0.547	-0.042
A502	0.467	-2.882	A542	0.436	-0.675
A503	---	---	A543	0.555	-0.619
A504	0.571	-1.412	A544	0.755	0.780
A505	0.664	-1.881	A545	0.709	0.346
A506	0.437	-1.349	A546	0.218	2.068
A507	0.424	-0.077	A547	0.289	0.505
A508	0.683	-1.135	A548	0.416	1.015
A509	1.061	-1.360			
A510	0.593	-0.020			
A511	0.461	-1.481			
A512	0.594	-1.273			
A513	---	---			
A514	0.777	-1.190			
A515	0.450	-1.682			
A516	0.380	1.830			
A517	---	---			
A518	0.339	-1.995			
A519	0.639	-1.282			
A520	0.350	-2.636			
A521	0.569	-1.275			
A522	0.444	0.296			
A523	0.075 ▲	7.376 ▲			
A524	0.392	-1.451			
A525	0.810	-1.398			
A526	0.777	0.130			
A527	0.076 ▲	0.925			
A528	0.416	1.015			
A529	0.494	0.429			
A530	0.543	-1.069			
A531	-0.050 ▲	-26.476 ▲			
A532	0.477	1.184			
A533	0.686	-1.096			
A534	0.791	-1.467			
A535	0.520	-0.520			
A536	0.656	-0.146			
A537	0.468	-0.755			
A538	0.930	0.103			
A539	0.658	-0.146			
A540	0.378	0.226			

TABLE 5-2

Estimated Item Discrimination Parameter \hat{a}_g And Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test A6 Obtained by the Tetrachoric Method. (Results Provided by the Courtesy of Professor Shiba.)

Item g	\hat{a}_g	\hat{b}_g	Item g	\hat{a}_g	\hat{b}_g
A601	0.664	-1.862	A641	0.628	0.564
A602	0.517	-2.699	A642	0.673	-0.967
A603	0.776	-1.028	A643	0.707	-0.520
A604	0.581	-1.115	A644	1.132	-0.040
A605	0.596	-0.664	A645	0.472	0.117
A606	1.143	-0.877	A646	0.501	-0.447
A607	0.745	-0.653	A647	0.566	0.792
A608	0.564	-0.204	A648	0.733	-1.590
A609	0.558	-0.431	A649	0.458	-0.432
A610	0.492	-1.132	A650	0.579	0.040
A611	0.660	-0.200	A651	0.611	-0.595
A612	0.794	-0.466	A652	0.281	-0.740
A613	1.085	-0.272	A653	0.572	-0.363
A614	0.519	0.564	A654	0.232	2.918
A615	0.310	0.067	A655	0.838	-0.031
A616	0.570	0.242	A656	0.498	-1.099
A617	0.818	-1.422			
A618	0.499	-0.919			
A619	0.561	-0.920			
A620	0.925	-0.206			
A621	0.803	-0.639			
A622	0.546	-1.524			
A623	0.452	-1.238			
A624	0.552	-2.028			
A625	0.402	-1.607			
A626	0.508	-0.728			
A627	0.325	-0.097			
A628	0.215	-2.900			
A629	0.626	-0.264			
A630	0.631	-0.656			
A631	0.591	-0.491			
A632	0.597	-1.189			
A633	0.383	-0.894			
A634	0.923	-1.504			
A635	0.707	-2.217			
A636	0.635	-1.455			
A637	0.475	-0.816			
A638	0.421	1.341			
A639	0.034▲	22.634▲			
A640	0.561	0.245			

TABLE 5-3

Estimated Item Discrimination Parameter \hat{a}_g And Difficulty Parameter \hat{b}_g of Each of the 55 Items of Test J1 Obtained by the Tetrachoric Method. (Results Provided by the Courtesy of Professor Shiba.)

Item g	\hat{a}_g	\hat{b}_g	Item g	\hat{a}_g	\hat{b}_g
J101	0.668	0.072	J141	0.549	-0.894
J102	0.599	-0.817	J142	0.400	0.566
J103	0.664	-1.013	J143	0.620	-0.190
J104	0.727	-0.799	J144	0.452	-0.510
J105	0.686	-0.301	J145	0.798	-0.401
J106	0.475	-0.815	J146	0.727	-0.051
J107	0.497	0.090	J147	0.267	1.125
J108	0.809	-2.051	J148	0.542	0.231
J109	0.470	-1.011	J149	0.499	-0.224
J110	0.678	-0.517	J150	0.524	-0.237
J111	0.901	-1.329	J151	0.424	0.999
J112	0.521	-0.714	J152	0.309	0.847
J113	0.553	-0.930	J153	0.438	1.696
J114	0.513	0.657	J154	0.100	5.150▲
J115	0.767	-0.279	J155	0.569	1.536
J116	0.406	-1.117	J156	0.630	1.313
J117	0.390	-0.880			
J118	0.594	-0.959			
J119	0.659	-0.926			
J120	0.191	2.502			
J121	0.482	-0.967			
J122	0.524	-0.819			
J123	0.552	0.103			
J124	0.560	-1.863			
J125	0.567	-1.541			
J126	0.383	-0.727			
J127	0.531	-1.643			
J128	0.630	-1.144			
J129	0.812	1.174			
J130	0.379	-1.805			
J131	0.905	-0.447			
J132	0.454	0.0			
J133	0.614	-1.873			
J134	0.287	2.244			
J135	0.819	-0.205			
J136	0.371	0.374			
J137	0.580	0.0			
J138	---	---			
J139	0.362	1.321			
J140	0.403	0.107			

TABLE 5-4

Estimated Item Discrimination Parameter \hat{a}_g And Difficulty Parameter \hat{b}_g of Each of the 60 Items of Test J2 Obtained by the Tetrachoric Method. (Results Provided by the Courtesy of Professor Shiba.)

Item g	\hat{a}_g	\hat{b}_g	Item g	\hat{a}_g	\hat{b}_g
J201	0.607	-1.485	J241	1.024	-1.174
J202	---	---	J242	0.764	-0.939
J203	0.517	0.327	J243	0.411	-0.789
J204	0.374	-0.941	J244	0.360	-0.266
J205	0.526	-2.126	J245	0.866	-0.122
J206	0.557	-0.904	J246	0.278	0.112
J207	0.754	-1.329	J247	0.541	-0.210
J208	0.415	-2.009	J248	0.404	-1.762
J209	0.859	-0.936	J249	0.743	-0.285
J210	0.609	-1.883	J250	0.717	-0.378
J211	0.681	-0.906	J251	0.906	-0.938
J212	0.671	-1.041	J252	0.591	-0.059
J213	0.593	-1.079	J253	0.598	0.019
J214	0.596	-0.899	J254	0.613	-0.038
J215	0.937	-0.263	J255	1.146	0.066
J216	0.662	-0.598	J256	0.582	0.477
J217	0.515	0.262	J257	0.538	-0.317
J218	0.685	-0.106	J258	0.454	0.121
J219	1.008	-0.310	J259	0.825	0.189
J220	1.174	0.131	J260	0.091▲	1.773
J221	0.450	0.341			
J222	0.721	-0.650			
J223	0.462	-1.551			
J224	0.697	-0.682			
J225	0.689	-1.234			
J226	0.688	-0.653			
J227	0.663	-0.995			
J228	0.667	-1.387			
J229	0.653	-1.098			
J230	0.603	-1.065			
J231	1.195	-1.213			
J232	0.890	-1.309			
J233	0.354	0.540			
J234	0.386	0.028			
J235	0.972	-0.631			
J236	0.917	-0.533			
J237	0.283	-1.212			
J238	0.886	0.709			
J239	0.539	-0.190			
J240	0.192	0.246			

means item 4 of Test A6, and so forth. We can see in these tables that the estimated item parameters are mostly reasonable with a few exceptions. In these tables, ▲ is attached to each of the estimated discrimination parameters which assume values less than 0.100, and to each of the estimated difficulty parameters which exceed 3.000 in absolute value. Those items which are marked for both estimated parameters are A523, A531 and A639. We must conclude for these items that not only the information provided by them for measuring the ability in question is limited, but their estimated parameters may include substantial error. The closest to this group of items is item J154, whose estimated difficulty parameter exceeds 3.000 in absolute value and whose estimated discrimination parameter is just 0.100. The other group consists of items A527 and J260, whose estimated discrimination parameters are small, but whose estimated difficulty parameters are reasonable. There is less problem for these two items.

For J1/1075* and J1/2259** Cases, we followed the same procedure of Tetrachoric Method independently, and obtained the corresponding results. To start with, Tables 5-5 and 5-6 present the

* There was a mistake in the tape sent to us and one subject's response pattern (Subject No. 231 of the second grader group) was missing. Thus actually 1,074 subjects are involved in the whole process of Tetrachoric Method, as Table 3-2 indicates. In order to avoid confusions, however, we call it J1/1075 Case, instead of J1/1074.

** Since J1/2559 Case was analyzed later, the response pattern of the missing subject had been supplemented, and J1/2559 Case in the Tetrachoric Method consists of exactly 2,259 subjects.

TABLE 5-5
Tetrachoric Correlation Matrix of the Fifty-Five Item Response Tendencies of Test J1 in the J1/1075 Case.

	J101	J102	J103	J104	J105	J106	J107	J108	J109	J110
J101	1.00000	0.30935	0.39791	0.33850	0.29904	0.26317	0.27566	0.30272	0.25337	0.29338
	0.43044	0.31305	0.29421	0.41238	0.41056	0.10827	0.10115	0.30170	0.24789	0.17085
	0.28498	0.26612	0.35337	0.30091	0.22179	0.29616	0.32307	0.41196	0.35104	0.17697
	0.41732	0.25297	0.27088	0.23282	0.28907	0.17383	0.33124	0.18293	0.18859	0.25425
	0.27917	0.32995	0.26562	0.33467	0.39184	0.26608	0.30593	0.22554	0.32048	0.36767
	0.20212	0.25670	0.12231	0.50233	0.40676					
J102	0.30935	1.00000	0.31529	0.30305	0.30809	0.28091	0.25633	0.41906	0.17834	0.25370
	0.34997	0.22497	0.26707	0.27568	0.27853	0.18069	0.19496	0.25638	0.24492	0.08870
	0.27005	0.22062	0.11891	0.22486	0.23874	0.12534	0.21914	0.29098	0.20666	0.18698
	0.28704	0.17355	0.30148	0.15517	0.27531	0.09861	0.29579	0.23516	0.20962	0.25229
	0.18193	0.31944	0.14041	0.28241	0.24416	0.20532	0.21318	0.26038	0.22076	0.20238
	0.19437	0.06023	0.04128	0.13424	0.17818					
J103	0.39791	0.31529	1.00000	0.31744	0.23228	0.26850	0.35556	0.24811	0.22524	0.35196
	0.35062	0.22025	0.26182	0.26607	0.36242	0.22497	0.22868	0.36420	0.22347	0.13660
	0.20870	0.24935	0.38642	0.26602	0.34852	0.20407	0.36412	0.40914	0.27403	0.12592
	0.33368	0.16632	0.18727	0.23758	0.33274	0.19019	0.28462	0.20189	0.27403	0.20981
	0.21874	0.25807	0.14719	0.20593	0.38369	0.16622	0.29989	0.23038	0.23544	0.21631
	0.23761	0.01170	0.08639	0.36941	0.29599					
J104	0.33850	0.30305	0.31744	1.00000	0.41568	0.28443	0.31946	0.31191	0.25248	0.31245
	0.33496	0.25405	0.28219	0.32413	0.35373	0.19969	0.15717	0.24053	0.32057	0.12947
	0.24170	0.23749	0.29589	0.32421	0.26304	0.32498	0.23714	0.41057	0.37698	0.14477
	0.34746	0.19570	0.39260	0.12542	0.36065	0.25693	0.31862	0.22096	0.07251	0.33079
	0.25548	0.30614	0.16709	0.33730	0.43372	0.25675	0.14977	0.27139	0.20638	0.28149
	0.15200	0.25177	0.11713	0.41511	0.21442					
J105	0.29904	0.30809	0.23228	0.41568	1.00000	0.29312	0.30232	0.44853	0.25363	0.31644
	0.47107	0.24694	0.32003	0.31609	0.36300	0.25139	0.24167	0.25397	0.33025	0.13519
	0.29810	0.27993	0.22910	0.28829	0.22380	0.32957	0.23853	0.40782	0.39773	0.27811
	0.41186	0.22375	0.40366	0.11593	0.39351	0.16305	0.34411	0.30141	0.28357	0.31226
	0.28904	0.35195	0.18740	0.37501	0.43003	0.23939	0.22455	0.21483	0.27306	0.22244
	0.08615	0.34016	0.16381	0.35953	0.32183					
J106	0.26317	0.28091	0.26850	0.28443	0.29312	1.00000	0.21749	0.26835	0.20142	0.30066
	0.30290	0.25569	0.28171	0.15104	0.24364	0.27501	0.23397	0.15257	0.39619	0.04769
	0.16951	0.20257	0.19162	0.14858	0.27441	0.23606	0.21319	0.20040	0.23384	0.22951
	0.26897	0.18490	0.15530	0.05990	0.28331	0.15893	0.30218	0.19954	0.09121	0.20420
	0.24516	0.27060	0.08533	0.29660	0.27384	0.15284	0.09620	0.18986	0.22531	0.15927
	0.12626	0.17371	0.05026	0.26586	0.18373					

TABLE 5-5 (Continued)

J107	0.27566	0.25633	0.35556	0.31946	0.30232	0.21749	1.00000	0.38260	0.16603	0.30616
	0.29424	0.10439	0.27734	0.21249	0.29084	0.15821	0.11978	0.30982	0.31161	0.11346
	0.19877	0.23987	0.23634	0.31750	0.25268	0.16091	0.33629	0.31408	0.31976	0.16672
	0.27793	0.09383	0.34322	0.09937	0.29201	0.23296	0.21356	0.15641	0.16495	0.22641
	0.20428	0.25931	0.09870	0.24559	0.37316	0.24477	0.25184	0.21071	0.20921	0.12110
	0.12033	0.23199	0.07357	0.27923	0.26611					
J108	0.30272	0.41906	0.24811	0.31191	0.44853	0.26835	0.38260	1.00000	0.0	0.27627
	0.49299	0.31901	0.32654	0.31789	0.44662	0.31252	0.18635	0.11513	0.29577	0.09096
	0.27955	0.37888	0.26652	0.38822	0.41225	0.21464	0.40184	0.38467	0.38065	0.19478
	0.41433	0.25082	0.50813	0.09428	0.48109	0.28623	0.31035	0.13553	0.21231	0.33403
	0.18594	0.35370	0.17812	0.52473	0.41778	0.16518	0.28929	0.32300	0.33827	0.21229
	0.16262	0.17956	0.26073	0.27832	0.18057					
J109	0.25337	0.17834	0.22524	0.25248	0.25363	0.20142	0.16603	0.0	1.00000	0.16851
	0.23214	0.15584	0.13365	0.18667	0.20073	0.13181	0.13657	0.22954	0.22336	0.09710
	0.16344	0.15536	0.11748	0.21577	0.23167	0.13910	0.11509	0.19003	0.08135	0.13728
	0.21000	0.03619	0.0	0.04800	0.21358	0.08312	0.05303	0.12973	0.17916	0.13328
	0.14266	0.14281	0.17360	0.19348	0.18594	0.10596	0.13237	0.20065	0.21071	0.12203
	0.09904	0.06880	0.0	0.07630	0.21518					
J110	0.29338	0.25370	0.35196	0.31245	0.31644	0.30066	0.30616	0.27627	0.16851	1.00000
	0.38309	0.14885	0.20979	0.22535	0.33430	0.11796	0.24586	0.24232	0.27613	0.07026
	0.21413	0.30197	0.28361	0.17672	0.25418	0.24969	0.19251	0.30240	0.40160	0.26607
	0.35462	0.11064	0.33105	0.10775	0.40160	0.07856	0.30840	0.27039	0.23907	0.47275
	0.24825	0.30468	0.23106	0.28809	0.48460	0.08262	0.24220	0.25461	0.25399	0.06866
	0.08803	0.34082	0.0	0.31906	0.26012					
J111	0.43044	0.34997	0.35062	0.33496	0.47107	0.30290	0.29424	0.49299	0.23214	0.38309
	1.00000	0.29991	0.28153	0.36773	0.40822	0.22914	0.18871	0.38888	0.36003	0.20238
	0.30082	0.43076	0.29071	0.39165	0.27795	0.34872	0.38708	0.49329	0.33595	0.26235
	0.41930	0.26165	0.49849	0.19446	0.46664	0.28752	0.40033	0.13212	0.29698	0.40603
	0.26097	0.39801	0.25324	0.44287	0.44083	0.22931	0.27728	0.33430	0.30632	0.43459
	0.18757	0.23415	0.09266	0.35113	0.34134					
J112	0.31305	0.22497	0.32353	0.25405	0.24694	0.25569	0.10439	0.31901	0.15586	0.14885
	0.29991	1.00000	0.25967	0.30566	0.28159	0.04621	0.13193	0.22898	0.26138	0.09441
	0.16739	0.20785	0.12542	0.26464	0.24627	0.12038	0.21514	0.27918	0.18720	0.13179
	0.35070	0.25021	0.31648	0.07637	0.19771	0.24680	0.25671	0.11048	0.06551	0.17846
	0.13927	0.24174	0.05547	0.31002	0.30341	0.23901	0.24748	0.14965	0.18757	0.24104
	0.18194	0.03851	0.06170	0.23069	0.21416					
J113	0.29421	0.26707	0.22025	0.28219	0.32003	0.28171	0.27734	0.32654	0.13365	0.20979
	0.28153	0.25967	1.00000	0.25795	0.26050	0.15725	0.19161	0.29228	0.33101	0.16131
	0.24081	0.22810	0.24109	0.18516	0.24314	0.18226	0.30674	0.25529	0.27674	0.13231
	0.30175	0.20846	0.40697	0.02516	0.26512	0.21186	0.19518	0.23792	0.15038	0.22889
	0.29100	0.25837	0.16765	0.28232	0.30251	0.20407	0.17571	0.12247	0.23164	0.25050
	0.17049	0.16488	0.17977	0.16743	0.27629					

TABLE 5-5 (Continued)

J114	0.41238	0.27568	0.26182	0.32413	0.31609	0.15104	0.21249	0.31789	0.18667	0.22535
	0.36773	0.30566	0.25195	1.00000	0.25201	0.12669	0.12049	0.22405	0.22895	0.26300
	0.20900	0.25027	0.24000	0.16640	0.20463	0.23341	0.17402	0.31590	0.29481	0.24748
	0.30209	0.24225	0.31348	0.12856	0.31632	0.19414	0.29328	0.20463	0.27386	0.30927
	0.24276	0.31651	0.19093	0.34786	0.30765	0.35264	0.23146	0.30502	0.18155	0.32716
	0.25815	0.27287	0.11674	0.43397	0.29570					
J115	0.41056	0.27853	0.36242	0.35373	0.36300	0.24364	0.29084	0.44662	0.20073	0.33430
	0.40822	0.28159	0.26050	0.25201	1.00000	0.23207	0.14414	0.31233	0.37859	0.23641
	0.27262	0.28667	0.23220	0.34080	0.33131	0.26488	0.27878	0.39831	0.36745	0.09161
	0.48375	0.25818	0.34083	0.17634	0.39278	0.30622	0.33913	0.25121	0.22415	0.16826
	0.31950	0.37187	0.25396	0.44173	0.40959	0.27163	0.34450	0.24546	0.30429	0.18044
	0.18849	0.30033	0.07258	0.43746	0.41451					
J116	0.10827	0.18069	0.22497	0.19969	0.25139	0.27501	0.15821	0.31252	0.13181	0.11796
	0.22914	0.04621	0.15725	0.12669	0.23207	1.00000	0.11860	0.13189	0.23529	0.04060
	0.18672	0.11207	0.13342	0.24163	0.26362	0.08019	0.24244	0.21516	0.20270	0.10930
	0.26710	0.08330	0.26611	0.70992	0.27696	0.10473	0.21302	0.17758	0.14707	0.14980
	0.11258	0.19660	0.10674	0.21925	0.16172	0.13088	0.14985	0.19200	0.19294	0.10141
	0.18229	0.12980	0.15552	0.21411	0.19530					
J117	0.10115	0.19496	0.22868	0.15717	0.24167	0.23397	0.11978	0.18635	0.13657	0.24586
	0.18871	0.13193	0.19161	0.12049	0.14414	0.11860	1.00000	0.18826	0.18962	0.11998
	0.12712	0.13011	0.11742	0.18282	0.11691	0.15937	0.21105	0.17364	0.30674	0.22992
	0.12704	0.10844	0.21720	0.0	0.30891	0.11122	0.19984	0.12894	0.14145	0.28267
	0.17888	0.25571	0.0	0.15746	0.19496	0.12059	0.10234	0.0	0.11314	0.13800
	0.10813	0.18436	0.08196	0.21085	0.19123					
J118	0.30170	0.25638	0.36420	0.24053	0.25397	0.15257	0.30982	0.11513	0.22954	0.24232
	0.38888	0.22898	0.29228	0.22405	0.31233	0.13189	0.18826	1.00000	0.27544	0.08921
	0.23684	0.33980	0.21378	0.23396	0.30673	0.16281	0.24064	0.28650	0.38464	0.02964
	0.30395	0.17216	0.17289	0.19595	0.31104	0.19374	0.16917	0.23352	0.25404	0.12875
	0.10940	0.26088	0.17997	0.21836	0.34895	0.32409	0.25626	0.19178	0.24842	0.21098
	0.15902	0.14186	0.08743	0.27590	0.36816					
J119	0.24789	0.24492	0.22347	0.32057	0.33025	0.39619	0.31161	0.29577	0.22336	0.27613
	0.36003	0.26138	0.33101	0.22895	0.37859	0.23529	0.18962	0.27544	1.00000	0.23252
	0.28653	0.17217	0.25665	0.37190	0.30620	0.20337	0.29188	0.21332	0.31360	0.06720
	0.42308	0.23837	0.29082	0.10755	0.33296	0.24604	0.31133	0.15932	0.11782	0.17648
	0.22932	0.19532	0.14077	0.29063	0.36530	0.18769	0.19785	0.23773	0.19248	0.28582
	0.15998	0.18978	0.04783	0.27007	0.24341					
J120	0.17085	0.08870	0.13660	0.12947	0.13519	0.04769	0.11346	0.09096	0.09710	0.07026
	0.20238	0.09441	0.16131	0.26300	0.23641	0.04060	0.11998	0.08921	0.23252	1.00000
	0.08053	0.16036	0.16185	0.13704	0.08067	0.14804	0.09082	0.19324	0.11827	0.12574
	0.24059	0.12506	0.12040	0.05850	0.16674	0.16257	0.16859	0.09278	0.05089	0.13705
	0.20136	0.14277	0.15085	0.27529	0.15007	0.25652	0.10441	0.08644	0.09640	0.11600
	0.10345	0.17493	0.12505	0.24404	0.16602					

TABLE 5-5 (Continued)

J121	0.28498	0.27005	0.20870	0.24170	0.29810	0.16951	0.19877	0.27955	0.16344	0.21413
	0.30082	0.16739	0.24081	0.20900	0.27262	0.18672	0.12712	0.23684	0.28653	0.08053
	1.00000	0.16315	0.23029	0.26220	0.15035	0.18275	0.24781	0.28103	0.31836	0.21538
	0.33018	0.16696	0.22443	0.12711	0.31063	0.18217	0.28844	0.18951	0.20917	0.21694
	0.20422	0.24092	0.16639	0.27236	0.21273	0.13178	0.17717	0.24030	0.19672	0.14677
	0.06747	0.16582	0.06697	0.23594	0.26813					
J122	0.26612	0.22062	0.24935	0.23749	0.27993	0.20257	0.23987	0.37888	0.15538	0.30197
	0.43076	0.20785	0.22810	0.25027	0.28667	0.11207	0.13011	0.39980	0.17217	0.16036
	0.16315	1.00000	0.31542	0.18708	0.27764	0.16124	0.22901	0.30502	0.25241	0.16497
	0.33690	0.23653	0.19648	0.18533	0.27791	0.13804	0.15961	0.07297	0.20442	0.24402
	0.26922	0.22600	0.12912	0.24162	0.25421	0.25323	0.14632	0.23117	0.23780	0.18704
	0.10887	0.23427	0.09686	0.25734	0.31274					
J123	0.35337	0.11891	0.38642	0.29589	0.22910	0.19162	0.23634	0.26652	0.11748	0.28361
	0.29071	0.1542	0.24109	0.24000	0.23220	0.13342	0.11742	0.21378	0.25665	0.16185
	0.23029	0.31542	1.00000	0.18699	0.21319	0.17147	0.25460	0.20743	0.23943	0.10428
	0.37902	0.17790	0.25676	0.12443	0.32410	0.19918	0.29377	0.17196	0.19042	0.19163
	0.14763	0.31843	0.18704	0.25148	0.29052	0.05023	0.25889	0.26025	0.26611	0.27407
	0.08067	0.13627	0.10811	0.35223	0.23526					
J124	0.30091	0.22486	0.26607	0.32421	0.28829	0.14858	0.31750	0.38822	0.21577	0.17672
	0.39165	0.26464	0.18516	0.16640	0.34088	0.24163	0.18282	0.23396	0.37190	0.13704
	0.26220	0.18708	0.18699	1.00000	0.24912	0.17315	0.38256	0.29780	0.27273	0.10787
	0.36782	0.12931	0.25786	0.12702	0.37952	0.17814	0.28660	0.16791	0.14685	0.15302
	0.13448	0.20623	0.14264	0.31250	0.32517	0.17498	0.21897	0.27252	0.23735	0.10116
	0.16224	0.16067	0.10620	0.34328	0.31917					
J125	0.22179	0.23874	0.34852	0.26304	0.22380	0.27441	0.25268	0.41225	0.23167	0.25418
	0.27795	0.24627	0.24314	0.20463	0.33131	0.26362	0.11691	0.30673	0.30620	0.08067
	0.15035	0.24764	0.21319	0.24912	1.00000	0.25268	0.23704	0.32566	0.28133	0.16237
	0.33207	0.17050	0.24042	0.05517	0.27483	0.05356	0.22476	0.13477	0.05230	0.20652
	0.15476	0.26353	0.14157	0.30395	0.34034	0.15559	0.21559	0.20316	0.16642	0.07089
	0.06878	0.05966	0.0	0.31466	0.13016					
J126	0.29616	0.12534	0.20407	0.32498	0.32927	0.23606	0.16091	0.21464	0.13910	0.24969
	0.34872	0.12038	0.18226	0.23341	0.26488	0.08019	0.15937	0.16281	0.20337	0.14804
	0.18275	0.16124	0.17147	0.17315	0.25568	1.00000	0.17831	0.32461	0.13654	0.16979
	0.22128	0.21350	0.28181	0.18210	0.26693	0.12272	0.24177	0.11369	0.15159	0.28394
	0.22407	0.29142	0.14039	0.23768	0.29413	0.18948	0.29291	0.17888	0.15677	0.13492
	0.09721	0.12393	0.06654	0.31946	0.24320					
J127	0.32307	0.21914	0.36412	0.23714	0.23853	0.21319	0.33629	0.40184	0.11509	0.19251
	0.38708	0.21514	0.30674	0.17402	0.27878	0.24244	0.21105	0.24064	0.29188	0.09082
	0.24781	0.22901	0.25460	0.38256	0.23704	0.17831	1.00000	0.36539	0.24094	0.11410
	0.35251	0.13214	0.24431	0.04895	0.28346	0.21080	0.23678	0.09069	0.11030	0.14501
	0.11489	0.24369	0.12298	0.26189	0.29640	0.03146	0.30083	0.23553	0.18693	0.28658
	0.18112	0.08532	0.08784	0.30286	0.21967					

TABLE 5-5 (Continued)

J128	0.41196	0.29098	0.40914	0.41057	0.40782	0.20040	0.31408	0.38467	0.19003	0.30240
	0.49329	0.27918	0.25529	0.31990	0.39831	0.21516	0.17364	0.28650	0.21332	0.19324
	0.28103	0.30502	0.20743	0.29780	0.32566	0.32461	0.36539	1.00000	0.33568	0.17941
	0.36509	0.22161	0.43798	0.21986	0.30675	0.20434	0.33729	0.17290	0.22646	0.30753
	0.22774	0.38867	0.19474	0.35843	0.43961	0.20824	0.26090	0.29280	0.29426	0.21415
	0.18978	0.18754	0.24010	0.40386	0.28102					
J129	0.35104	0.20666	0.27403	0.37698	0.39773	0.23384	0.31976	0.38065	0.08135	0.40160
	0.33595	0.18720	0.27674	0.29481	0.36745	0.20270	0.30674	0.38464	0.31360	0.11827
	0.31836	0.25241	0.23943	0.27273	0.28133	0.13654	0.24094	0.33568	1.00000	0.17791
	0.40416	0.32244	0.43971	0.20242	0.53346	0.17698	0.36200	0.25604	0.31838	0.33622
	0.33108	0.35699	0.18811	0.37774	0.45545	0.24371	0.23612	0.19733	0.23116	0.18054
	0.21323	0.34251	0.15177	0.37115	0.43637					
J130	0.17697	0.18698	0.12592	0.14477	0.27811	0.22951	0.16672	0.19478	0.13728	0.26607
	0.26235	0.13179	0.13231	0.24748	0.09161	0.10930	0.22992	0.02964	0.06720	0.12574
	0.21538	0.16497	0.10428	0.10787	0.16237	0.16979	0.11410	0.17941	0.17791	1.00000
	0.19959	0.06047	0.29090	0.14770	0.23993	0.10503	0.07932	0.05336	0.0	0.36474
	0.25821	0.19653	0.08775	0.16530	0.26935	0.0	0.03772	0.19344	0.08128	0.12169
	0.08645	0.24015	0.0	0.25082	0.21522					
J131	0.41732	0.28704	0.33368	0.34746	0.41186	0.26897	0.27793	0.41433	0.21000	0.35462
	0.41930	0.35070	0.30175	0.30209	0.48375	0.26770	0.32704	0.30395	0.42308	0.24059
	0.33018	0.33690	0.37902	0.36782	0.33207	0.22128	0.35251	0.36500	0.40416	0.19259
	1.00000	0.28767	0.31298	0.11669	0.31724	0.23522	0.51583	0.24723	0.25680	0.21238
	0.33045	0.37305	0.24248	0.48575	0.34742	0.24626	0.33433	0.29190	0.29921	0.21611
	0.17739	0.21370	0.08868	0.46748	0.40727					
J132	0.25297	0.17355	0.16632	0.19570	0.22375	0.18490	0.09383	0.25082	0.03619	0.11064
	0.26165	0.25021	0.20846	0.24225	0.25818	0.08330	0.10844	0.17216	0.23837	0.12506
	0.16696	0.23653	0.17790	0.12931	0.17050	0.21350	0.13214	0.22161	0.32244	0.06047
	0.28767	1.00000	0.29162	0.11936	0.20570	0.14899	0.26881	0.14693	0.14429	0.16775
	0.16188	0.26005	0.17745	0.19173	0.24485	0.24092	0.21727	0.10114	0.18894	0.24477
	0.22279	0.18145	0.06210	0.23397	0.30002					
J133	0.27088	0.30148	0.18727	0.39260	0.40366	0.15530	0.34322	0.50813	0.0	0.33105
	0.49849	0.31648	0.40697	0.31348	0.34063	0.26611	0.21720	0.17289	0.29082	0.12040
	0.22443	0.19648	0.25676	0.25786	0.24042	0.28181	0.24431	0.43798	0.43971	0.29090
	0.31298	0.29162	1.00000	0.12500	0.44739	0.23625	0.23948	0.23528	0.16927	0.48267
	0.18399	0.33519	0.18892	0.33558	0.46961	0.16295	0.14473	0.27288	0.24671	0.19285
	0.06851	0.20207	0.0	0.36090	0.21570					
J134	0.23282	0.15517	0.23758	0.12542	0.11593	0.05990	0.09937	0.09428	0.04800	0.10775
	0.19446	0.07637	0.02516	0.12856	0.17634	0.10992	0.0	0.19595	0.10755	0.05850
	0.12711	0.18533	0.12443	0.12702	0.05517	0.18210	0.04895	0.21986	0.20242	0.14770
	0.11669	0.11936	0.12500	1.00000	0.20540	0.11002	0.15179	0.15509	0.06275	0.14796
	0.14505	0.18624	0.12101	0.17388	0.19250	0.19270	0.17957	0.25859	0.14301	0.18425
	0.17912	0.20837	0.08320	0.22567	0.24308					

TABLE 5-5 (Continued)

J135	0.28907	0.27531	0.33274	0.36065	0.39351	0.28331	0.29201	0.48109	0.21358	0.40160
	0.46664	0.19771	0.26512	0.31632	0.39278	0.27696	0.30891	0.31104	0.33296	0.16674
	0.31063	0.27791	0.32410	0.37952	0.27483	0.26683	0.28346	0.30675	0.53346	0.23993
	0.31724	0.20570	0.44739	0.20540	1.00000	0.17023	0.28226	0.27339	0.21636	0.40200
	0.22766	0.41365	0.21571	0.34856	0.50045	0.19124	0.24477	0.25031	0.28531	0.24895
	0.18942	0.26884	0.19095	0.43382	0.36839					
J136	0.17383	0.09861	0.19019	0.25693	0.18305	0.15893	0.23296	0.28623	0.08312	0.07856
	0.28752	0.24680	0.21186	0.19414	0.30622	0.10473	0.11122	0.19374	0.24604	0.16257
	0.18217	0.13804	0.19918	0.17814	0.05356	0.12272	0.21080	0.20434	0.17698	0.10503
	0.23522	0.14899	0.23625	0.11002	0.17023	1.00000	0.16214	0.09354	0.02874	0.10346
	0.21151	0.10625	0.0	0.17436	0.21114	0.11555	0.12160	0.16559	0.15373	0.12616
	0.12453	0.17790	0.0	0.26466	0.16850					
J137	0.33124	0.29579	0.28462	0.31862	0.34411	0.30218	0.21356	0.31035	0.05303	0.30840
	0.40033	0.25671	0.19518	0.29328	0.33913	0.21302	0.19984	0.16917	0.31133	0.16859
	0.28844	0.15961	0.29377	0.28660	0.22476	0.24177	0.23678	0.33729	0.38200	0.07932
	0.51583	0.26881	0.23948	0.15179	0.28226	0.16214	1.00000	0.29200	0.28991	0.30807
	0.20735	0.38675	0.22786	0.35762	0.42002	0.25700	0.27690	0.25557	0.19138	0.22824
	0.16311	0.16904	0.19869	0.37773	0.32348					
J139	0.18293	0.23516	0.20189	0.22096	0.30141	0.19954	0.15641	0.13553	0.12973	0.27039
	0.13212	0.11048	0.23792	0.20463	0.25121	0.17758	0.12894	0.23352	0.15932	0.09278
	0.18951	0.07297	0.17196	0.16791	0.13477	0.11369	0.09069	0.17290	0.25604	0.05336
	0.24723	0.14693	0.23528	0.15509	0.27339	0.09354	0.29200	1.00000	0.16917	0.19714
	0.13326	0.24042	0.18021	0.16515	0.21414	0.14516	0.20542	0.22342	0.15829	0.23366
	0.19805	0.24738	0.18187	0.24243	0.32714					
J140	0.18859	0.20962	0.18978	0.07251	0.28357	0.09121	0.16495	0.21231	0.17916	0.23907
	0.29698	0.06551	0.15038	0.27386	0.22415	0.14707	0.14145	0.25404	0.11782	0.05089
	0.20917	0.20442	0.19042	0.14685	0.05230	0.15159	0.11030	0.22646	0.31838	0.0
	0.25680	0.14429	0.16927	0.06275	0.21636	0.02874	0.28991	0.16917	1.00000	0.11785
	0.17707	0.24367	0.64064	0.28476	0.15240	0.16105	0.21451	0.20129	0.21001	0.14348
	0.05209	0.10665	0.0	0.27834	0.23768					
J141	0.25425	0.25229	0.20981	0.33079	0.31226	0.20420	0.22641	0.33403	0.13328	0.47275
	0.40603	0.17846	0.22889	0.30927	0.16826	0.14980	0.28267	0.12875	0.17648	0.13705
	0.21694	0.24402	0.19163	0.15302	0.20652	0.28394	0.14501	0.30753	0.33622	0.36474
	0.21238	0.16775	0.48267	0.14796	0.40200	0.10346	0.30807	0.19714	0.11785	1.00000
	0.32183	0.29720	0.12499	0.24177	0.37306	0.12547	0.09708	0.19163	0.20668	0.09747
	0.0	0.33495	0.22304	0.31786	0.25772					
J142	0.27917	0.18193	0.21874	0.25548	0.28904	0.24516	0.20428	0.18594	0.14266	0.24825
	0.26097	0.13927	0.29100	0.24276	0.31950	0.11258	0.17888	0.10940	0.22932	0.20136
	0.20422	0.26922	0.14763	0.13448	0.15476	0.22407	0.11489	0.22774	0.33108	0.25821
	0.33045	0.16188	0.18399	0.14505	0.22766	0.21151	0.20735	0.13326	0.17707	0.32183
	1.00000	0.30228	0.10904	0.22830	0.27880	0.30287	0.18092	0.22037	0.23534	0.22871
	0.16394	0.21856	0.0	0.29906	0.27739					

TABLE 5-5 (Continued)

J143	0.32995	0.31944	0.25807	0.30614	0.35195	0.27060	0.25931	0.35370	0.14281	0.30468
	0.39801	0.24174	0.25837	0.31651	0.37187	0.19660	0.25571	0.26088	0.19532	0.14277
	0.24092	0.22600	0.31843	0.20823	0.26353	0.29142	0.38867	0.35699	0.35699	0.19653
	0.37305	0.26005	0.33519	0.18624	0.41365	0.10625	0.38675	0.24042	0.24367	0.29720
	0.30228	1.00000	0.21972	0.38730	0.32319	0.23554	0.27404	0.24892	0.28685	0.21422
	0.22333	0.25101	0.10722	0.34149	0.35933					
J144	0.26562	0.14041	0.14719	0.16709	0.18740	0.08533	0.09870	0.17812	0.17360	0.23106
	0.25324	0.05547	0.16765	0.19093	0.25396	0.10674	0.0	0.17997	0.14077	0.15085
	0.16639	0.12912	0.18704	0.14264	0.14157	0.14039	0.12298	0.19474	0.18811	0.08775
	0.24248	0.17745	0.18892	0.12101	0.21571	0.0	0.22786	0.18021	0.64064	0.12499
	0.10904	0.21972	1.00000	0.24170	0.18086	0.11818	0.20396	0.28260	0.21739	0.14854
	0.13612	0.20601	0.04427	0.24051	0.15793					
J145	0.33467	0.28241	0.20593	0.33730	0.37501	0.29660	0.24559	0.52473	0.19348	0.28809
	0.44287	0.31002	0.28232	0.34786	0.44173	0.21925	0.15746	0.21836	0.29063	0.27529
	0.27236	0.24162	0.25148	0.31250	0.30395	0.23768	0.26189	0.35843	0.37774	0.16530
	0.48575	0.19173	0.33558	0.17388	0.34856	0.17436	0.35762	0.16515	0.28476	0.24177
	0.22830	0.38730	0.24170	1.00000	0.29924	0.15148	0.32319	0.41905	0.36531	0.29461
	0.25577	0.28920	0.06249	0.31389	0.39920					
J146	0.39184	0.24416	0.38369	0.43372	0.43003	0.27384	0.37316	0.41778	0.18594	0.48460
	0.44083	0.30341	0.30251	0.30765	0.40959	0.16172	0.19496	0.34895	0.36530	0.15007
	0.27273	0.25421	0.29052	0.32517	0.34034	0.29413	0.29640	0.43961	0.45545	0.26935
	0.34742	0.24485	0.46961	0.19250	0.50045	0.21114	0.42002	0.21414	0.15240	0.37306
	0.27880	0.32319	0.18086	0.29924	1.00000	0.26445	0.26241	0.23249	0.32094	0.26630
	0.17889	0.26710	0.12202	0.39181	0.32767					
J147	0.26608	0.20532	0.16622	0.25675	0.23939	0.15284	0.24477	0.16518	0.10596	0.08262
	0.22931	0.23901	0.20407	0.35264	0.27163	0.13088	0.12059	0.32409	0.18769	0.25652
	0.13178	0.25323	0.05023	0.17498	0.15559	0.18948	0.03146	0.20824	0.24371	0.0
	0.24626	0.24092	0.16295	0.19270	0.19124	0.11555	0.25700	0.14516	0.16105	0.12547
	0.30287	0.23554	0.11818	0.15148	0.26445	1.00000	0.20298	0.12776	0.14227	0.16507
	0.27413	0.19470	0.22060	0.40295	0.36069					
J148	0.30593	0.21318	0.29989	0.14977	0.22455	0.09620	0.25184	0.28929	0.13237	0.24220
	0.27728	0.24748	0.17571	0.23146	0.34450	0.14985	0.10234	0.25626	0.19785	0.10441
	0.17717	0.14632	0.25889	0.21897	0.21559	0.29291	0.30083	0.26090	0.23612	0.03772
	0.33433	0.21727	0.14473	0.17957	0.24477	0.12160	0.27690	0.20542	0.21451	0.09708
	0.18092	0.27404	0.20396	0.32319	0.26241	0.20298	1.00000	0.20458	0.21693	0.24626
	0.15209	0.20964	0.17376	0.33810	0.33199					
J149	0.22554	0.26038	0.23038	0.27139	0.21483	0.18986	0.21071	0.32300	0.20065	0.25461
	0.33430	0.14965	0.12247	0.30502	0.24546	0.19200	0.0	0.19178	0.23773	0.08644
	0.24030	0.23717	0.26025	0.27252	0.20316	0.17888	0.23553	0.29280	0.19733	0.19344
	0.29190	0.10114	0.27288	0.25859	0.25031	0.16559	0.25557	0.22342	0.20129	0.19163
	0.22037	0.24892	0.28260	0.41905	0.32549	0.12776	0.20458	1.00000	0.21535	0.11287
	0.15548	0.24598	0.10954	0.25488	0.25786					

TABLE 5-5 (Continued)

J150	0.32048	0.22078	0.23544	0.20638	0.27306	0.22531	0.20921	0.33827	0.21071	0.25399
	0.30632	0.18757	0.23164	0.18155	0.30429	0.19294	0.11314	0.24842	0.19248	0.09640
	0.19672	0.23780	0.26611	0.23735	0.16642	0.15677	0.18693	0.29426	0.23116	0.08128
	0.29921	0.18894	0.24671	0.14301	0.28531	0.15373	0.19138	0.15859	0.21001	0.20668
	0.23534	0.28685	0.21739	0.36531	0.32094	0.14227	0.21693	0.21535	1.00000	0.24536
	0.11369	0.21868	0.09721	0.28590	0.24682					
J151	0.36767	0.20238	0.21631	0.28149	0.22244	0.15927	0.12110	0.21229	0.12203	0.06866
	0.43459	0.24104	0.25050	0.32716	0.18044	0.10141	0.13800	0.21098	0.28582	0.11600
	0.14877	0.18704	0.27407	0.10116	0.07089	0.13492	0.28658	0.21415	0.18054	0.12169
	0.21611	0.24477	0.19285	0.18425	0.24895	0.12616	0.22824	0.23366	0.14348	0.09747
	0.22871	0.21422	0.14854	0.29461	0.26630	0.16507	0.24626	0.11287	0.24536	1.00000
	0.27145	0.20005	0.09034	0.36964	0.38954					
J152	0.20212	0.19437	0.23761	0.15200	0.08615	0.12626	0.12033	0.16262	0.09904	0.08803
	0.18757	0.16794	0.17049	0.25815	0.18849	0.18229	0.10813	0.15902	0.15998	0.10345
	0.06747	0.10887	0.08067	0.16224	0.06878	0.09721	0.18112	0.18978	0.21323	0.08645
	0.17739	0.22279	0.06851	0.17912	0.16942	0.12453	0.16311	0.19805	0.05209	0.0
	0.16394	0.22333	0.13612	0.25577	0.17889	0.27413	0.15209	0.15548	0.11369	0.27145
	1.00000	0.22674	0.18008	0.25111	0.25376					
J153	0.25670	0.06023	0.01170	0.25177	0.34016	0.17371	0.23199	0.17956	0.06880	0.34082
	0.23415	0.03851	0.16488	0.27287	0.30033	0.12980	0.18436	0.14186	0.18978	0.17493
	0.16582	0.23427	0.13627	0.16067	0.05966	0.12393	0.08532	0.18754	0.34251	0.24015
	0.21370	0.18145	0.20207	0.20837	0.26884	0.17790	0.16904	0.24738	0.10665	0.33495
	0.21856	0.25101	0.20601	0.28920	0.26710	0.19470	0.20964	0.24598	0.21368	0.20005
	0.22674	1.00000	0.18219	0.34618	0.26838					
J154	0.12231	0.04128	0.08639	0.11713	0.16381	0.05025	0.07357	0.26073	0.0	0.0
	0.09266	0.06170	0.17977	0.11674	0.07258	0.15552	0.08196	0.08743	0.04783	0.12505
	0.06697	0.09686	0.10811	0.10620	0.0	0.06654	0.08784	0.24010	0.15177	0.0
	0.08868	0.06210	0.0	0.08320	0.19095	0.0	0.19869	0.18187	0.0	0.22304
	0.0	0.10722	0.04427	0.06249	0.12202	0.22060	0.17376	0.10954	0.09721	0.09034
	0.18008	0.18219	1.00000	0.18318	0.16472					
J155	0.50233	0.13424	0.36941	0.41511	0.35953	0.26586	0.27923	0.27832	0.07630	0.31906
	0.35113	0.23069	0.16743	0.43397	0.43746	0.21411	0.21085	0.27590	0.27007	0.24404
	0.23594	0.25734	0.35223	0.34328	0.31466	0.31946	0.30286	0.40386	0.37115	0.25082
	0.46748	0.23397	0.36090	0.22567	0.43382	0.26466	0.37773	0.24243	0.27834	0.31786
	0.29906	0.34149	0.24051	0.31389	0.39181	0.40295	0.33810	0.25488	0.28590	0.36964
	0.25111	0.34618	0.18318	1.00000	0.46901					
J156	0.40676	0.17818	0.29599	0.21442	0.32183	0.18373	0.26611	0.18057	0.21518	0.26012
	0.34134	0.21416	0.27629	0.29570	0.41451	0.19530	0.19123	0.36816	0.24341	0.16602
	0.26813	0.31274	0.23526	0.31917	0.13016	0.24320	0.21967	0.28102	0.43637	0.21522
	0.40727	0.30002	0.21570	0.24308	0.36839	0.16850	0.32348	0.32714	0.23768	0.25772
	0.27739	0.35933	0.15793	0.39920	0.32767	0.36069	0.33199	0.25786	0.24682	0.36954
	0.25376	0.26838	0.16472	0.46901	1.00000					

TABLE 5-6
Tetrachoric Correlation Matrix of the Fifty-Five Item Response Tendencies of Test J1 in the J1/2259 Case.

	J101	J102	J103	J104	J105	J106	J107	J108	J109	J110
J101	1.00000	0.32878	0.33142	0.27233	0.36527	0.23930	0.25433	0.28207	0.25357	0.20154
	0.44109	0.30687	0.25598	0.25899	0.13501	0.16455	0.31979	0.25637	0.17382	0.17382
	0.26701	0.27938	0.30775	0.22350	0.21587	0.19550	0.27860	0.33976	0.34834	0.16264
	0.39523	0.15432	0.29977	0.23934	0.32843	0.18602	0.30441	0.16192	0.22883	0.24048
	0.20900	0.26363	0.24065	0.33405	0.36443	0.19770	0.30278	0.21787	0.27089	0.27333
	0.22068	0.15374	0.08216	0.44011	0.35776					
J102	0.32878	1.00000	0.25744	0.29398	0.31323	0.27692	0.22315	0.34279	0.17459	0.21537
	0.36948	0.21190	0.22886	0.16958	0.28203	0.17924	0.19360	0.31720	0.22714	0.15051
	0.22386	0.17091	0.18226	0.26193	0.18780	0.14647	0.17569	0.30612	0.22842	0.15818
	0.28004	0.15986	0.32263	0.15234	0.29703	0.13125	0.22780	0.19857	0.13798	0.15917
	0.13424	0.25861	0.14061	0.23948	0.26860	0.11470	0.19364	0.20211	0.27458	0.20833
	0.17808	0.05059	0.09907	0.17276	0.20069					
J103	0.33142	0.25744	1.00000	0.29043	0.22569	0.29332	0.27870	0.26929	0.19894	0.26395
	0.31830	0.23922	0.21887	0.19483	0.32117	0.21294	0.17885	0.37334	0.21838	0.10776
	0.22921	0.23554	0.25229	0.25574	0.26041	0.13096	0.27447	0.34302	0.26709	0.12394
	0.29851	0.13316	0.22007	0.18540	0.30940	0.17912	0.19937	0.20954	0.16755	0.13751
	0.17154	0.22286	0.15681	0.21545	0.30422	0.09800	0.21892	0.22128	0.16487	0.21465
	0.16324	0.07617	0.13251	0.28797	0.26846					
J104	0.27233	0.29398	0.29043	1.00000	0.39883	0.31907	0.36837	0.31992	0.24911	0.30267
	0.34721	0.20428	0.27708	0.27711	0.28433	0.13762	0.19176	0.29315	0.37348	0.11671
	0.22498	0.21369	0.26077	0.29045	0.29474	0.21978	0.26971	0.38054	0.34684	0.18866
	0.35477	0.15407	0.43199	0.12502	0.37596	0.23601	0.30466	0.19580	0.15284	0.33623
	0.29254	0.25167	0.12727	0.23514	0.41563	0.18405	0.30466	0.30094	0.15284	0.33623
	0.21615	0.19910	0.12740	0.31191	0.23505					
J105	0.36527	0.31323	0.22569	0.39883	1.00000	0.30991	0.34336	0.40032	0.26986	0.35883
	0.45612	0.23761	0.28128	0.26241	0.30027	0.16277	0.27616	0.26098	0.32569	0.14302
	0.26217	0.21015	0.21113	0.32009	0.21887	0.22925	0.32256	0.33256	0.39452	0.25486
	0.35614	0.13377	0.41424	0.10697	0.40355	0.20881	0.32481	0.22164	0.28243	0.32547
	0.24058	0.32786	0.22472	0.29897	0.43677	0.20639	0.24142	0.24620	0.31215	0.21091
	0.15990	0.24051	0.22750	0.39625	0.36754					
J106	0.23930	0.27692	0.29332	0.31907	0.30991	1.00000	0.21231	0.26363	0.21671	0.27603
	0.29502	0.19027	0.24077	0.12964	0.21112	0.16374	0.19719	0.21194	0.32772	0.01639
	0.19895	0.13890	0.20067	0.14805	0.25926	0.16085	0.17443	0.19679	0.20856	0.22147
	0.26351	0.15887	0.24655	0.05390	0.30965	0.17535	0.24218	0.17377	0.14348	0.16832
	0.20358	0.23799	0.11370	0.21841	0.26008	0.07512	0.14409	0.19499	0.19201	0.14742
	0.11725	0.20108	0.08912	0.21864	0.20874					

TABLE 5-6 (Continued)

J107	0.25433 0.30830 0.17741 0.28634 0.16667 0.14747	0.22315 0.14291 0.19873 0.13519 0.21866 0.17926	0.27870 0.25336 0.16130 0.34570 0.06630 0.14786 0.10483	0.36837 0.18064 0.36686 0.33735 0.42737 0.27648	0.34336 0.23108 0.23335 0.33735 0.42737 0.30746	0.21231 0.16250 0.15881 0.22421 0.22039	1.00000 0.16042 0.31874 0.24195 0.22579	0.27784 0.27873 0.23400 0.18167 0.23125	0.24037 0.36437 0.35473 0.16195 0.23282	0.28396 0.07629 0.13672 0.24148 0.13768
J108	0.28207 0.42276 0.26681 0.35007 0.22206 0.15689	0.34279 0.23951 0.29821 0.20079 0.32157 0.17722	0.26929 0.27054 0.25560 0.42225 0.23348 0.21716	0.31992 0.25802 0.28728 0.11014 0.44349 0.28132	0.40032 0.36545 0.25657 0.41884 0.39355 0.23489	0.26363 0.27495 0.25432 0.27501 0.14182	0.27784 0.25173 0.32762 0.24471 0.32500	1.00000 0.14620 0.34936 0.12418 0.27689	0.14605 0.24056 0.36361 0.21784 0.29693	0.24479 0.18819 0.22637 0.33301 0.25023
J109	0.25357 0.29407 0.15980 0.22427 0.08800 0.15005	0.17459 0.14462 0.15639 0.04003 0.09323 0.0	0.19894 0.09173 0.17222 0.19625 0.08599 0.0	0.24911 0.14285 0.24806 0.06872 0.11783 0.12347	0.26986 0.17570 0.19831 0.25135 0.21396 0.26572	0.21671 0.07347 0.09477 0.08832 0.09231	0.24037 0.14721 0.20105 0.14591 0.18190	0.14605 0.25028 0.15462 0.12897 0.19272	1.00000 0.31049 0.17544 0.13597 0.19163	0.19502 0.09826 0.13319 0.13506 0.13087
J110	0.20154 0.34715 0.16808 0.23766 0.25913 0.10603	0.21537 0.10876 0.23478 0.04709 0.24541 0.32331	0.26395 0.17541 0.20961 0.28349 0.14203 0.05963	0.30267 0.18712 0.23219 0.05018 0.21089 0.31022	0.35883 0.24057 0.19382 0.39802 0.42511 0.21264	0.27603 0.07868 0.20060 0.16885 0.03832	0.28396 0.23930 0.15502 0.19084 0.20739	0.24479 0.15953 0.22003 0.28835 0.27424	0.19502 0.27441 0.31175 0.18384 0.22393	1.00000 0.08441 0.23563 0.43748 0.13608
J111	0.44109 1.00000 0.30293 0.42603 0.22705 0.26151	0.36948 0.33203 0.31310 0.20111 0.32337 0.13547	0.31830 0.25644 0.26753 0.47531 0.25778 0.11726	0.34721 0.29944 0.34079 0.17264 0.40524 0.31467	0.45612 0.39185 0.27374 0.44115 0.42631 0.30765	0.29502 0.15326 0.28111 0.24768 0.16991	0.30830 0.21980 0.35573 0.38724 0.34050	0.42276 0.38704 0.42995 0.15171 0.32743	0.29407 0.35815 0.37403 0.25987 0.28496	0.34715 0.22610 0.19589 0.33938 0.33624
J112	0.30687 0.33203 0.16608 0.33084 0.13857 0.24092	0.21190 1.00000 0.20443 0.16503 0.19689 0.01806	0.23922 0.16712 0.13270 0.30844 0.10543 0.03083	0.20428 0.18685 0.18413 0.13499 0.27379 0.18573	0.23763 0.23806 0.17685 0.19655 0.25177 0.19613	0.19027 0.07220 0.09405 0.14877 0.19275	0.14291 0.12531 0.19319 0.20481 0.20485	0.23951 0.27621 0.23735 0.09837 0.15949	0.14462 0.23957 0.15875 0.08667 0.15550	0.10876 0.07077 0.11378 0.12883 0.17349
J113	0.25598 0.25644 0.24144 0.27066 0.20395 0.17705	0.22886 0.16712 0.21350 0.12520 0.19295 0.14128	0.21887 1.00000 0.22188 0.36584 0.16608 0.15630	0.27708 0.23361 0.21431 0.12794 0.20729 0.15045	0.28128 0.25438 0.19665 0.27203 0.27686 0.23394	0.24077 0.12733 0.16169 0.15859 0.13608	0.25336 0.13086 0.23829 0.15876 0.20758	0.27054 0.29373 0.25003 0.17976 0.17889	0.09173 0.28003 0.28007 0.15122 0.19742	0.17541 0.10190 0.08777 0.19860 0.24099

TABLE 5-6 (Continued)

J114	0.25899	0.16958	0.19483	0.27711	0.26241	0.12964	0.18064	0.25802	0.14285	0.18712
	0.29944	0.18685	0.23361	1.00000	0.22788	0.07992	0.08776	0.17771	0.18293	0.21394
	0.14379	0.19305	0.18617	0.17193	0.17029	0.16577	0.11032	0.23014	0.19787	0.16615
	0.22843	0.14648	0.28086	0.12639	0.25131	0.11672	0.22922	0.17134	0.24155	0.25380
	0.17281	0.22546	0.14987	0.23806	0.27564	0.22046	0.18024	0.21628	0.17460	0.21402
	0.20080	0.23034	0.11722	0.30724	0.20630					
J115	0.35874	0.28203	0.32117	0.28433	0.30027	0.21712	0.23108	0.36545	0.17570	0.24057
	0.39185	0.23806	0.25438	0.22788	1.00000	0.16033	0.18686	0.27299	0.32088	0.20010
	0.23261	0.23216	0.20813	0.29486	0.24404	0.20993	0.21009	0.36513	0.32673	0.07875
	0.44083	0.20370	0.35140	0.16821	0.33462	0.29106	0.29441	0.17413	0.18212	0.16105
	0.26324	0.31606	0.18755	0.37591	0.34045	0.20229	0.30099	0.21082	0.27751	0.23827
	0.18383	0.23861	0.11608	0.38895	0.34037					
J116	0.13501	0.17924	0.21294	0.13762	0.16277	0.16374	0.16250	0.27495	0.07347	0.07868
	0.15326	0.07220	0.12733	0.07992	0.16033	1.00000	0.09137	0.15176	0.18260	0.0
	0.17948	0.09866	0.09411	0.21735	0.13678	0.07698	0.12106	0.20224	0.23410	0.07683
	0.19817	0.06611	0.16734	0.08052	0.21932	0.06355	0.08741	0.11501	0.09959	0.08683
	0.08260	0.15879	0.09599	0.16033	0.15846	0.05560	0.18165	0.10337	0.15461	0.09722
	0.11712	0.11474	0.10984	0.17262	0.13721					
J117	0.16455	0.19360	0.17885	0.19176	0.27616	0.19719	0.16042	0.25173	0.14721	0.23930
	0.21980	0.12531	0.13086	0.06776	0.18686	0.09137	1.00000	0.17751	0.21416	0.09124
	0.13514	0.13813	0.11486	0.10339	0.14152	0.09807	0.15632	0.17866	0.24670	0.23093
	0.13875	0.11395	0.25244	0.03099	0.30148	0.07023	0.18115	0.15940	0.16099	0.32507
	0.19004	0.22771	0.06333	0.16711	0.24075	0.10858	0.14551	0.10594	0.18375	0.11590
	0.14225	0.18862	0.06820	0.19707	0.14728					
J118	0.31979	0.31720	0.37334	0.29315	0.26098	0.21194	0.27873	0.14620	0.25028	0.15953
	0.38704	0.27621	0.29373	0.17771	0.27299	0.15176	0.17751	1.00000	0.30917	0.14337
	0.22924	0.26948	0.19321	0.18322	0.24996	0.12067	0.29364	0.31691	0.37578	0.08011
	0.37381	0.17603	0.21984	0.24208	0.31477	0.19965	0.13113	0.16916	0.22172	0.07863
	0.18901	0.17150	0.14844	0.25302	0.30880	0.25069	0.30975	0.19457	0.23405	0.20069
	0.17846	0.0	0.04572	0.22707	0.33100					
J119	0.25637	0.22714	0.21838	0.37348	0.32569	0.32772	0.36437	0.24056	0.31049	0.27441
	0.35815	0.23957	0.28005	0.18293	0.32088	0.18260	0.21416	0.30917	1.00000	0.16613
	0.24679	0.20696	0.23759	0.34858	0.26573	0.11877	0.32507	0.22300	0.34414	0.10955
	0.38984	0.17723	0.31096	0.14381	0.33959	0.27045	0.26995	0.15896	0.15868	0.17015
	0.22872	0.21688	0.11599	0.21882	0.38464	0.14742	0.23838	0.28662	0.22880	0.24063
	0.21557	0.14871	0.08792	0.28325	0.29952					
J120	0.17382	0.15051	0.10776	0.11671	0.14302	0.01639	0.07921	0.18819	0.09826	0.08441
	0.22610	0.07077	0.10190	0.21394	0.20010	0.0	0.09124	0.14337	0.16613	1.00000
	0.08931	0.16613	0.14348	0.14658	0.04695	0.12609	0.13668	0.16621	0.15922	0.11207
	0.21911	0.12013	0.15776	0.09463	0.19574	0.10586	0.14327	0.09745	0.09856	0.12308
	0.08885	0.18218	0.16400	0.25024	0.11525	0.13601	0.12167	0.06122	0.13790	0.13285
	0.12682	0.08253	0.05798	0.14630	0.14222					

TABLE 5-6 (Continued)

J121	0.26701	0.22386	0.22921	0.22498	0.26217	0.19895	0.17741	0.26281	0.15980	0.16808
	0.30293	0.16608	0.24144	0.14379	0.23261	0.17948	0.13514	0.22924	0.24679	0.08931
	1.00000	0.14822	0.18051	0.23476	0.19684	0.15852	0.27026	0.26302	0.17460	0.17460
	0.24744	0.13178	0.24492	0.15584	0.30938	0.16325	0.21457	0.20861	0.16478	0.18777
	0.18000	0.24304	0.11680	0.20554	0.27084	0.07858	0.23123	0.22511	0.20477	0.17525
	0.09386	0.11705	0.03879	0.17564	0.25124					
J122	0.27938	0.17091	0.23554	0.21369	0.21015	0.13890	0.19873	0.29821	0.15639	0.23478
	0.31310	0.20443	0.21350	0.19305	0.23216	0.09866	0.13813	0.26948	0.20696	0.16613
	0.14822	1.00000	0.23010	0.17548	0.19285	0.09777	0.16559	0.25323	0.22268	0.15501
	0.28317	0.16255	0.20483	0.15391	0.22247	0.12006	0.16127	0.08797	0.14410	0.17181
	0.19407	0.17922	0.11943	0.19665	0.22290	0.17198	0.15208	0.21624	0.18696	0.19307
	0.11912	0.18774	0.08175	0.20634	0.22787					
J123	0.30775	0.18226	0.25229	0.26077	0.21113	0.20067	0.16130	0.25560	0.17222	0.20961
	0.26753	0.13270	0.22188	0.18617	0.20813	0.09411	0.11486	0.19321	0.23759	0.14348
	0.18051	0.23010	1.00000	0.18694	0.17000	0.13629	0.19957	0.25189	0.22196	0.10383
	0.32267	0.08987	0.24730	0.10662	0.27183	0.18694	0.22461	0.11801	0.18303	0.19223
	0.13617	0.18347	0.15809	0.23374	0.26506	0.07150	0.21101	0.19376	0.20994	0.22978
	0.12436	0.12239	0.08128	0.25847	0.21100					
J124	0.22350	0.26193	0.25574	0.29045	0.32009	0.14805	0.36686	0.28728	0.24806	0.23219
	0.34079	0.18413	0.21431	0.17193	0.29486	0.21735	0.10339	0.18322	0.34858	0.14658
	0.23476	0.17548	0.18694	1.00000	0.21060	0.09607	0.30612	0.27290	0.32963	0.10086
	0.25929	0.09877	0.24908	0.14339	0.33303	0.13512	0.25599	0.18122	0.16942	0.19556
	0.06978	0.23359	0.14090	0.21475	0.35273	0.17852	0.21528	0.22483	0.22865	0.16921
	0.14340	0.17997	0.09809	0.31173	0.29452					
J125	0.21587	0.18780	0.26041	0.29474	0.21887	0.25926	0.23335	0.25657	0.19831	0.19382
	0.27374	0.17685	0.19665	0.17029	0.24404	0.13678	0.14152	0.24996	0.26573	0.04695
	0.19684	0.19285	0.17000	0.21060	1.00000	0.14414	0.18841	0.23249	0.21926	0.11469
	0.28249	0.08750	0.28976	0.10011	0.33479	0.08492	0.18027	0.10161	0.11273	0.19822
	0.09911	0.20644	0.15297	0.21972	0.30816	0.06034	0.20784	0.19402	0.11619	0.08219
	0.09979	0.07949	0.03311	0.23501	0.16628					
J126	0.19550	0.14647	0.13096	0.21978	0.22925	0.16085	0.15881	0.25432	0.09477	0.20060
	0.28111	0.09405	0.16169	0.16577	0.20993	0.07698	0.09807	0.12067	0.11877	0.12609
	0.15852	0.09777	0.13629	0.09607	0.14414	1.00000	0.11030	0.23396	0.17336	0.07940
	0.18567	0.15703	0.23999	0.12204	0.22956	0.08941	0.18499	0.05259	0.14649	0.25681
	0.16946	0.20932	0.10244	0.17712	0.25528	0.08984	0.17516	0.14479	0.18517	0.15224
	0.10736	0.16118	0.0	0.23388	0.12261					
J127	0.27860	0.17569	0.27447	0.26971	0.27605	0.17443	0.31874	0.32762	0.20105	0.15502
	0.35573	0.19319	0.23829	0.11032	0.21009	0.12106	0.15632	0.29364	0.32507	0.13668
	0.16705	0.16559	0.19957	0.30612	0.18841	0.11030	1.00000	0.29571	0.24269	0.16406
	0.39992	0.12196	0.30306	0.06765	0.31400	0.18481	0.26615	0.09441	0.16295	0.13480
	0.12685	0.19284	0.15311	0.22816	0.28276	0.13533	0.23871	0.24867	0.20771	0.18030
	0.16340	0.0	0.07434	0.25315	0.29270					

TABLE 5-6 (Continued)

J128	0.33976	0.30612	0.34302	0.38054	0.33256	0.19679	0.23400	0.34936	0.15462	0.22003
	0.42995	0.23735	0.27671	0.23014	0.36513	0.20224	0.17866	0.31691	0.22300	0.16621
	0.27026	0.25323	0.25189	0.27290	0.23249	0.23396	0.29571	1.00000	0.26566	0.20944
	0.34207	0.18934	0.39398	0.22018	0.29566	0.19762	0.24486	0.15540	0.19334	0.27771
	0.20064	0.29057	0.22738	0.33406	0.33929	0.16378	0.23198	0.26730	0.30003	0.20921
	0.19437	0.10892	0.17452	0.31683	0.25591					
J129	0.34834	0.22842	0.26709	0.34684	0.39452	0.20856	0.35473	0.36361	0.17544	0.31175
	0.37403	0.15875	0.25009	0.19787	0.32673	0.23470	0.24670	0.37578	0.34414	0.15922
	0.26302	0.22268	0.22196	0.32963	0.21926	0.17336	0.24269	0.26566	1.00000	0.09298
	0.38685	0.25385	0.37280	0.18039	0.47290	0.16772	0.37928	0.24701	0.25089	0.28912
	0.26979	0.30165	0.14219	0.27176	0.47198	0.20604	0.27218	0.21873	0.23784	0.25906
	0.21095	0.27064	0.12969	0.35584	0.40009					
J130	0.16264	0.15038	0.12394	0.18866	0.25486	0.22147	0.13672	0.22637	0.13319	0.23563
	0.19589	0.11378	0.08777	0.16615	0.07875	0.07683	0.23093	0.08011	0.10955	0.11207
	0.17480	0.15501	0.10383	0.10086	0.11469	0.07940	0.16406	0.20944	0.09298	1.00000
	0.20916	0.05631	0.29100	0.10049	0.23186	0.09031	0.11970	0.13281	0.07600	0.33837
	0.24257	0.21790	0.14122	0.17200	0.22006	0.03235	0.06391	0.16538	0.15585	0.09405
	0.12188	0.19414	0.06860	0.16921	0.18932					
J131	0.39523	0.28004	0.29851	0.35477	0.35614	0.26351	0.28634	0.35007	0.22427	0.23766
	0.42603	0.33084	0.27066	0.22843	0.44083	0.19817	0.13875	0.37381	0.38984	0.21911
	0.24744	0.28317	0.32267	0.25929	0.28249	0.18567	0.39992	0.34207	0.38685	0.20916
	1.00000	0.22419	0.30519	0.17637	0.32348	0.24167	0.40561	0.16901	0.24339	0.15636
	0.27082	0.27667	0.22135	0.37320	0.34477	0.19225	0.32473	0.29826	0.29311	0.22007
	0.24071	0.12817	0.06342	0.38645	0.33690					
J132	0.15432	0.15986	0.13316	0.15407	0.13377	0.15887	0.13519	0.20079	0.04003	0.04709
	0.20111	0.16503	0.12520	0.14648	0.20370	0.06611	0.11395	0.17603	0.17723	0.12013
	0.13178	0.16255	0.08987	0.09877	0.08750	0.15703	0.12196	0.18934	0.25385	0.05631
	0.22419	1.00000	0.19126	0.02586	0.13962	0.10351	0.21718	0.12262	0.14845	0.15659
	0.11299	0.16586	0.09358	0.15594	0.20566	0.15917	0.17611	0.06750	0.13792	0.13352
	0.16686	0.11354	0.04264	0.21810	0.15306					
J133	0.29977	0.32263	0.22007	0.43199	0.41424	0.24655	0.34570	0.42225	0.19625	0.28349
	0.47531	0.30844	0.36584	0.28086	0.35140	0.16734	0.25244	0.21984	0.31096	0.15776
	0.24492	0.20483	0.24730	0.24908	0.28976	0.23999	0.30306	0.39398	0.37280	0.29100
	0.30519	0.19126	1.00000	0.16653	0.50279	0.25152	0.33835	0.18754	0.20965	0.45558
	0.23681	0.31902	0.17279	0.27826	0.45700	0.10823	0.21136	0.29921	0.26615	0.19620
	0.22365	0.18748	0.07861	0.36121	0.20363					
J134	0.23934	0.15234	0.18540	0.12502	0.10697	0.05390	0.06630	0.11014	0.06872	0.05018
	0.17264	0.13499	0.12794	0.12639	0.16821	0.08052	0.03099	0.24208	0.14381	0.09463
	0.15584	0.15391	0.10662	0.14339	0.10011	0.12204	0.06765	0.22018	0.18039	0.10049
	0.17637	0.02586	0.16653	1.00000	0.20581	0.11377	0.09519	0.15572	0.09725	0.05475
	0.12820	0.10349	0.12740	0.18434	0.16620	0.14809	0.17437	0.20721	0.13311	0.15843
	0.19422	0.12645	0.05182	0.14986	0.22182					

TABLE 5-6 (Continued)

J135	0.32843	0.29703	0.30940	0.37596	0.40355	0.30965	0.33735	0.41884	0.25135	0.39802
	0.44115	0.19655	0.27203	0.25131	0.33462	0.21932	0.30148	0.31477	0.33959	0.19574
	0.30938	0.22247	0.27183	0.33303	0.33479	0.22956	0.31400	0.29566	0.47290	0.23186
	0.32348	0.13962	0.50279	0.20581	1.00000	0.17838	0.29010	0.25644	0.22116	0.37688
	0.23804	0.33200	0.20709	0.27905	0.48112	0.12541	0.27848	0.27024	0.27508	0.25137
	0.21813	0.24021	0.15914	0.38449	0.36803					
J136	0.18602	0.13125	0.17912	0.23601	0.20881	0.17535	0.22421	0.27501	0.08832	0.16685
	0.24768	0.14877	0.15859	0.11672	0.29106	0.06355	0.07023	0.19965	0.27045	0.10586
	0.16325	0.12006	0.18594	0.13512	0.08492	0.18481	0.16772	0.16772	0.09031	0.10692
	0.24167	0.10351	0.25152	0.11377	0.17838	1.00000	0.09972	0.07236	0.02829	0.10652
	0.17301	0.10385	0.03479	0.17977	0.22558	0.11429	0.12541	0.12272	0.16104	0.13560
	0.17446	0.15578	0.0	0.26516	0.19782					
J137	0.30441	0.22780	0.19937	0.30466	0.32481	0.24218	0.24195	0.24471	0.14591	0.19084
	0.38724	0.20481	0.15876	0.22922	0.29441	0.08741	0.18115	0.13113	0.26995	0.14327
	0.21457	0.16127	0.22461	0.25599	0.18027	0.18499	0.26615	0.24486	0.37928	0.11970
	0.40561	0.21718	0.33835	0.09519	0.29010	0.09972	1.00000	0.22846	0.22926	0.25172
	0.20554	0.33172	0.16924	0.28529	0.39447	0.17574	0.22648	0.22475	0.20772	0.16864
	0.17530	0.15884	0.16520	0.29146	0.32471					
J139	0.16192	0.19857	0.20954	0.19580	0.22164	0.17377	0.18167	0.12418	0.12897	0.28835
	0.15171	0.09837	0.17976	0.17134	0.17413	0.11501	0.15940	0.16916	0.15896	0.09745
	0.20861	0.08797	0.11801	0.18122	0.10161	0.05259	0.09441	0.15540	0.24701	0.13281
	0.16901	0.12262	0.18754	0.15572	0.25644	0.07236	0.22846	1.00000	0.12863	0.22196
	0.11505	0.17487	0.14794	0.16122	0.19638	0.12254	0.12839	0.19612	0.16847	0.20690
	0.14566	0.22065	0.14440	0.19647	0.27873					
J140	0.22883	0.13798	0.16755	0.15284	0.28243	0.14348	0.18195	0.21784	0.13597	0.18384
	0.25987	0.08667	0.15122	0.24155	0.18212	0.09959	0.16099	0.22172	0.15868	0.09856
	0.16478	0.14410	0.18303	0.16942	0.11273	0.14649	0.16295	0.19334	0.25089	0.07600
	0.24339	0.14845	0.20965	0.09725	0.22116	0.02829	0.22926	0.12863	1.00000	0.17290
	0.13226	0.20887	0.63435	0.24907	0.20858	0.12060	0.19040	0.12477	0.21136	0.12041
	0.07825	0.11136	0.07829	0.21644	0.18541					
J141	0.24048	0.15917	0.13751	0.33623	0.32547	0.16832	0.24148	0.33301	0.13506	0.43748
	0.33938	0.12883	0.19860	0.25380	0.16105	0.08683	0.32507	0.07863	0.17015	0.12308
	0.18777	0.17181	0.19223	0.19556	0.19822	0.25681	0.13480	0.27771	0.28912	0.33837
	0.15636	0.15659	0.45558	0.05475	0.37688	0.10692	0.25172	0.22196	0.17290	1.00000
	0.34401	0.31472	0.18929	0.22335	0.34323	0.11664	0.13520	0.16756	0.23385	0.14267
	0.10738	0.33450	0.23139	0.27829	0.16112					
J142	0.20900	0.13424	0.17154	0.29254	0.24058	0.20358	0.16667	0.22206	0.08800	0.25913
	0.22705	0.13857	0.20395	0.17281	0.26324	0.08260	0.19004	0.18901	0.22872	0.08885
	0.18000	0.19407	0.13617	0.06978	0.09911	0.16946	0.12685	0.20064	0.26979	0.24257
	0.27082	0.11299	0.23681	0.12820	0.23804	0.17301	0.20554	0.11505	0.13226	0.34401
	1.00000	0.26053	0.10648	0.22793	0.27777	0.20325	0.19319	0.21504	0.17817	0.15088
	0.15617	0.21365	0.06436	0.24658	0.21961					

TABLE 5-6 (Continued)

J143	0.26363	0.25861	0.22286	0.25167	0.32786	0.23799	0.21866	0.32157	0.09323	0.24541
	0.32337	0.19689	0.19295	0.22546	0.31606	0.15879	0.22771	0.17150	0.21688	0.18218
	0.24304	0.17922	0.18347	0.23359	0.20644	0.20932	0.19284	0.29057	0.30165	0.21790
	0.27667	0.16586	0.31902	0.10349	0.33200	0.10385	0.33172	0.17487	0.20887	0.31472
	0.26053	1.00000	0.25049	0.32613	0.34081	0.17781	0.24625	0.19550	0.25801	0.20318
	0.19823	0.18479	0.15601	0.31193	0.30804					
J144	0.24065	0.14061	0.15881	0.12727	0.22472	0.11370	0.12525	0.23348	0.08599	0.14203
	0.25778	0.10543	0.16608	0.14987	0.18755	0.09599	0.06333	0.14844	0.11599	0.16400
	0.11680	0.11943	0.15809	0.14090	0.15297	0.10244	0.15311	0.22738	0.14219	0.14122
	0.22135	0.09358	0.17279	0.12740	0.20709	0.03479	0.16924	0.14794	0.63435	0.18929
	0.10648	0.25049	1.00000	0.24204	0.18547	0.11842	0.17357	0.17621	0.19224	0.14804
	0.09083	0.14937	0.08145	0.17369	0.13285					
J145	0.33405	0.23918	0.21545	0.23514	0.29897	0.21841	0.14786	0.44349	0.11783	0.21089
	0.40524	0.27379	0.20729	0.23806	0.37591	0.16033	0.16711	0.25302	0.21882	0.25024
	0.20554	0.19665	0.23374	0.21475	0.21972	0.17712	0.22816	0.33406	0.27176	0.17200
	0.37320	0.15594	0.27826	0.18434	0.27905	0.17977	0.28929	0.16122	0.24907	0.22335
	0.22193	0.32613	0.24204	1.00000	0.28123	0.10293	0.28257	0.30198	0.28297	0.26311
	0.25394	0.20950	0.0	0.26637	0.26383					
J146	0.36443	0.26860	0.30422	0.41563	0.43677	0.26008	0.42737	0.39355	0.21396	0.42511
	0.42631	0.25177	0.27686	0.27564	0.34045	0.15846	0.24075	0.30880	0.38464	0.11525
	0.27084	0.22290	0.26506	0.32273	0.30816	0.25528	0.28276	0.33929	0.47198	0.22006
	0.34477	0.20566	0.45700	0.16620	0.48112	0.22556	0.39447	0.19638	0.20858	0.34323
	0.27777	0.34481	0.18547	0.28123	1.00000	0.20066	0.26529	0.29355	0.30091	0.27123
	0.18813	0.27056	0.16733	0.37390	0.30743					
J147	0.19770	0.11470	0.09800	0.18405	0.20639	0.07512	0.22039	0.14182	0.09231	0.03832
	0.16991	0.19275	0.13608	0.22046	0.20229	0.05560	0.10858	0.25069	0.14742	0.13601
	0.07858	0.17198	0.07150	0.17852	0.06034	0.08984	0.13533	0.16378	0.20604	0.03235
	0.19225	0.15917	0.10823	0.14809	0.12541	0.11429	0.17574	0.12254	0.12060	0.11664
	0.20325	0.17781	0.11842	0.10293	0.20066	1.00000	0.12864	0.07918	0.10626	0.13486
	0.19435	0.15060	0.14899	0.32530	0.28648					
J148	0.30278	0.19364	0.21892	0.19656	0.24142	0.14409	0.22579	0.32500	0.18190	0.20739
	0.34050	0.20485	0.20758	0.18024	0.30099	0.18165	0.14551	0.30975	0.23838	0.12167
	0.23123	0.15208	0.21101	0.21528	0.20784	0.17516	0.23871	0.23198	0.27218	0.06391
	0.32473	0.17611	0.21136	0.17437	0.27848	0.12541	0.22648	0.12839	0.19040	0.13520
	0.19319	0.24625	0.17357	0.28257	0.26529	0.12864	1.00000	0.21042	0.20456	0.24055
	0.18185	0.14180	0.13102	0.26804	0.26642					
J149	0.21787	0.20211	0.22128	0.30094	0.24620	0.19499	0.23125	0.27689	0.19272	0.27424
	0.32743	0.15949	0.17889	0.21628	0.21082	0.10337	0.10594	0.19457	0.28662	0.06122
	0.22511	0.21624	0.19376	0.22483	0.19402	0.14479	0.24867	0.26730	0.21873	0.16538
	0.29826	0.06750	0.29921	0.20721	0.27024	0.12272	0.22475	0.19612	0.12477	0.16756
	0.21504	0.19530	0.17821	0.30198	0.29355	0.07918	0.21042	1.00000	0.21089	0.09136
	0.15225	0.21224	0.15445	0.22000	0.25645					

TABLE 5-6 (Continued)

J150	0.27089	0.27458	0.16487	0.22374	0.31215	0.19201	0.23282	0.29693	0.19163	0.22393
	0.28496	0.15550	0.19742	0.17460	0.27751	0.15461	0.18375	0.23405	0.22880	0.13790
	0.20477	0.18696	0.20994	0.22865	0.11619	0.18517	0.20771	0.30003	0.23784	0.15585
	0.29311	0.13792	0.26615	0.13311	0.27508	0.16104	0.20772	0.16847	0.21136	0.23385
	0.17817	0.25801	0.19224	0.28297	0.30091	0.10626	0.20456	0.21089	1.00000	0.21504
	0.16789	0.16944	0.15504	0.27101	0.26161					
J151	0.27333	0.20833	0.21465	0.20047	0.21091	0.14742	0.13768	0.25023	0.13087	0.13608
	0.33624	0.17349	0.24099	0.21402	0.23827	0.09722	0.11590	0.20069	0.24063	0.13285
	0.17525	0.19307	0.22978	0.16921	0.08219	0.15224	0.18030	0.20921	0.25906	0.09405
	0.22007	0.13352	0.19620	0.15843	0.25137	0.13560	0.16864	0.20690	0.12041	0.14267
	0.15088	0.20318	0.14804	0.28311	0.27123	0.13486	0.24055	0.09136	0.21504	1.00000
	0.20766	0.17497	0.13576	0.31482	0.33449					
J152	0.22068	0.17808	0.16324	0.21615	0.15990	0.11725	0.14747	0.15689	0.15005	0.10603
	0.26151	0.24092	0.17705	0.20080	0.18383	0.11712	0.14225	0.17846	0.21557	0.12682
	0.09386	0.11912	0.12436	0.14340	0.09979	0.10736	0.16340	0.19437	0.21095	0.12188
	0.24071	0.16686	0.22365	0.19422	0.21813	0.17446	0.17530	0.14566	0.07825	0.10738
	0.15617	0.19823	0.09083	0.25394	0.18813	0.19435	0.18185	0.15225	0.16789	0.20766
	1.00000	0.23207	0.12654	0.22525	0.24550					
J153	0.15374	0.05059	0.07617	0.19910	0.24051	0.20108	0.17926	0.17722	0.0	0.32331
	0.13547	0.01806	0.14128	0.23034	0.23861	0.11474	0.18862	0.0	0.14871	0.08253
	0.11705	0.18774	0.12239	0.17997	0.07949	0.16118	0.0	0.10892	0.27064	0.19414
	0.12817	0.11354	0.18748	0.12685	0.24021	0.15578	0.15884	0.22065	0.11136	0.33450
	0.21365	0.18479	0.14937	0.20950	0.27056	0.15060	0.14180	0.21224	0.16944	0.17497
	0.23207	1.00000	0.17011	0.31216	0.23174					
J154	0.08216	0.09907	0.13251	0.12740	0.22750	0.08912	0.10483	0.21716	0.0	0.05963
	0.11726	0.03083	0.15630	0.11722	0.11608	0.10984	0.06820	0.04572	0.08792	0.05798
	0.03879	0.08175	0.08128	0.09809	0.03311	0.0	0.07434	0.17452	0.12969	0.06860
	0.06342	0.04264	0.07861	0.05182	0.15914	0.0	0.16520	0.14440	0.07829	0.23139
	0.06436	0.15601	0.08145	0.0	0.16733	0.14899	0.13102	0.15445	0.15504	0.13576
	0.12654	0.17011	1.00000	0.20438	0.16377					
J155	0.44011	0.17276	0.28797	0.31191	0.39625	0.21864	0.27648	0.28132	0.12347	0.31022
	0.31467	0.18573	0.15045	0.30724	0.38895	0.17262	0.19707	0.22707	0.28325	0.14630
	0.17564	0.20634	0.25847	0.31173	0.23501	0.23388	0.25315	0.31683	0.35584	0.16921
	0.38645	0.21810	0.36121	0.14986	0.38449	0.26516	0.29146	0.19647	0.21644	0.27829
	0.24658	0.31193	0.17369	0.26637	0.37390	0.32530	0.26604	0.22000	0.27101	0.31482
	0.22525	0.31216	0.20438	1.00000	0.43811					
J156	0.35716	0.20069	0.26846	0.23505	0.36754	0.20874	0.30746	0.23489	0.26572	0.21264
	0.30765	0.19613	0.23394	0.20630	0.34037	0.13721	0.14728	0.33100	0.29952	0.14222
	0.25124	0.22787	0.21100	0.29452	0.16628	0.12261	0.29270	0.25591	0.40009	0.18932
	0.33690	0.15306	0.20363	0.22182	0.36803	0.19782	0.32471	0.27873	0.18541	0.16112
	0.21961	0.30804	0.13285	0.26383	0.30743	0.28648	0.26642	0.25645	0.26161	0.33449
	0.24550	0.23174	0.16377	0.43811	1.00000					

tetrachoric correlation matrices of the fifty-five items of Test J1 in these two cases, respectively. It should be noted that in both tables there are many small positive correlation coefficients observed for item J154. In applying factor analysis for these tetrachoric correlation matrices, the principal factor solution was adopted, with 55 and 42 common factors in communality estimation, respectively, in these two separate cases. These are the maximum numbers of common factors useable without making any estimated communalities exceed unity. Tables 5-7 and 5-8 present the resulting eigenvalues in the J1/1075 and J1/2259 Cases, respectively. We can see from each result that there is only one dominating common factor, since all the other eigenvalues are negligibly small, i.e., the unidimensionality of the latent space is confirmed in each case. The factor loadings of these common factors are given in Tables 5-9 and 5-10. In these tables, all those values which exceed 0.300 are marked by \blacktriangledown , while those which are negative and whose absolute values exceed the same number are marked by \blacktriangledown , except in the first column where all the values except for those of items J120, J134 and J154 in the J1/1075 Case and of items J116, J120, J134 and J154 in the J1/2259 Case do exceed 0.3000. Observation of these two tables reveals that there exist a few minor clusters such as those of items J141 and J153, and of items J140 and J144 in both cases, but overall the results support the unidimensionality of the latent space.

The estimates of the item discrimination and item difficulty parameters were obtained by (4.1) and (4.2), and the results are

TABLE 5-7

Eigenvalues of the Tetrachoric Correlation Matrix in the J1/1075 Case Whose Diagonal Elements Were Replaced by the Estimated Communalities Based upon the Fifty-Five Common Factors, Obtained by the Principal Factor Solution in SPSS Version H, release 9.1.

FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
1	14.07600	25.6	25.6
2	2.00527	3.6	29.2
3	1.85225	3.4	32.6
4	1.68286	3.1	35.7
5	1.46180	2.7	38.3
6	1.41706	2.6	40.9
7	1.34809	2.5	43.4
8	1.29391	2.4	45.7
9	1.26612	2.3	48.0
10	1.21675	2.2	50.2
11	1.19252	2.2	52.4
12	1.13169	2.1	54.4
13	1.08745	2.0	56.4
14	1.06089	1.9	58.4
15	1.00829	1.8	60.2
16	0.98982	1.8	62.0
17	0.96252	1.8	63.7
18	0.95201	1.7	65.5
19	0.89599	1.6	67.1
20	0.89268	1.6	68.7
21	0.87130	1.6	70.3
22	0.83960	1.5	71.8
23	0.82416	1.5	73.3
24	0.79013	1.4	74.8
25	0.76911	1.4	76.2
26	0.74202	1.3	77.5
27	0.72782	1.3	78.8
28	0.70499	1.3	80.1
29	0.68304	1.2	81.4
30	0.66735	1.2	82.6
31	0.66201	1.2	83.8
32	0.62523	1.1	84.9
33	0.61147	1.1	86.0
34	0.60033	1.1	87.1
35	0.56625	1.0	88.1
36	0.54957	1.0	89.1
37	0.52276	1.0	90.1
38	0.50601	0.9	91.0
39	0.48853	0.9	91.9
40	0.45904	0.8	92.7
41	0.43907	0.8	93.5
42	0.42453	0.8	94.3
43	0.39065	0.7	95.0
44	0.35969	0.7	95.7
45	0.33716	0.6	96.3
46	0.32326	0.6	96.9
47	0.30133	0.5	97.4
48	0.27201	0.5	97.9
49	0.25921	0.5	98.4
50	0.23477	0.4	98.8
51	0.19081	0.3	99.2
52	0.15292	0.3	99.4
53	0.14473	0.3	99.7
54	0.09919	0.2	99.9
55	0.06580	0.1	100.0

TABLE 5-8

Eigenvalues of the Tetrachoric Correlation Matrix in the J1/2259 Case Whose Diagonal Elements Were Replaced by the Estimated Communalities Based upon the Forty-Two Common Factors, Obtained by the Principal Factor Solution in BMDP4M Revised in 1982.

FACTOR	VARIANCE EXPLAINED	CUMULATIVE PROPORTION OF VARIANCE	
		IN DATA SPACE	IN FACTOR SPACE
1	12.5805	0.3722	0.3748
2	1.6690	0.4216	0.4245
3	1.3843	0.4625	0.4658
4	1.2342	0.4990	0.5025
5	1.0798	0.5310	0.5347
6	0.8874	0.5572	0.5612
7	0.8429	0.5822	0.5863
8	0.8042	0.6059	0.6102
9	0.7240	0.6274	0.6318
10	0.7035	0.6482	0.6528
11	0.6818	0.6683	0.6731
12	0.6767	0.6884	0.6932
13	0.6238	0.7068	0.7118
14	0.6085	0.7248	0.7299
15	0.5866	0.7422	0.7474
16	0.5413	0.7582	0.7635
17	0.5106	0.7733	0.7788
18	0.4790	0.7875	0.7930
19	0.4694	0.8013	0.8070
20	0.4529	0.8147	0.8205
21	0.4305	0.8275	0.8333
22	0.4174	0.8398	0.8458
23	0.3975	0.8516	0.8576
24	0.3724	0.8626	0.8687
25	0.3646	0.8734	0.8796
26	0.3507	0.8838	0.8900
27	0.3468	0.8940	0.9003
28	0.3305	0.9038	0.9102
29	0.3176	0.9132	0.9197
30	0.3063	0.9223	0.9288
31	0.2882	0.9308	0.9374
32	0.2757	0.9389	0.9456
33	0.2565	0.9465	0.9532
34	0.2354	0.9535	0.9602
35	0.2182	0.9599	0.9667
36	0.2139	0.9663	0.9731
37	0.1903	0.9719	0.9788
38	0.1717	0.9770	0.9839
39	0.1688	0.9820	0.9889
40	0.1459	0.9863	0.9933
41	0.1206	0.9899	0.9969
42	0.1055	0.9930	1.0000
43	0.0663	0.9949	
44	0.0533	0.9965	
45	0.0450	0.9979	
46	0.0350	0.9989	
47	0.0237	0.9996	
48	0.0091	0.9999	
49	0.0046	1.0000	
50	-0.0055		
51	-0.0277		
52	-0.0399		
53	-0.0508		
54	-0.0791		
55	-0.0889		

TABLE 5-9

Factor Loading Matrix for the Fifty-Five Items of Test J1 in the J1/1075 Case.

ITEM	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7
J101	0.61043	0.19598	-0.05464	0.07542	0.07286	-0.18941	-0.14135
J102	0.47598	-0.10294	-0.12100	-0.08564	-0.00427	-0.03974	0.10686
J103	0.54035	0.04782	-0.25590	0.02518	0.29484	0.02543	-0.25564
J104	0.57770	-0.11864	0.00231	0.12198	0.07184	-0.03308	0.00607
J105	0.61634	-0.12708	0.11562	-0.04205	-0.03089	0.02378	0.14063
J106	0.44726	-0.15486	-0.07819	0.05233	0.17241	0.00990	0.30015
J107	0.49329	-0.12425	-0.09758	0.01361	0.09995	0.12483	-0.08452
J108	0.63700	-0.34440	-0.16968	-0.09753	-0.45234	0.05166	-0.05187
J109	0.31339	0.07604	-0.12758	-0.11168	0.37257	-0.10823	0.18090
J110	0.53911	-0.19497	0.22553	-0.17537	0.28185	0.04353	-0.06265
J111	0.70100	-0.09472	-0.05455	-0.07089	-0.06857	-0.25146	-0.08487
J112	0.43670	-0.01963	-0.24108	0.17325	-0.06594	-0.16625	0.06981
J113	0.48428	-0.08023	-0.07331	0.08558	-0.03805	0.02050	0.19791
J114	0.53419	0.14031	0.12352	0.08886	-0.08975	-0.21592	0.00148
J115	0.63185	0.07652	-0.12490	-0.01808	-0.02749	0.05582	0.05837
J116	0.35899	-0.08805	-0.10085	-0.05841	-0.08215	0.22747	0.07647
J117	0.33359	-0.15038	0.13042	0.08361	0.14209	0.13210	0.10490
J118	0.48805	0.19061	-0.15250	-0.01070	0.27958	0.15336	-0.07751
J119	0.52329	-0.06907	-0.21062	0.06751	0.06373	0.07083	0.29423
J120	0.28878	0.13649	0.06027	0.13521	-0.06289	-0.11481	0.10335
J121	0.44657	-0.03185	-0.01931	-0.08235	0.01485	0.29948	0.06723
J122	0.47122	0.01455	-0.01102	-0.00421	0.05332	-0.12274	-0.07499
J123	0.46670	0.04409	-0.07771	-0.06309	0.06972	-0.05100	-0.17089
J124	0.49890	-0.05324	-0.23578	-0.01375	-0.04186	0.15332	-0.02585
J125	0.46241	-0.19754	-0.26570	-0.05983	0.16120	0.05038	-0.03056
J126	0.42898	-0.02245	0.07570	0.02962	0.07486	-0.15596	-0.09084
J127	0.47687	-0.09154	-0.32314	0.00752	-0.04546	0.03237	-0.14351
J128	0.61289	-0.05743	-0.05558	0.00133	-0.04110	-0.06901	-0.23566
J129	0.62127	-0.03373	0.20749	-0.01614	0.01439	0.30965	0.03696
J130	0.33121	-0.24558	0.27901	0.07706	0.11497	-0.22906	0.03468
J131	0.65912	0.08031	-0.16017	-0.06083	-0.04098	0.00190	0.13589
J132	0.39622	0.11709	0.02072	0.09270	-0.13175	-0.03400	0.07169
J133	0.59063	-0.39896	0.15478	-0.01710	-0.23000	-0.09010	-0.08355
J134	0.29280	0.17472	0.10620	0.07367	0.02350	-0.02260	-0.17259
J135	0.64151	-0.19051	0.12960	-0.02264	0.06544	0.19200	-0.07295
J136	0.34499	-0.04909	-0.12861	0.19779	-0.04179	-0.09400	0.06426
J137	0.56344	0.07955	0.01312	-0.05585	-0.05771	0.11900	0.04678
J139	0.38553	0.13285	0.13835	-0.00844	0.01118	0.24990	0.09375
J140	0.38741	0.30171	0.12788	-0.62076	-0.01057	-0.00312	0.04837
J141	0.49966	-0.33105	0.43054	0.03567	0.06502	-0.06275	-0.09764
J142	0.44664	0.04192	0.18276	0.12073	0.11081	-0.15720	0.23457
J143	0.57445	0.07038	0.09103	-0.04597	-0.04398	0.00343	0.01080
J144	0.36260	0.24799	0.12820	-0.54492	-0.04326	-0.07702	0.00933
J145	0.61314	0.03202	-0.06676	-0.13497	-0.23942	-0.10460	0.17558
J146	0.65428	-0.14909	0.05045	0.07158	0.11651	0.04997	-0.12365
J147	0.40778	0.31189	0.07136	0.25840	-0.04069	0.07560	0.07242
J148	0.45427	0.21737	-0.11561	-0.03423	-0.01966	0.06490	-0.13935
J149	0.45706	0.01330	-0.00825	-0.17993	-0.01596	-0.09085	-0.02823
J150	0.45803	0.01970	-0.03507	-0.09321	-0.04019	-0.04152	0.00427
J151	0.43711	0.21778	-0.03726	0.20683	-0.11853	-0.22810	0.01314
J152	0.32579	0.26849	-0.02789	0.20620	-0.11235	0.07830	0.06023
J153	0.41996	0.07903	0.41016	0.09334	-0.04081	0.07338	0.08552
J154	0.21850	0.10422	0.11416	0.18322	-0.24558	0.32040	-0.16296
J155	0.65222	0.22260	0.13611	0.16775	0.01086	-0.01122	-0.20694
J156	0.57965	0.32560	0.11026	0.13656	0.01438	0.09790	0.02313

TABLE 5-9 (Continued)

ITEM	FACTOR 8	FACTOR 9	FACTOR 10	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14
J101	0.00763	-0.00051	-0.03522	-0.08039	0.01240	-0.00642	0.04204
J102	-0.15886	0.25598	0.17169	-0.03037	-0.04909	-0.13255	0.04312
J103	-0.03843	0.08286	0.02414	-0.11331	-0.05337	-0.01341	0.05923
J104	0.04746	-0.04592	0.05422	-0.04929	0.29107	-0.09222	0.11532
J105	-0.03021	0.01756	0.04449	0.02040	0.13036	0.07887	-0.07228
J106	0.06482	0.13181	0.01592	-0.20103	-0.06081	0.04698	0.06756
J107	0.00889	-0.05946	-0.02294	0.20386	0.07183	0.03308	0.12526
J108	0.00554	0.05483	0.07655	0.08379	-0.15657	0.08641	0.04770
J109	0.08677	0.20700	0.09128	0.12404	0.18789	0.04689	-0.09323
J110	0.06638	-0.04436	-0.05647	-0.06437	-0.12554	-0.04045	0.12596
J111	-0.10491	0.09073	-0.06255	0.11389	0.00773	0.07512	-0.16961
J112	-0.16206	-0.03849	0.10444	-0.09824	-0.05507	-0.11130	-0.04372
J113	-0.25317	0.03674	-0.04896	0.03438	0.06900	0.12557	0.23286
J114	-0.06060	0.03956	0.12123	-0.01037	0.07639	-0.00804	0.03485
J115	0.13234	-0.22059	0.03884	0.07629	-0.05233	-0.08098	-0.01629
J116	0.12379	0.16273	0.02715	-0.02105	0.05664	0.00486	-0.06743
J117	-0.14093	0.08106	-0.07484	-0.07269	-0.06092	0.17381	-0.20435
J118	-0.25509	-0.01375	0.02197	0.25815	-0.02638	-0.04137	0.01745
J119	0.04280	-0.10076	-0.13409	-0.00872	0.14772	0.02277	0.03526
J120	0.10949	-0.14115	0.08654	0.05337	0.08353	0.20858	0.00575
J121	0.02439	0.01699	-0.08103	0.01370	0.03364	-0.01897	-0.05137
J122	-0.04886	0.00382	0.07016	0.25823	-0.25539	0.20300	0.12116
J123	0.07169	-0.04059	-0.24170	-0.13459	-0.04397	0.14286	0.25507
J124	0.16440	-0.02170	-0.05092	0.12486	0.15739	0.00774	-0.24109
J125	0.06581	-0.07428	0.26553	-0.07083	-0.10840	-0.03932	0.02255
J126	0.05148	-0.06655	0.14437	-0.13544	0.09231	0.02915	-0.11531
J127	0.01793	0.08644	-0.21217	-0.00592	0.02428	0.14433	-0.07062
J128	-0.01154	0.02382	0.17210	0.00135	0.10136	0.00574	-0.05203
J129	-0.14557	-0.17134	-0.10908	0.06521	-0.14151	-0.10648	-0.05821
J130	0.12589	0.14817	-0.03379	0.02768	-0.07672	0.00240	-0.12932
J131	0.15480	-0.19684	-0.02219	-0.11887	-0.11863	0.05139	0.00596
J132	-0.18168	-0.11359	0.01246	-0.08165	-0.10105	-0.07639	0.01383
J133	-0.23030	-0.15042	-0.06192	0.03626	0.15696	-0.21655	0.00972
J134	0.10290	0.11907	0.02762	0.10482	-0.06879	-0.22826	0.00023
J135	-0.02801	0.06623	-0.11528	0.05560	0.00871	0.00002	-0.13188
J136	0.05517	-0.17266	-0.15034	0.16634	0.09668	-0.00722	0.07486
J137	0.03466	-0.08286	0.04912	-0.37338	-0.01676	0.00039	-0.02903
J139	-0.02054	0.15854	-0.04602	-0.12255	0.10473	-0.17746	0.15098
J140	-0.21390	-0.06442	0.00918	0.00270	0.05406	0.12442	-0.08026
J141	-0.01994	0.07582	0.08357	-0.06801	-0.00579	0.09418	0.01231
J142	0.04651	-0.09349	0.05061	0.04292	-0.13590	0.08597	0.05201
J143	-0.03036	0.05158	0.06652	-0.11766	-0.13964	-0.03690	-0.04010
J144	-0.02819	-0.02170	0.01927	-0.01353	0.16830	0.01198	0.08245
J145	0.19290	0.04428	-0.00444	0.04053	-0.15185	-0.08222	-0.06027
J146	-0.06678	-0.10346	-0.01917	-0.01683	0.06681	-0.09673	0.02931
J147	-0.13325	-0.11780	0.35280	0.11681	0.04397	0.03586	-0.01138
J148	0.06002	-0.00689	-0.00757	-0.07652	-0.09852	-0.00025	-0.00867
J149	0.28899	0.16644	0.04992	0.12518	0.02985	-0.17810	0.11637
J150	0.02931	0.05994	-0.05824	0.06600	-0.06063	0.02506	0.08360
J151	-0.18556	0.23518	-0.34330	-0.10102	0.03946	-0.00230	-0.00504
J152	-0.00127	0.21780	0.03088	0.02226	-0.03241	-0.13385	-0.00239
J153	0.22570	0.02197	-0.10606	0.18331	0.00466	-0.00660	0.12340
J154	0.03886	0.24208	0.17636	-0.04213	0.09775	0.28220	0.10525
J155	0.16845	-0.19582	-0.04034	-0.14097	0.09644	0.06087	-0.10289
J156	0.00245	0.02689	-0.11936	0.07491	-0.14164	-0.04541	-0.17847

TABLE 5-9 (Continued)

ITEM	FACTOR 15	FACTOR 16	FACTOR 17	FACTOR 18	FACTOR 19	FACTOR 20	FACTOR 21
J101	-0.05062	-0.00199	-0.03897	0.11128	-0.04133	-0.15403	-0.07230
J102	-0.04130	0.19733	-0.03480	-0.01181	-0.02851	-0.01680	-0.05333
J103	0.09212	0.18128	0.00089	0.03122	-0.05555	0.05087	0.11975
J104	-0.03338	-0.04123	0.00203	-0.05638	-0.03357	-0.17535	0.13379
J105	-0.14037	-0.07260	-0.13220	-0.01985	0.05232	-0.15706	-0.00195
J106	0.09626	-0.03889	-0.07096	-0.18814	-0.07029	-0.04105	-0.01104
J107	0.04874	0.12994	-0.12659	0.04178	-0.03517	-0.02776	-0.16051
J108	0.07475	-0.02123	-0.03388	0.00046	-0.06175	-0.10978	-0.00834
J109	-0.06954	-0.11282	0.05947	0.13835	0.00668	-0.07174	0.10184
J110	-0.05644	-0.01973	0.01546	0.03448	-0.17792	0.04698	-0.08360
J111	-0.13643	-0.05985	0.03280	-0.22197	-0.06769	0.10922	-0.03707
J112	-0.07060	0.00826	0.15287	0.15405	-0.10458	-0.05189	0.00955
J113	0.02623	-0.01397	-0.08573	0.16900	0.13575	0.09279	-0.05526
J114	0.09963	0.06482	0.17363	0.08671	-0.01497	-0.05057	-0.03283
J115	-0.01829	-0.05299	-0.14863	0.05522	-0.06145	0.04333	0.09697
J116	0.17974	0.02141	-0.03847	-0.14002	0.16599	-0.01286	0.04476
J117	0.08684	0.07699	-0.01552	0.07423	-0.09521	0.08256	0.10204
J118	-0.06923	-0.06666	0.07131	-0.03824	0.05431	0.06267	-0.01881
J119	0.00336	-0.06781	0.09422	-0.14178	-0.05240	0.13538	-0.11237
J120	0.02524	0.04044	0.13721	0.09438	-0.02245	0.25674	0.08544
J121	-0.13012	0.12784	0.00822	0.00235	0.11239	-0.03670	-0.02888
J122	-0.04514	-0.04770	0.09318	-0.16734	0.04943	-0.06330	-0.00108
J123	-0.00037	-0.00868	0.12385	-0.03694	0.13202	0.01290	0.14198
J124	-0.05216	0.05903	0.08787	0.02692	-0.03095	-0.02848	-0.07838
J125	0.23929	-0.24558	0.08867	0.02652	0.11842	0.01677	-0.08608
J126	-0.04459	-0.16033	-0.23322	-0.07250	0.06083	0.16590	-0.00261
J127	0.06165	0.09279	-0.08667	0.05662	-0.02881	0.04726	-0.11826
J128	-0.08070	0.02553	-0.12028	0.02936	-0.01885	0.00299	0.08564
J129	0.02442	0.01840	0.08458	0.01980	-0.03647	-0.11159	0.06874
J130	0.12194	0.11812	0.04375	0.08529	0.08154	-0.00997	-0.12145
J131	-0.11469	0.07279	0.09602	0.04084	0.11319	-0.05137	-0.05448
J132	-0.00066	-0.10102	0.01005	-0.07709	0.00556	0.0812	-0.00063
J133	0.08184	0.00375	0.00334	0.04542	0.16224	0.08663	0.00975
J134	-0.03343	0.04124	-0.03817	-0.16583	0.03641	0.08373	0.03709
J135	0.09273	-0.09860	0.11333	-0.02856	-0.01604	0.03340	0.15555
J136	-0.01615	0.19967	-0.06026	-0.05054	-0.04862	0.04820	0.15351
J137	-0.21065	0.13193	0.08480	-0.13860	-0.06254	0.02249	-0.05117
J139	-0.07393	0.00589	-0.01702	0.06971	0.12448	0.05832	-0.00677
J140	0.08436	0.12097	-0.03622	-0.03775	-0.02965	-0.06160	0.01891
J141	-0.09080	0.02847	0.10199	0.03788	0.02206	0.05770	-0.03335
J142	0.06016	0.16511	-0.19030	-0.03282	0.05640	-0.03019	0.05056
J143	-0.00453	-0.00822	-0.09797	0.02633	0.03900	0.05304	0.12199
J144	0.15265	-0.04143	0.02538	0.01929	-0.07526	0.07319	-0.04784
J145	-0.03540	-0.11393	0.04105	0.14884	-0.03698	0.02298	0.09747
J146	-0.04995	-0.09008	0.01419	-0.00857	-0.15864	-0.02504	-0.04961
J147	0.05158	0.04984	0.01126	-0.11080	0.00411	-0.03457	-0.06979
J148	-0.05122	-0.07585	-0.17177	0.13695	-0.02493	0.11037	-0.10698
J149	-0.03081	0.10462	0.10277	-0.07149	0.08409	0.06196	-0.02294
J150	-0.03142	-0.11115	-0.09363	0.03685	-0.01672	-0.09503	0.12667
J151	0.06003	-0.15763	-0.01095	-0.07677	-0.00225	-0.07024	-0.04579
J152	0.20528	0.05950	0.00459	0.00625	-0.17568	0.07703	0.02788
J153	0.01334	-0.11038	-0.04599	0.02525	-0.16714	-0.01085	-0.09557
J154	-0.12390	-0.04717	0.05091	0.03739	-0.00548	0.00475	0.02204
J155	0.24915	0.01805	0.01818	-0.03320	0.06334	-0.13960	-0.04122
J156	-0.10249	-0.01657	-0.01129	0.07986	0.20171	-0.00543	-0.05941

TABLE 5-9 (Continued)

ITEM	FACTOR 22	FACTOR 23	FACTOR 24	FACTOR 25	FACTOR 26	FACTOR 27	FACTOR 28
J101	-0.01051	0.13638	0.06865	-0.02555	0.03706	-0.15833	-0.13576
J102	-0.10832	-0.09979	0.09154	-0.08661	0.11990	-0.10792	-0.06194
J103	0.03894	0.00349	0.01832	-0.03525	0.00479	0.07004	0.03360
J104	-0.13667	-0.02174	-0.09058	0.02778	-0.01904	-0.05733	0.09109
J105	0.04154	-0.09691	-0.08012	0.00673	0.13662	0.07309	0.05648
J106	0.12566	-0.00054	-0.01153	0.05996	-0.10227	-0.08919	-0.09816
J107	-0.14363	-0.09493	-0.01074	0.01064	-0.07225	-0.00859	0.00935
J108	-0.01158	-0.05849	0.12613	0.05553	0.06422	0.03630	0.00411
J109	0.01313	0.02589	0.04315	0.02256	0.01176	0.02618	0.06765
J110	0.02766	-0.06745	0.00399	-0.07815	-0.05328	0.00849	0.06236
J111	0.02217	-0.02197	-0.04344	-0.09975	-0.01419	0.03435	-0.01988
J112	0.23039	-0.01275	0.03401	0.08553	-0.07301	0.03676	0.04444
J113	0.01333	0.10903	-0.01853	0.02566	-0.05779	-0.02626	-0.01626
J114	-0.06683	-0.12053	-0.03099	0.08491	0.04048	0.03467	-0.02506
J115	0.07334	-0.01885	0.09031	-0.14512	0.09230	-0.00209	-0.02164
J116	0.08680	0.04077	-0.02773	-0.11105	-0.03640	0.04781	-0.01309
J117	0.01500	-0.09295	-0.05874	0.03084	0.00127	-0.06690	0.00054
J118	0.04463	-0.07044	-0.11299	0.02577	-0.00270	-0.00679	-0.13735
J119	-0.04739	0.04505	0.06891	0.03166	0.00527	0.01479	-0.03235
J120	-0.11067	-0.01120	0.01096	-0.12523	0.07759	0.00113	-0.05842
J121	-0.01629	0.09678	0.02093	0.10019	0.12788	-0.01392	-0.10222
J122	0.05493	-0.02275	-0.04130	-0.04128	0.02771	-0.06855	0.13665
J123	-0.05766	-0.05217	0.02443	0.07085	0.03797	-0.06209	0.04690
J124	-0.01163	0.04290	0.11130	-0.00812	-0.05444	-0.11633	0.09818
J125	-0.02846	0.01437	-0.06876	0.00155	0.06308	0.08749	-0.04722
J126	-0.04099	-0.02683	0.00623	0.17986	0.00074	-0.05391	0.03693
J127	-0.02223	0.06277	-0.11607	0.01581	-0.01516	-0.03723	0.04521
J128	0.02121	0.12316	-0.20181	-0.09431	-0.00087	0.02940	-0.02533
J129	-0.11456	0.15088	-0.11523	0.09026	0.02154	0.03743	-0.04782
J130	0.07788	0.05507	-0.03215	0.03609	0.12788	0.03859	-0.01058
J131	0.03322	0.02983	-0.06818	-0.09669	0.04899	0.00468	0.06810
J132	0.07270	0.10188	-0.00432	0.07289	0.08460	-0.10283	0.10911
J133	0.05171	-0.00646	0.00479	-0.08481	-0.08257	-0.05082	0.03229
J134	0.01281	0.08262	0.05769	0.04702	0.04036	0.01161	-0.06436
J135	-0.06108	-0.02052	0.18606	0.05265	0.06143	-0.01313	0.00385
J136	0.18575	-0.08353	-0.01956	0.11423	0.03221	0.06933	-0.06477
J137	-0.05000	0.00147	-0.04672	-0.02236	-0.02303	0.04391	-0.02132
J139	0.09012	-0.14164	0.02192	-0.09285	0.06251	0.04035	0.04870
J140	0.03561	-0.05589	-0.00829	0.05654	-0.05428	0.05801	-0.00143
J141	0.03495	0.02721	0.07859	-0.02174	-0.11491	0.00773	-0.03015
J142	-0.10193	0.14508	0.10046	-0.00865	-0.05412	0.14777	0.06679
J143	-0.09093	-0.03561	-0.05130	0.00893	0.00847	-0.12425	0.01760
J144	0.07926	0.14303	0.03803	-0.00281	0.04455	-0.03356	0.02179
J145	-0.12794	-0.06295	-0.10841	0.00983	-0.15107	0.01884	-0.09089
J146	-0.03521	0.09751	0.07949	-0.00901	0.00794	0.14645	0.01466
J147	-0.04800	-0.05604	0.08551	-0.00761	-0.07261	-0.02572	0.00759
J148	-0.00024	-0.11075	0.06406	0.12654	0.02167	0.07904	0.02914
J149	-0.01438	-0.00217	-0.03369	0.12769	-0.09856	0.02456	0.03106
J150	0.05664	0.04410	0.11569	-0.07786	-0.10720	-0.02955	-0.07884
J151	-0.10969	-0.03962	0.01355	-0.08057	0.00473	0.13234	-0.00724
J152	-0.00638	0.08878	-0.08873	-0.01497	0.00832	-0.02570	0.13529
J153	0.08491	-0.04128	-0.11269	-0.00952	0.06168	-0.06595	-0.01928
J154	0.07023	0.09519	0.01443	0.04500	-0.01210	0.05018	-0.03712
J155	0.08746	-0.11461	0.00721	-0.03737	-0.03963	-0.03471	-0.06801
J156	0.02028	-0.00748	0.04518	-0.01220	-0.10221	-0.01166	0.05329

TABLE 5-9 (Continued)

ITEM	FACTOR 29	FACTOR 30	FACTOR 31	FACTOR 32	FACTOR 33	FACTOR 34	FACTOR 35
J101	0.00461	0.06086	-0.06572	-0.01929	-0.03663	-0.03935	-0.02763
J102	0.06101	-0.01381	0.01346	0.04512	-0.00286	0.03731	0.02358
J103	-0.02162	0.01588	-0.05148	0.09074	-0.01254	0.00244	-0.01502
J104	0.10508	-0.05639	-0.02724	0.02173	0.01886	0.10068	-0.02201
J105	-0.10245	-0.03358	0.01751	0.05835	-0.05113	-0.02419	-0.01858
J106	-0.08512	-0.03019	-0.07976	0.01689	-0.00324	-0.03228	-0.03429
J107	-0.11491	0.07982	-0.00961	0.03667	0.09194	-0.00303	-0.04786
J108	0.01454	-0.01378	-0.05306	-0.00043	0.04011	0.00331	0.01647
J109	-0.00435	0.13227	0.00491	-0.00855	0.03521	-0.00775	-0.00609
J110	0.00503	-0.00365	-0.04984	-0.02666	-0.08517	0.02102	0.04587
J111	0.00589	0.05212	-0.03010	-0.10435	-0.02282	-0.00314	-0.05238
J112	-0.00065	-0.05064	0.05710	0.02859	-0.03253	-0.00309	-0.05955
J113	-0.00676	-0.07473	-0.03430	-0.05190	-0.02437	0.01946	0.00414
J114	-0.01105	0.09848	-0.03668	-0.05319	-0.05829	-0.06076	0.04062
J115	0.05877	-0.00846	-0.09386	-0.03223	0.00244	-0.00264	-0.03017
J116	-0.01961	0.14298	0.02248	0.01035	-0.05280	0.05404	0.00971
J117	0.06013	-0.04865	0.07224	0.06570	0.02986	-0.01677	0.02016
J118	0.02172	-0.05288	0.06193	-0.05440	-0.01151	0.05113	0.01040
J119	0.02086	0.03051	0.01471	0.08471	-0.05378	-0.03363	0.00610
J120	-0.05933	-0.02822	-0.01813	0.07583	0.00935	-0.01809	0.00381
J121	0.02242	-0.00834	0.01422	-0.03374	-0.02615	0.02609	0.07216
J122	0.02841	-0.05300	-0.03571	0.04331	-0.00406	-0.01495	0.01853
J123	-0.08283	0.02884	0.04883	0.00295	0.00306	-0.00010	-0.01044
J124	0.04423	-0.07269	0.05737	0.00341	0.03013	-0.04410	0.00457
J125	0.08816	-0.00255	0.02396	-0.02773	0.08790	-0.03308	-0.00097
J126	0.00553	-0.02195	-0.06057	-0.00176	-0.02731	0.02646	0.05002
J127	0.06291	-0.01585	0.00755	-0.03104	-0.01960	-0.01691	0.00947
J128	-0.00800	-0.01725	-0.00041	0.04304	-0.00027	-0.07372	0.03053
J129	0.04596	0.04380	-0.04544	0.04093	-0.03237	-0.02835	-0.03644
J130	-0.11572	-0.05758	0.01108	0.00988	0.04222	0.05322	-0.01787
J131	-0.01416	0.01515	0.04825	-0.01506	-0.05945	0.07378	-0.00722
J132	0.01159	0.10496	0.00154	0.07007	0.07079	-0.02244	0.05172
J133	-0.04416	0.04109	0.02650	0.04338	-0.04081	-0.01013	-0.01847
J134	-0.00838	-0.04216	0.04254	0.11739	-0.00471	0.01329	-0.03843
J135	-0.03055	-0.03138	-0.03250	-0.07681	-0.05806	-0.00145	-0.02723
J136	0.04224	0.04869	-0.02769	-0.06331	0.09049	0.02638	0.01605
J137	-0.02759	0.01475	0.02370	-0.04230	0.09492	-0.00032	0.00115
J139	0.04978	-0.05880	-0.03804	-0.03107	0.02684	-0.08328	0.01083
J140	0.00336	0.00613	-0.02468	0.03814	-0.00100	-0.01872	0.01741
J141	0.15411	0.08987	0.00343	0.01420	0.05353	0.04181	0.00347
J142	0.10185	-0.03506	0.06099	-0.04789	-0.03250	-0.04049	-0.02284
J143	-0.06230	0.00911	0.11016	-0.12579	0.04234	-0.03311	-0.06891
J144	0.00871	-0.06270	0.00211	-0.00357	0.06166	0.05557	-0.04795
J145	-0.03124	-0.04256	-0.04491	0.05180	-0.00431	0.04780	0.01581
J146	-0.15596	-0.05650	0.03199	-0.03940	0.04048	0.00625	0.06126
J147	-0.05462	0.00090	0.04398	-0.01643	-0.02097	0.02211	-0.00464
J148	0.04314	0.07890	0.07807	0.04447	-0.06313	0.03702	-0.03347
J149	0.02624	-0.05472	0.00956	-0.01673	-0.02138	-0.07300	0.00655
J150	-0.05010	0.01542	0.14525	0.01549	0.02183	-0.00946	0.08977
J151	0.06669	-0.03258	0.01920	0.03695	0.04181	0.00572	-0.01139
J152	-0.04483	0.02723	-0.01810	-0.07676	-0.02399	0.04356	0.05115
J153	0.04606	0.04618	0.07894	0.01555	0.01015	-0.01645	-0.01739
J154	-0.00280	-0.01587	-0.02509	0.00512	-0.01380	-0.01462	-0.02879
J155	0.03604	-0.06401	0.01391	-0.01167	-0.02195	0.00057	0.02771
J156	-0.04575	0.00534	-0.14002	0.01836	0.08296	0.01456	0.01260

TABLE 5-9 (Continued)

ITEM	FACTOR 36	FACTOR 37	FACTOR 38	FACTOR 39	FACTOR 40	FACTOR 41	FACTOR 42
J101	0.05383	-0.00447	0.00980	0.01487	0.00900	-0.00646	0.03567
J102	-0.02005	0.02179	0.00368	0.00610	-0.00606	-0.00391	-0.07787
J103	0.03437	-0.02104	-0.00415	-0.00999	-0.04800	-0.03668	0.02030
J104	-0.02015	-0.00887	0.00556	-0.00791	-0.01130	0.00438	-0.03008
J105	0.05027	-0.00726	-0.00351	-0.00125	-0.02193	-0.07189	0.01375
J106	-0.01704	0.01468	0.00769	-0.01533	0.00097	0.01841	-0.01339
J107	-0.00368	0.01785	-0.01333	-0.01218	0.00525	0.01583	0.03258
J108	0.01511	0.00717	-0.00121	0.00789	0.01085	-0.01292	0.05650
J109	-0.01854	0.02139	0.00510	0.01405	0.03537	0.03075	0.03192
J110	-0.01156	0.00497	-0.00386	0.00387	-0.00358	0.02987	0.00476
J111	0.04390	0.01384	0.00198	-0.00182	-0.05139	0.02929	-0.00724
J112	-0.01571	-0.01765	-0.00755	-0.01177	0.00590	0.01350	0.02132
J113	0.03470	-0.02642	-0.00208	0.00770	0.01340	0.02070	-0.06764
J114	-0.00079	-0.02737	-0.00052	-0.00559	0.01822	-0.03621	-0.05572
J115	-0.06229	-0.02740	-0.00209	0.01618	-0.01698	-0.02595	0.00164
J116	0.00157	-0.04294	0.01145	-0.00479	0.00882	-0.00082	-0.01892
J117	-0.00563	-0.00781	0.01139	0.02911	-0.00744	0.00727	0.05312
J118	0.00842	0.01214	0.00181	-0.00115	-0.00765	-0.05702	0.00101
J119	-0.04101	0.00614	-0.02323	0.01522	0.00434	-0.03258	-0.00731
J120	0.00853	0.00656	0.01172	-0.01962	0.00506	0.00377	0.00012
J121	-0.04608	-0.02957	-0.01198	-0.01787	-0.03842	0.07374	0.09011
J122	-0.01684	-0.01524	0.00417	-0.00201	0.04088	0.03733	-0.01056
J123	0.01762	-0.01277	-0.00258	0.01582	-0.03192	0.02301	0.00410
J124	0.07575	-0.01404	-0.00319	-0.00410	-0.02170	0.02360	-0.06820
J125	0.03222	-0.00524	-0.00388	0.00510	-0.01174	0.02536	-0.00589
J126	0.04660	0.00605	-0.00141	0.00188	0.01638	-0.00841	0.02731
J127	-0.03724	-0.00802	0.01504	-0.01574	0.04585	-0.05510	0.04665
J128	-0.05759	0.01205	-0.01167	-0.00304	0.01310	0.04717	-0.03038
J129	0.02479	0.02644	0.01001	-0.00157	-0.00426	0.01207	-0.00830
J130	-0.01193	0.01274	0.00237	0.00336	-0.01534	0.01075	-0.03285
J131	0.01360	0.04054	-0.00441	0.00247	0.03891	-0.02196	0.02155
J132	-0.01768	0.01873	0.00422	-0.01665	-0.03221	-0.02576	-0.01941
J133	-0.01112	0.01156	0.00705	0.01516	-0.00175	0.02658	0.02864
J134	0.04452	-0.01570	-0.00831	0.00716	0.07041	0.00717	0.00217
J135	-0.02441	0.00944	-0.00114	-0.01965	0.03373	0.00755	-0.01961
J136	0.02028	0.01569	0.00244	0.00412	0.02048	0.01279	-0.02587
J137	0.01712	-0.01840	0.00945	0.00899	0.02451	0.01510	-0.01212
J139	0.04863	0.01734	0.00346	-0.01567	0.01803	0.02619	0.05179
J140	0.00593	-0.01013	-0.01029	0.00562	0.01657	0.01832	-0.03391
J141	0.01186	-0.00725	-0.01172	-0.01053	0.01183	-0.05103	0.02378
J142	0.01848	0.00878	0.00124	-0.00326	-0.01794	-0.00566	-0.00610
J143	-0.04686	-0.01201	-0.01576	-0.00282	0.01320	-0.02820	-0.00981
J144	-0.00988	0.00470	0.00546	-0.00686	-0.00758	-0.01952	0.03026
J145	0.02920	-0.00801	-0.00224	-0.00503	-0.00574	0.00977	0.02139
J146	-0.02261	-0.01963	0.01363	0.00702	0.01619	-0.01753	-0.02323
J147	-0.01535	-0.01184	0.01030	0.00170	-0.01187	0.02886	0.08808
J148	-0.02239	0.01025	0.01470	-0.00592	-0.00914	0.05138	-0.06199
J149	-0.04916	0.01278	0.01470	0.01291	-0.03189	-0.04281	0.01860
J150	0.01847	0.02190	0.00212	-0.01103	-0.01011	-0.02115	-0.01432
J151	-0.02609	-0.00013	-0.00253	0.00128	0.00358	0.01467	0.02631
J152	0.04472	0.01674	-0.01504	0.01010	-0.00543	0.00774	0.02184
J153	0.00842	-0.03518	-0.00012	-0.00200	-0.00948	0.01099	-0.00892
J154	-0.02704	0.02648	-0.00498	0.01243	-0.02276	0.00029	-0.01892
J155	-0.01695	0.02969	-0.00762	0.00192	-0.00099	0.00354	-0.01813
J156	-0.03715	-0.01099	-0.00170	0.00494	-0.01509	-0.02264	-0.03299

TABLE 5-9 (Continued)

ITEM	FACTOR 43	FACTOR 44	FACTOR 45	FACTOR 46	FACTOR 47	FACTOR 48	FACTOR 49
J101	0.03967	-0.01468	0.04098	-0.09454	0.03327	-0.03316	0.07816
J102	-0.04116	-0.01887	0.05606	-0.03741	0.04166	0.09662	-0.04559
J103	-0.03185	0.01825	-0.09033	-0.03375	-0.01189	0.04329	0.02678
J104	0.04340	-0.00964	-0.01872	0.02991	-0.02790	-0.00075	0.02352
J105	-0.07573	-0.06095	0.04883	0.00955	0.06070	-0.05130	0.00092
J106	0.01135	0.03546	0.02439	0.00028	-0.06139	-0.01301	-0.08902
J107	0.00929	0.06567	-0.03147	-0.00550	0.05928	-0.02305	0.05237
J108	0.04796	-0.04527	-0.02204	-0.00543	-0.06320	-0.03656	0.04041
J109	-0.05670	0.01173	0.00395	0.04500	-0.04553	0.00482	0.05617
J110	0.02840	-0.12679	-0.04172	0.04508	-0.01719	-0.01967	0.09785
J111	-0.02615	-0.01353	-0.02827	0.04093	-0.05396	0.02832	-0.00904
J112	0.02625	-0.00570	0.03827	0.00360	0.08596	0.07878	0.03475
J113	-0.08318	-0.01525	-0.08402	0.02019	-0.04218	-0.00704	0.05388
J114	0.05083	0.02419	-0.08272	0.06995	-0.00915	-0.08386	-0.08482
J115	-0.00270	0.11454	-0.00688	0.11560	-0.01509	-0.00595	-0.04904
J116	0.06862	-0.02714	0.02758	-0.03430	0.02945	-0.01107	0.09162
J117	0.02193	0.00235	-0.06264	-0.04128	-0.00311	-0.07324	-0.00683
J118	0.05866	0.05967	0.03641	-0.02768	-0.00907	-0.08797	0.04517
J119	0.03065	-0.03730	0.02167	0.01571	0.03568	-0.04076	-0.00324
J120	0.02585	-0.03668	0.04992	0.01480	0.01015	0.07868	0.09087
J121	-0.01741	0.01444	0.00654	0.01740	0.00730	0.00730	0.03545
J122	0.00149	0.04494	0.04470	0.02338	0.10016	-0.03543	0.05126
J123	0.00317	-0.00392	0.09064	0.01421	-0.03041	-0.00356	-0.14452
J124	0.04768	0.00912	0.00027	0.01104	-0.05361	-0.02614	-0.01633
J125	-0.02591	-0.03661	-0.00137	-0.01793	0.03734	0.06656	-0.03456
J126	0.06048	0.04526	-0.02560	-0.00006	0.08225	0.11737	-0.00670
J127	-0.04749	-0.01741	0.04506	0.08804	-0.03153	0.06209	-0.06599
J128	0.02203	-0.03992	-0.01260	-0.08900	-0.00099	-0.09363	-0.11699
J129	0.01425	-0.02932	0.00959	0.11305	0.03481	0.08116	-0.02938
J130	0.05634	0.04182	-0.01875	0.08181	-0.01575	-0.02079	-0.00466
J131	0.02279	0.03474	-0.10097	-0.10025	-0.07405	0.06246	-0.07642
J132	-0.03436	0.02465	-0.02948	-0.03046	-0.11675	-0.06053	0.11022
J133	-0.00828	0.05184	0.01661	0.00295	0.03718	0.01218	0.00314
J134	-0.03248	-0.03096	-0.03674	0.07632	-0.09120	-0.02364	0.00428
J135	-0.05981	0.02893	-0.06157	-0.13013	0.07908	-0.02942	-0.02890
J136	0.00090	-0.08752	0.01253	-0.04172	0.02396	0.01290	-0.01038
J137	-0.04886	0.05182	-0.04247	0.04102	0.13360	-0.06758	0.05159
J139	0.04992	0.01861	0.03457	0.02546	-0.05084	-0.02219	-0.01741
J140	0.01846	0.04993	0.03985	-0.02348	-0.07625	0.13063	0.02503
J141	-0.02777	0.01835	0.08077	-0.00122	-0.03233	-0.02393	-0.07554
J142	0.01869	0.03079	0.04107	-0.05189	0.01381	-0.06124	0.01891
J143	0.03831	-0.06934	0.01930	0.02828	-0.05182	0.04480	0.10928
J144	0.01105	-0.06244	-0.01595	-0.00209	0.07664	-0.10303	-0.06403
J145	-0.04011	0.03124	0.04624	-0.03349	-0.05082	-0.08281	0.01236
J146	0.00383	0.02570	0.08384	-0.06616	-0.09719	0.05261	0.00198
J147	-0.02344	-0.06773	-0.03367	0.01424	-0.06476	0.01499	-0.11870
J148	-0.00509	-0.00498	0.04282	0.00967	0.00041	-0.09083	-0.02084
J149	-0.02393	0.00388	-0.03481	-0.04348	0.02212	0.04693	0.06643
J150	0.01418	-0.00461	-0.07884	0.12076	0.09868	0.04591	-0.05125
J151	0.03486	0.00698	-0.04201	-0.01860	0.00876	0.03999	0.02428
J152	-0.02010	0.03225	0.08706	0.01963	0.06624	-0.01318	-0.02930
J153	-0.02442	0.03352	-0.03887	-0.10427	0.00833	0.12481	-0.03722
J154	0.02488	0.03578	-0.00507	0.02548	-0.00933	0.05268	0.04737
J155	-0.08756	-0.00218	0.03694	0.03842	-0.02128	-0.02036	0.11439
J156	0.01180	-0.09271	0.00200	-0.03976	0.05506	0.03536	-0.06906

TABLE 5-9 (Continued)

ITEM	FACTOR 50	FACTOR 51	FACTOR 52	FACTOR 53	FACTOR 54	FACTOR 55
J101	0.03142	0.08503	-0.08541	0.03466	-0.04517	0.07272
J102	0.02207	0.01248	0.07447	-0.05042	0.02570	-0.11835
J103	-0.11117	-0.01416	0.06125	0.11280	-0.13397	-0.03643
J104	-0.04373	0.05862	-0.13490	0.08246	0.08054	0.06797
J105	0.05133	-0.00373	0.02756	-0.02744	-0.00589	0.12547
J106	-0.04144	-0.08182	0.08166	0.00424	0.04386	0.14398
J107	0.04660	0.05344	-0.01937	-0.15265	0.07909	-0.00817
J108	-0.08513	-0.18616	-0.06582	0.08115	0.05689	-0.05921
J109	-0.02641	-0.10130	0.05861	0.04389	0.01260	-0.08387
J110	0.15721	-0.01742	0.08529	0.02682	0.05081	0.03369
J111	-0.08266	0.07870	-0.09197	-0.05516	0.09025	-0.07117
J112	0.05415	-0.01380	-0.06075	-0.08624	0.10397	-0.10237
J113	-0.01280	-0.06726	-0.07862	-0.08339	-0.05319	-0.01954
J114	-0.04658	0.04429	0.10699	-0.03441	0.08957	0.01116
J115	0.08594	-0.01741	-0.01366	-0.08415	-0.01917	0.04524
J116	0.04879	-0.00032	-0.01978	-0.11514	-0.00405	-0.08924
J117	-0.04519	0.09673	-0.03875	-0.12613	0.08848	0.03994
J118	0.03942	-0.13202	0.01867	0.08638	0.05083	-0.01314
J119	-0.07478	0.07982	-0.08409	0.10063	-0.08984	-0.09396
J120	-0.00390	-0.09616	-0.04332	-0.00418	0.07287	0.11241
J121	-0.06925	0.00847	0.05974	-0.01966	0.05165	0.09216
J122	-0.09174	0.07934	0.04863	-0.01573	-0.12476	0.01965
J123	0.09639	-0.06017	-0.02170	-0.03848	0.07087	-0.10473
J124	0.05126	-0.06057	0.12736	-0.01713	-0.07459	0.05804
J125	0.04580	0.09325	0.00841	0.03954	0.06247	0.12120
J126	0.01681	-0.04292	0.05232	-0.05936	-0.03985	-0.12571
J127	0.07379	0.06662	0.00998	0.11383	0.05983	-0.04711
J128	0.04017	-0.09433	-0.06346	-0.01769	-0.03369	-0.06096
J129	-0.03058	-0.06256	0.02127	-0.10532	-0.09966	-0.06773
J130	0.08399	0.02617	-0.11058	0.10914	-0.12982	-0.06070
J131	-0.04651	0.01535	0.02312	-0.07293	0.00428	0.07853
J132	0.11942	0.04390	-0.01046	-0.01132	0.03355	-0.04073
J133	-0.04100	-0.00267	0.13904	0.16533	0.03936	0.08781
J134	0.01715	0.02824	0.00784	-0.02108	0.15429	0.05025
J135	0.09387	0.03236	-0.07191	0.04692	-0.00793	0.01305
J136	0.04402	0.07838	0.08740	0.01060	-0.10131	0.05218
J137	0.03037	-0.08230	-0.02050	0.11924	0.00578	-0.03104
J139	-0.04033	0.08924	-0.07873	0.00571	-0.04392	-0.10324
J140	0.06283	0.03732	-0.10699	0.09012	0.00379	0.09505
J141	-0.00018	-0.05639	-0.05082	-0.08559	-0.10545	0.09828
J142	0.01883	0.10997	0.06385	0.07754	0.14243	-0.08691
J143	-0.07526	0.02134	0.05948	0.01617	-0.11427	0.03446
J144	-0.05995	0.01750	0.10847	-0.07679	0.00949	-0.06924
J145	0.04148	0.12978	0.07766	0.03365	-0.07629	-0.12602
J146	-0.10470	0.06798	0.02930	-0.10032	-0.00694	-0.02018
J147	0.08991	0.01315	-0.03166	0.05248	-0.15273	-0.03457
J148	-0.09003	-0.01308	-0.05925	0.01679	-0.06427	0.12805
J149	0.02721	-0.04232	-0.08614	-0.10824	-0.05631	0.09493
J150	-0.01912	0.05708	-0.08504	0.03127	0.00598	0.04182
J151	0.09117	-0.08459	0.10140	-0.06122	-0.10561	0.09237
J152	-0.02202	-0.04100	-0.06313	-0.00054	0.02306	0.14314
J153	-0.04012	-0.07298	0.01189	0.10280	0.03694	-0.10717
J154	0.04657	0.13107	0.13752	0.04719	0.05026	0.00714
J155	-0.07563	-0.04006	0.00230	-0.06700	0.01859	-0.11677
J156	-0.07183	-0.00912	-0.01794	0.06291	0.14311	0.00796

TABLE 5-10

Factor Loading Matrix for the Fifty-Five Items of Test J1 in the J1/2259 Case.

ITEM	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7
J101	0.591	-0.194	0.109	0.055	-0.057	-0.142	-0.015
J102	0.476	-0.103	-0.059	-0.150	-0.079	0.053	0.177
J103	0.497	-0.189	-0.088	-0.049	0.088	-0.054	0.265
J104	0.582	0.078	-0.208	-0.058	0.025	-0.004	-0.051
J105	0.625	0.127	-0.019	-0.028	0.090	0.074	-0.046
J106	0.447	0.052	-0.176	-0.125	0.063	-0.121	0.126
J107	0.507	0.011	-0.199	-0.003	0.231	0.112	-0.108
J108	0.614	0.092	0.066	-0.194	-0.294	0.369	0.106
J109	0.363	-0.132	-0.187	-0.133	0.218	-0.147	-0.020
J110	0.500	0.387	-0.150	-0.061	0.187	-0.283	0.048
J111	0.692	-0.097	0.009	-0.184	-0.126	-0.023	-0.064
J112	0.403	-0.223	-0.038	-0.047	-0.209	-0.080	-0.054
J113	0.456	-0.054	-0.046	-0.039	-0.024	0.084	0.157
J114	0.430	0.067	0.146	0.103	-0.084	-0.051	-0.034
J115	0.579	-0.143	0.050	0.110	-0.146	0.031	-0.075
J116	0.292	-0.045	-0.032	-0.023	0.044	0.208	0.181
J117	0.366	0.224	-0.066	-0.052	0.001	-0.077	0.014
J118	0.507	-0.400	-0.078	-0.028	0.130	-0.183	0.107
J119	0.550	-0.136	-0.261	-0.002	0.180	-0.022	-0.131
J120	0.283	-0.064	0.170	0.038	-0.150	-0.022	-0.091
J121	0.428	-0.043	-0.045	-0.073	0.010	-0.007	0.118
J122	0.414	-0.070	0.017	0.022	-0.075	-0.129	0.095
J123	0.418	-0.057	0.019	-0.040	-0.015	-0.042	0.023
J124	0.493	-0.072	-0.123	0.023	0.236	0.260	-0.040
J125	0.413	-0.042	-0.134	-0.185	0.050	-0.006	0.010
J126	0.347	0.109	0.052	-0.046	-0.141	-0.028	-0.106
J127	0.468	-0.195	-0.104	-0.125	0.058	0.137	-0.098
J128	0.565	-0.072	0.045	-0.098	-0.155	0.067	0.121
J129	0.609	0.022	-0.054	0.144	0.165	0.095	-0.120
J130	0.334	0.282	-0.023	-0.098	-0.112	-0.192	0.112
J131	0.627	-0.270	0.021	-0.020	-0.058	-0.069	-0.160
J132	0.309	-0.052	0.074	0.084	-0.100	0.052	-0.167
J133	0.638	0.211	-0.139	-0.232	-0.219	0.114	-0.179
J134	0.291	-0.161	0.086	0.136	-0.053	-0.147	0.219
J135	0.651	0.136	-0.108	-0.057	0.088	0.044	0.036
J136	0.348	-0.083	-0.151	0.085	-0.150	-0.045	-0.110
J137	0.512	0.025	0.053	0.048	0.030	0.100	-0.220
J139	0.354	0.113	0.015	0.146	0.167	-0.076	0.201
J140	0.392	0.007	0.582	-0.254	0.360	-0.025	-0.119
J141	0.496	0.624	0.018	-0.065	-0.098	-0.050	-0.032
J142	0.411	0.164	-0.004	0.095	-0.105	-0.207	-0.031
J143	0.509	0.113	0.123	0.015	-0.063	0.050	-0.009
J144	0.361	0.019	0.659	-0.282	0.261	-0.032	0.013
J145	0.535	-0.093	0.236	-0.072	-0.305	-0.095	0.036
J146	0.664	0.136	-0.139	0.003	0.097	0.070	-0.124
J147	0.318	-0.097	0.099	0.336	0.040	0.028	-0.129
J148	0.465	-0.164	0.079	0.033	-0.013	0.054	0.057
J149	0.457	0.019	-0.056	-0.059	0.030	-0.076	0.189
J150	0.459	0.012	0.067	-0.006	-0.013	0.031	0.058
J151	0.422	-0.104	0.105	0.221	-0.087	0.002	0.121
J152	0.369	-0.088	0.031	0.238	-0.146	-0.079	0.038
J153	0.361	0.401	0.097	0.358	0.017	-0.120	0.071
J154	0.237	0.183	0.097	0.260	0.076	0.418	0.330
J155	0.597	0.052	0.082	0.391	0.033	0.025	-0.198
J156	0.551	-0.134	0.010	0.337	0.166	-0.041	0.039

TABLE 5-10 (Continued)

ITEM	FACTOR 8	FACTOR 9	FACTOR 10	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14
J101	-0.081	-0.060	-0.145	-0.161	0.189	-0.118	0.088
J102	-0.087	-0.100	-0.095	0.014	-0.057	-0.061	0.108
J103	-0.011	-0.149	0.062	-0.065	0.237	-0.059	-0.014
J104	-0.094	0.107	0.157	0.068	0.057	-0.032	0.009
J105	-0.043	0.006	-0.107	0.053	0.058	0.021	0.074
J106	0.088	-0.163	0.039	0.344 ↓	0.120	-0.115	0.225
J107	-0.028	0.065	0.080	-0.021	0.003	0.091	-0.022
J108	0.219	-0.070	-0.009	0.036	0.029	0.232	-0.041
J109	-0.046	0.126	-0.261	-0.015	-0.009	0.107	0.112
J110	0.216	-0.045	-0.013	-0.159	0.065	0.088	-0.042
J111	-0.048	0.054	-0.176	-0.130	-0.033	0.023	0.018
J112	-0.164	0.038	-0.063	0.109	0.022	-0.093	0.008
J113	-0.162	0.017	0.314 ↓	0.051	-0.121	0.098	0.128
J114	-0.120	0.164	0.067	-0.062	0.014	0.019	0.059
J115	0.210	-0.104	0.112	-0.026	0.065	-0.031	0.011
J116	0.123	-0.130	0.056	0.031	-0.032	-0.053	-0.006
J117	-0.096	-0.250	-0.157	0.143	-0.072	0.124	-0.019
J118	-0.254	-0.172	0.119	-0.046	-0.055	0.126	-0.166
J119	0.094	0.120	0.068	0.206	-0.126	0.134	0.106
J120	-0.014	0.089	-0.128	-0.076	-0.106	0.231	-0.012
J121	0.038	-0.065	-0.001	-0.031	-0.101	-0.095	-0.011
J122	-0.028	0.048	0.045	-0.060	0.111	0.276	-0.178
J123	0.063	0.026	0.017	-0.056	0.099	0.043	0.069
J124	0.141	0.186	-0.109	-0.174	-0.087	0.031	0.035
J125	0.034	-0.037	0.092	-0.035	0.086	-0.119	-0.042
J126	0.023	-0.089	0.085	-0.145	0.010	-0.074	-0.002
J127	-0.002	0.126	-0.105	0.061	0.078	0.104	-0.048
J128	-0.104	0.051	0.060	-0.094	0.136	-0.055	-0.056
J129	0.018	-0.224	0.035	-0.062	-0.237	-0.024	-0.183
J130	-0.075	0.104	-0.181	0.149	0.081	0.042	0.015
J131	0.127	0.038	-0.013	0.200	0.111	-0.028	-0.163
J132	-0.084	-0.185	0.065	0.138	-0.068	-0.010	-0.056
J133	-0.228	0.123	0.162	-0.104	-0.112	-0.177	0.146
J134	-0.061	0.132	0.102	-0.168	-0.148	-0.141	-0.078
J135	0.001	-0.081	-0.033	-0.135	-0.111	-0.033	0.029
J136	0.140	0.055	0.219	0.023	0.085	0.168	0.172
J137	-0.005	0.003	-0.172	0.157	-0.046	-0.268	-0.120
J139	-0.023	-0.018	-0.055	0.024	-0.160	-0.118	0.049
J140	-0.040	-0.050	0.103	0.060	-0.015	0.032	0.044
J141	-0.216	-0.021	-0.077	-0.091	0.026	0.088	-0.102
J142	-0.023	-0.052	0.112	0.152	0.022	0.061	-0.174
J143	0.007	-0.084	-0.094	0.073	-0.021	-0.089	-0.042
J144	0.002	0.102	0.114	0.049	0.024	0.008	0.090
J145	0.281	0.023	-0.095	0.049	-0.154	-0.027	-0.037
J146	-0.002	-0.029	0.071	-0.107	-0.039	-0.077	-0.071
J147	-0.233	0.038	0.047	0.074	0.053	0.109	-0.095
J148	0.112	-0.108 ↓	-0.030	-0.053	-0.068	0.008	-0.124
J149	0.168	0.401 ↓	0.045	0.053	-0.002	-0.161	-0.236
J150	0.031	0.002	-0.062	0.011	-0.009	0.044	0.041
J151	-0.000	-0.082	-0.093	-0.113	-0.124	0.105	0.302 ↓
J152	-0.100	0.140	-0.012	0.153	-0.202	-0.038	0.121
J153	0.213	0.062	0.161	0.045	-0.097	0.013	0.048
J154	-0.189	0.100	-0.062	0.156	0.186	0.024	-0.071
J155	0.064	-0.043	0.004	-0.127	0.358 ↓	-0.102	0.138
J156	0.012	0.013	-0.175	0.018	-0.029	-0.006	0.017

TABLE 5-10 (Continued)

ITEM	FACTOR 15	FACTOR 16	FACTOR 17	FACTOR 18	FACTOR 19	FACTOR 20	FACTOR 21
J101	-0.036	-0.095	-0.035	0.043	-0.132	-0.099	0.036
J102	-0.005	0.178	0.144	-0.146	-0.089	-0.093	-0.078
J103	0.036	0.125	0.044	0.108	0.209	0.014	0.009
J104	-0.063	0.058	0.049	-0.014	-0.062	0.085	-0.028
J105	0.001	-0.020	-0.006	-0.141	-0.133	-0.105	-0.047
J106	-0.088	0.070	-0.016	-0.037	-0.126	-0.004	-0.051
J107	0.049	0.028	-0.023	-0.018	-0.037	-0.060	0.053
J108	0.078	-0.012	-0.143	0.049	-0.121	-0.102	-0.105
J109	-0.023	0.052	-0.101	-0.030	-0.147	0.172	-0.074
J110	-0.143	0.081	-0.004	-0.122	0.192	-0.116	0.021
J111	-0.180	0.047	-0.099	-0.160	0.052	-0.063	-0.014
J112	0.011	0.150	-0.208	0.041	0.100	-0.195	0.184
J113	-0.164	-0.151	0.129	0.100	-0.042	-0.018	0.159
J114	-0.134	0.160	-0.025	0.150	-0.096	0.073	-0.099
J115	0.016	0.135	0.168	-0.149	0.066	0.086	0.007
J116	0.180	0.043	-0.060	0.066	-0.050	0.070	0.056
J117	0.165	0.033	-0.058	-0.025	0.100	0.055	-0.070
J118	0.054	-0.009	-0.026	-0.116	0.032	0.032	-0.054
J119	-0.078	-0.013	-0.017	-0.004	0.035	0.134	0.044
J120	-0.022	0.113	0.263	0.059	0.060	0.169	-0.173
J121	0.031	-0.087	0.104	0.008	-0.154	0.012	0.099
J122	-0.080	0.089	-0.010	0.246	-0.067	-0.182	-0.083
J123	-0.130	-0.112	0.056	0.124	0.038	0.030	-0.039
J124	0.124	0.241	0.095	0.066	-0.046	-0.026	0.249
J125	0.010	0.089	-0.122	0.213	-0.016	0.185	-0.007
J126	-0.132	0.002	-0.032	-0.113	-0.204	0.163	0.002
J127	0.087	-0.204	0.017	0.040	0.145	0.003	0.066
J128	0.061	0.043	0.139	-0.107	0.024	0.052	0.072
J129	0.019	-0.080	0.006	0.066	0.010	-0.096	-0.122
J130	0.262	-0.110	0.081	0.096	-0.061	-0.030	0.020
J131	-0.029	-0.105	0.120	0.083	0.081	0.035	0.007
J132	-0.070	0.126	0.017	0.068	0.005	-0.004	-0.019
J133	0.140	-0.102	-0.001	0.034	0.116	-0.041	-0.138
J134	0.160	-0.052	-0.014	-0.045	-0.073	0.015	-0.049
J135	0.096	-0.072	-0.048	0.080	0.057	0.078	-0.157
J136	0.121	-0.071	0.046	-0.206	0.068	-0.095	-0.031
J137	-0.188	-0.012	0.130	0.058	0.033	-0.066	-0.027
J139	-0.012	0.048	0.176	0.025	0.099	-0.047	-0.011
J140	0.019	-0.002	-0.057	-0.032	-0.009	-0.031	-0.061
J141	-0.024	-0.022	0.015	0.022	0.040	0.139	0.240
J142	0.019	-0.122	0.036	-0.086	-0.092	0.035	0.113
J143	0.028	0.036	0.066	-0.000	-0.020	0.038	0.071
J144	0.079	-0.002	-0.010	-0.014	0.065	-0.016	0.061
J145	0.017	0.033	-0.025	0.013	0.041	0.005	0.064
J146	-0.084	-0.012	-0.092	-0.017	-0.003	-0.164	0.005
J147	0.088	0.152	-0.038	-0.054	-0.142	-0.045	0.044
J148	-0.091	-0.109	-0.236	-0.080	0.009	0.200	0.111
J149	-0.056	-0.067	-0.070	-0.068	-0.034	-0.022	-0.123
J150	0.012	-0.027	0.060	-0.127	-0.053	-0.001	0.005
J151	-0.199	-0.186	-0.045	0.089	0.056	-0.039	0.070
J152	0.085	0.114	-0.209	-0.025	0.171	0.073	-0.009
J153	0.022	0.106	-0.073	0.058	-0.038	-0.039	-0.003
J154	-0.183	-0.029	-0.045	-0.123	0.124	0.065	-0.083
J155	0.150	-0.051	-0.066	0.028	0.036	0.085	-0.059
J156	0.098	-0.168	0.059	0.015	-0.088	-0.050	-0.006

TABLE 5-10 (Continued)

ITEM	FACTOR 22	FACTOR 23	FACTOR 24	FACTOR 25	FACTOR 26	FACTOR 27	FACTOR 28
J101	0.189	0.165	-0.023	-0.220	0.084	0.012	0.065
J102	0.007	0.041	-0.086	-0.075	-0.098	-0.022	-0.103
J103	-0.151	0.022	0.093	0.041	0.167	-0.032	0.125
J104	-0.145	0.032	0.060	-0.102	0.070	0.087	-0.071
J105	0.030	-0.080	-0.038	-0.090	-0.047	0.018	-0.009
J106	-0.040	0.011	0.042	0.028	-0.046	-0.007	0.051
J107	-0.083	-0.005	-0.032	-0.045	0.026	-0.028	0.092
J108	-0.060	-0.042	0.021	-0.003	0.130	-0.096	-0.025
J109	0.071	0.006	-0.019	0.031	0.181	-0.013	0.040
J110	-0.027	-0.071	-0.119	-0.047	-0.088	-0.108	-0.043
J111	-0.002	0.077	0.012	0.132	-0.062	0.014	0.063
J112	0.090	-0.097	0.024	0.039	0.024	-0.082	-0.108
J113	0.095	-0.137	-0.140	-0.106	-0.058	0.010	0.155
J114	-0.096	-0.161	-0.054	-0.061	0.090	-0.085	-0.078
J115	0.276	-0.113	0.061	0.098	0.063	0.004	0.103
J116	-0.011	0.130	-0.095	-0.034	-0.025	0.009	-0.119
J117	0.098	-0.032	-0.007	0.019	-0.008	0.194	0.102
J118	-0.058	-0.080	-0.027	-0.050	-0.064	0.053	-0.072
J119	0.124	0.092	0.129	0.077	-0.060	0.062	-0.160
J120	-0.008	-0.004	0.074	-0.075	-0.075	-0.117	0.014
J121	0.023	0.025	-0.004	0.123	0.068	-0.084	-0.045
J122	0.137	0.096	-0.043	0.153	-0.077	0.083	0.034
J123	0.006	0.100	-0.004	-0.067	0.065	0.032	-0.036
J124	0.006	0.037	-0.018	0.012	-0.040	0.043	-0.004
J125	0.080	-0.117	0.100	-0.023	-0.076	0.002	0.009
J126	-0.169	0.071	-0.031	0.069	-0.096	-0.029	0.136
J127	-0.144	-0.005	-0.068	-0.004	-0.045	0.021	0.151
J128	-0.088	0.086	-0.009	0.049	-0.044	0.143	0.022
J129	0.006	0.101	0.021	-0.088	0.067	0.046	-0.044
J130	-0.067	0.018	0.032	0.040	-0.131	-0.133	-0.006
J131	0.035	0.085	-0.116	-0.099	-0.082	-0.112	-0.109
J132	-0.111	0.135	-0.128	0.208	0.016	-0.023	-0.020
J133	0.125	-0.064	-0.105	0.097	0.014	0.012	-0.011
J134	0.046	0.114	0.144	0.023	-0.024	-0.052	-0.041
J135	0.040	-0.044	0.071	-0.011	-0.056	-0.078	0.022
J136	-0.030	0.074	0.063	0.008	0.174	-0.101	-0.019
J137	-0.012	0.038	0.050	0.016	0.070	-0.013	0.075
J139	-0.044	-0.084	-0.107	0.047	0.130	-0.080	-0.089
J140	-0.020	0.005	-0.059	0.029	0.090	0.065	-0.030
J141	0.036	0.090	0.002	-0.007	0.164	0.038	-0.088
J142	-0.004	-0.030	0.106	0.006	0.044	-0.010	-0.030
J143	-0.016	-0.087	0.084	0.022	-0.086	-0.029	0.050
J144	0.031	0.043	0.114	0.029	-0.059	-0.078	0.019
J145	-0.083	-0.165	0.041	-0.175	0.048	0.228	-0.029
J146	-0.067	-0.006	0.253	-0.081	-0.107	-0.054	0.020
J147	-0.039	-0.119	0.037	0.006	-0.005	-0.021	0.009
J148	0.055	-0.049	-0.145	0.026	-0.013	-0.192	0.002
J149	-0.030	-0.055	-0.077	0.111	0.034	0.126	-0.007
J150	0.008	0.045	-0.066	-0.022	-0.045	0.066	-0.038
J151	-0.131	-0.023	0.115	0.135	-0.053	0.094	-0.108
J152	-0.088	0.165	-0.064	-0.122	-0.007	-0.044	0.139
J153	0.071	0.114	-0.059	-0.019	-0.044	0.028	0.124
J154	0.117	0.030	0.076	-0.032	-0.021	-0.019	-0.030
J155	-0.038	-0.065	-0.104	0.039	-0.104	0.091	-0.134
J156	-0.021	-0.136	-0.006	0.104	0.060	-0.013	0.104

TABLE 5-10 (Continued)

ITEM	FACTOR 29	FACTOR 30	FACTOR 31	FACTOR 32	FACTOR 33	FACTOR 34	FACTOR 35
J101	-0.057	-0.154	-0.000	0.000	-0.081	-0.077	-0.054
J102	-0.100	-0.034	-0.099	-0.065	-0.142	0.018	0.046
J103	-0.057	-0.002	0.097	-0.062	-0.010	-0.050	-0.060
J104	-0.034	0.103	-0.075	-0.030	-0.082	0.119	0.050
J105	0.063	0.044	0.061	0.021	0.081	0.045	-0.035
J106	0.150	-0.087	-0.004	-0.048	0.010	0.010	0.030
J107	-0.026	-0.016	-0.049	0.053	-0.088	-0.027	-0.011
J108	-0.045	-0.025	-0.094	-0.072	0.040	0.027	-0.037
J109	-0.038	0.154	-0.087	0.074	0.027	-0.059	-0.031
J110	-0.028	0.035	-0.032	-0.079	0.072	-0.058	0.055
J111	0.243	0.011	0.139	-0.068	-0.101	0.054	-0.047
J112	-0.018	-0.020	-0.013	-0.014	0.153	-0.015	-0.053
J113	-0.003	-0.031	0.022	-0.041	0.063	-0.030	-0.020
J114	-0.043	0.020	0.221	0.032	-0.031	0.004	-0.061
J115	-0.041	0.141	-0.026	0.034	-0.047	-0.011	-0.098
J116	0.051	0.114	0.103	-0.048	-0.040	-0.115	-0.053
J117	-0.205	-0.091	0.080	-0.030	0.030	0.155	-0.043
J118	0.124	-0.039	0.006	0.114	-0.027	0.019	-0.017
J119	-0.068	-0.127	0.061	-0.048	0.046	-0.091	-0.026
J120	0.014	-0.135	0.032	-0.015	0.011	-0.066	-0.005
J121	0.010	-0.065	0.135	0.058	0.057	-0.003	0.046
J122	-0.000	0.080	-0.038	-0.015	0.012	-0.012	0.125
J123	-0.064	-0.005	-0.002	0.006	0.047	0.059	0.141
J124	0.010	-0.020	0.060	-0.048	0.013	0.070	0.037
J125	0.099	-0.006	-0.121	0.083	-0.011	0.069	0.046
J126	-0.032	-0.004	-0.064	-0.072	0.179	-0.014	-0.103
J127	-0.007	-0.082	-0.021	-0.041	-0.013	0.034	-0.061
J128	-0.016	0.080	0.019	0.098	0.062	0.008	0.043
J129	0.102	0.053	0.009	-0.039	-0.020	-0.055	-0.052
J130	-0.016	0.065	0.099	0.127	-0.052	0.012	-0.036
J131	0.015	0.143	-0.044	-0.009	0.060	0.101	-0.133
J132	-0.027	-0.119	-0.077	0.155	-0.006	-0.086	-0.005
J133	-0.007	0.057	-0.003	-0.010	-0.054	-0.043	0.035
J134	-0.029	-0.040	-0.027	-0.093	0.137	0.132	0.012
J135	0.073	-0.022	-0.024	-0.074	0.045	-0.018	0.014
J136	0.089	-0.083	0.031	0.079	0.014	0.061	0.092
J137	-0.011	0.013	0.029	-0.036	-0.002	0.100	0.090
J139	-0.016	-0.056	-0.111	0.020	0.019	0.063	-0.062
J140	-0.040	0.058	0.127	-0.020	0.100	0.020	0.057
J141	0.117	-0.068	-0.099	0.003	0.009	-0.004	-0.027
J142	-0.054	0.092	0.059	-0.168	-0.111	-0.087	0.032
J143	-0.026	0.008	0.015	-0.035	-0.028	-0.105	0.134
J144	0.021	-0.031	-0.149	-0.005	-0.105	-0.020	-0.042
J145	0.100	-0.038	-0.012	0.083	0.028	-0.049	0.043
J146	-0.168	0.011	0.025	0.195	0.015	-0.050	-0.027
J147	0.006	-0.040	-0.065	-0.117	-0.034	0.047	-0.004
J148	-0.096	-0.044	0.048	0.058	-0.127	0.106	0.127
J149	-0.071	-0.137	-0.017	-0.030	-0.073	-0.073	-0.071
J150	-0.082	0.039	-0.049	0.103	0.078	-0.059	0.024
J151	-0.066	0.110	-0.054	-0.017	-0.092	0.059	-0.077
J152	-0.024	0.106	-0.033	-0.049	0.029	-0.080	0.087
J153	0.063	-0.011	0.033	0.108	-0.059	0.110	-0.080
J154	0.059	0.005	0.024	0.057	0.058	-0.025	0.006
J155	-0.002	-0.081	0.000	-0.047	0.009	-0.025	0.027
J156	0.092	0.050	-0.075	0.024	0.049	-0.067	0.069

TABLE 5-10 (Continued)

ITEM	FACTOR 36	FACTOR 37	FACTOR 38	FACTOR 39	FACTOR 40	FACTOR 41	FACTOR 42
J101	0.023	0.022	-0.020	-0.062	-0.024	0.040	0.045
J102	0.003	-0.133	-0.020	0.034	-0.069	-0.004	-0.023
J103	-0.071	0.018	0.018	0.022	-0.055	-0.085	-0.024
J104	0.038	0.140	-0.066	0.016	-0.088	0.052	0.055
J105	0.030	0.131	-0.011	-0.027	-0.081	-0.075	-0.019
J106	-0.145	0.013	-0.026	-0.001	0.085	0.050	-0.005
J107	-0.054	-0.031	0.116	-0.044	-0.093	-0.033	0.042
J108	0.032	-0.020	-0.040	-0.045	0.017	0.004	-0.025
J109	-0.040	0.040	-0.010	0.006	0.107	-0.055	-0.013
J110	0.022	0.020	-0.027	-0.091	0.027	0.037	-0.012
J111	0.079	-0.035	0.013	-0.028	0.046	-0.035	-0.001
J112	-0.033	0.097	0.004	0.110	-0.067	0.053	-0.011
J113	0.038	-0.013	-0.052	-0.021	0.057	-0.067	-0.044
J114	0.041	-0.097	0.002	-0.034	-0.008	0.095	-0.060
J115	-0.012	-0.057	-0.057	-0.012	-0.003	0.058	0.030
J116	0.013	0.021	0.177	-0.029	0.053	0.033	-0.005
J117	0.085	0.010	0.034	0.019	0.018	-0.021	-0.044
J118	-0.053	-0.050	0.017	0.075	0.005	0.011	-0.008
J119	0.016	-0.010	0.041	-0.112	-0.068	0.030	-0.028
J120	-0.051	0.122	0.026	0.035	-0.018	-0.028	0.015
J121	0.182	0.045	-0.001	0.075	0.006	-0.025	0.108
J122	0.001	0.013	0.060	-0.022	-0.034	-0.019	0.059
J123	-0.019	-0.002	0.035	0.127	0.087	0.025	-0.066
J124	-0.080	-0.026	-0.121	0.073	0.028	-0.041	-0.007
J125	0.136	-0.068	-0.001	-0.057	-0.052	-0.056	0.000
J126	-0.029	-0.000	0.069	0.044	-0.071	-0.030	0.007
J127	-0.021	-0.030	-0.010	-0.035	0.004	0.113	0.070
J128	0.071	0.118	-0.021	-0.097	0.055	0.107	-0.057
J129	0.008	0.080	-0.098	0.004	-0.014	-0.008	-0.091
J130	-0.041	-0.022	-0.071	-0.049	-0.015	-0.030	-0.008
J131	0.016	-0.056	0.017	0.048	0.012	-0.045	-0.008
J132	-0.014	0.001	-0.136	-0.050	0.025	-0.015	0.005
J133	-0.135	0.046	0.056	-0.008	0.011	-0.031	0.006
J134	-0.110	-0.051	-0.021	-0.129	0.008	-0.015	-0.023
J135	0.031	-0.022	-0.050	0.099	0.029	0.112	0.095
J136	0.059	-0.040	0.047	0.030	-0.008	-0.034	-0.026
J137	-0.018	-0.038	0.089	-0.042	0.023	-0.011	-0.017
J139	0.056	0.047	0.075	-0.073	0.042	-0.026	0.078
J140	-0.049	-0.087	-0.045	-0.015	-0.054	0.007	0.073
J141	-0.030	-0.105	0.018	0.019	-0.015	0.012	-0.032
J142	-0.032	0.001	-0.064	0.024	0.027	-0.042	0.057
J143	0.037	-0.000	0.064	0.049	-0.050	0.007	-0.052
J144	0.065	0.079	0.020	0.030	0.030	-0.007	-0.063
J145	-0.081	0.006	0.018	-0.060	0.015	-0.048	0.059
J146	0.002	-0.047	0.015	0.010	0.105	-0.018	0.014
J147	0.016	0.023	0.080	-0.017	0.143	0.017	0.023
J148	-0.099	0.097	-0.004	-0.030	-0.018	0.006	-0.019
J149	0.041	-0.010	-0.022	0.095	0.006	-0.018	-0.037
J150	-0.042	-0.062	0.064	0.074	0.014	0.025	0.016
J151	-0.011	0.002	0.004	0.017	-0.023	-0.010	0.015
J152	0.119	-0.053	-0.049	0.004	0.002	-0.032	0.023
J153	-0.052	0.040	0.037	0.075	-0.037	0.044	0.005
J154	-0.044	-0.009	-0.029	0.002	-0.018	-0.028	0.048
J155	0.026	-0.003	-0.037	0.003	0.036	-0.080	0.006
J156	0.017	-0.041	0.005	-0.008	-0.094	0.065	-0.090

presented in Tables 5-11 and 5-12, together with the proportion correct \hat{p}_g and the normal deviate $\hat{\gamma}_g$, for each item. Comparison of these two tables reveals that these two sets of results are fairly consistent with each other. It is also observed that the estimation of both the discrimination and difficulty parameters has been substantially ameliorated by the addition of older examinees, i.e., 460 and 461 second graders of junior high schools, respectively, in the J1/1075 and J1/2259 Cases, the fact which is especially conspicuous in the estimated discrimination and difficulty parameters of items J154, J120 and J134 in these tables when they are compared with the corresponding values shown in Table 5-3.

VI. Scale Adjustment I

As was mentioned in the preceding section, the estimated item parameters obtained as the result of the Tetrachoric Method are based upon the ability scale whose origin and unit are set equal to the mean and the standard deviation of the ability distribution of each specific examinee group. The results shown in Tables 5-1 through 5-4, 5-11 and 5-12 in the preceding section, therefore, are not directly comparable with one another. In order to make them comparable, we need some appropriate scale adjustment, or equating, so that all the estimated item characteristic functions be put on the single ability scale.

As we can see in Table 3-1, there are a certain number of test items which belong to the two tests of each pair of adjacent tests.

TABLE 5-11

Estimates of the Item Discrimination And Difficulty Parameters of Each of the 55 Items of Test J1, Together with Its Proportion Correct And Normal Deviate. J1/1075 Case.

Item g	Discrimination Parameter \hat{a}_g	Difficulty Parameter \hat{b}_g	Proportion Correct \hat{p}_g	Normal Deviate $\hat{\gamma}_g$
J101	0.771	-0.304	0.57356	-0.18545
J102	0.541	-1.036	0.68901	-0.49305
J103	0.642	-1.240	0.74860	-0.67009
J104	0.708	-1.125	0.74209	-0.64980
J105	0.783	-0.461	0.61173	-0.28383
J106	0.500	-0.934	0.66201	-0.41796
J107	0.567	-0.299	0.55866	-0.14757
J108	0.826	-2.102	0.90968	-1.33879
J109	0.330	-1.317	0.66015	-0.41287
J110	0.640	-0.724	0.65177	-0.39010
J111	0.983	-1.473	0.84916	-1.03284
J112	0.485	-0.916	0.65549	-0.40019
J113	0.554	-1.213	0.72160	-0.58760
J114	0.632	-0.096	0.52048	-0.05136
J115	0.815	-0.457	0.61359	-0.28869
J116	0.385	-1.221	0.66946	-0.43842
J117	0.354	-0.785	0.60335	-0.26203
J118	0.559	-1.273	0.73277	-0.62121
J119	0.614	-1.182	0.73184	-0.61839
J120	0.302	0.983	0.38827	0.28383
J121	0.499	-0.988	0.67039	-0.44099
J122	0.534	-1.030	0.68622	-0.48516
J123	0.528	-0.045	0.50838	-0.02101
J124	0.576	-1.859	0.82309	-0.92721
J125	0.522	-1.776	0.79423	-0.82119
J126	0.475	-0.805	0.63501	-0.34515
J127	0.543	-1.757	0.79888	-0.83763
J128	0.776	-1.141	0.75791	-0.69960
J129	0.793	1.131	0.24115	0.70261
J130	0.351	-1.988	0.74488	-0.65846
J131	0.876	-0.554	0.64246	-0.36504
J132	0.432	-0.248	0.53911	-0.09819
J133	0.732	-1.818	0.85847	-1.07347
J134	0.306	1.848	0.29423	0.54107
J135	0.836	-0.356	0.59032	-0.22837
J136	0.368	0.027	0.49628	0.00932
J137	0.682	-0.153	0.53445	-0.08646
J139	0.418	1.071	0.33985	0.41287
J140	0.420	-0.012	0.50186	-0.00466
J141	0.577	-1.115	0.71136	-0.55736
J142	0.499	0.120	0.47858	0.05372
J143	0.702	-0.435	0.59870	-0.24998
J144	0.389	-0.723	0.60335	-0.26203
J145	0.776	-0.499	0.62011	-0.30577
J146	0.865	-0.309	0.58007	-0.20207
J147	0.447	-0.000	0.50000	0.00000
J148	0.510	0.144	0.47393	0.06539
J149	0.514	-0.453	0.58194	-0.20686
J150	0.515	-0.332	0.56052	-0.15229
J151	0.486	0.666	0.38547	0.29115
J152	0.345	0.366	0.45251	0.11932
J153	0.463	1.187	0.30912	0.49835
J154	0.224	1.890	0.33985	0.41287
J155	0.860	0.744	0.31378	0.48516
J156	0.711	1.131	0.25605	0.65557

TABLE 5-12

Estimates of the Item Discrimination And Difficulty Parameters of Each of the 55 Items of Test J1, Together with Its Proportion Correct And Normal Deviate. J1/2259 Case.

Item g	Discrimination Parameter \hat{a}_g	Difficulty Parameter \hat{b}_g	Proportion Correct \hat{p}_g	Normal Deviate \hat{Y}_g
J101	0.733	-0.528	0.62240	-0.31179
J102	0.541	-1.240	0.72244	-0.59011
J103	0.573	-1.545	0.77866	-0.76768
J104	0.716	-1.094	0.73794	-0.63701
J105	0.801	-0.388	0.59584	-0.24259
J106	0.500	-1.027	0.67685	-0.45891
J107	0.588	-0.089	0.51793	-0.04496
J108	0.778	-2.249	0.91633	-1.38080
J109	0.390	-1.156	0.66268	-0.41979
J110	0.577	-0.617	0.62107	-0.30829
J111	0.959	-1.548	0.85790	-1.07093
J112	0.440	-1.319	0.70252	-0.53166
J113	0.512	-1.344	0.72997	-0.61272
J114	0.476	0.190	0.46746	0.08166
J115	0.710	-0.514	0.61709	-0.29785
J116	0.305	-1.949	0.71536	-0.56911
J117	0.393	-0.913	0.63081	-0.33400
J118	0.588	-1.851	0.82603	-0.93859
J119	0.659	-1.256	0.75520	-0.69095
J120	0.295	0.757	0.41523	0.21411
J121	0.474	-1.189	0.69456	-0.50882
J122	0.455	-1.321	0.70784	-0.54709
J123	0.460	-0.142	0.52368	-0.05939
J124	0.567	-1.594	0.78398	-0.78571
J125	0.453	-1.969	0.79194	-0.81317
J126	0.370	-0.712	0.59761	-0.24717
J127	0.530	-1.581	0.77025	-0.73967
J128	0.685	-1.377	0.78176	-0.77815
J129	0.768	1.112	0.24923	0.67691
J130	0.354	-2.115	0.76007	-0.70653
J131	0.805	-0.781	0.68792	-0.48996
J132	0.325	-0.131	0.51616	-0.04052
J133	0.829	-1.657	0.85480	-1.05724
J134	0.304	1.327	0.34971	0.38610
J135	0.858	-0.515	0.63125	-0.33517
J136	0.371	-0.030	0.50421	-0.01055
J137	0.596	0.036	0.49270	0.01830
J139	0.379	1.296	0.32315	0.45891
J140	0.426	-0.078	0.51217	-0.03051
J141	0.571	-0.975	0.68570	-0.48370
J142	0.451	-0.161	0.52634	-0.06607
J143	0.591	-0.392	0.57902	-0.19939
J144	0.387	-0.688	0.59805	-0.24830
J145	0.635	-0.767	0.65958	-0.41132
J146	0.888	-0.236	0.56220	-0.15655
J147	0.335	0.079	0.49004	0.02497
J148	0.525	-0.354	0.56529	-0.16440
J149	0.514	-0.399	0.57238	-0.18244
J150	0.517	-0.331	0.56043	-0.15206
J151	0.465	0.607	0.39885	0.25632
J152	0.397	0.182	0.47322	0.06718
J153	0.387	1.720	0.26737	0.62079
J154	0.244	2.041	0.31430	0.48370
J155	0.744	0.955	0.28420	0.57041
J156	0.660	1.163	0.26073	0.64110

To be more specific, for the three pairs of adjacent tests, A5 and A6, A6 and J1, and J1 and J2, there are 16, 16 and 20 such overlapping test items, respectively. Table 6-1 presents the two item numbers, which are expressed in the notation adopted in the present study, of each item which belongs to the two adjacent tests of each pair.

If we can find the best fitted line for the scatter diagram of the estimated difficulty parameters with respect to these overlapping items, then we shall be able to obtain the estimated distance between the means of the two ability distributions, and the ratio of the standard deviations of these two distributions. If we follow a similar procedure for the estimated discrimination parameters with the constraint that the fitted line pass $(0,0)$, then we shall obtain another estimate of the ratio of the standard deviations of the two ability distributions. Since in each scatter diagram both sets of observations include error, it is obvious that a simple linear regression method for fitting a linear relationship between the two sets of estimates is not appropriate. There have been developed many methods (e.g., Deming, 1943) which deal with such a situation, however. In the present study, we shall use an iterative method based upon the dominating principal component obtained for the two sets of observations.

Let $\{\hat{a}_{g1}\}$ and $\{\hat{a}_{g2}\}$ be two sets of estimated item discrimination parameters obtained upon the examinee groups 1 and 2, respectively, where g ($=1,2,\dots,m$) indicates an overlapping test item. Since the discrimination parameter, a_g , is proportional to

TABLE 6-1

Three Sets of Overlapping Test Items between Adjacent Tests.

	Tests A5 & A6	Tests A6 & J1	Tests J1 & J2
1	A533 A601	A641 J101	J137 J201
2	A534 A602	A642 J102	J138 J202
3	A535 A603	A643 J103	J139 J203
4	A536 A604	A644 J104	J140 J204
5	A537 A605	A645 J105	J141 J205
6	A538 A606	A646 J106	J142 J206
7	A539 A607	A647 J107	J143 J207
8	A540 A608	A648 J108	J144 J208
9	A541 A609	A649 J109	J145 J209
10	A542 A610	A650 J110	J146 J210
11	A543 A611	A651 J111	J147 J211
12	A544 A612	A652 J112	J148 J212
13	A545 A613	A653 J113	J149 J213
14	A546 A614	A654 J114	J150 J214
15	A547 A615	A655 J115	J151 J215
16	A548 A616	A656 J116	J152 J216
17			J153 J217
18			J154 J218
19			J155 J219
20			J156 J220

the slope of the item characteristic function at $\theta = b_g$ both in the normal ogive and in the logistic models, without considering the error of estimation we can write

$$(6.1) \quad a_{g2} = (\sigma_2/\sigma_1) a_{g1} ,$$

where σ_1 and σ_2 represent the standard deviations of the ability distributions of the examinee groups 1 and 2, respectively. Thus the second principal component of the two variables degenerates, and the first principal component provides us with the linear relationship between $\{a_{g1}\}$ and $\{a_{g2}\}$. With fallible data, however, this is not the case. It is well known that the first and second principal components of two random variables are their linear combinations which provide us with the maximum and minimum variances, respectively, with the constraint that the total variance stay the same. Thus we can take the first, dominating principal component as the best fitted linear relationship between $\{\hat{a}_{g1}\}$ and $\{\hat{a}_{g2}\}$.

Let A be the (2×2) symmetric matrix of the cross-products of \hat{a}_{g1} and \hat{a}_{g2} . Thus we can write

$$(6.2) \quad A = \left\{ \sum_{g=1}^m \hat{a}_{g1} \hat{a}_{gj} \right\} \quad i, j = 1, 2 .$$

It is well known that the two eigenvalues, λ_1 and λ_2 , of the matrix A equal the variances of the first and second principal components of $\{\hat{a}_{g1}\}$ and $\{\hat{a}_{g2}\}$, respectively. Let y be the

random vector of the two principal components, y_1 and y_2 , of $\hat{a}_1 = \{\hat{a}_{g1}\}$ and $\hat{a}_2 = \{\hat{a}_{g2}\}$ ($g=1,2,\dots,m$). Thus we have

$$(6.3) \quad \hat{y} = \{y_1, y_2\} \quad ,$$

with

$$(6.4) \quad \text{Var.}(y_t) = \lambda_t \quad t = 1, 2 \quad ,$$

and

$$(6.5) \quad \hat{y} = \Gamma \hat{a} \quad ,$$

where Γ is the (2×2) matrix whose columns are the two eigenvectors corresponding to the two eigenvalues, λ_1 and λ_2 , respectively, and \hat{a}_g is the random vector of order 2 such that

$$(6.6) \quad \hat{a} = (\hat{a}_1, \hat{a}_2) \quad .$$

It is well known that, when Γ is a (2×2) matrix, we can write

$$(6.7) \quad \Gamma = \begin{bmatrix} \cos \alpha & -\sin \alpha \\ \sin \alpha & \cos \alpha \end{bmatrix} \quad ,$$

where α is the angle of the rotated axis specified by the first principal component with the axis representing a_1 . Thus we have

$$(6.8) \quad \begin{cases} y_1 = \hat{a}_1 \cos \alpha + \hat{a}_2 \sin \alpha \\ y_2 = -\hat{a}_1 \sin \alpha + \hat{a}_2 \cos \alpha \end{cases} .$$

Let u_1 be the eigenvector corresponding to the eigenvalue λ_1 . We can write, therefore,

$$(6.9) \quad u_1 = (u_{11}, u_{12}) = (\cos \alpha, \sin \alpha) .$$

The estimate of the two standard deviations is given by

$$(6.10) \quad \hat{\sigma}_2/\hat{\sigma}_1 = \tan \alpha = u_{12}/u_{11} .$$

Thus all we need is to compute the cross-products of \hat{a}_{g1} and \hat{a}_{g2} and produce the matrix A, to find out the eigenvector u_1 corresponding to its first, dominating eigenvalue, λ_1 , of the matrix A, and take the ratio of the first element of the eigenvector u_1 to its second element.

We notice, however, in the above method that equal weights are put upon the error in \hat{a}_1 and upon the error in \hat{a}_2 , which is not justifiable in the present situation, since the values of \hat{a}_{g1} and \hat{a}_{g2} are not determined on the same ability scale. To be more specific, if the unit of the scale is larger, then the values of the estimated discrimination parameters and their errors will also become larger, and vice versa. In minimizing the sum of the squared discrepancies from the first, dominating principal component, y_1 ,

therefore, the set of \hat{a}_{g1} which is based upon the larger scale unit is more heavily penalized.

To ameliorate this situation, let us consider the following logic. Suppose that the ratio, σ_2/σ_1 , is known, and we define the weight w in such a way that

$$(6.11) \quad w = \sigma_1/\sigma_2 ,$$

and we further define

$$(6.12) \quad a_{g1}^* \begin{cases} = a_{g1} & i=1 \\ = wa_{g2} & i=2 \end{cases} .$$

It is noted that, unlike a_{g1} and a_{g2} , a_{g1}^* and a_{g2}^* are comparable. We further define the (2x2) matrix A^* such that

$$(6.13) \quad A^* = \left\{ \sum_{g=1}^m a_{g1}^* a_{g2}^* \right\} = \begin{bmatrix} \sum_{g=1}^m a_{g1}^2 & w \sum_{g=1}^m a_{g1} a_{g2} \\ w \sum_{g=1}^m a_{g1} a_{g2} & w^2 \sum_{g=1}^m a_{g2}^2 \end{bmatrix}$$

It is easy to see that the matrix A^* can be obtained directly from the matrix A , which is given by (6.2), by multiplying both its second row and second column by w . The two principal components, y_1^* and y_2^* , of $a_1^* = \{a_{g1}^*\}$ and $a_2^* = \{a_{g2}^*\}$ ($g=1,2,\dots,m$) are given by

$$(6.14) \quad \begin{cases} y_1^* = a_1^* \cos \alpha^* + a_2^* \sin \alpha^* \\ y_2^* = -a_1^* \sin \alpha^* + a_2^* \cos \alpha^* \end{cases} ,$$

where $\cos \alpha^*$ and $\sin \alpha^*$ are obtained as the two elements of the eigenvector, $u_1^* = (u_{11}^*, u_{12}^*)$, corresponding to the first, dominating eigenvalue, λ_1^* , of the matrix A^* . Thus we can write

$$(6.15) \quad u_1^* = (u_{11}^*, u_{12}^*) = (\cos \alpha^*, \sin \alpha^*) ,$$

and

$$(6.16) \quad \tan \alpha^* = u_{12}^*/u_{11}^* .$$

From this result, we obtain

$$(6.17) \quad \tan \alpha = (\tan \alpha^*)/w = (u_{12}^*/u_{11}^*) (\sigma_2/\sigma_1) .$$

Since, in practice, (σ_2/σ_1) is not known, the estimated ratio $(\hat{\sigma}_2/\hat{\sigma}_1)$ obtained by (6.10) can be used as its initial estimate, and the cycle of formulae (6.11) through (6.17) can be repeated, until (u_{12}^*/u_{11}^*) converges to unity.

The situation is somewhat different if we use the sets of estimated difficulty parameters of the overlapping items for the equating purposes. Let $\{b_{g1}\}$ and $\{b_{g2}\}$ ($g=1,2,\dots,m$) be the two sets of estimated item difficulty parameters of the m

overlapping test items obtained upon the examinee groups 1 and 2, respectively. Since the difficulty parameter b_g is the point of θ at which the conditional probability for answering the item correctly is 0.5, without considering the error of estimation we can write

$$(6.18) \quad b_{g2} = (\sigma_1/\sigma_2) b_{g1} + (\mu_1 - \mu_2)/\sigma_2 \quad ,$$

where μ_1 and μ_2 are the means of the two ability distributions of the examinee groups 1 and 2, respectively. Thus unlike the case of the item discrimination parameter the best fitted line for the scatter diagram of the estimated difficulty parameters does not include the origin, unless $\mu_1 = \mu_2$. For this reason, it will be appropriate to shift the origins of b_{g1} and b_{g2} to their respective means, and follow the same process from there. Thus we must use the covariance matrix B such that

$$(6.19) \quad B = \left\{ \sum_{g=1}^m [b_{gi} - \frac{1}{m} \sum_{h=1}^m \hat{b}_{hi}] [\hat{b}_{gj} - \frac{1}{m} \sum_{h=1}^m \hat{b}_{hj}] \right\}$$

$i, j = 1, 2 \quad ,$

instead of the matrix of cross-products as we did for the scatter diagrams of estimated item discrimination parameters. Following the same iterative procedure by defining the matrix B^* and using it in place of A^* , which is obtained by multiplying the second row and the second column of the matrix B by the weight v such that

$$(6.20) \quad v = \sigma_2/\sigma_1 = \tan \alpha ,$$

we obtain the estimate of $\cot \alpha$ which equals the ratio, (σ_1/σ_2) . Note that this ratio is given as the slope of the fitted linear relationship between $\{b_{g1}\}$ and $\{b_{g2}\}$, as is obvious from (6.18).

It is indicated in (6.18) that the intercept of the fitted linear relationship between $\{b_{g1}\}$ and $\{b_{g2}\}$ can be used as the estimated distance of μ_1 from μ_2 measured with σ_2 as the unit. If we wish to obtain the estimate of the distance of μ_2 from μ_1 with σ_1 as the unit of measurement, then we can simply multiply this intercept by (-1) , and then divide the result by the slope of the fitted line.

Figure 6-1 presents the three scatter diagrams of $\{\hat{a}_{g1}\}$ and $\{\hat{a}_{g2}\}$ for the overlapping test items in the A5/0599 and A6/0412 Cases, in the A6/0412 and J1/0614 Cases, and in the J1/0614 and J2/0758 Cases, together with the three similar scatter diagrams between J1/0614 and J1/1075 Cases, between J1/0614 and J1/2259 Cases, and between J1/1075 and J1/2259 Cases, respectively. Note that in the last three pairs of cases all the 55 items of Test J1 are treated as the overlapping items. In each of these six graphs, the best fitted line obtained by the iterative method described earlier in this section is shown by a thin, solid line. In the process of fitting these lines, however, those dots circled in the graphs were excluded, in order to hold some consistency with the corresponding estimation

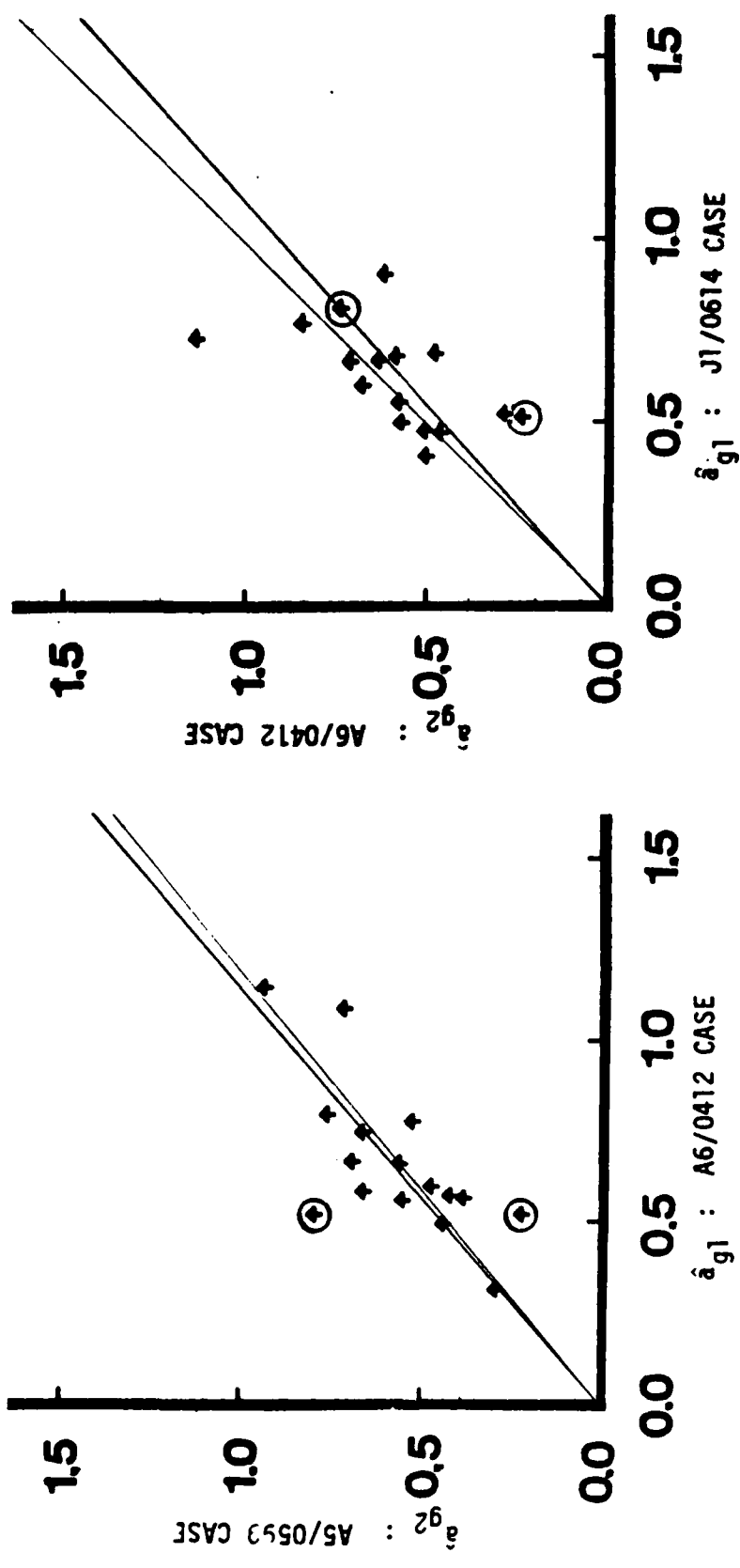


FIGURE 6-1

Two Sets of Estimated Item Discrimination Parameters of the Items Commonly Included by Two Adjacent Tests Which Were Obtained by the Tetrachoric Method. Fitted Linear Relationships Based upon Those Two Sets of Points (Thin Line) and upon Those and the Corresponding Two Sets of Estimated Difficulty Parameters (Thick Line) Are Also Shown. Circled Points Are Not Included in Line Fitting. The Graph on the Left Hand Side Shows 16 Common Items in Tests A5 and A6, Based upon the A5/0599 Case (a_{g2}) and A6/0412 Case (a_{g1}), Respectively, and the Graph on the Right Hand Side Shows 16 Common Items in Tests A6 and J1 Based upon the A6/0412 Case (a_{g2}) and J1/0614 Case (a_{g1}), Respectively.

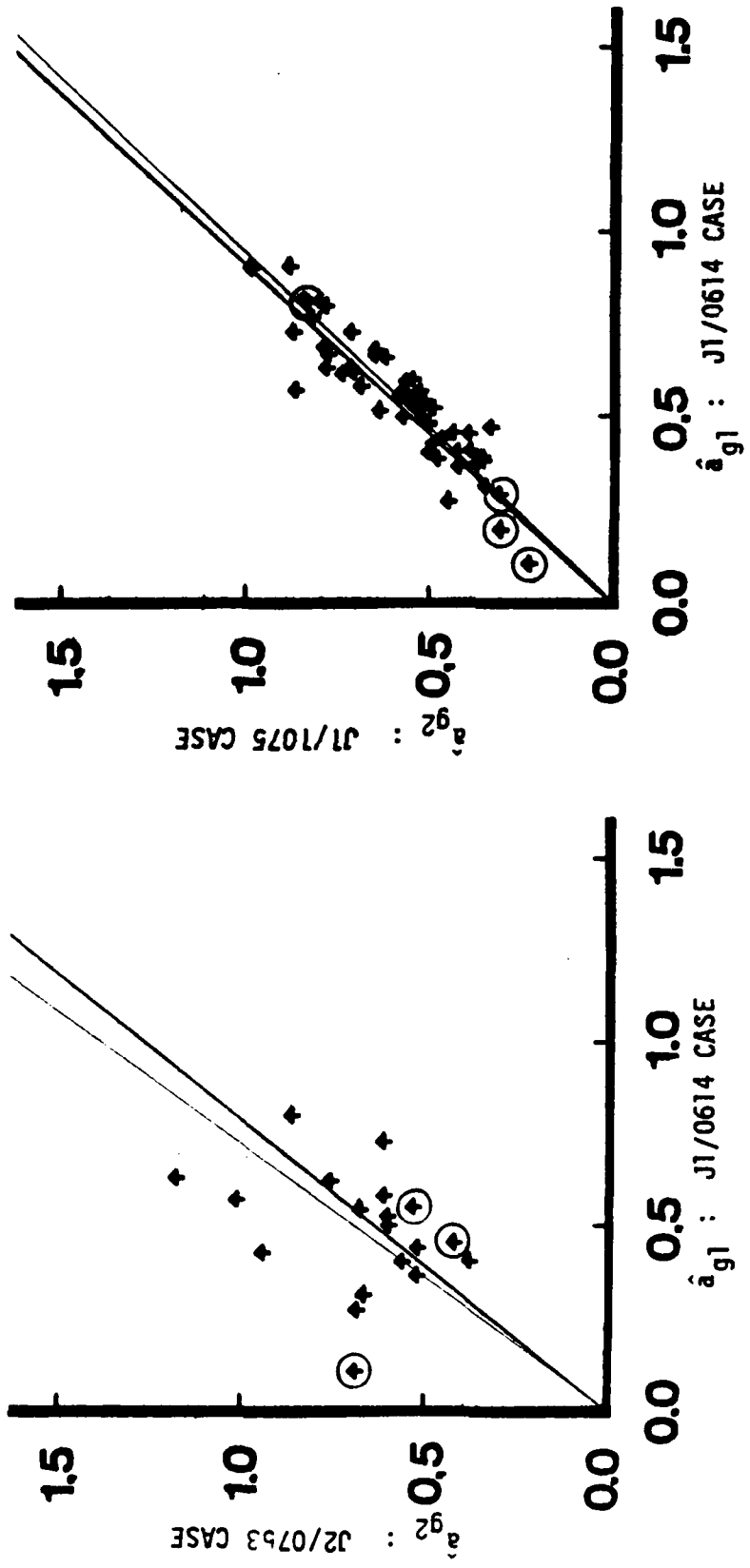


FIGURE 6-1 (Continued)

19 Common Items in Tests J1 and J2 Based upon the J1/0614 Case (a_{g1}) and J2/0758 Case (a_{g2}), Respectively.

55 Common Items in Test J1 Based upon the J1/0614 Case (a_{g1}) and J1/1075 Case (a_{g2}), Respectively.

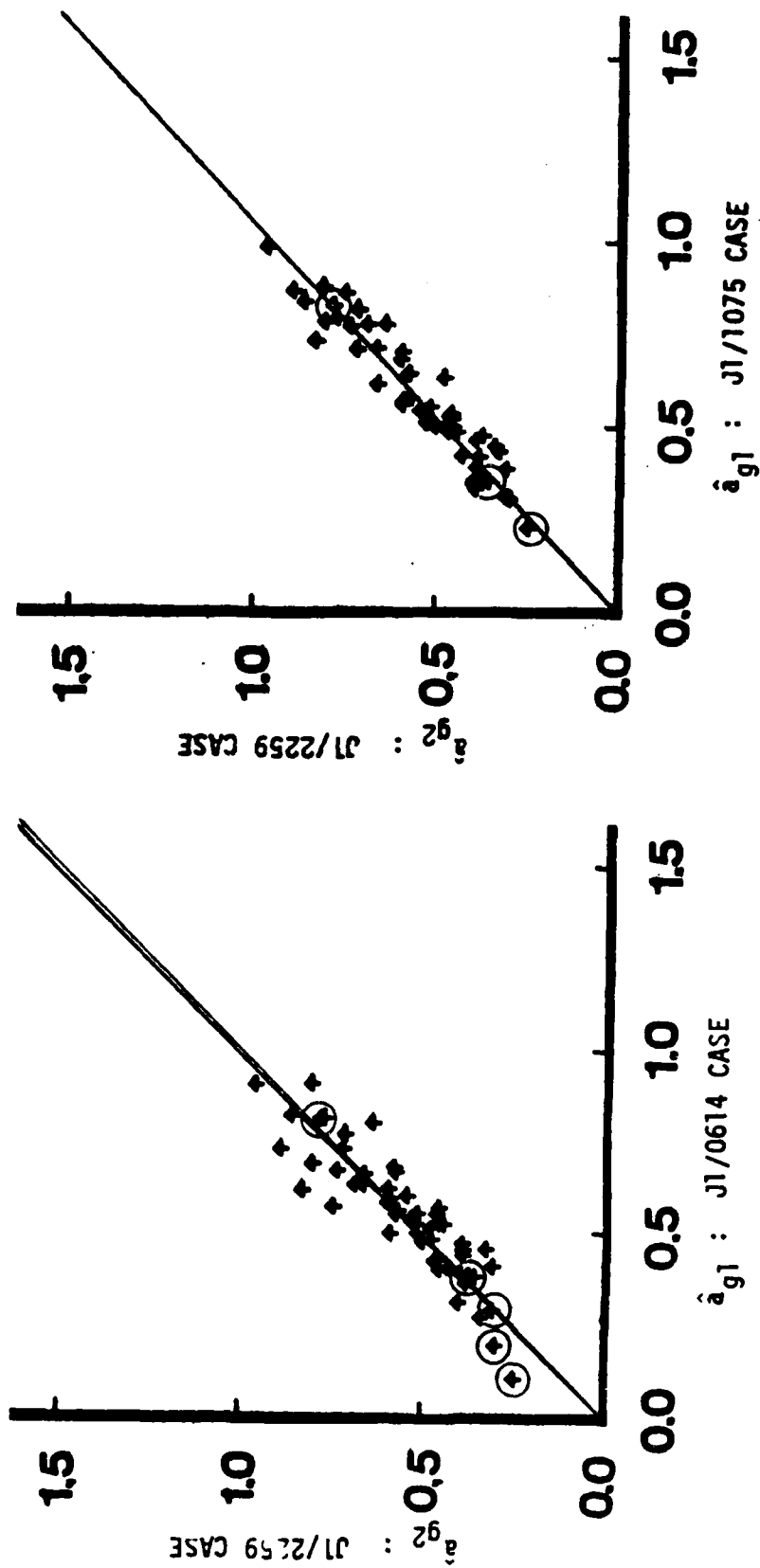


FIGURE 6-1 (Continued)

55 Common Items in Test J1 Based upon the J1/0614 Case (\hat{a}_{g1}) and J1/2259 Case (\hat{a}_{g2}), Respectively.

55 Common Items in Test J1 Based upon the J1/1075 Case (\hat{a}_{g1}) and J1/2259 Case (\hat{a}_{g2}), Respectively.

based upon the scatter diagrams of the estimated difficulty parameters. The criterion for this exclusion will be explained in the subsequent paragraph. The slope and intercepts of each of these six fitted linear relationships between the two sets of estimated discrimination parameters are shown in the third and fourth columns of Table 6-2, respectively. We can see that the estimated intercept is close to zero in each case, the result which was expected from theory.

Figure 6-2 presents the corresponding six scatter diagrams of $\{b_{g1}\}$ and $\{b_{g2}\}$. Again in each graph the best fitted line is drawn by a thin, solid line. It is observed in these graphs that some of the estimated difficulty parameters are largely deviated from the rest. Since it is intrinsic in the Tetrachoric Method that those deviated values include large errors, all the dots having, at least, one estimated difficulty parameter outside the range of $[-2.0, 2.0]$ were excluded in the process of fitting the linear relationship. Those excluded dots are circled in Figure 6-2. The same items were also excluded in the process of fitting the line for the scatter diagrams of the estimated item discrimination parameters, and these are represented by the encircled dots in Figure 6-1. The slope and intercept of each of the six fitted relationships between the two sets of estimated difficulty parameters are shown in the sixth and seventh columns of Table 6-2, respectively.

Since, for each pair, we obtained two estimates of the ratio of the standard deviations of the ability distributions of the two examinee groups, the geometric mean of the two estimates was computed,

TABLE 6-2
 Slope And Intercept of Each of the Fitted Linear Relationships between the Two Sets
 of Estimated Item Parameters a_g or b_g of the Common Test Items Based upon the
 Examinee Groups 1 and 2.

Examinee Group 1	Examinee Group 2	a_g		Combined Slope	b_g		Combined	
		Slope	Intercept		Slope	Intercept	Slope	Intercept
A6/0412	A5/0599	0.834	0.004	0.868	1.106	0.606	1.152	0.634
J1/0614	A6/0412	1.014	-0.016	0.901	1.250	0.581	1.110	0.486
J1/0614	J2/0758	1.376	-0.001	1.254	0.875	-1.213	0.797	-1.171
J1/0614	J1/1075	1.055	-0.002	1.089	0.889	-0.272	0.918	-0.263
J1/0614	J1/2259	1.000	-0.004	1.009	0.983	-0.294	0.992	-0.292
J1/1075	J1/2259	0.948	-0.002	0.945	1.061	-0.036	1.058	-0.038

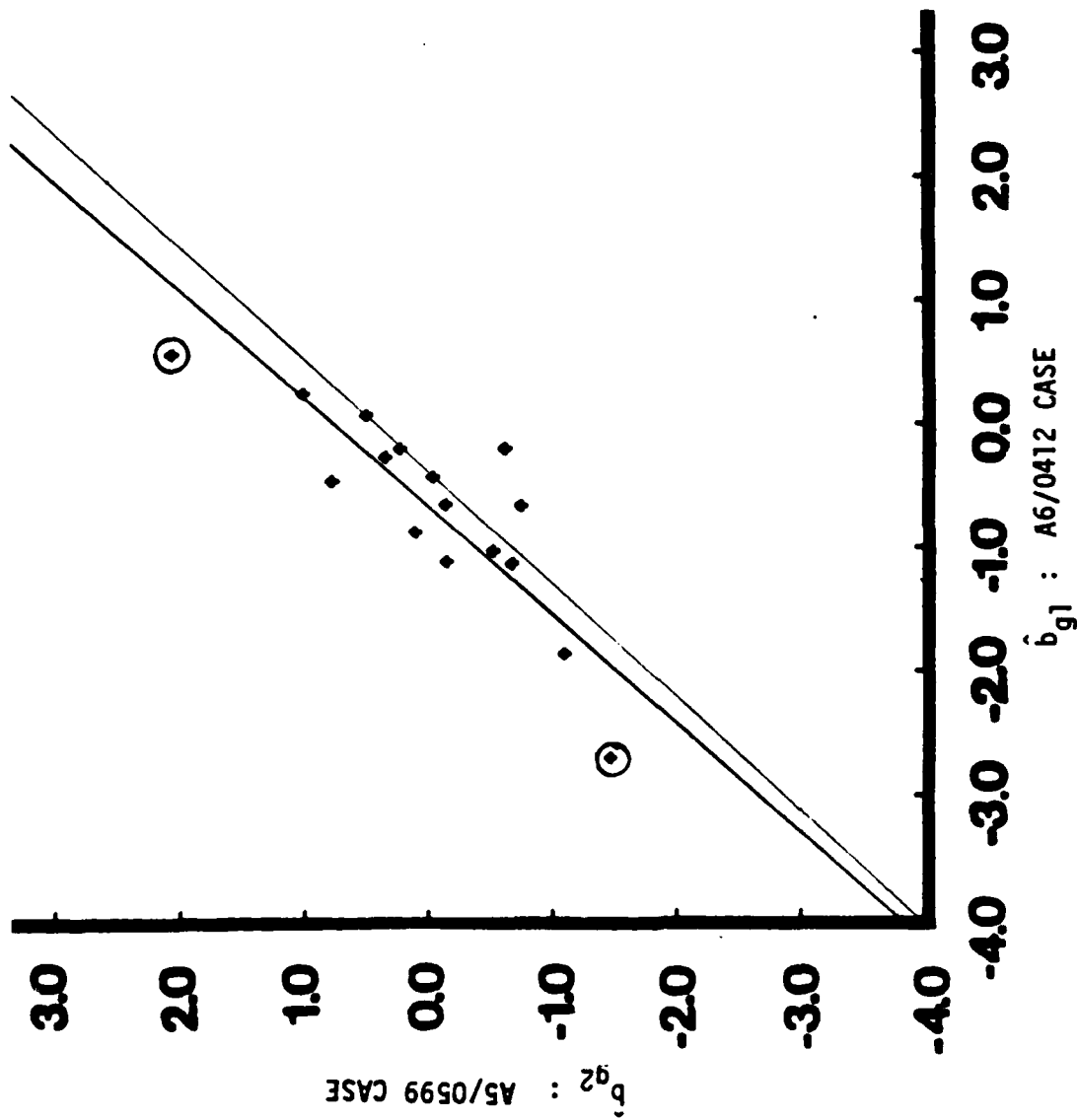


FIGURE 6-2

Two Sets of Estimated Item Difficulty Parameters of the Items Commonly Included by Two Adjacent Tests Which Were Obtained by the Tetrachoric Method. Fitted Linear Relationships Based upon Those Two Sets of Points (Thin Line) and upon Those and the Corresponding Two Sets of Estimated Discrimination Parameters (Thick Line) Are Also Shown. Circled Points Are Not Included in Line Fitting. 16 Common Items in Tests A5 and A6, Based upon the A5/0599 Case (b_{g2}) and A6/0412 Case (b_{g1}), Respectively.

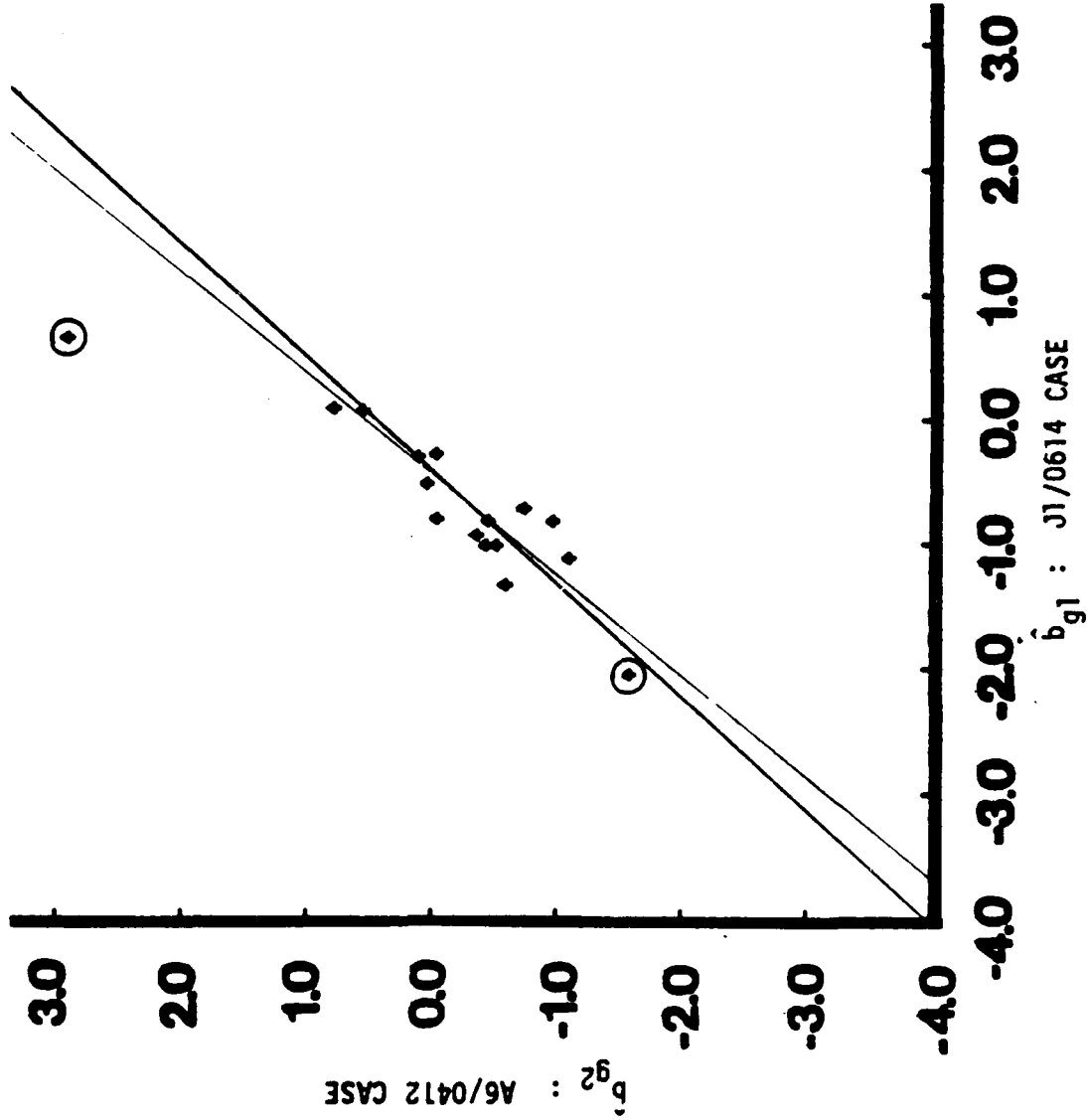


FIGURE 6-2 (Continued)
16 Common Items in Tests A6 and J1 Based upon the A6/0412 Case (b_{g2}) and J1/0614 Case (b_{g1}), Respectively.

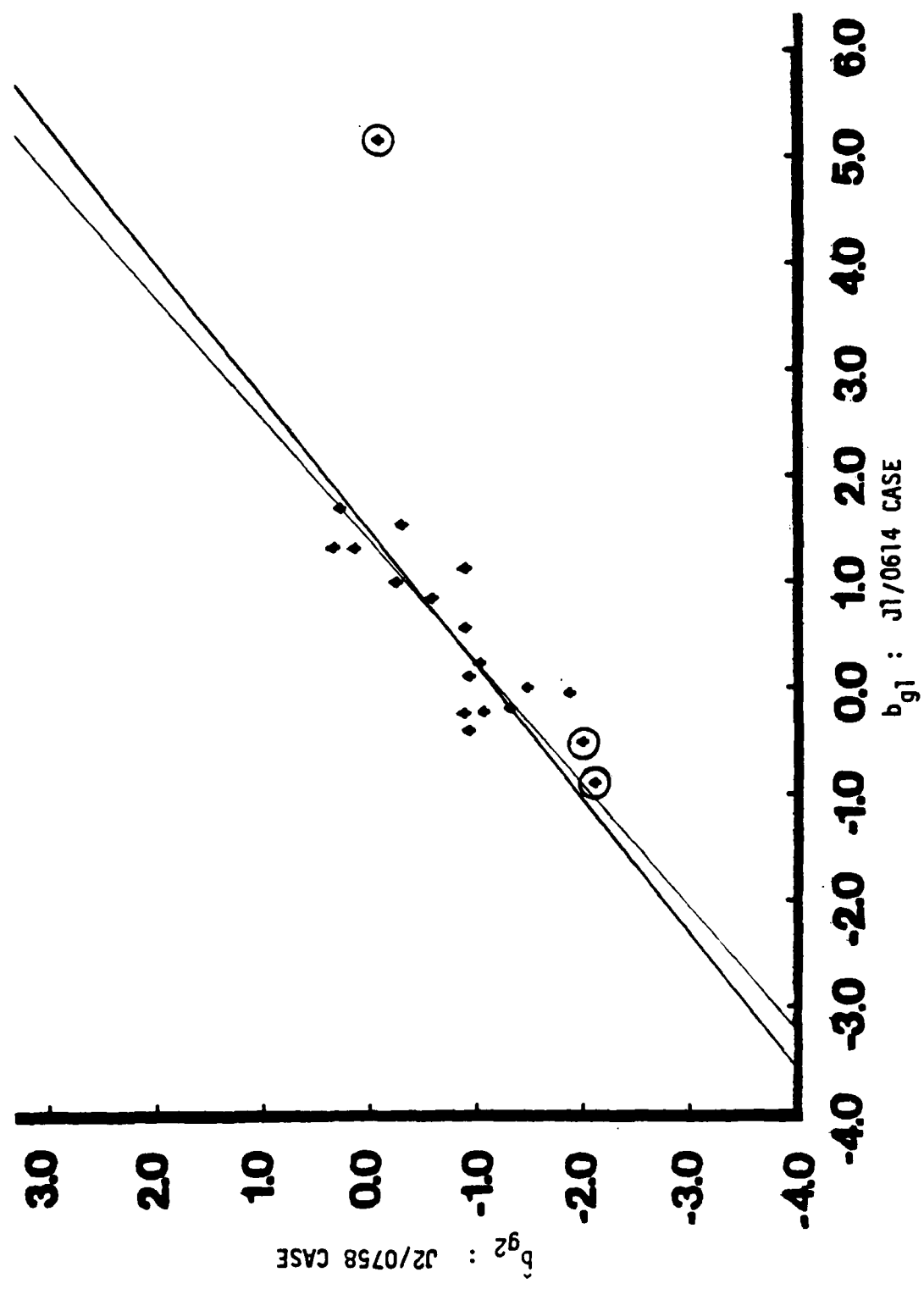


FIGURE 6-2 (Continued)

19 Common Items in Tests J1 and J2 Based upon the J1/0614 Case (b_{g1}) and J2/0758 Case (b_{g2}), Respectively.

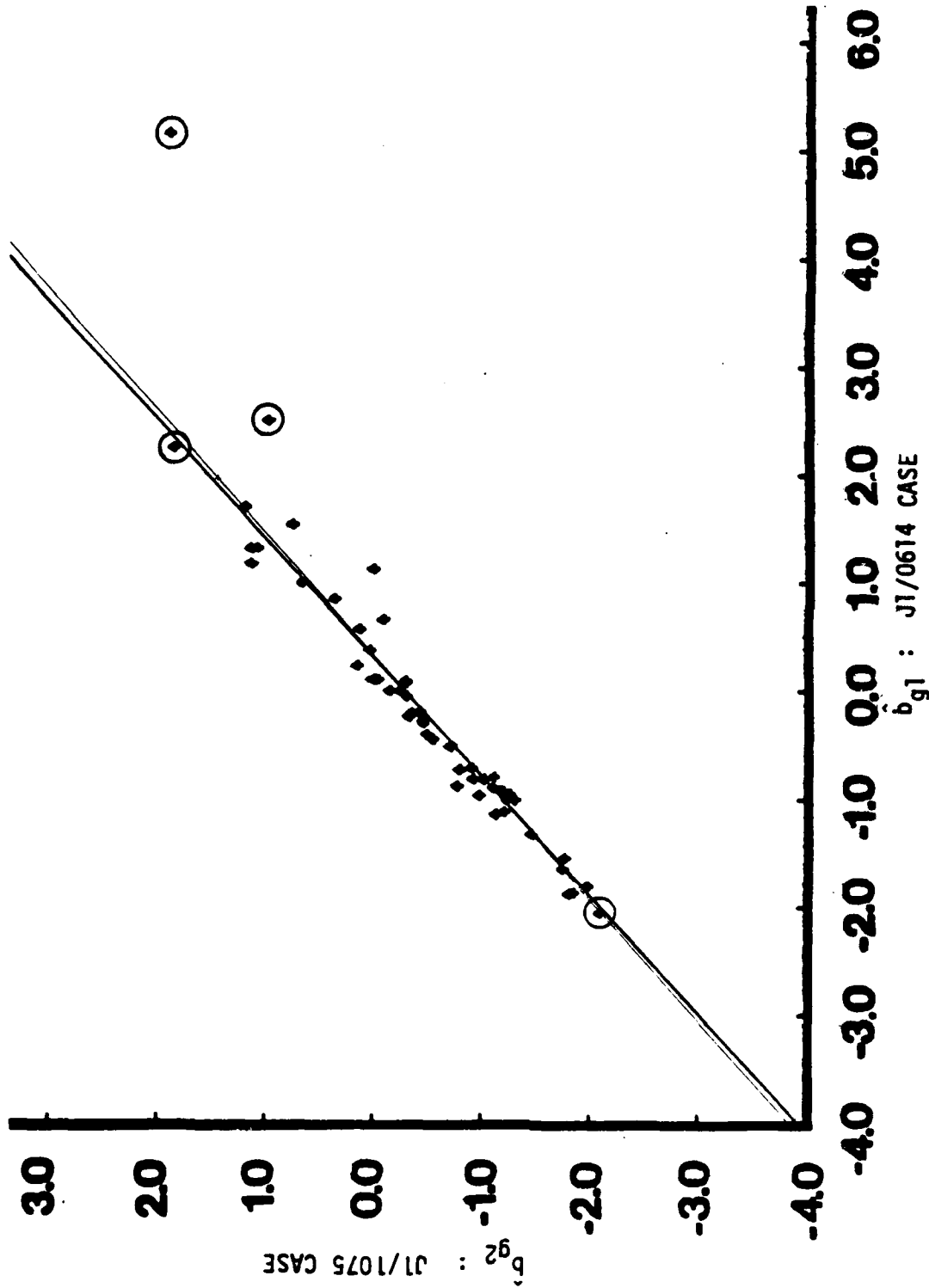


FIGURE 6-2 (Continued)

55 Common Items in Test J1 Based upon the JI/0614 Case (b_{g1}) and JI/1075 Case (b_{g2}), Respectively.

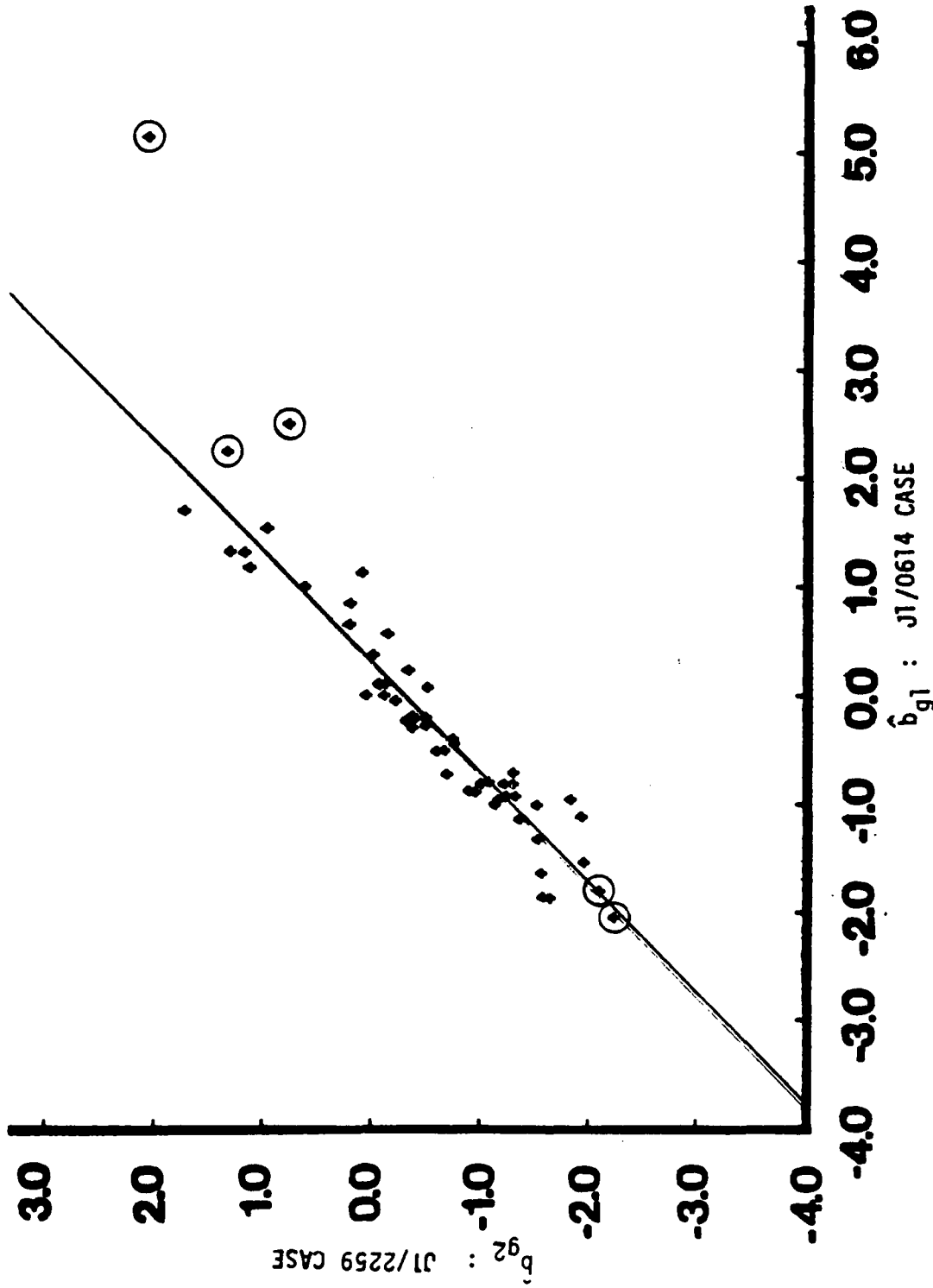


FIGURE 6-2 (Continued)

55 Common Items in Test J1 Based upon the J1/0614 Case (b_{g1}) and J1/2259 Case (b_{g2}), Respectively.

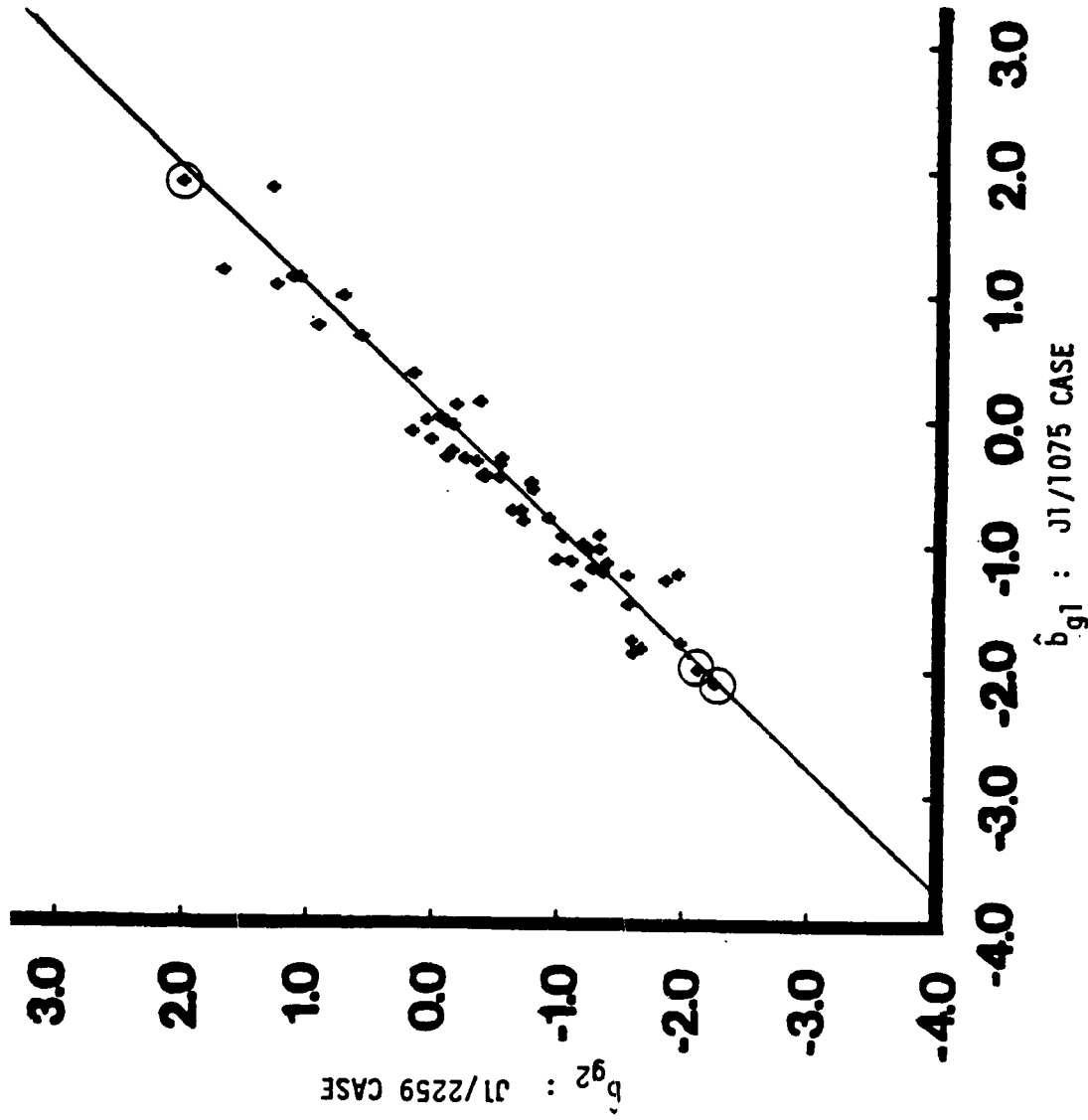


FIGURE 6-2 (Continued)

55 Common Items in Test J1 Based upon the J1/1075 Case (b_{g1}) and J1/2259 Case (b_{g2}), Respectively.

and used as the ultimate estimate of the ratio. The resulting linear function is shown by a thick, solid line in each graph of Figures 6-1 and 6-2. Note that, in Figure 6-2, not only the slope of the line is different from the one for the dotted line, but its intercept was also changed accordingly. Table 6-2 presents the slope thus obtained for each pair of sets of estimated discrimination parameters in its fifth column, and the slope and intercept of each of the six combined linear relationships for the estimated difficulty parameters in the eighth and ninth columns. Main intermediate results in the process of obtaining these values are shown in Appendix as Table A-1.

In order to put all the six ability distributions on a single ability scale, the following procedure was taken. First, we must pick up one examinee group who has taken a specific test, and decide to use the mean and standard deviation of its ability distribution as the origin and unit of the single ability scale. Let us call this specific examinee group as Subject Set 1. We can write

$$(6.21) \quad \frac{\mu_k - \mu_1}{\sigma_1} = \sum_{u=1}^{k-1} \left[\frac{\mu_{u+1} - \mu_u}{\sigma_u} \quad \begin{matrix} u \\ \Pi \end{matrix} \quad \frac{\sigma_s}{\sigma_{s-1}} \right]$$

with $\sigma_0 \equiv 1$, and

$$(6.22) \quad \frac{\sigma_k}{\sigma_1} = \prod_{s=1}^{k-1} (\sigma_{s+1} / \sigma_s)$$

for Subject Set $k (>1)$. (6.21) and (6.22) indicate that the indirect comparisons of the mean and standard deviation of any examinee group with those of Subject Set 1 are possible through $(k-2)$ other examinee groups. For example, if we choose J2/0758 Case as Subject Set 1, $k = 4$ for the A5/0599 Case, since this examinee group can indirectly be compared with Subject Set 1 through two more examinee groups, i.e., A6/0412 and J1/0614 Cases. Since both the estimate of the ratio of the standard deviations of the ability distributions of two examinee groups, who took two adjacent tests, and the estimate of the distance between their means measured by the standard deviation of either one of the two examinee groups are available, (6.21) and (6.22) will provide us with the estimated mean and standard deviation of the ability distribution of every examinee group which are based upon the single ability scale with its origin and unit set equal to the mean and standard deviation of the ability distribution of Subject Set 1.

In the present study, our choice of Subject Set 1 is J1/0614 Case. Table 6-3 presents in its first six rows the estimates of the mean and the standard deviation of the ability distribution thus obtained for each of the six examinee groups. In these five cases other than J1/0614, $k = 3$ in the A5/0599 Case, and $k = 2$ otherwise. Since J1/1075 and J2/2259 Cases are directly compared using this result and $k = 3$, we obtained another set of estimates of the mean and the standard deviation for each case. These results are shown in the seventh and eighth rows of Table 6-3. We can see that they are reasonably close to the corresponding results obtained by the direct

TABLE 6-3

Estimated Mean and Standard Deviation of Each of the Six Ability Distributions on the Ability Scale, Which Uses the Mean and the Standard Deviation of the J1/0614 Case As Its Origin and Unit, Respectively, and Those of Each of the Three Ability Distributions of the Combined Examinee Groups. Those Estimates Obtained Indirectly for the J1/1075 and J1/2259 Cases Are Also Shown.

Examinee Group	Mean	S.D.
A5/0599	-0.9335053873988D 00	0.7821682606788D 00
A6/0412	-0.4377494503856D 00	0.9007008047842D 00
J1/0614	0.0000000000000D 00	0.1000000000000D 01
J2/0758	0.1468885831893D 01	0.1253937346912D 01
J1/1075	0.2865059655582D 00	0.1089166526997D 01
J1/2259	0.2945629608377D 00	0.1008543903576D 01
J1/1075(2259)	0.2566381868855D 00	0.1066889245353D 01
J1/2259(1075)	0.3252226313344D 00	0.1029602899800D 01
A5-A6	-0.7314762617317D 00	0.8674202978083D 00
J1-J2	0.7754551956083D 00	0.1298071512414D 01
A5-A6-J1-J2	0.2397633167859D 00	0.1368853296181D 01

comparisons with the J1/0614 Case, or with $k = 2$.

Since in using Logist 5 we produced three combined examinee groups, i.e., the combinations of A5/0599 and A6/0412 Cases, of the J1/1075 and J2/0758 Cases and of the A5/0599, A6/0412, J1/1075 and J2/0758 Cases, it is necessary to estimate the mean and the standard deviation of the ability distribution of each of these three combined examinee groups. We can write for the density function $f(\theta)$, the mean $E(\theta)$ and the variance $\text{Var.}(\theta)$ of any combined distribution

$$(6.23) \quad f(\theta) = \sum_{i=1}^M p_i f_i(\theta) ,$$

$$(6.24) \quad E(\theta) = \sum_{i=1}^M p_i \int_{-\infty}^{\infty} \theta f_i(\theta) d\theta = \sum_{i=1}^M p_i E_i(\theta)$$

and

$$(6.25) \quad \text{Var.}(\theta) = \sum_{i=1}^M p_i \int_{-\infty}^{\infty} \theta^2 f_i(\theta) d\theta - [E(\theta)]^2 ,$$
$$= \sum_{i=1}^M p_i \text{Var.}_i(\theta) + \sum_{i=1}^M p_i [E_i(\theta)]^2 - [E(\theta)]^2 ,$$

where M is the number of original distributions involved, p_i is the probability assigned to the original population i , $f_i(\theta)$ is the density function for population i , and $E_i(\theta)$ and $\text{Var.}_i(\theta)$ are the mean and the variance of the ability distribution of the

population i , respectively. Using the estimated mean and standard deviation of the ability distribution of each examinee group involved and the proportion of the examinees of such a group i to those of the combined group as the estimate of p_i , we can obtain the estimated mean and standard deviation of each combined examinee group Through (6.24) and (6.25). These results are also shown in the last three rows of Table 6-3. The estimated ability distribution of each of the original and the combined examinee groups is also presented in Figure 6-3.

Tables 6-4 through 6-9 present the estimated item discrimination and difficulty parameters of each item of Tests A5, A6, J1 and J2, which were obtained by the Tetrachoric Method used for the A5/0599, A6/0412, J1/0614 and J2/0758 Cases, and then readjusted to this single ability scale, together with the two additional sets of estimated item parameters of the 55 items of Test J1 obtained upon the J1/1075 and J1/2259 Cases. In these tables, all the estimated item discrimination parameters and difficulty parameters which are less than 0.100 and exceed 3.000 in absolute value, respectively, are marked with ●.

VII. Item Parameters Estimated by Logist 5

As was mentioned in Section 3, in using Logist 5 we combined two or more examinee groups, who took different tests having some overlapping items, in order to provide us with the larger samples of examinees in the effort of increasing the accuracy of estimation. There are three such cases, and they are described in Table 3-2 of Section 3. For brevity, hereafter we shall call them Case A5-A6, Case J1-J2 and Case A5-A6-J1-J2, respectively, indicating the tests

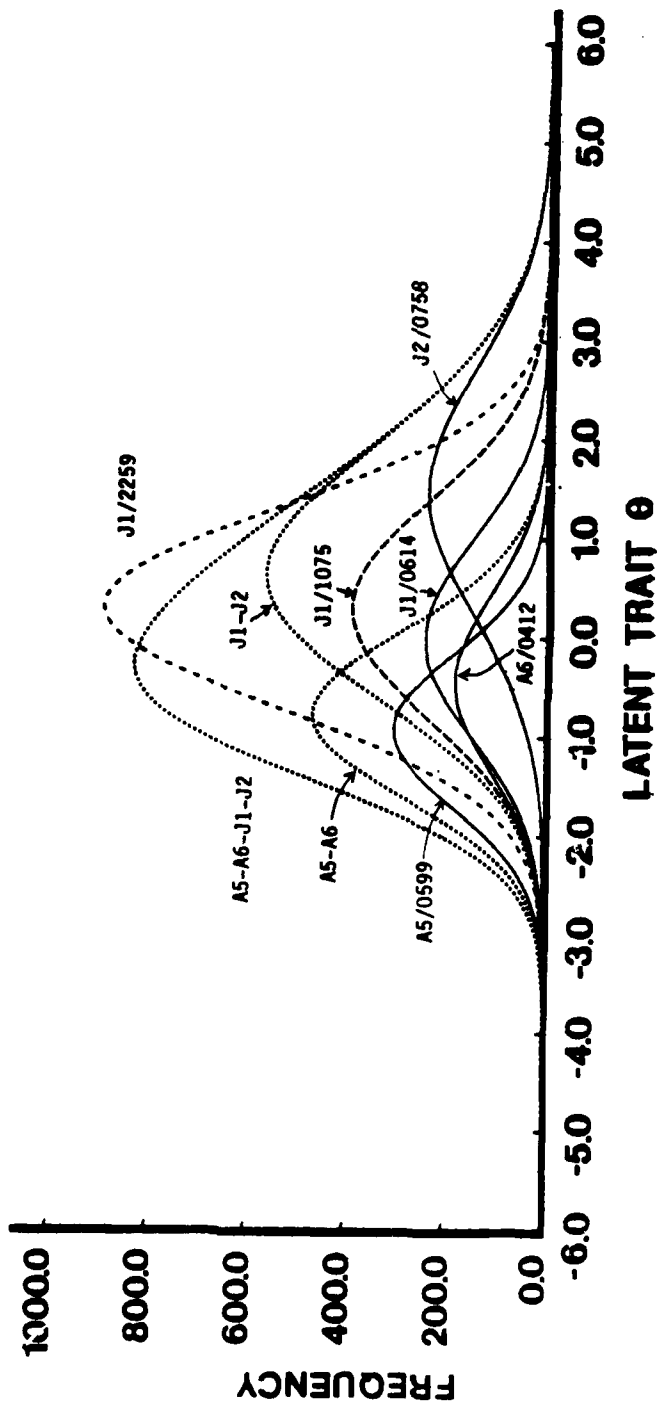


FIGURE 6-3

Estimated Ability Distributions (Solid Lines) of the A5/0599, A6/0412, J1/0614 And J2/0758 Cases, Those of the J1/1075 Case (Long Dashed Line) And of the J1/2259 Case (Short Dashed Line), Together with Those (Dotted Lines) of the Combined Examinee Groups, A5-A6 , J1-J2 And A5-A6-J1-J2.

TABLE 6-4

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 48 Items of Test A5, Based upon the Tetrachoric Method Applied for the A5/0599 Case. After the Scale Adjustment Was Made.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
A501	0.822	-2.292	A541	0.699	-0.966
A502	0.597	-3.188 ●	A542	0.557	-1.461
A503	---	---	A543	0.710	-1.418
A504	0.730	-2.038	A544	0.965	-0.323
A505	0.849	-2.405	A545	0.906	-0.663
A506	0.559	-1.989	A546	0.279	0.684
A507	0.542	-0.994	A547	0.369	-0.539
A508	0.873	-1.821	A548	0.532	-0.140
A509	1.356	-1.997			
A510	0.758	-0.949			
A511	0.589	-2.092			
A512	0.759	-1.929			
A513	---	---			
A514	0.993	-1.864			
A515	0.575	-2.249			
A516	0.486	0.498			
A517	---	---			
A518	0.433	-2.494			
A519	0.817	-1.936			
A520	0.447	-2.995			
A521	0.727	-1.931			
A522	0.568	-0.702			
A523	0.096 ●	4.836 ●			
A524	0.501	-2.068			
A525	1.036	-2.027			
A526	0.993	-0.832			
A527	0.097 ●	-0.210			
A528	0.532	-0.140			
A529	0.632	-0.598			
A530	0.694	-1.770			
A531	-0.064 ●	-21.642 ●			
A532	0.610	-0.007			
A533	0.877	-1.791			
A534	1.011	-2.081			
A535	0.665	-1.340			
A536	0.839	-1.048			
A537	0.598	-1.524			
A538	1.189	-0.853			
A539	0.841	-1.048			
A540	0.483	-0.757			

TABLE 6-5

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test A6, Based upon the Tetrachoric Method Applied for the A6/0412 Case. After the Scale Adjustment Was Made.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
A601	0.737	-2.115	A641	0.697	0.070
A602	0.574	-2.869	A642	0.747	-1.309
A603	0.862	-1.364	A643	0.785	-0.906
A604	0.645	-1.442	A644	1.257	-0.474
A605	0.662	-1.036	A645	0.524	-0.332
A606	1.269	-1.228	A646	0.556	-0.840
A607	0.827	-1.026	A647	0.628	0.276
A608	0.626	-0.621	A648	0.814	-1.870
A609	0.620	-0.826	A649	0.508	-0.827
A610	0.546	-1.457	A650	0.643	-0.402
A611	0.733	-0.618	A651	0.678	-0.974
A612	0.882	-0.857	A652	0.312	-1.104
A613	1.205	-0.683	A653	0.635	-0.765
A614	0.576	0.070	A654	0.258	2.190
A615	0.344	-0.377	A655	0.930	-0.466
A616	0.633	-0.220	A656	0.553	-1.428
A617	0.908	-1.719			
A618	0.554	-1.265			
A619	0.623	-1.266			
A620	1.027	-0.623			
A621	0.892	-1.013			
A622	0.606	-1.810			
A623	0.502	-1.553			
A624	0.613	-2.264			
A625	0.446	-1.885			
A626	0.564	-1.093			
A627	0.361	-0.525			
A628	0.239	-3.050 ●			
A629	0.695	-0.676			
A630	0.701	-1.029			
A631	0.656	-0.880			
A632	0.663	-1.509			
A633	0.425	-1.243			
A634	1.025	-1.792			
A635	0.785	-2.435			
A636	0.705	-1.748			
A637	0.527	-1.173			
A638	0.467	0.770			
A639	0.038 ●	19.949 ●			
A640	0.623	-0.217			

TABLE 6-6

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test J1, Based upon the Tetrachoric Method Applied for the J1/0614 Case. After the Scale Adjustment Was Made.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	0.668	0.072	J141	0.549	-0.894
J102	0.599	-0.817	J142	0.400	0.566
J103	0.664	-1.013	J143	0.620	-0.190
J104	0.727	-0.799	J144	0.452	-0.510
J105	0.686	-0.301	J145	0.798	-0.401
J106	0.475	-0.815	J146	0.727	-0.051
J107	0.497	0.090	J147	0.267	1.125
J108	0.809	-2.051	J148	0.542	0.231
J109	0.470	-1.011	J149	0.499	-0.224
J110	0.678	-0.517	J150	0.524	-0.237
J111	0.901	-1.329	J151	0.424	0.999
J112	0.521	-0.714	J152	0.309	0.847
J113	0.553	-0.930	J153	0.438	1.696
J114	0.513	0.657	J154	0.100	5.150 ●
J115	0.767	-0.279	J155	0.569	1.536
J116	0.406	-1.117	J156	0.630	1.313
J117	0.390	-0.880			
J118	0.594	-0.959			
J119	0.659	-0.926			
J120	0.191	2.502			
J121	0.482	-0.967			
J122	0.524	-0.819			
J123	0.552	0.103			
J124	0.560	-1.863			
J125	0.567	-1.541			
J126	0.383	-0.727			
J127	0.531	-1.643			
J128	0.630	-1.144			
J129	0.812	1.174			
J130	0.379	-1.805			
J131	0.905	-0.447			
J132	0.454	0.000			
J133	0.614	-1.873			
J134	0.287	2.244			
J135	0.819	-0.205			
J136	0.371	0.374			
J137	0.580	0.000			
J138	---	---			
J139	0.362	1.321			
J140	0.403	0.107			

TABLE 6-7

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 60 Items of Test J2, Based upon the Tetrachoric Method Applied for the J2/0758 Case. After the Scale Adjustment Was Made.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J201	0.484	-0.393	J241	0.817	-0.003
J202	---	---	J242	0.609	0.291
J203	0.412	1.879	J243	0.328	0.480
J204	0.298	0.289	J244	0.287	1.135
J205	0.419	-1.197	J245	0.691	1.316
J206	0.444	0.335	J246	0.222	1.609
J207	0.601	-0.198	J247	0.431	1.206
J208	0.331	-1.050	J248	0.322	-0.741
J209	0.685	0.295	J249	0.593	1.112
J210	0.486	-0.892	J250	0.572	0.995
J211	0.543	0.333	J251	0.723	0.293
J212	0.535	0.164	J252	0.471	1.395
J213	0.473	0.116	J253	0.477	1.493
J214	0.475	0.342	J254	0.489	1.421
J215	0.747	1.139	J255	0.914	1.552
J216	0.528	0.719	J256	0.464	2.067
J217	0.411	1.797	J257	0.429	1.071
J218	0.546	1.336	J258	0.362	1.621
J219	0.804	1.080	J259	0.658	1.706
J220	0.936	1.633	J260	0.073●	3.692●
J221	0.359	1.896			
J222	0.575	0.654			
J223	0.368	-0.476			
J224	0.556	0.614			
J225	0.549	-0.078			
J226	0.549	0.650			
J227	0.529	0.221			
J228	0.532	-0.270			
J229	0.521	0.092			
J230	0.481	0.133			
J231	0.953	-0.052			
J232	0.710	-0.173			
J233	0.282	2.146			
J234	0.308	1.504			
J235	0.775	0.678			
J236	0.731	0.801			
J237	0.226	-0.051			
J238	0.707	2.358			
J239	0.430	1.231			
J240	0.552	1.777			

TABLE 6-8

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test J1, Based upon the Tetrachoric Method Applied for the J1/1075 Case. After the Scale Adjustment Was Made.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	0.708	-0.044	J141	0.530	-0.928
J102	0.497	-0.842	J142	0.458	0.417
J103	0.590	-1.064	J143	0.644	-0.187
J104	0.650	-0.939	J144	0.357	-0.501
J105	0.719	-0.215	J145	0.713	-0.257
J106	0.459	-0.731	J146	0.794	-0.050
J107	0.521	-0.039	J147	0.410	0.287
J108	0.759	-2.003	J148	0.468	0.443
J109	0.303	-1.148	J149	0.472	-0.206
J110	0.588	-0.502	J150	0.473	-0.076
J111	0.902	-1.318	J151	0.446	1.012
J112	0.446	-0.712	J152	0.316	0.685
J113	0.508	-1.035	J153	0.425	1.579
J114	0.580	0.182	J154	0.206	2.345
J115	0.748	-0.211	J155	0.790	1.097
J116	0.353	-1.044	J156	0.653	1.518
J117	0.325	-0.569			
J118	0.513	-1.100			
J119	0.564	-1.001			
J120	0.277	1.357			
J121	0.458	-0.789			
J122	0.491	-0.835			
J123	0.484	0.237			
J124	0.529	-1.738			
J125	0.479	-1.648			
J126	0.436	-0.590			
J127	0.498	-1.627			
J128	0.712	-0.957			
J129	0.728	1.518			
J130	0.322	-1.879			
J131	0.805	-0.317			
J132	0.396	0.017			
J133	0.672	-1.693			
J134	0.281	2.299			
J135	0.768	-0.101			
J136	0.337	0.316			
J137	0.626	0.119			
J138	---	---			
J139	0.384	1.453			
J140	0.386	0.273			

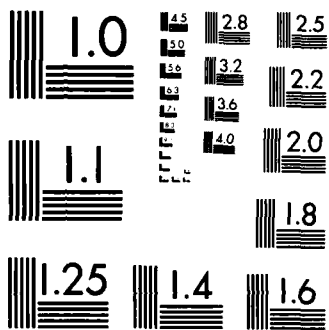
TABLE 6-9

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test J1, Based upon the Tetrachoric Method Applied for the J1/2259 Case. After the Scale Adjustment Was Made.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	0.726	-0.238	J141	0.566	-0.689
J102	0.537	-0.956	J142	0.447	0.132
J103	0.568	-1.263	J143	0.586	-0.100
J104	0.710	-0.809	J144	0.384	-0.399
J105	0.794	-0.097	J145	0.630	-0.479
J106	0.495	-0.741	J146	0.880	0.057
J107	0.583	0.205	J147	0.333	0.374
J108	0.771	-1.974	J148	0.521	-0.062
J109	0.386	-0.872	J149	0.509	-0.108
J110	0.572	-0.327	J150	0.512	-0.040
J111	0.950	-1.266	J151	0.462	0.907
J112	0.437	-1.036	J152	0.394	0.478
J113	0.508	-1.061	J153	0.384	2.029
J114	0.472	0.486	J154	0.242	2.353
J115	0.704	-0.224	J155	0.738	1.258
J116	0.303	-1.671	J156	0.655	1.468
J117	0.390	-0.626			
J118	0.583	-1.573			
J119	0.653	-0.972			
J120	0.293	1.058			
J121	0.470	-0.904			
J122	0.451	-1.038			
J123	0.456	0.151			
J124	0.562	-1.313			
J125	0.450	-1.691			
J126	0.367	-0.424			
J127	0.525	-1.299			
J128	0.679	-1.094			
J129	0.761	1.416			
J130	0.351	-1.839			
J131	0.798	-0.494			
J132	0.322	0.162			
J133	0.822	-1.377			
J134	0.302	1.633			
J135	0.850	-0.225			
J136	0.368	0.264			
J137	0.591	0.331			
J138	---	---			
J139	0.375	1.602			
J140	0.422	0.216			

involved. The numbers of subjects in these three cases are 1,011 , 1,833 and 2,844 , respectively, as are shown in Table 3-2. In addition to these three cases, because of their larger sample sizes, J1/1075 and J1/2259 Cases were also analyzed alone, by assuming, separately, three-parameter logistic model as well as (two-parameter) logistic model. We shall call these four additional cases Case J1/1075: c_g -Zero, Case J1/1075: c_g -Free, Case J1/2259: c_g -Zero, and Case J1/2259: c_g -Free, respectively, depending upon whether the adopted model is two-parameter or three-parameter logistic model in each case.

Tables 7-1 and 7-2 present the estimated item discrimination parameter \hat{a}_g and the estimated item difficulty parameters \hat{b}_g of each item of Tests A5 and A6, respectively, which were obtained upon the Case A5-A6. In Logist 5, the resulting estimates of item parameters and individual parameters are adjusted to the scale of ability whose origin and unit are set equal to the mean and the standard deviation of the estimated individual parameters of the sample of subjects in question, excluding those which fall outside the interval, $[-3, 3]$, after the last iteration. In Case A5-A6, one examinee was excluded because of his too low value of ability estimate, and seven examinees were excluded because of their too high values of ability estimate, to leave us 1,003 examinees in this process of standardization. Since the percentage of those examinees who were excluded is only 0.79 and negligibly small, hereafter, we shall treat the distribution of θ for the 1,003 examinees as if it were of the whole group of examinees. The same applies for Cases



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TABLE 7-1

Estimated Item Discrimination Parameter \hat{a}_g And Item Difficulty Parameter \hat{b}_g of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
A501	0.800	-1.717	A541	0.564	-0.237
A502	0.557	-2.729	A542	0.479	-0.829
A503	0.636	-2.873	A543	0.520	-0.477
A504	0.668	-1.462	A544	0.861	0.196
A505	0.842	-1.809	A545	0.953	0.017
A506	0.500	-1.444	A546	0.344	1.077
A507	0.533	-0.306	A547	0.307	0.297
A508	0.823	-1.238	A548	0.506	0.591
A509	1.533	-1.352			
A510	0.688	-0.293			
A511	0.518	-1.575			
A512	0.738	-1.321			
A513	1.102	-2.196			
A514	0.963	-1.268			
A515	0.512	-1.700			
A516	0.456	1.216			
A517	1.896	-1.742			
A518	0.400	-1.903			
A519	0.753	-1.361			
A520	0.391	-2.574			
A521	0.687	-1.331			
A522	0.436	0.020			
A523	0.089▲	5.596▲			
A524	0.469	-1.454			
A525	1.075	-1.397			
A526	0.944	-0.175			
A527	0.094▲	0.290			
A528	0.457	0.607			
A529	0.574	0.108			
A530	0.673	-1.134			
A531	0.031▲	41.264▲			
A532	0.548	0.747			
A533	0.848	-1.208			
A534	0.877	-1.568			
A535	0.678	-0.694			
A536	0.711	-0.484			
A537	0.515	-0.723			
A538	1.263	-0.313			
A539	0.761	-0.371			
A540	0.453	-0.016			

Note: The estimated item parameters for items A533 through A548 are the same as those for items A601 through A616 in Table 7-2, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6.

TABLE 7-2

Estimated Item Discrimination Parameter \hat{a}_g And Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
A601	0.848	-1.208	A641	0.628	0.907
A602	0.877	-1.568	A642	0.658	-0.618
A603	0.678	-0.694	A643	0.731	-0.162
A604	0.711	-0.484	A644	1.147	0.280
A605	0.515	-0.723	A645	0.487	0.481
A606	1.263	-0.313	A646	0.497	-0.070
A607	0.761	-0.371	A647	0.536	1.185
A608	0.453	-0.016	A648	0.873	-1.038
A609	0.564	-0.237	A649	0.440	-0.070
A610	0.479	-0.829	A650	0.546	0.390
A611	0.520	-0.477	A651	0.617	-0.263
A612	0.861	0.196	A652	0.273	-0.381
A613	0.953	0.017	A653	0.544	-0.043
A614	0.344	1.077	A654	0.243	3.015▲
A615	0.307	0.297	A655	0.857	0.301
A616	0.506	0.591	A656	0.499	-0.736
A617	0.995	-0.923			
A618	0.510	-0.532			
A619	0.603	-0.517			
A620	0.912	0.118			
A621	0.881	-0.264			
A622	0.628	-1.018			
A623	0.459	-0.818			
A624	0.608	-1.541			
A625	0.408	-1.190			
A626	0.527	-0.337			
A627	0.437	0.276			
A628	0.242	-2.154			
A629	0.653	0.088			
A630	0.636	-0.330			
A631	0.593	-0.140			
A632	0.645	-0.779			
A633	0.399	-0.491			
A634	1.183	-0.996			
A635	0.946	-1.538			
A636	0.718	-0.973			
A637	0.483	-0.433			
A638	0.455	1.587			
A639	0.056▲	13.295▲			
A640	0.536	0.600			

Note: The estimated item parameters for items A601 through A616 are the same as those for items A533 through A548 in Table 7-1 respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6.

J1-J2 and A5-A6-J1-J2, as we shall see later in this section.

It is interesting to note that the two items, A531 and A639, whose estimated item parameters by the Tetrachoric Method assume the most extreme values as are shown in Tables 5-1 and 5-2, are also the two items who have the most extreme sets of estimated item parameters in Tables 7-1 and 7-2. For convenience, the estimated item discrimination parameters which is less than 0.100 and the estimated item difficulty parameters which exceed 3.000 are marked with ▲ in these tables, and also in Tables 7-3 through 7-9 and in Table 7-11, which will be presented later in this Section. These marks reveal a strong consistency in extreme parameter estimates between the results of the Tetrachoric Method and those of Logist 5. We notice, moreover, that the whole configurations of the estimated discrimination parameters and of the estimated difficulty parameters are very similar to those obtained by the Tetrachoric Method.

The corresponding results of Tests J1 and J2 obtained upon the Case J1-J2 are shown in Tables 7-3 and 7-4, respectively. In this case, those who were excluded in the process of standardization because of their too low and too high values of ability estimate number one and twelve, respectively, to make the number of remaining examinees 1,820. It is noted, again, that the percentage of those who were excluded is negligibly small, i.e., 0.71 .

We can see in these two tables that item J138 in Table 7-3 and item J202 in Table 7-4 are the only marked items, whose estimated discrimination parameters are less than 0.100 and whose estimated

TABLE 7-3

Estimated Item Discrimination Parameter \hat{a}_g And Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	0.970	-0.617	J141	0.687	-1.267
J102	0.642	-1.215	J142	0.606	-0.292
J103	0.867	-1.316	J143	0.858	-0.728
J104	0.903	-1.266	J144	0.496	-1.016
J105	0.951	-0.752	J145	0.863	-0.679
J106	0.611	-1.111	J146	0.983	-0.721
J107	0.630	-0.617	J147	0.664	-0.382
J108	1.381	-1.862	J148	0.707	-0.352
J109	0.406	-1.387	J149	0.599	-0.672
J110	0.784	-0.956	J150	0.588	-0.553
J111	1.527	-1.482	J151	0.719	0.120
J112	0.577	-1.119	J152	0.553	-0.156
J113	0.708	-1.322	J153	0.536	0.696
J114	0.773	-0.442	J154	0.473	0.458
J115	1.021	-0.748	J155	1.103	0.209
J116	0.448	-1.372	J156	1.025	0.552
J117	0.423	-0.979			
J118	0.734	-1.354			
J119	0.777	-1.311			
J120	0.388	0.387			
J121	0.619	-1.145			
J122	0.648	-1.202			
J123	0.609	-0.399			
J124	0.820	-1.738			
J125	0.677	-1.743			
J126	0.580	-1.004			
J127	0.748	-1.674			
J128	1.063	-1.256			
J129	0.843	0.685			
J130	0.463	-1.839			
J131	1.095	-0.827			
J132	0.517	-0.554			
J133	1.070	-1.724			
J134	0.383	1.076			
J135	1.025	-0.667			
J136	0.415	-0.317			
J137	0.796	-0.579			
J138	0.010▲	145.324▲			
J139	0.495	0.643			
J140	0.417	-0.347			

Note: The estimated item parameters for items J137 through J156 are the same as those for items J201 through J220 in Table 7-4, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case J1-J2.

TABLE 7-4

Estimated Item Discrimination Parameter \hat{a}_g And Item Difficulty Parameter \hat{b}_g of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J201	0.796	-0.579	J241	1.300	-0.592
J202	0.010▲	145.324▲	J242	0.878	-0.389
J203	0.495	0.643	J243	0.428	-0.249
J204	0.417	-0.347	J244	0.315	0.146
J205	0.687	-1.267	J245	0.892	0.342
J206	0.606	-0.292	J246	0.285	0.611
J207	0.858	-0.728	J247	0.546	0.271
J208	0.496	-1.016	J248	0.435	-1.121
J209	0.863	-0.679	J249	0.747	0.182
J210	0.983	-0.721	J250	0.765	0.102
J211	0.664	-0.382	J251	1.046	-0.399
J212	0.707	-0.352	J252	0.561	0.430
J213	0.599	-0.672	J253	0.617	0.482
J214	0.588	-0.553	J254	0.615	0.445
J215	0.719	0.120	J255	1.179	0.505
J216	0.553	-0.156	J256	0.548	0.975
J217	0.536	0.696	J257	0.573	0.190
J218	0.473	0.458	J258	0.442	0.585
J219	1.103	0.209	J259	0.843	0.659
J220	1.025	0.552	J260	0.126	1.664
J221	0.466	0.805			
J222	0.764	-0.143			
J223	0.506	-0.922			
J224	0.747	-0.153			
J225	0.810	-0.617			
J226	0.727	-0.131			
J227	0.731	-0.442			
J228	0.791	-0.742			
J229	0.756	-0.493			
J230	0.665	-0.480			
J231	1.701	-0.592			
J232	1.089	-0.689			
J233	0.332	1.041			
J234	0.385	0.506			
J235	1.110	-0.127			
J236	1.012	-0.035			
J237	0.294	-0.634			
J238	0.858	1.215			
J239	0.550	0.278			
J240	0.673	0.732			

Note: The estimated item parameters for items J210 through J220 are the same as those for items J137 through J156 in Table 7-3, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case J1-J2.

difficulty parameters are greater than 3.000 . As we can see in the notes attached to these two tables, they are a single item overlapping in Test J1 and J2, and also it is the item which has been discarded by Shiba (cf. Tables 5-3 and 5-4). Again we notice that the whole configurations of the two estimated item parameters in Tables 7-3 and 7-4 are very similar to those obtained by the Tetrachoric Method, which are shown in Tables 5-3 and 5-4, respectively.

Tables 7-5 through 7-8 present the resulting item parameter estimates of each item of Tests A5, A6, J1 and J2, respectively, which were obtained upon the Case A5-A6-J1-J2. Again, some subjects were excluded in the process of standardization, and those who were excluded because of their too low ability estimates and of their too high ones number one and thirteen, respectively. Thus we had 2,830 subjects in the standardization process of this case. The percentage of those examinees who were excluded is, again, negligibly small, i.e., 0.49 .

It is noted that, in general, the estimated discrimination parameters of the items of Tests A5 and A6 in Tables 7-5 and 7-6 are larger than the corresponding values shown in Tables 7-1 and 7-2, even in the extreme cases such as items A531, A639, A523 and A527. This is an expected result, for the distribution of the individual ability estimates in Case A5-A6-J1-J2 is likely to have a larger standard deviation than the one in Case A5-A6, and, therefore, the scale unit in Case A5-A6-J1-J2 is larger than that in Case A5-A6. The true comparison of these two sets of results will be possible after a

TABLE 7-5

Estimated Item Discrimination Parameter \hat{a}_g And Item Difficulty Parameter \hat{b}_g of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 And J2/0758 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
A501	1.017	-2.059	A541	0.737	-0.897
A502	0.708	-2.858	A542	0.624	-1.353
A503	0.808	-2.969	A543	0.679	-1.082
A504	0.852	-1.857	A544	1.117	-0.563
A505	1.077	-2.127	A545	1.236	-0.701
A506	0.636	-1.845	A546	0.446	0.114
A507	0.679	-0.950	A547	0.400	-0.489
A508	1.049	-1.681	A548	0.660	-0.263
A509	1.951	-1.772			
A510	0.877	-0.940			
A511	0.659	-1.948			
A512	0.939	-1.748			
A513	1.404	-2.434			
A514	1.226	-1.706			
A515	0.651	-2.046			
A516	0.580	0.246			
A517	2.405	-2.080			
A518	0.510	-2.205			
A519	0.961	-1.777			
A520	0.498	-2.733			
A521	0.874	-1.755			
A522	0.555	-0.694			
A523	0.112	3.754▲			
A524	0.596	-1.853			
A525	1.371	-1.806			
A526	1.200	-0.847			
A527	0.122	-0.488			
A528	0.580	-0.232			
A529	0.730	-0.625			
A530	0.853	-1.603			
A531	0.036▲	34.662▲			
A532	0.697	-0.123			
A533	1.095	-1.649			
A534	1.133	-1.927			
A535	0.877	-1.250			
A536	0.926	-1.087			
A537	0.668	-1.273			
A538	1.631	-0.955			
A539	0.985	-1.001			
A540	0.590	-0.728			

Note: The estimated item parameters for items A533 through A548 are the same as those for items A601 through A616 in Table 7-6, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6-J1-J2.

TABLE 7-6

Estimated Item Discrimination Parameter \hat{a}_g And Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 And J2/0758 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
A601	1.095	-1.649	A641	1.032	-0.140
A602	1.133	-1.927	A642	0.659	-0.911
A603	0.877	-1.250	A643	0.968	-0.796
A604	0.926	-1.087	A644	1.199	-0.610
A605	0.668	-1.273	A645	0.910	-0.325
A606	1.631	-0.955	A646	0.659	-0.658
A607	0.985	-1.001	A647	0.754	-0.066
A608	0.590	-0.728	A648	1.346	-1.391
A609	0.737	-0.897	A649	0.495	-0.788
A610	0.624	-1.353	A650	0.842	-0.457
A611	0.679	-1.082	A651	1.343	-0.948
A612	1.117	-0.563	A652	0.541	-0.741
A613	1.236	-0.701	A653	0.790	-0.767
A614	0.446	0.114	A654	0.753	0.132
A615	0.400	-0.489	A655	1.093	-0.336
A616	0.660	-0.263	A656	0.475	-1.055
A617	1.330	-1.405			
A618	0.672	-1.120			
A619	0.808	-1.100			
A620	1.236	-0.625			
A621	1.161	-0.914			
A622	0.833	-1.481			
A623	0.610	-1.330			
A624	0.811	-1.870			
A625	0.544	-1.607			
A626	0.697	-0.967			
A627	0.452	-0.508			
A628	0.323	-2.327			
A629	0.860	-0.650			
A630	0.854	-0.960			
A631	0.792	-0.819			
A632	0.862	-1.297			
A633	0.533	-1.082			
A634	1.568	-1.462			
A635	1.264	-1.865			
A636	0.955	-1.446			
A637	0.644	-1.039			
A638	0.611	0.468			
A639	0.079▲	8.694▲			
A640	0.709	-0.264			

Note: The estimated item parameters for items A601 through A616 are the same as those for items A533 through A548 in Table 7-5, respectively since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6-J1-J2. Also The estimated item parameters for items A641 through A656 are the same as those for J101 through J116 in Table 7-7, respectively, since they are overlapping items between Tests A6 and J1.

TABLE 7-7

Estimated Item Discrimination Parameter \hat{a}_g And Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 And J2/0758 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	1.032	-0.140	J141	0.779	-0.725
J102	0.659	-0.911	J142	0.687	0.134
J103	0.968	-0.796	J143	0.973	-0.250
J104	1.199	-0.610	J144	0.563	-0.504
J105	0.910	-0.325	J145	0.979	-0.206
J106	0.659	-0.658	J146	1.118	-0.242
J107	0.754	-0.066	J147	0.753	0.055
J108	1.346	-1.391	J148	0.802	0.082
J109	0.495	-0.788	J149	0.682	-0.200
J110	0.842	-0.457	J150	0.667	-0.096
J111	1.343	-0.948	J151	0.816	0.498
J112	0.541	-0.741	J152	0.628	0.255
J113	0.790	-0.767	J153	0.609	1.004
J114	0.753	0.132	J154	0.536	0.795
J115	1.093	-0.336	J155	1.254	0.576
J116	0.475	-1.055	J156	1.167	0.877
J117	0.478	-0.472			
J118	0.830	-0.804			
J119	0.880	-0.764			
J120	0.437	0.738			
J121	0.701	-0.618			
J122	0.731	-0.670			
J123	0.692	0.041			
J124	0.928	-1.143			
J125	0.768	-1.146			
J126	0.656	-0.494			
J127	0.848	-1.085			
J128	1.200	-0.718			
J129	0.956	0.999			
J130	0.522	-1.235			
J131	1.237	-0.337			
J132	0.584	-0.096			
J133	1.204	-1.135			
J134	0.433	1.344			
J135	1.161	-0.196			
J136	0.469	0.114			
J137	0.902	-0.119			
J138	0.010 ▲	145.711 ▲			
J139	0.562	0.958			
J140	0.472	0.085			

Note: The estimated item parameters for items J101 through J116 are the same as those for items A641 through A656 in Table 7-6, respectively, since they are overlapping items between Tests A6 and J1 and the results are of Case A5-A6-J1-J2. Also the estimated item parameters for items J137 through J156 are the same as those for items J201 through J220 in Table 7-8, respectively, since they are overlapping items between Tests J1 and J2.

TABLE 7-8

Estimated Item Discrimination Parameter \hat{a}_g And Item Difficulty Parameter \hat{b}_g of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 And J2/0758 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J201	0.902	-0.119	J241	1.487	-0.128
J202	0.010▲	145.711▲	J242	1.001	0.049
J203	0.562	0.958	J243	0.487	0.171
J204	0.472	0.085	J244	0.358	0.518
J205	0.779	-0.725	J245	1.016	0.690
J206	0.687	0.134	J246	0.324	0.927
J207	0.973	-0.250	J247	0.623	0.629
J208	0.563	-0.504	J248	0.496	-0.593
J209	0.979	-0.206	J249	0.849	0.550
J210	1.118	-0.242	J250	0.872	0.480
J211	0.753	0.055	J251	1.194	0.041
J212	0.802	0.082	J252	0.640	0.767
J213	0.682	-0.200	J253	0.703	0.814
J214	0.667	-0.096	J254	0.702	0.781
J215	0.816	0.498	J255	1.341	0.834
J216	0.628	0.255	J256	0.624	1.246
J217	0.609	1.004	J257	0.653	0.557
J218	0.536	0.795	J258	0.504	0.904
J219	1.254	0.576	J259	0.960	0.969
J220	1.167	0.877	J260	0.142	1.863
J221	0.531	1.097			
J222	0.870	0.265			
J223	0.578	-0.418			
J224	0.851	0.256			
J225	0.925	-0.149			
J226	0.831	0.276			
J227	0.833	0.003			
J228	0.902	-0.260			
J229	0.863	-0.042			
J230	0.757	-0.031			
J231	1.938	-0.129			
J232	1.242	-0.213			
J233	0.380	1.303			
J234	0.440	0.834			
J235	1.268	0.279			
J236	1.153	0.360			
J237	0.336	-0.163			
J238	0.977	1.457			
J239	0.626	0.634			
J240	0.767	1.033			

Note: The estimated item parameters for items J210 through J220 are the same as those for items J137 through J156 in Table 7-7, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case A5-A6-J1-J2.

suitable scale adjustment, which is to be done later. We also notice that there are more negative values in the estimated difficulty parameters in Tables 7-5 and 7-6 than in those in Tables 7-1 and 7-2. Again this is an expected result, for the mean of the distribution of the individual ability estimates in Case A5-A6-J1-J2 is likely to be higher than that in Case A5-A6, and, therefore, the origin of the scale in the former is shifted to the positive direction.

Comparison of the results in Tables 7-7 and 7-8 with those in Tables 7-3 and 7-4 reveals the same tendency for the estimated discrimination parameters of the items of Tests J1 and J2 as we observed for the items of Tests A5 and A6, and also the reversed tendency for the estimated difficulty parameters. Again they are no surprise, for the origin of the scale used for Case A5-A6-J1-J2 is expected to be shifted to the negative direction compared with that in Case J1-J2, and the unit is expected to be larger in the former case than in the latter.

The estimated item parameters of each item of Test J1 which were obtained upon the Cases J1/1075: c_g -Zero and J1/1075: c_g -Free are presented in Tables 7-9 and 7-10, respectively. Since in the latter three-parameter logistic model is assumed, there is an additional column of the estimated guessing parameter c_g in Table 7-10. The corresponding sets of results for Cases J1/2259: c_g -Zero and J1/2259: c_g -Free are shown in Tables 7-11 and 7-12, respectively. In these cases, item J138 is excluded, since it was discarded in Shiba's research and also it provided us with meaningless

TABLE 7-9

Estimated Item Discrimination Parameter \hat{a}_g And Item Difficulty Parameter \hat{b}_g of Each of the 55 Items of Test J1 Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	0.842	-0.309	J141	0.645	-1.025
J102	0.560	-0.994	J142	0.506	0.106
J103	0.757	-1.110	J143	0.749	-0.430
J104	0.788	-1.052	J144	0.397	-0.693
J105	0.832	-0.463	J145	0.822	-0.504
J106	0.535	-0.873	J146	0.915	-0.325
J107	0.550	-0.307	J147	0.499	-0.013
J108	1.214	-1.729	J148	0.536	0.112
J109	0.356	-1.184	J149	0.538	-0.436
J110	0.691	-0.693	J150	0.532	-0.333
J111	1.338	-1.298	J151	0.493	0.611
J112	0.501	-0.886	J152	0.390	0.298
J113	0.615	-1.120	J153	0.503	1.092
J114	0.674	-0.107	J154	0.248	1.613
J115	0.895	-0.458	J155	0.921	0.695
J116	0.388	-1.178	J156	0.788	1.047
J117	0.369	-0.723			
J118	0.637	-1.157			
J119	0.676	-1.105			
J120	0.338	0.846			
J121	0.543	-0.911			
J122	0.566	-0.978			
J123	0.531	-0.058			
J124	0.717	-1.591			
J125	0.594	-1.593			
J126	0.507	-0.751			
J127	0.652	-1.520			
J128	0.930	-1.040			
J129	0.734	1.188			
J130	0.406	-1.702			
J131	0.957	-0.549			
J132	0.448	-0.236			
J133	0.945	-1.567			
J134	0.330	1.651			
J135	0.898	-0.366			
J136	0.362	0.037			
J137	0.695	-0.173			
J138	---	---			
J139	0.456	0.945			
J140	0.420	-0.012			

TABLE 7-10

Estimated Item Discrimination Parameter \hat{a}_g , Item Difficulty Parameter \hat{b}_g And Guessing Parameter \hat{c}_g of Each of the 55 Items of Test J1 Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Three-Parameter Logistic Model.

Item	\hat{a}_g	\hat{b}_g	\hat{c}_g	Item	\hat{a}_g	\hat{b}_g	\hat{c}_g
J101	1.104	0.006	0.146	J141	0.667	-0.762	0.143
J102	0.588	-0.706	0.143	J142	1.024	0.687	0.245
J103	0.786	-0.872	0.143	J143	1.102	0.018	0.201
J104	0.854	-0.795	0.143	J144	0.451	-0.238	0.143
J105	1.034	-0.167	0.137	J145	0.903	-0.287	0.103
J106	0.599	-0.512	0.143	J146	1.053	-0.130	0.087
J107	0.678	0.054	0.143	J147	1.727	0.779	0.338
J108	1.012	-1.855	0.143	J148	0.895	0.613	0.207
J109	0.382	-0.726	0.143	J149	0.639	-0.063	0.143
J110	0.781	-0.382	0.143	J150	0.629	0.041	0.143
J111	1.286	-1.201	0.143	J151	0.889	0.980	0.181
J112	0.538	-0.541	0.143	J152	1.391	1.086	0.331
J113	0.634	-0.857	0.143	J153	1.250	1.212	0.167
J114	1.285	0.411	0.234	J154	0.764	1.895	0.249
J115	1.185	-0.100	0.173	J155	1.768	0.771	0.089
J116	0.421	-0.753	0.143	J156	1.592	1.030	0.086
J117	0.411	-0.245	0.143				
J118	0.640	-0.916	0.143				
J119	0.707	-0.851	0.143				
J120	1.205	1.310	0.278				
J121	0.584	-0.580	0.143				
J122	0.601	-0.665	0.143				
J123	0.697	0.311	0.143				
J124	0.679	-1.479	0.143				
J125	0.584	-1.415	0.143				
J126	0.568	-0.375	0.143				
J127	0.635	-1.364	0.143				
J128	0.964	-0.831	0.143				
J129	0.900	1.110	0.018				
J130	0.403	-1.402	0.143				
J131	1.327	-0.167	0.191				
J132	0.555	0.193	0.143				
J133	0.909	-1.471	0.143				
J134	0.702	1.715	0.162				
J135	0.922	-0.266	0.041				
J136	0.453	0.515	0.143				
J137	0.897	0.130	0.131				
J138	---	---	---				
J139	1.335	1.197	0.213				
J140	0.660	0.623	0.218				

TABLE 7-11

Estimated Item Discrimination Parameter \hat{a}_g And Item Difficulty
Parameter \hat{b}_g of Each of the 55 Items of Test J1 Which Were
Obtained by Logist 5 Based upon the J1/2259 Case, Assuming
the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	0.771	-0.509	J141	0.588	-0.945
J102	0.554	-1.192	J142	0.467	-0.157
J103	0.627	-1.428	J143	0.622	-0.379
J104	0.775	-1.034	J144	0.380	-0.685
J105	0.855	-0.377	J145	0.656	-0.752
J106	0.517	-0.972	J146	0.936	-0.243
J107	0.594	-0.083	J147	0.366	0.068
J108	0.987	-1.986	J148	0.525	-0.355
J109	0.389	-1.109	J149	0.505	-0.393
J110	0.596	-0.592	J150	0.542	-0.324
J111	1.165	-1.422	J151	0.474	0.558
J112	0.442	-1.283	J152	0.403	0.151
J113	0.532	-1.287	J153	0.436	1.525
J114	0.492	0.175	J154	0.257	1.822
J115	0.752	-0.502	J155	0.799	0.916
J116	0.305	-1.876	J156	0.744	1.077
J117	0.400	-0.861			
J118	0.665	-1.693			
J119	0.710	-1.189			
J120	0.296	0.715			
J121	0.506	-1.096			
J122	0.476	-1.245			
J123	0.465	-0.144			
J124	0.626	-1.465			
J125	0.493	-1.807			
J126	0.378	-0.664			
J127	0.579	-1.462			
J128	0.763	-1.285			
J129	0.763	1.130			
J130	0.392	-1.883			
J131	0.869	-0.753			
J132	0.335	-0.108			
J133	0.968	-1.526			
J134	0.301	1.275			
J135	0.925	-0.502			
J136	0.366	-0.015			
J137	0.611	0.025			
J138	---	---			
J139	0.401	1.179			
J140	0.419	-0.075			

TABLE 7-12

Estimated Item Discrimination Parameter \hat{a}_g , Item Difficulty Parameter \hat{b}_g And Guessing Parameter \hat{c}_g of Each of the 55 Items of Test J1 Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Three-Parameter Logistic Model.

Item	\hat{a}_g	\hat{b}_g	\hat{c}_g	Item	\hat{a}_g	\hat{b}_g	\hat{c}_g
J101	0.957	-0.195	0.151	J141	0.628	-0.646	0.146
J102	0.576	-0.924	0.146	J142	0.854	0.557	0.267
J103	0.644	-1.198	0.146	J143	0.915	0.114	0.209
J104	0.849	-0.781	0.146	J144	0.426	-0.226	0.146
J105	1.034	-0.154	0.109	J145	0.727	-0.455	0.146
J106	0.570	-0.627	0.146	J146	1.154	-0.041	0.101
J107	0.733	0.170	0.109	J147	1.571	1.025	0.373
J108	0.857	-2.097	0.146	J148	0.638	0.022	0.146
J109	0.424	-0.682	0.146	J149	0.600	-0.015	0.146
J110	0.712	-0.240	0.146	J150	0.660	0.043	0.146
J111	1.123	-1.342	0.146	J151	0.817	0.944	0.182
J112	0.461	-0.946	0.146	J152	1.026	0.949	0.308
J113	0.556	-0.998	0.146	J153	1.323	1.375	0.156
J114	1.004	0.743	0.245	J154	0.677	1.945	0.212
J115	0.955	-0.140	0.172	J155	1.505	0.920	0.085
J116	0.324	-1.385	0.146	J156	1.589	1.043	0.095
J117	0.444	-0.426	0.146				
J118	0.635	-1.581	0.146				
J119	0.749	-0.948	0.146				
J120	0.571	1.361	0.229				
J121	0.535	-0.777	0.146				
J122	0.497	-0.923	0.146				
J123	0.582	0.257	0.146				
J124	0.625	-1.261	0.146				
J125	0.491	-1.588	0.146				
J126	0.433	-0.190	0.146				
J127	0.580	-1.252	0.146				
J128	0.772	-1.103	0.146				
J129	0.884	1.063	0.013				
J130	0.388	-1.597	0.146				
J131	1.063	-0.418	0.178				
J132	0.413	0.415	0.146				
J133	0.968	-1.401	0.146				
J134	0.460	1.620	0.146				
J135	1.011	-0.342	0.085				
J136	0.460	0.459	0.146				
J137	0.769	0.269	0.108				
J138	---	---	---				
J139	1.005	1.355	0.193				
J140	0.531	0.358	0.146				

item parameter estimates in Cases J1-J2 and A5-A6-J1-J2, as was observed earlier in this section.

Observation of Tables 7-9 and 7-11 reveals that the estimated item discrimination parameters obtained by Logist 5 in Cases J1/1075: c_g -Zero and J1/2259: c_g -Zero tend to be greater than their counterparts obtained by the Tetrachoric Method, which are shown in Tables 5-11 and 5-12, respectively, while the estimated item difficulty parameters by Logist 5 in these two cases tend to be larger in absolute value. This fact indicates that the standard deviation of the estimated individual parameters may be larger than that of θ itself for the J1/1075 and J1/2259 Cases.

Comparison of Table 7-10 with Table 7-9, and of Table 7-12 with Table 7-11, reveals that the estimated discrimination parameters when three-parameter logistic model is assumed are, in general, larger than those when (two-parameter) logistic model is assumed, and the same is true with the estimated difficulty parameters. This is especially true when the estimated guessing parameter assumes a large value in Cases J1/1075: c_g -Free and J1/2259: c_g -Free, as we can see in items J114, J120, J139, J140, J142, J143, J147, J148, J152 and J154 in Case J1/1075, and in items J114, J120, J142, J143, J147, J152 and J154 in Case J1/2259. It is also noted that, except for these items, all the other items have estimated guessing parameters which are less than the chance level, i.e., 0.2 .

Enhancement of both the estimated discrimination and the estimated difficulty parameters when three-parameter logistic model is

assumed appeared to have a good reason. This topic has been more systematically investigated, and discussed in a separate paper (Samejima, ONR/RR-84-3). As a conclusion, the meaning of discrimination and difficulty parameters must seriously be reconsidered in the three-parameter logistic model.

Figure 7-1 presents five scatter diagrams, in which the estimated item discrimination parameters of the items of Test A5, A6, J1 or J2 obtained by Logist 5 in Case A5-A6 or in Case J1-J2 are plotted against those obtained by the Tetrachoric Method. In the third graph, the diagram consists of only sixteen items which overlap Tests A6 and J1, while in the other four it consists of all the items in each of the four tests except for those whose estimates are extremely deviated. The corresponding five graphs for the estimated difficulty parameters are shown in Figure 7-2. We can see in these two figures that there is a substantial consistency in the estimated item parameters obtained by Logist 5 based upon two examinee groups, i.e., Case A5-A6 or Case J1-J2, and those obtained by the Tetrachoric Method.

Figures 7-3 and 7-4 present similar graphs as those of Figures 7-1 and 7-2 excluding the third graph of sixteen items, using the results of Case A5-A6-J1-J2 instead of those of Case A5-A6 or Case J1-J2. We can see that, again, there exists a substantial consistency in each pair of estimated item parameters.

Figures 7-5 shows eight scatter diagrams of the estimated item discrimination parameters of Test J1. They consist of four pairs, in

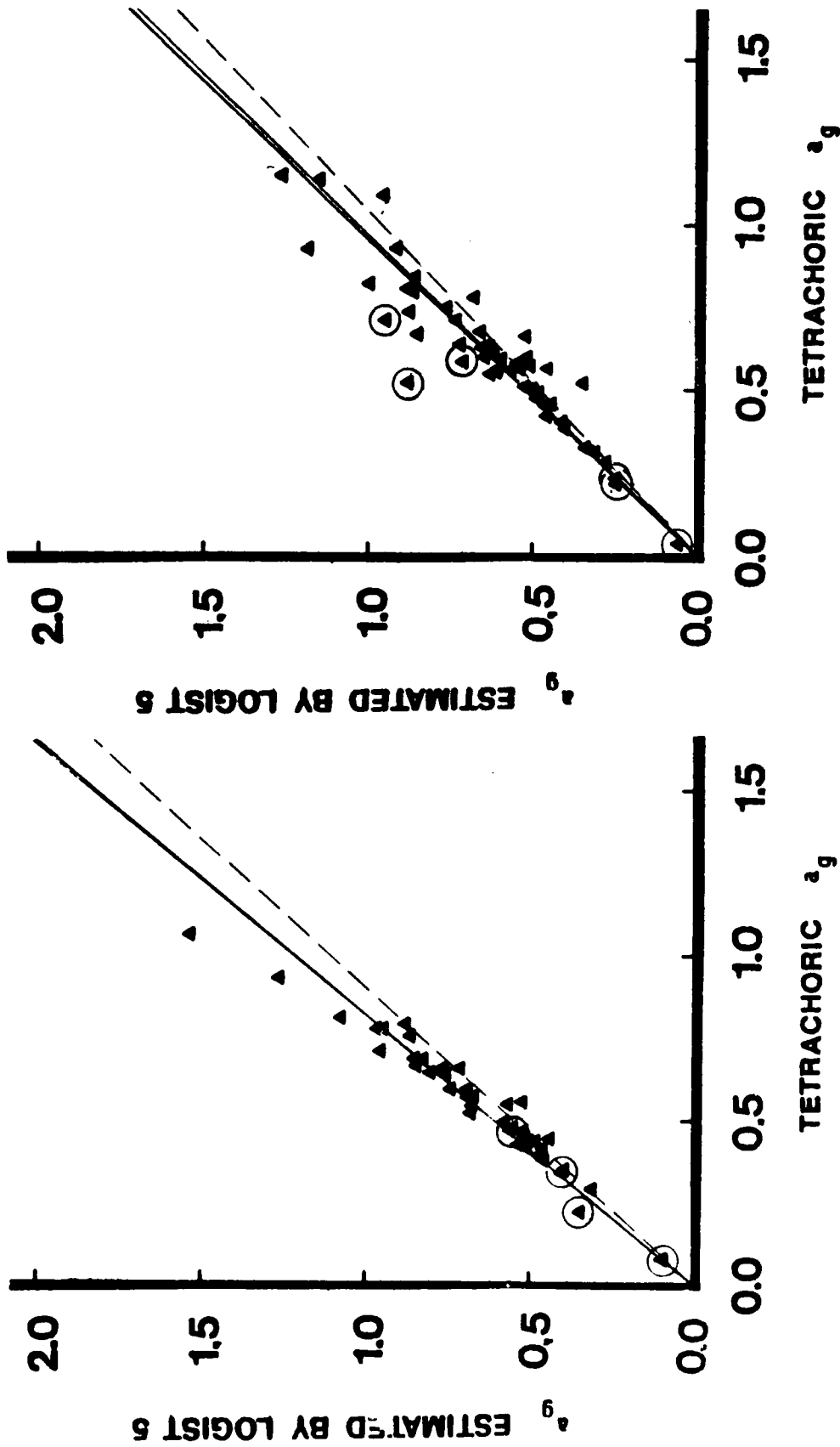


FIGURE 7-1

Estimated Item Discrimination Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. Both Sets of Estimates Are the Original Ones, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. The Graph on the Left Hand Side Is for the 44 Items of Test A5 Excluding Item A531 Based upon the A5/0599 Case on the Abscissa and upon the Case A5-A6 on the Ordinate, While the Graph on the Right Hand Side Is for the 56 Items of Test A6 Based upon the A6/0412 Case on the Abscissa and upon the Case A5-A6 on the Ordinate.

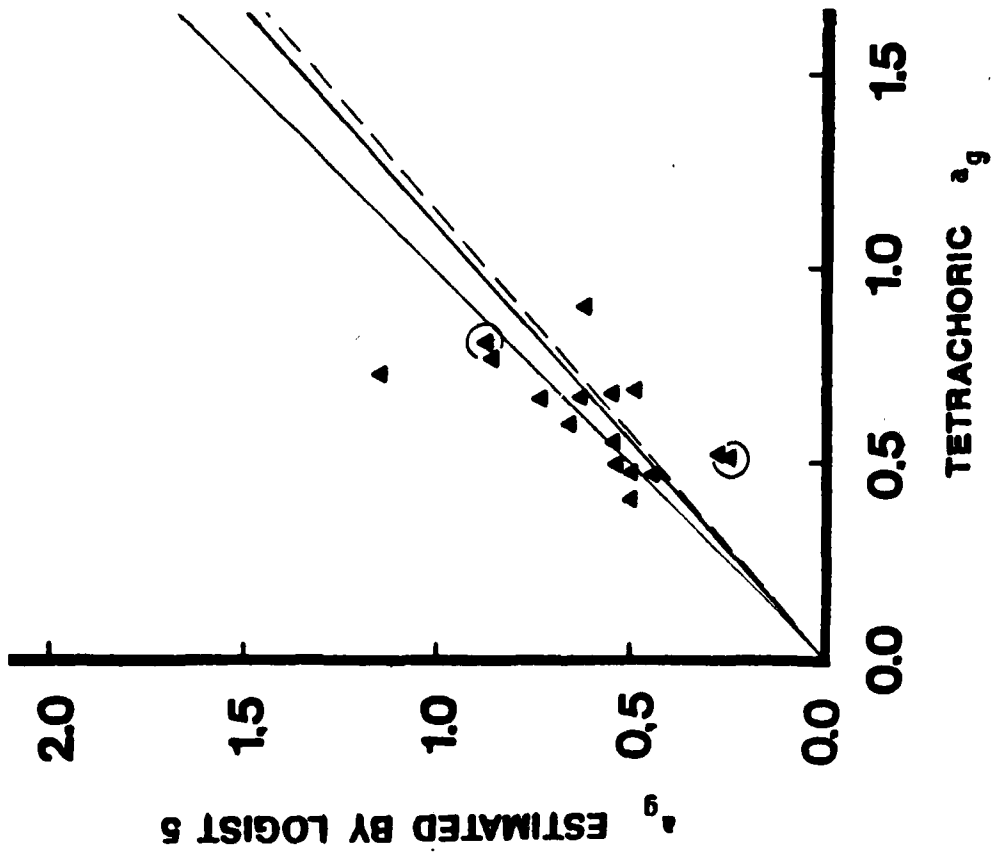
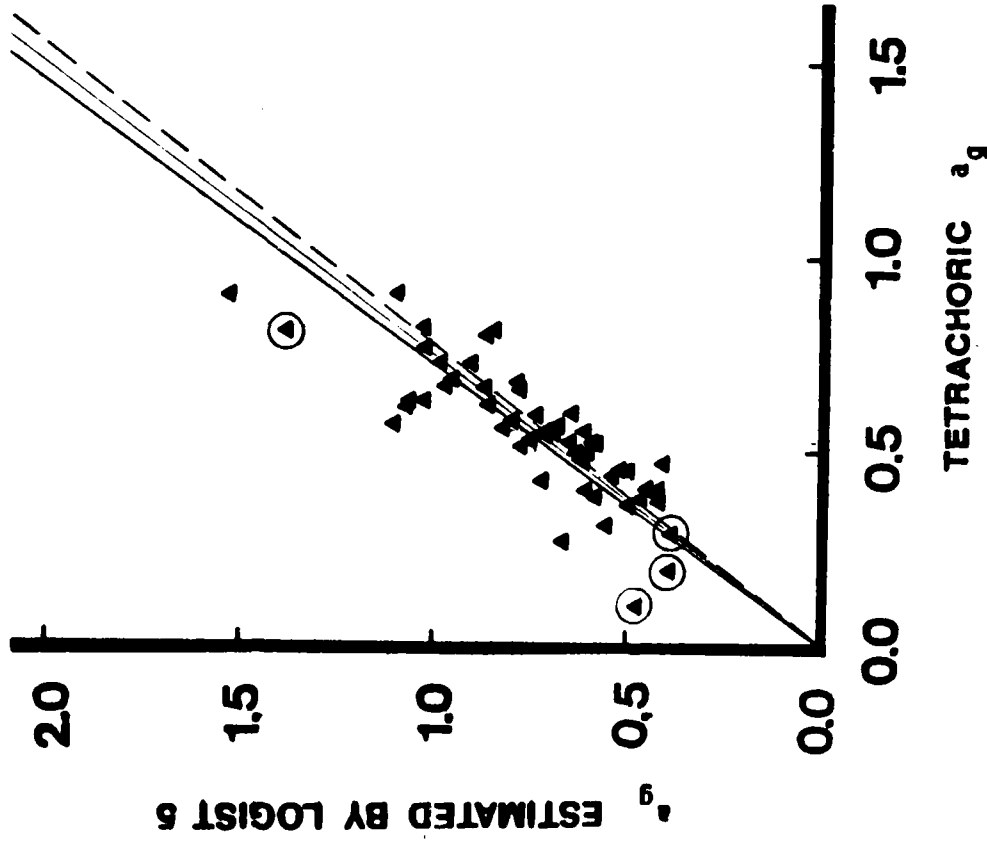
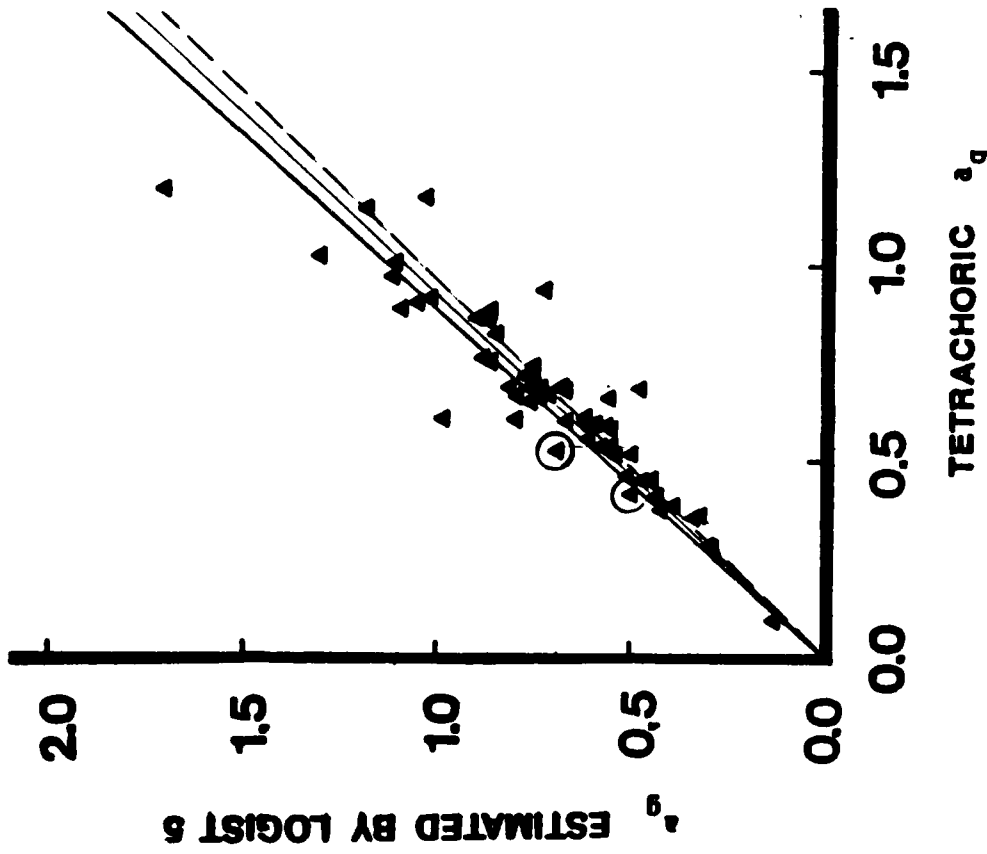


FIGURE 7-1 (Continued)
For the 16 Items Overlapping in Tests A6 And J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.



For the 55 Items of Test J1 Based upon the J1/0614 Case
on the Abscissa And upon the Case J1-J2 on the Ordinate.



For the 59 Items of Test J2 Based upon the J2/0758 Case
on the Abscissa And upon the Case J1-J2 on the Ordinate.

FIGURE 7-1 (Continued)

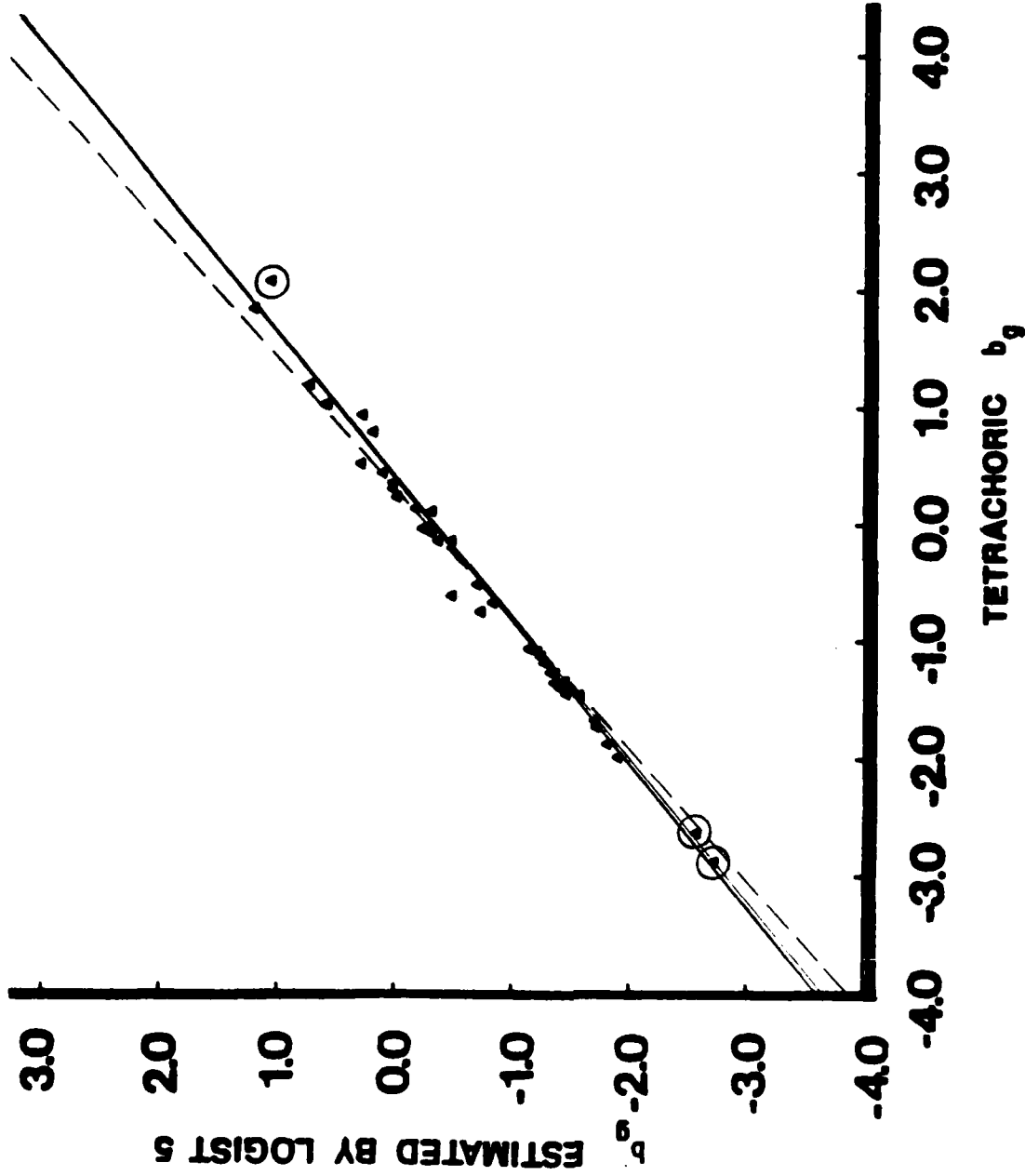


FIGURE 7-2

Estimated Item Difficulty Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. Both Sets of Estimates Are the Original Ones, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship Is Drawn by a Solid, Thin Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. For the 43 Items of Test A5 Excluding Items A523 and A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

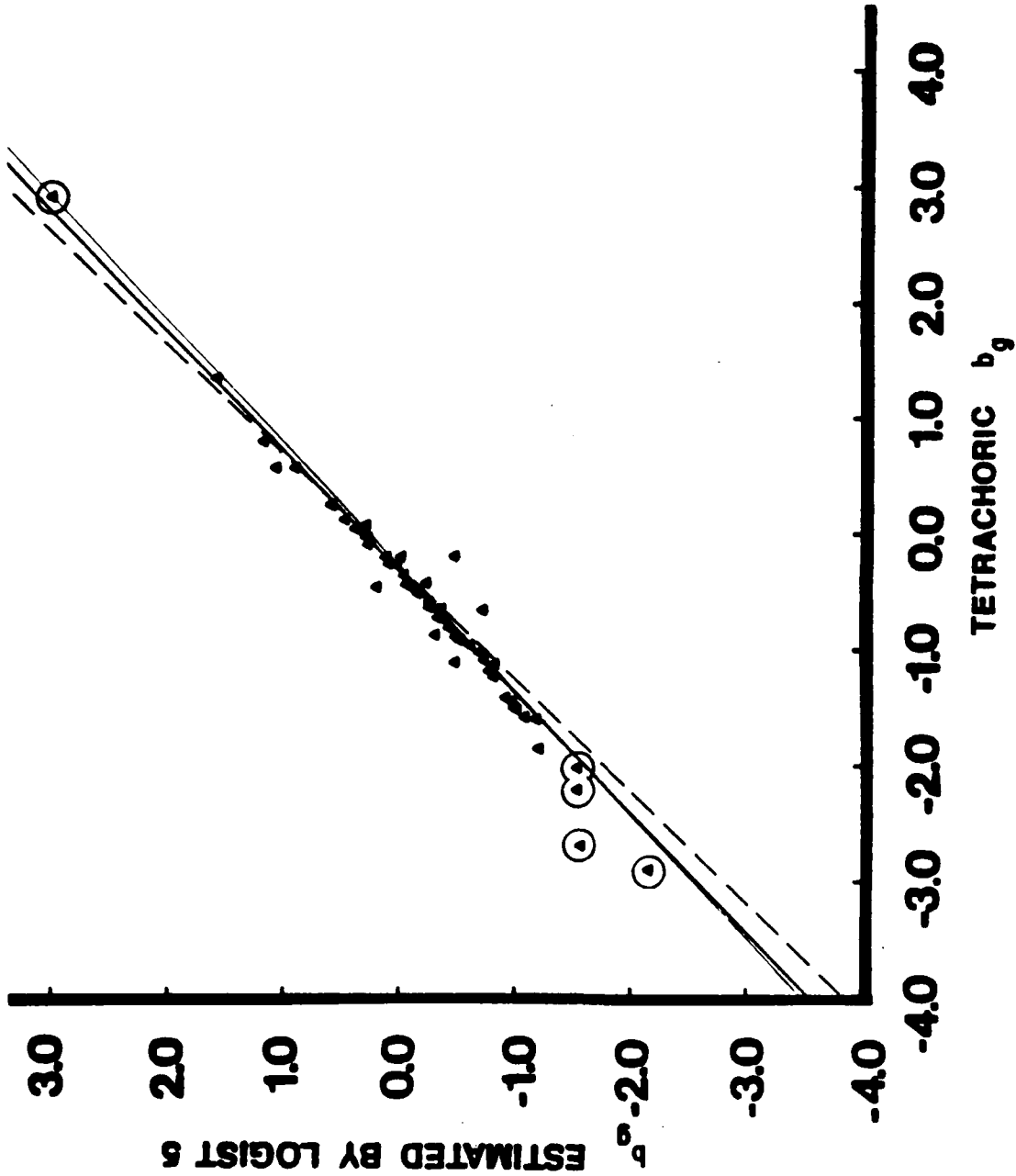


FIGURE 7-2 (Continued,

For the 55 Items of Test A6 Excluding Item A639 Based upon the A6/0412 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

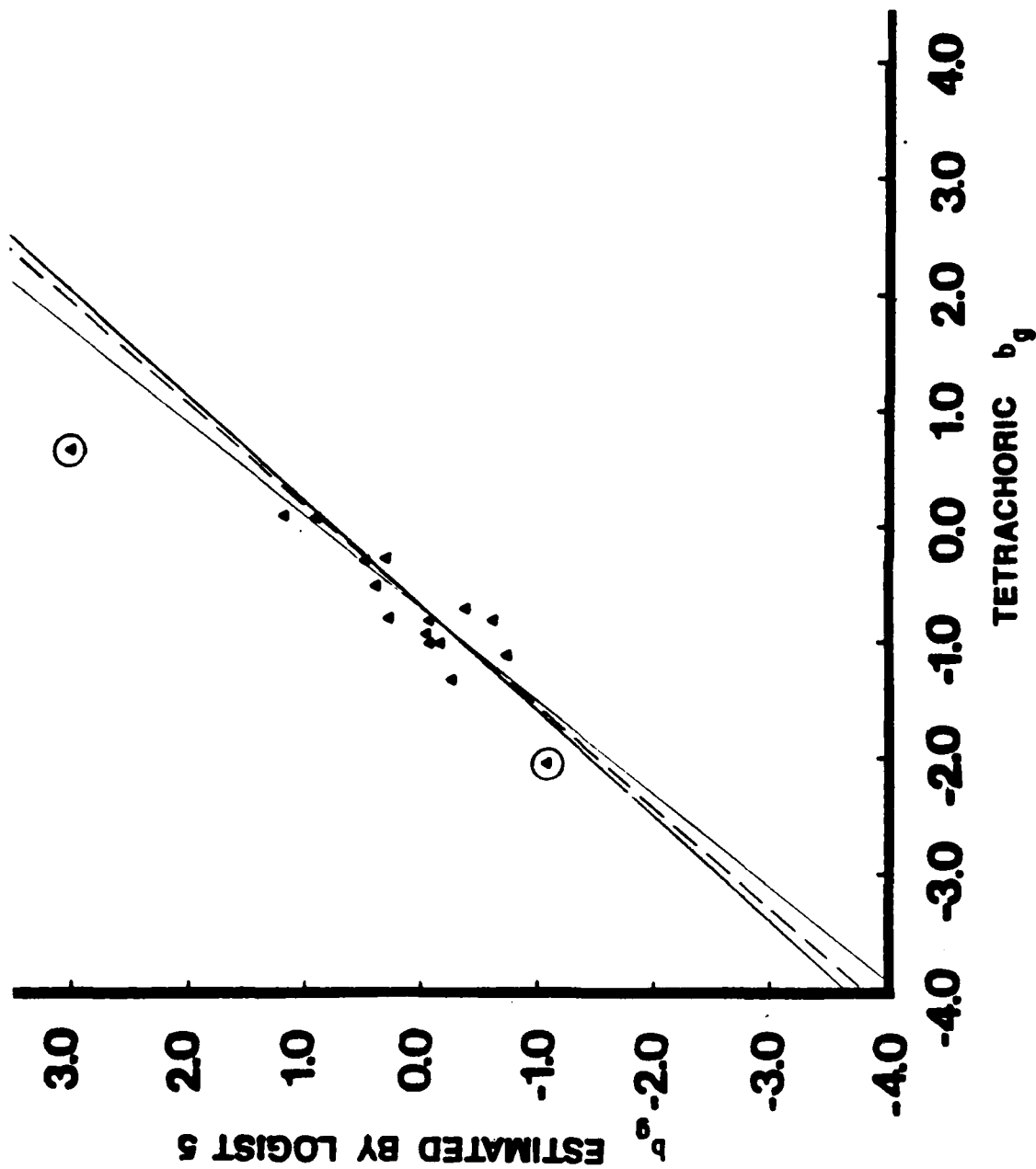


FIGURE 7-2 (Continued)

For the 16 Items Overlapping in Tests A6 and J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

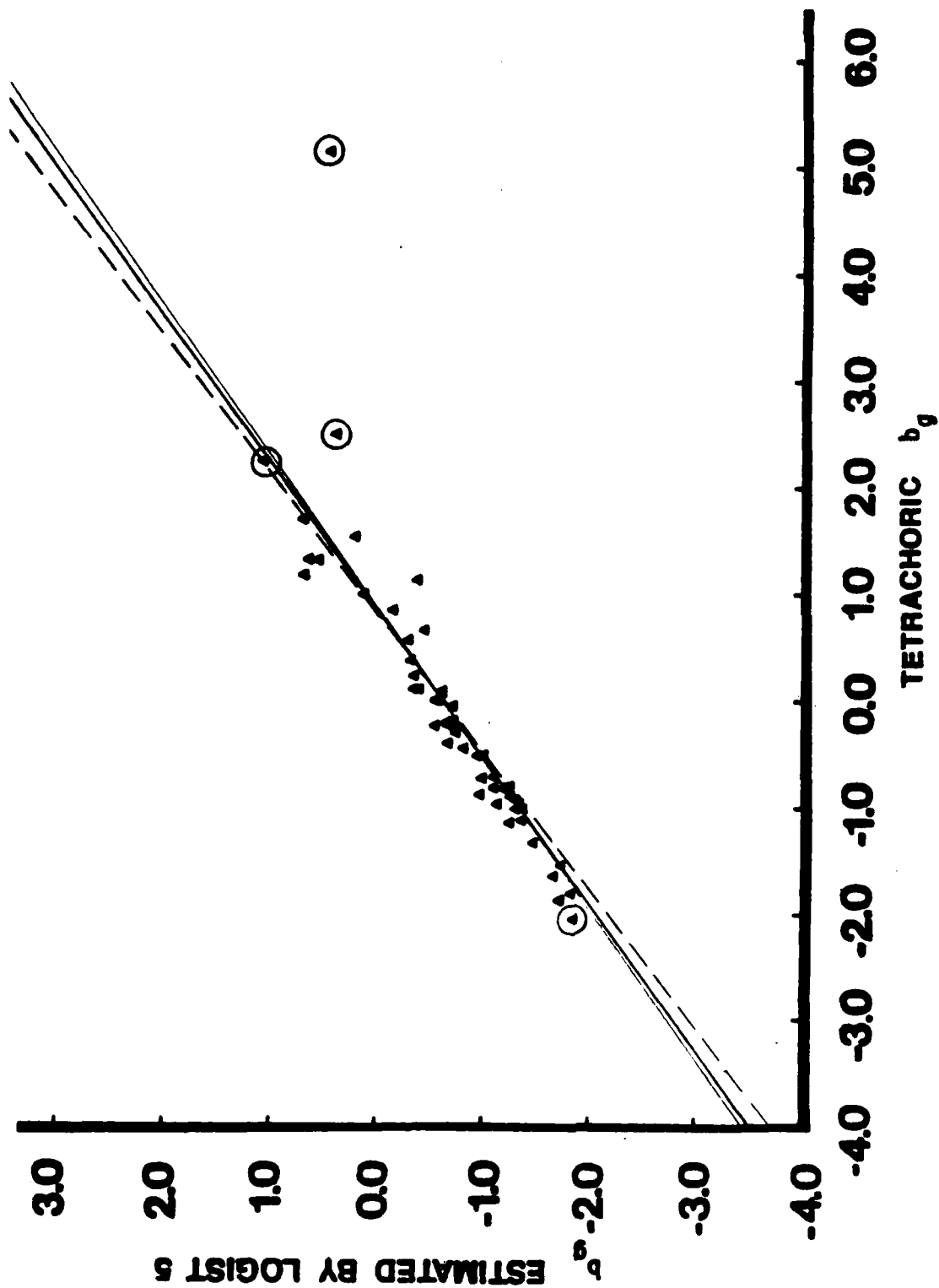


FIGURE 7-2 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

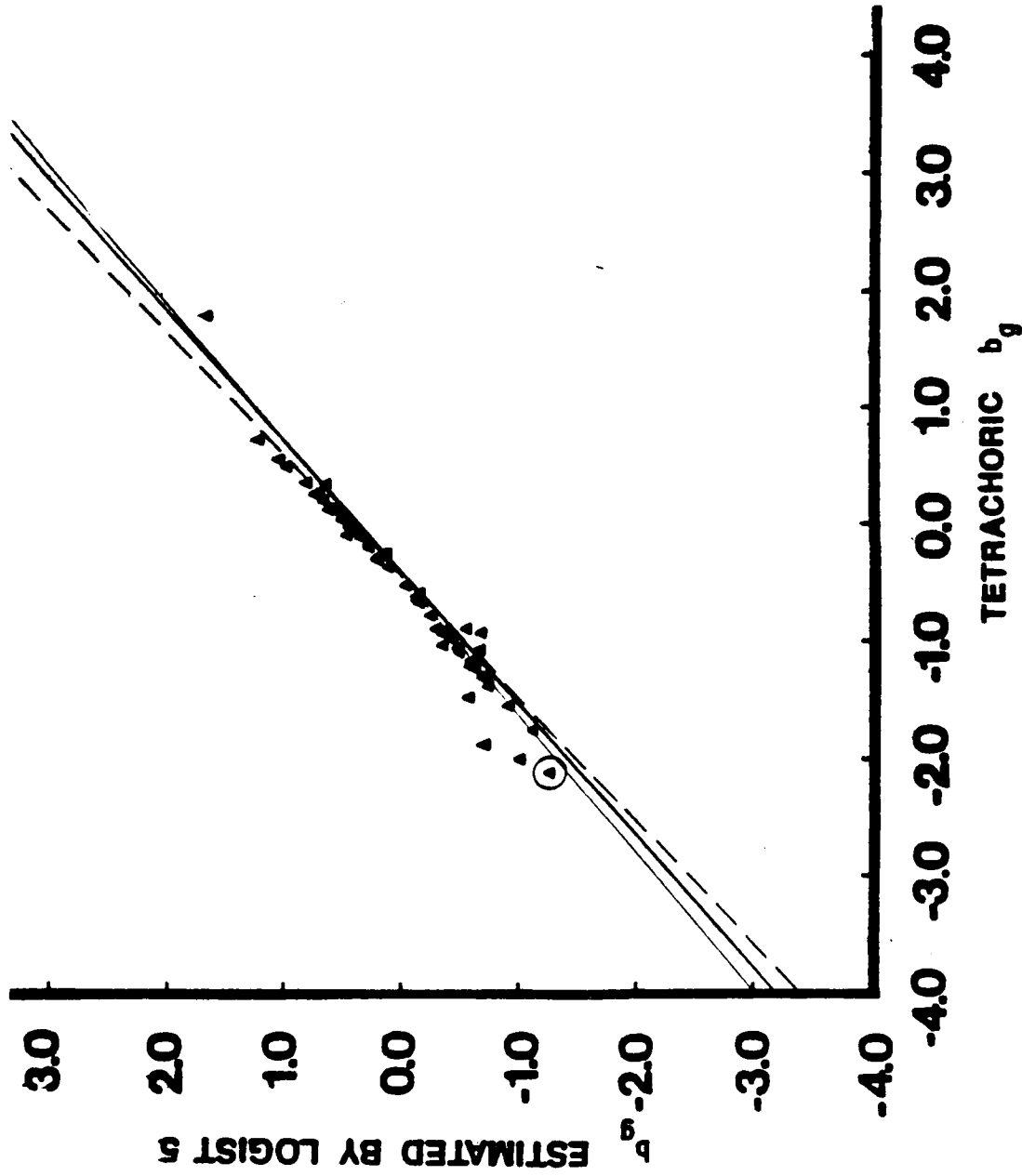


FIGURE 7-2 (Continued)

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

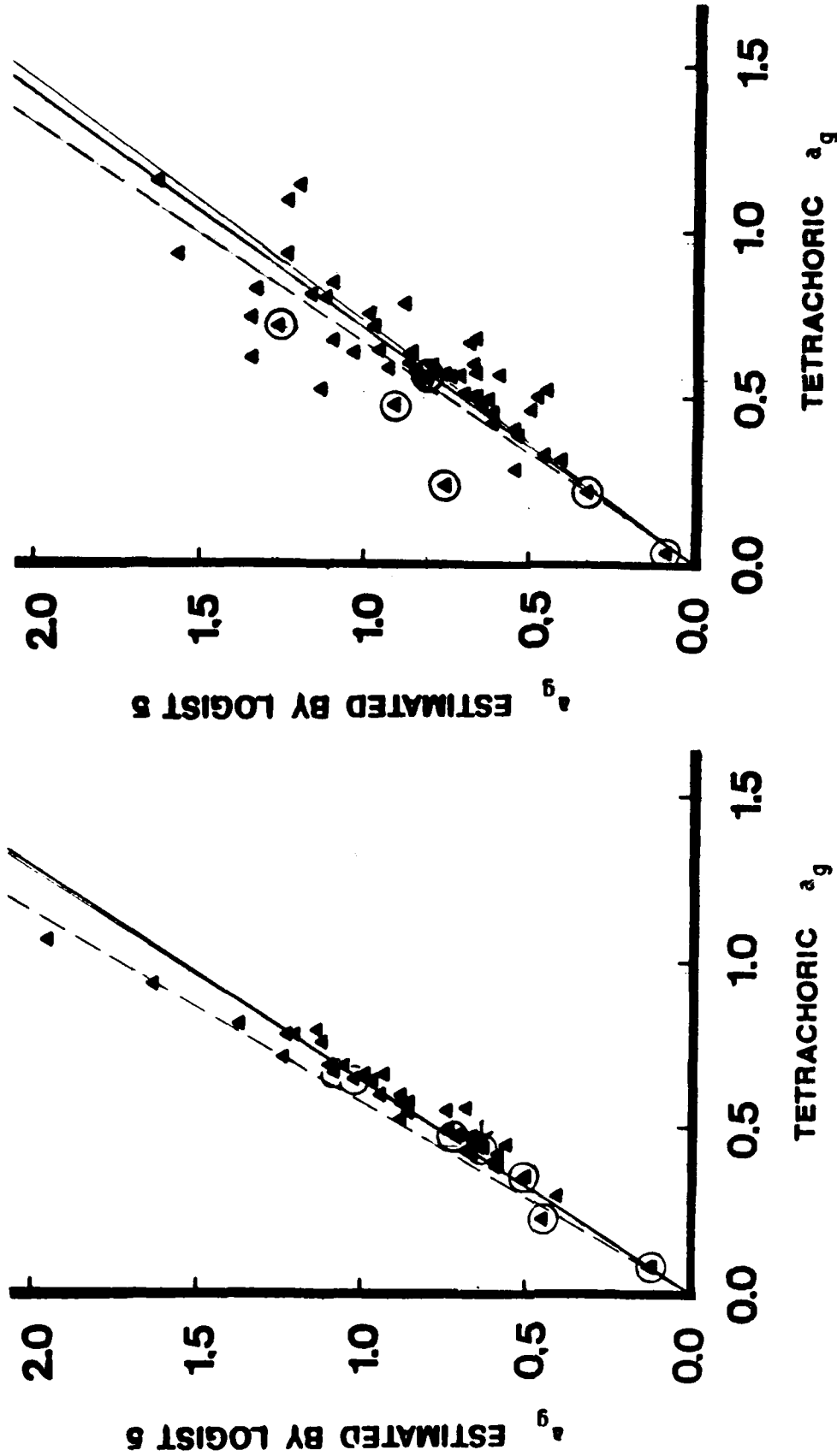


FIGURE 7-3

Estimated Item Discrimination Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. Both Sets of Estimates Are the Original Ones, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. The Graph on the Left Hand Side Is for the 44 Items of Test A5 Excluding Item A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate, While the Graph on the Right Hand Side Is for the 56 Items of Test A6 Based upon the A6/0412 Case on the Abscissa and upon the Case A5-A6-J1-J2 on the Ordinate.



FIGURE 7-3 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

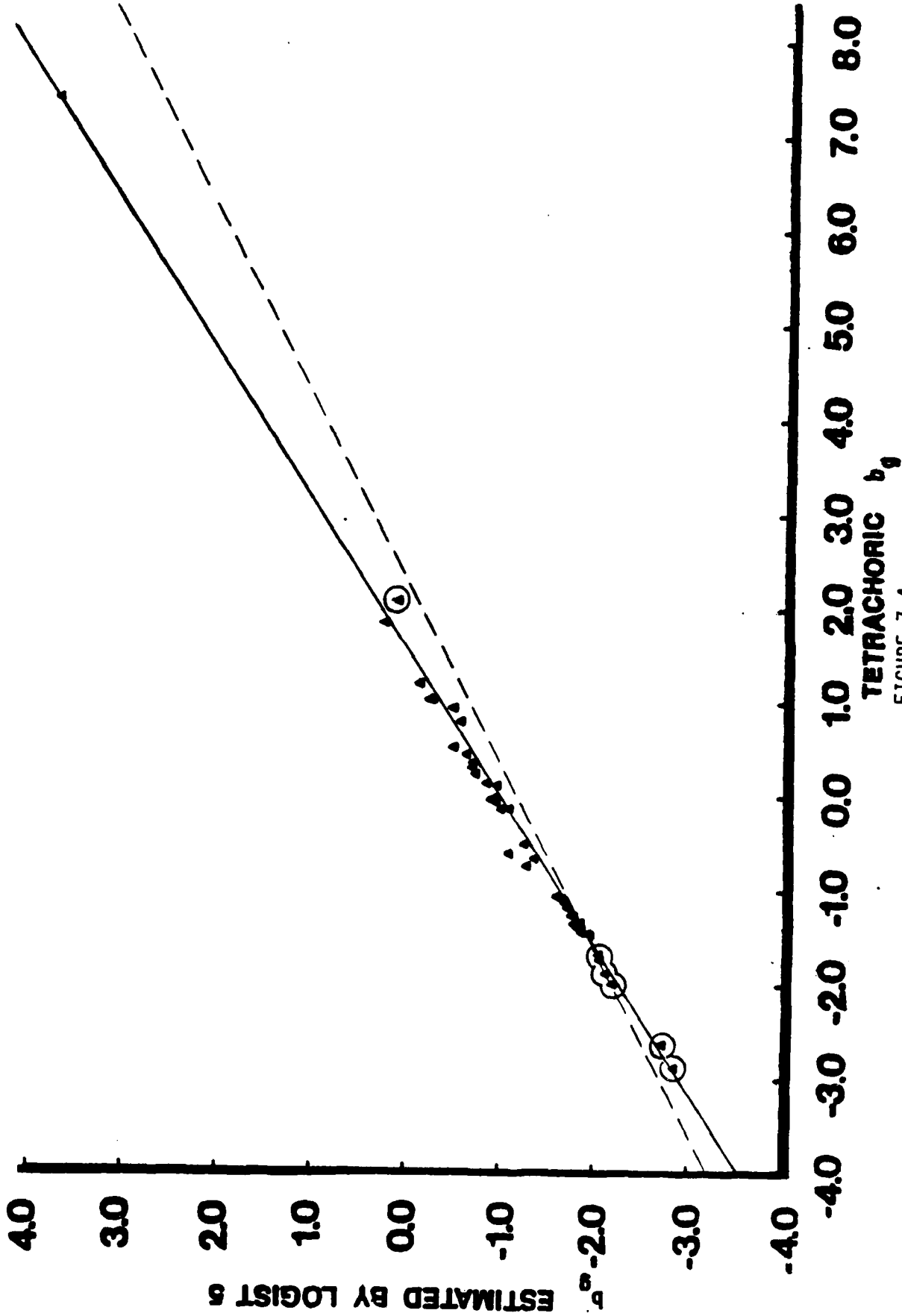


FIGURE 7-4

Estimated Item Difficulty Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. Both Sets of Estimates Are the Original Ones, i.e., before Any Scale Adjustment. For the 44 Items of Test A5 Excluding Item A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

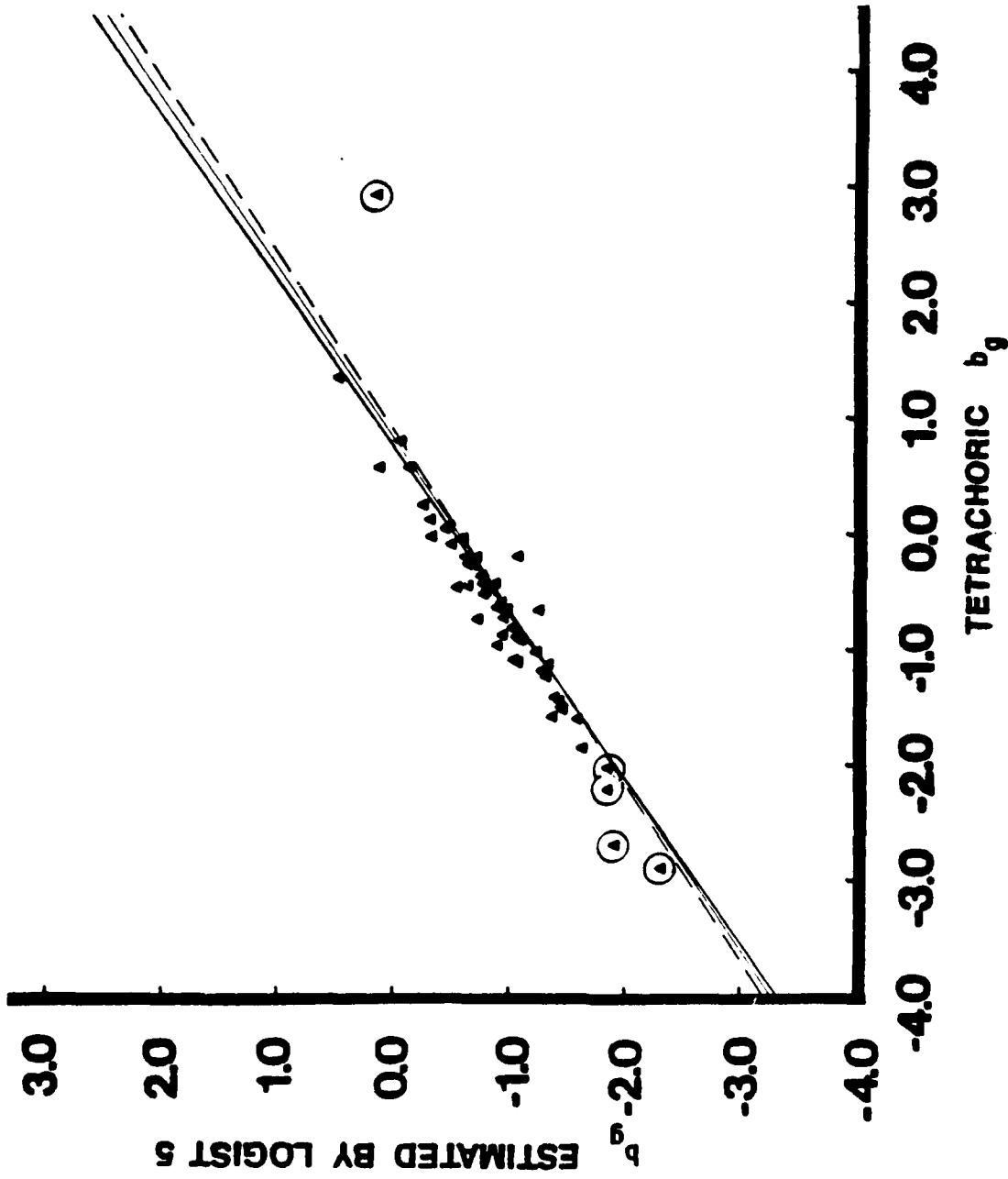


FIGURE 7-4 (Continued)

For the 55 Items of Test A6 Excluding Item A639 Based upon the A6/0412 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

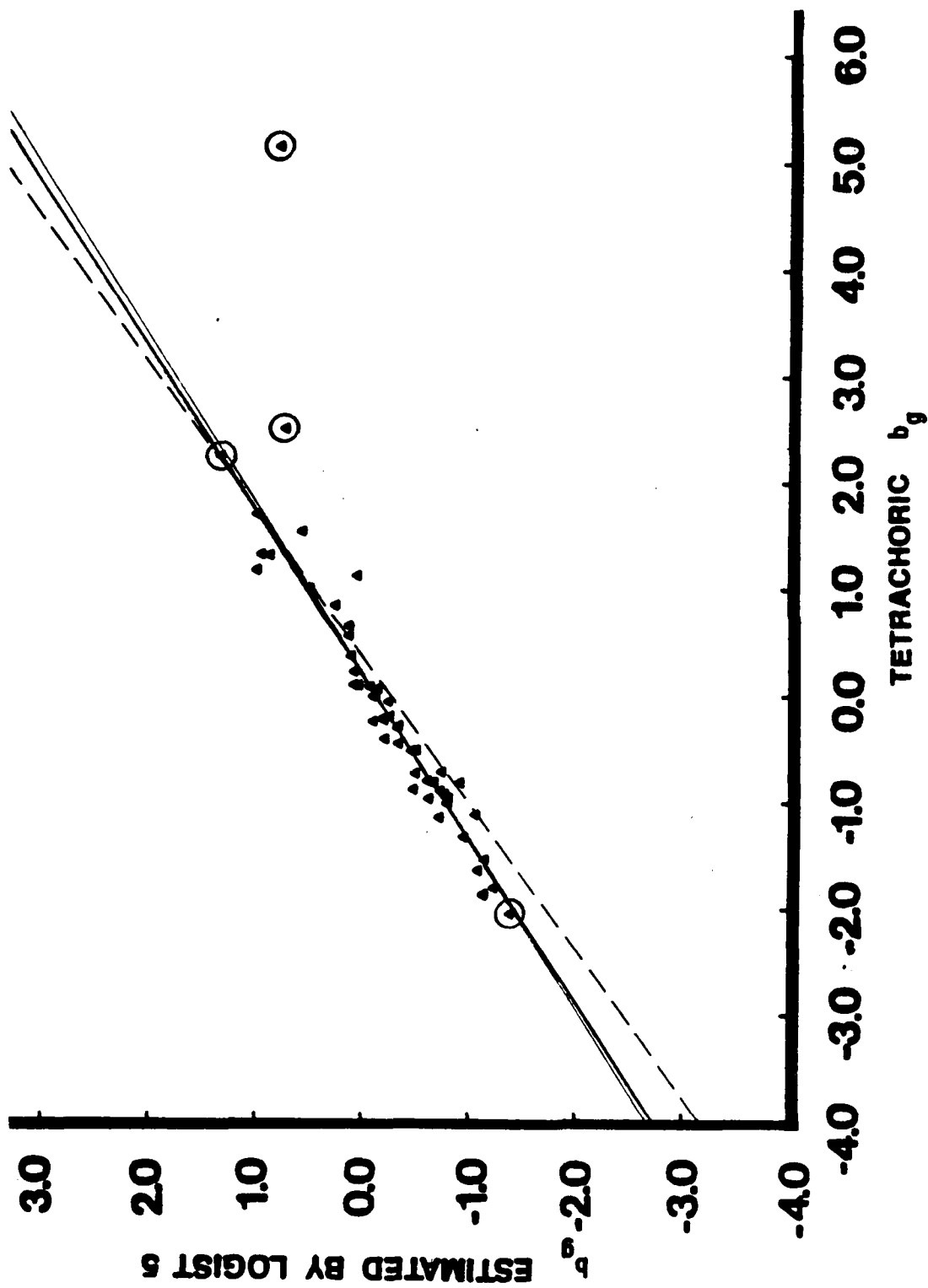


FIGURE 7-4 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

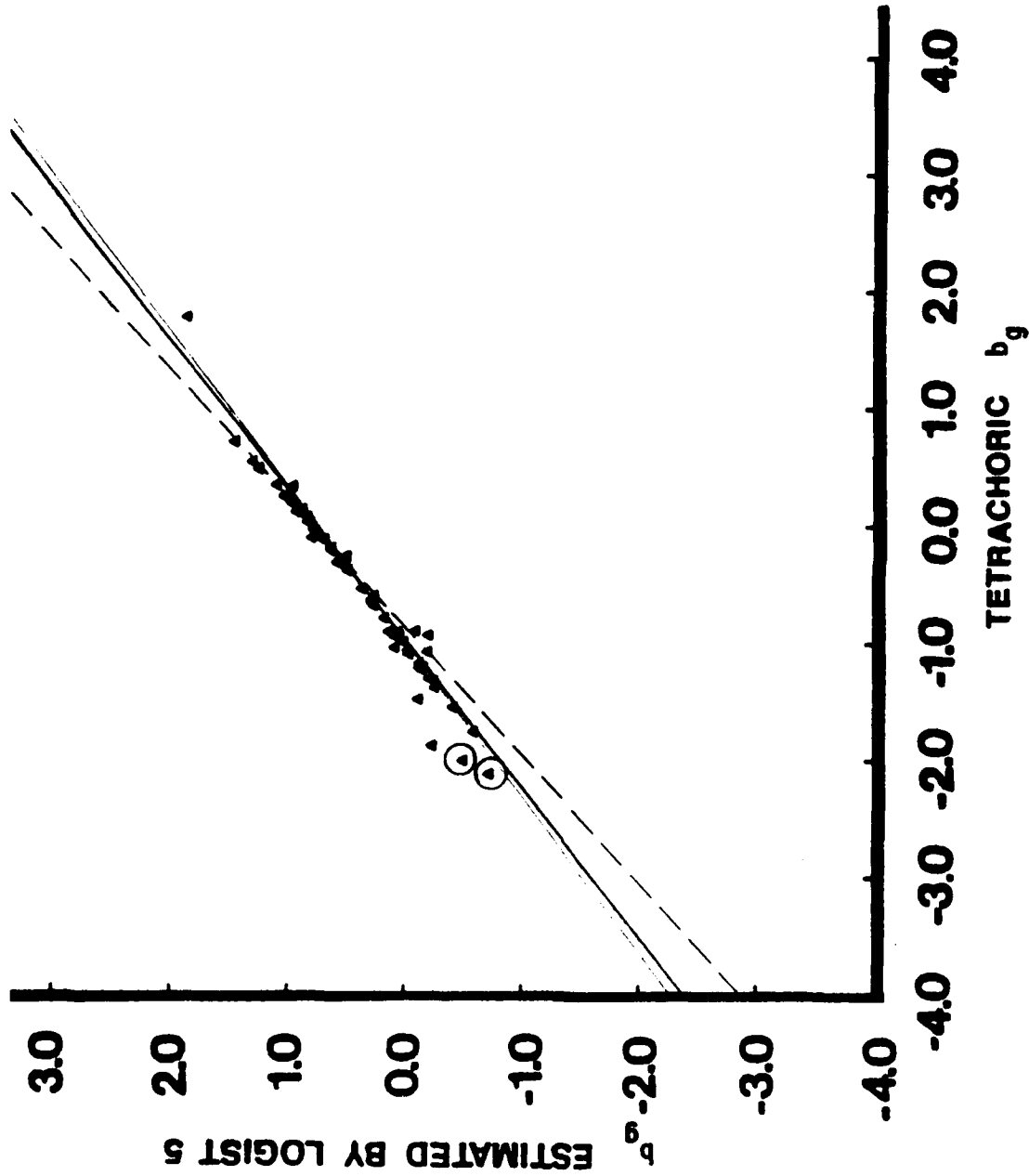


FIGURE 7-4 (Continued)

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

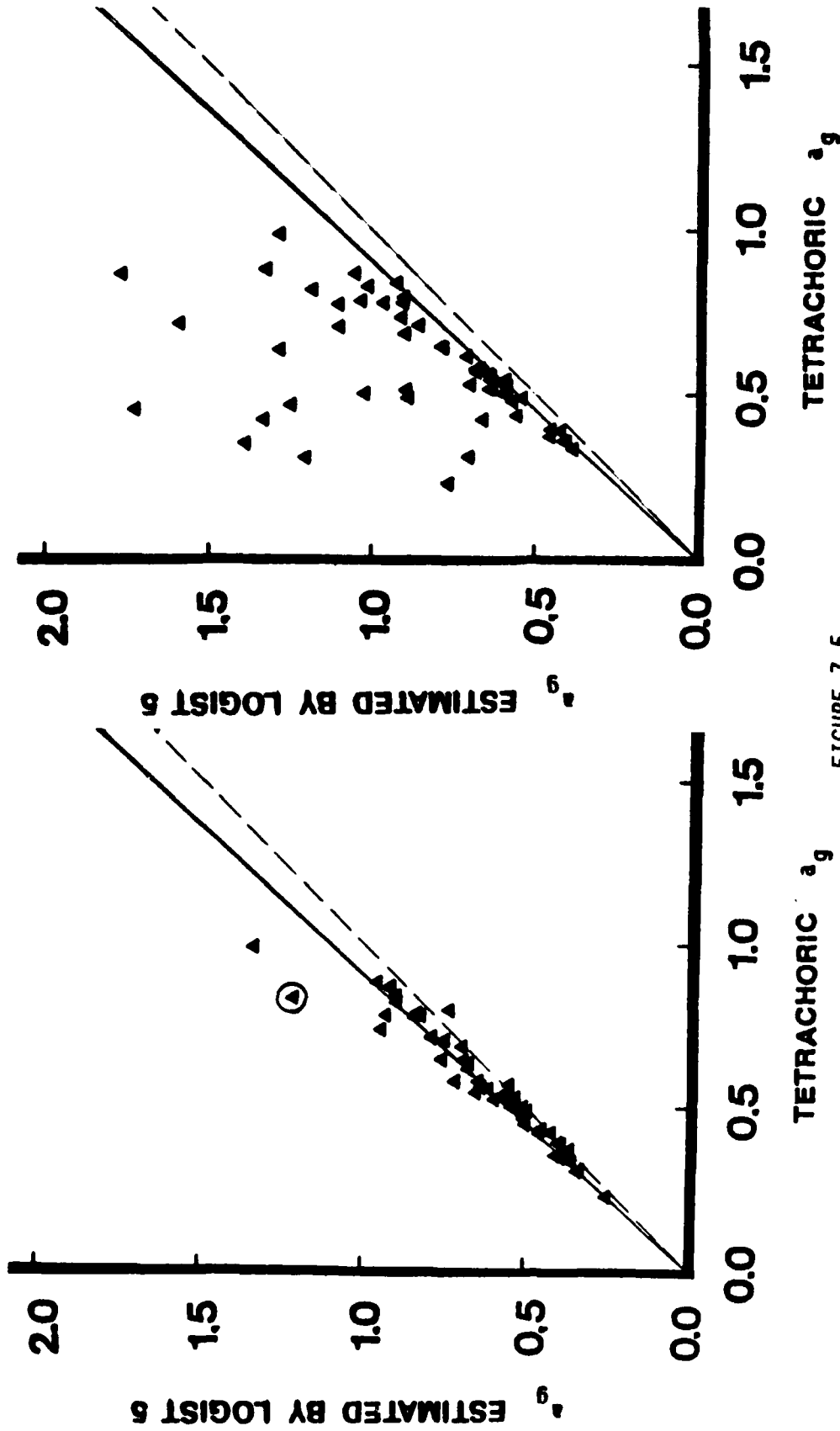


FIGURE 7-5

Estimated Item Discrimination Parameters of the 55 Items of Test J1 Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Logistic Model Is Assumed in the Graph on the Left Hand Side And Three-Parameter Logistic Model Is Assumed in the Graph on the Right Hand Side. Both Sets of Estimates in Each Graph are the Original One, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship When the Logistic Model Is Assumed Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. J1/1075 Case.

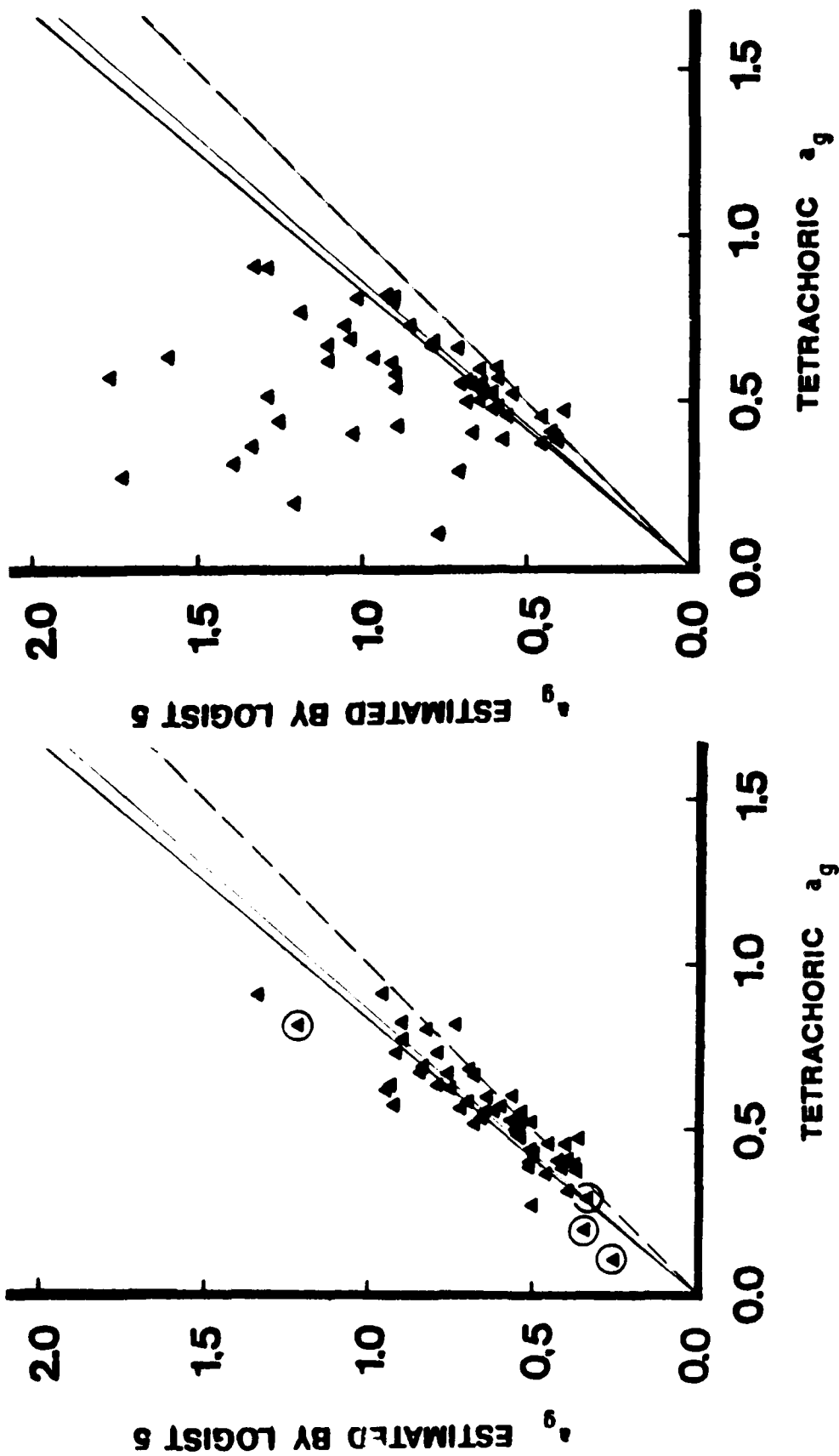


FIGURE 7-5 (Continued)
J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

7 1 000 (12 000 000 001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 021 022 023 024 025 026 027 028 029 030 031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 046 047 048 049 050 051 052 053 054 055 056 057 058 059 060 061 062 063 064 065 066 067 068 069 070 071 072 073 074 075 076 077 078 079 080 081 082 083 084 085 086 087 088 089 090 091 092 093 094 095 096 097 098 099 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200

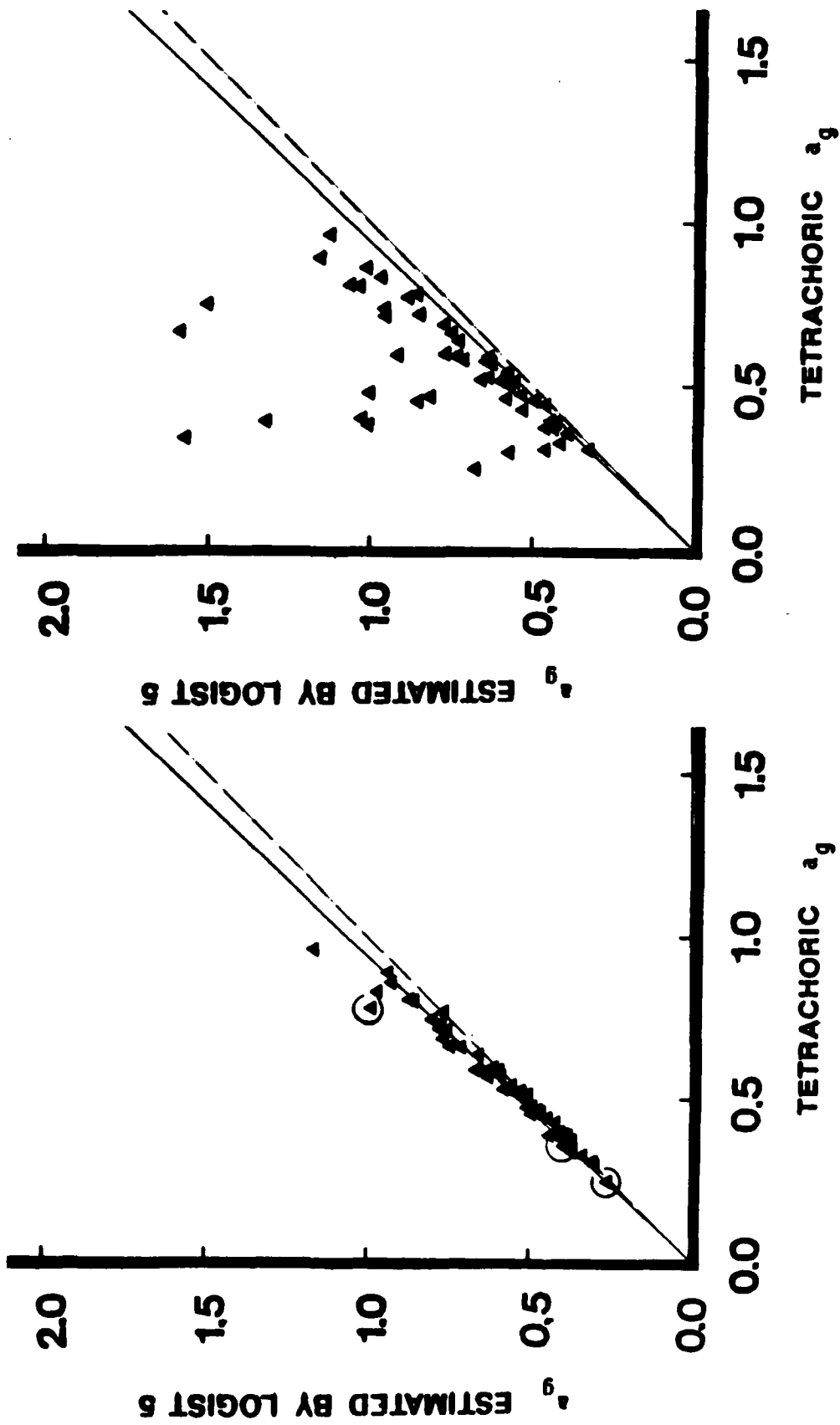


FIGURE 7-5 (Continued): J1/2259 Case.

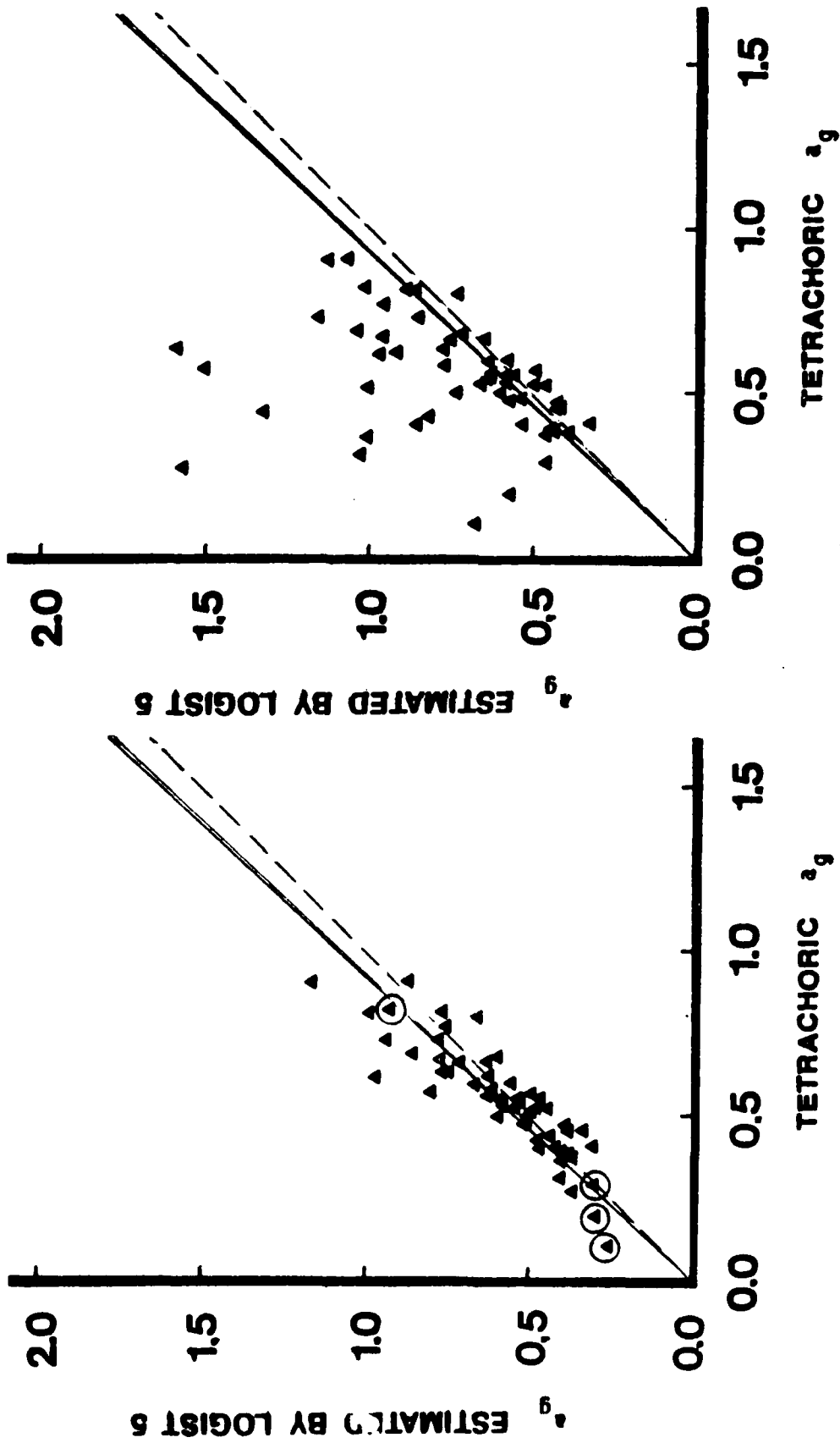


FIGURE 7-5 (Continued)

J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

each of which the Logist 5 results of " c_g -Zero" and " c_g -Free" are compared. The first two pairs concern with Case J1/1075 and the last two with Case J1/2259. In the first pair, these results are plotted against those of J1/1075 Case of the Tetrachoric Method, and in the second they are plotted against the results of J1/0614 Case of the Tetrachoric Method. In the third pair, the results of Case J1/2259: c_g -Zero and c_g -Free are plotted against those of J1/2259 Case of the Tetrachoric Method, and in the fourth pair, they are plotted against the results of J1/0614 Case of the Tetrachoric Method. We can see a substantial consistency between the two sets of estimated item discrimination parameters in the first graph of each of the four pairs, i.e., when (two-parameter) logistic model is assumed in using Logist 5, whereas there exists little consistency in the second graph of each pair, i.e., when three-parameter logistic model is assumed. We notice that the greatest consistency is observed in the first graph of the first pair of scatter diagrams and in the first pair of the third pair. They are Case J1/1075: c_g -Zero of Logist 5 against J1/1075 Case of the Tetrachoric Method and Case J1/2259: c_g -Zero against J1/2259 Case, i.e., the only two situations which concern the same examinee group both in using Logist 5 and in using Tetrachoric Method, and no guessing parameter is assumed in using Logist 5. This fact suggests that these two methods provide us with consistent results when the item parameter configurations are such as those of Test J1, if the sample size is 1,000 or above. The corresponding eight scatter diagrams for the estimated item difficulty parameters are

presented as Figure 7-6. We can see a similar tendency as we have observed for the estimated discrimination parameters, although inconsistency between the two sets of estimates is less conspicuous when three-parameter logistic model is assumed in using Logist 5.

Figure 7-7 presents four graphs which clarify how estimated item parameters differ when three-parameter logistic model is assumed in comparison with those when (two-parameter) logistic model is assumed. The first two graphs concern with the group of 1,075 examinees and the last two with the group of 2,259 examinees, and in each pair the first graph concerns with the adoption of the (two-parameter) logistic model and the second with the three-parameter logistic model. In each graph, the estimated item difficulty parameters of the items of Test J1 are taken on the abscissa, and the estimated discrimination parameters are taken on the ordinate. Both the results of the Tetrachoric Method and those of Logist 5 are plotted in each of the four graphs, to make the total number of points 110. To avoid confusion, there are five different symbols, i.e., \blacktriangle , \star , \blacklozenge , \blacklozenge and $+$, in these graphs, and an arrow is drawn for each item from the point indicating the result of the Tetrachoric Method to that of Logist 5.

Comparison of the first graph of Figure 7-7 with the second, and of the third graph with the fourth, excloses how radically the two estimated parameters of these items of Test J1 are enhanced because of the existence of the guessing parameter c_g when three-parameter logistic model is assumed in using Logist 5. These tendencies are

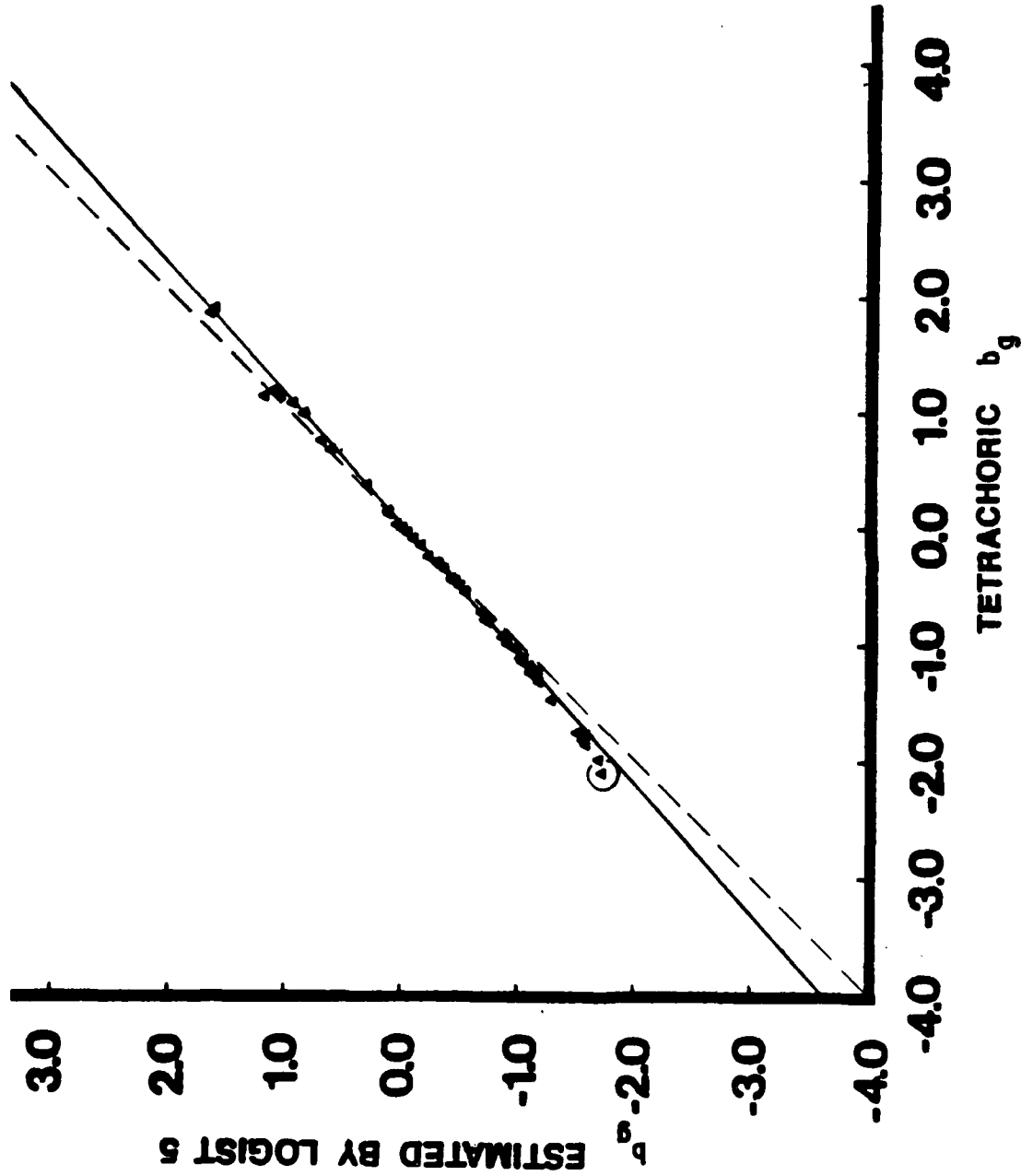


FIGURE 7-6

Estimated Item Difficulty Parameters of the 55 Items of Test J1 Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. Both Sets of Estimates in Each Graph Are the Original One, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship When the Logistic Model Is Assumed Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. Logistic Model Is Assumed in Using Logist 5. J1/1075 Case.

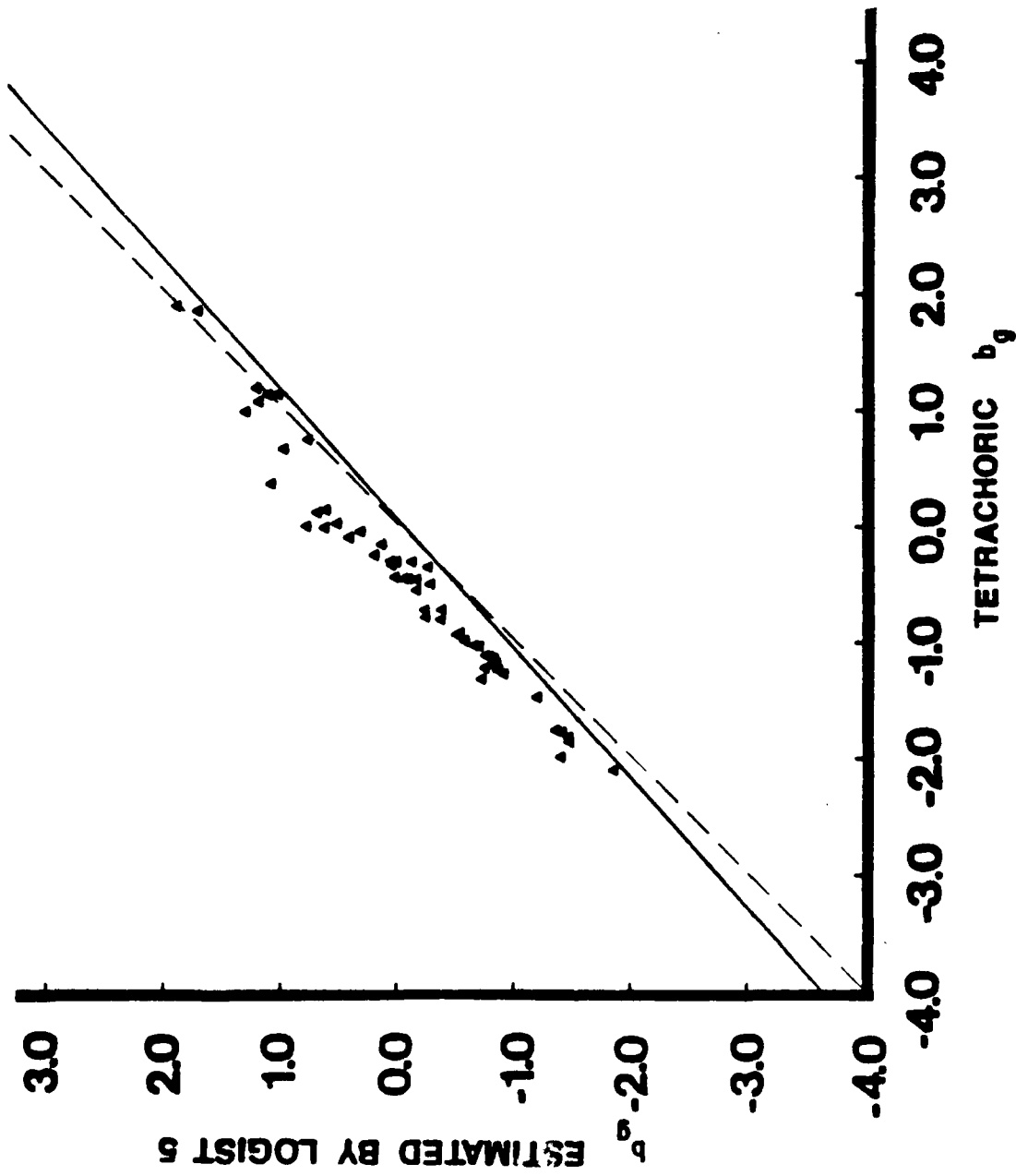


FIGURE 7-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/1075 Case.

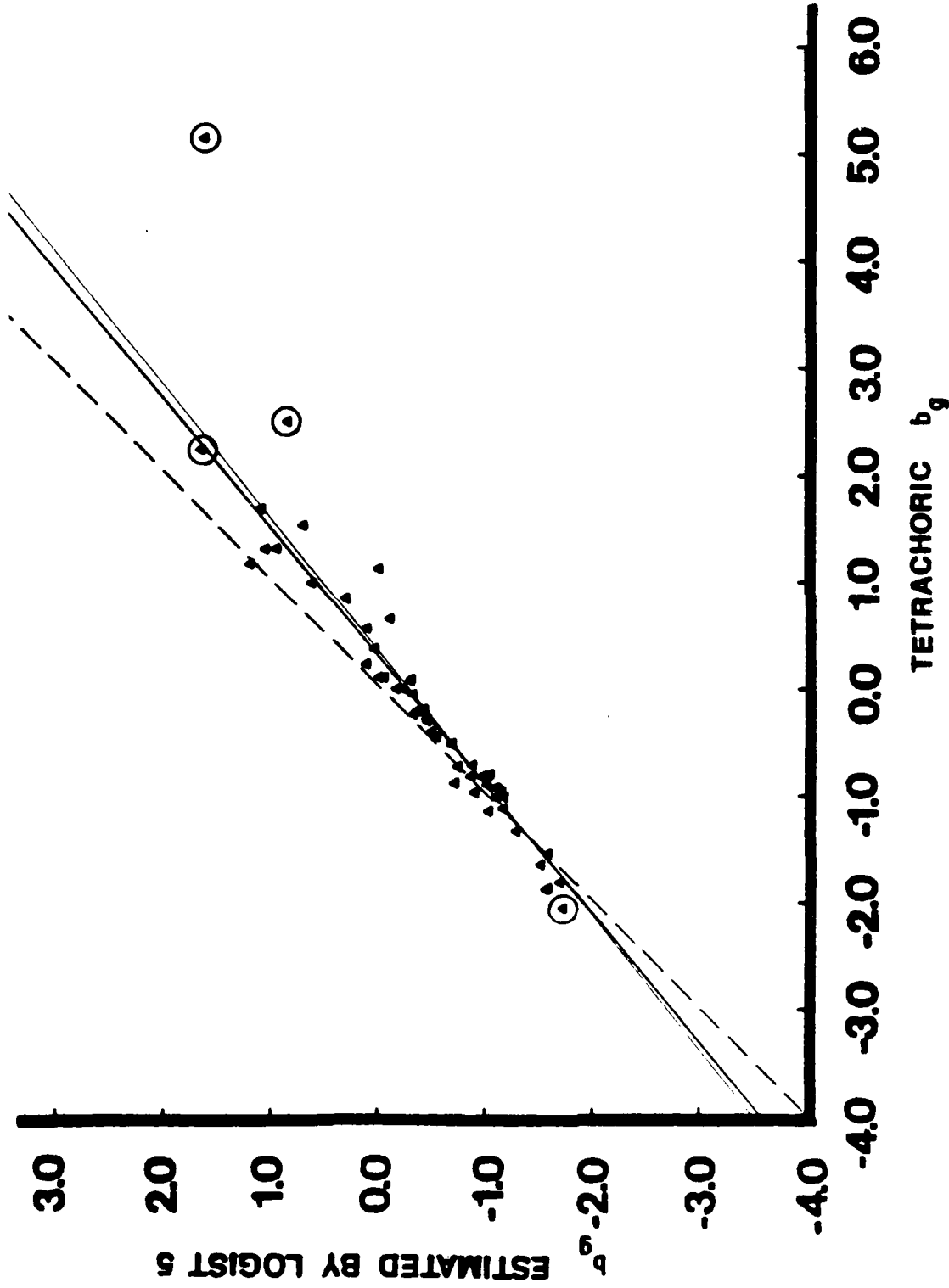


FIGURE 7-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

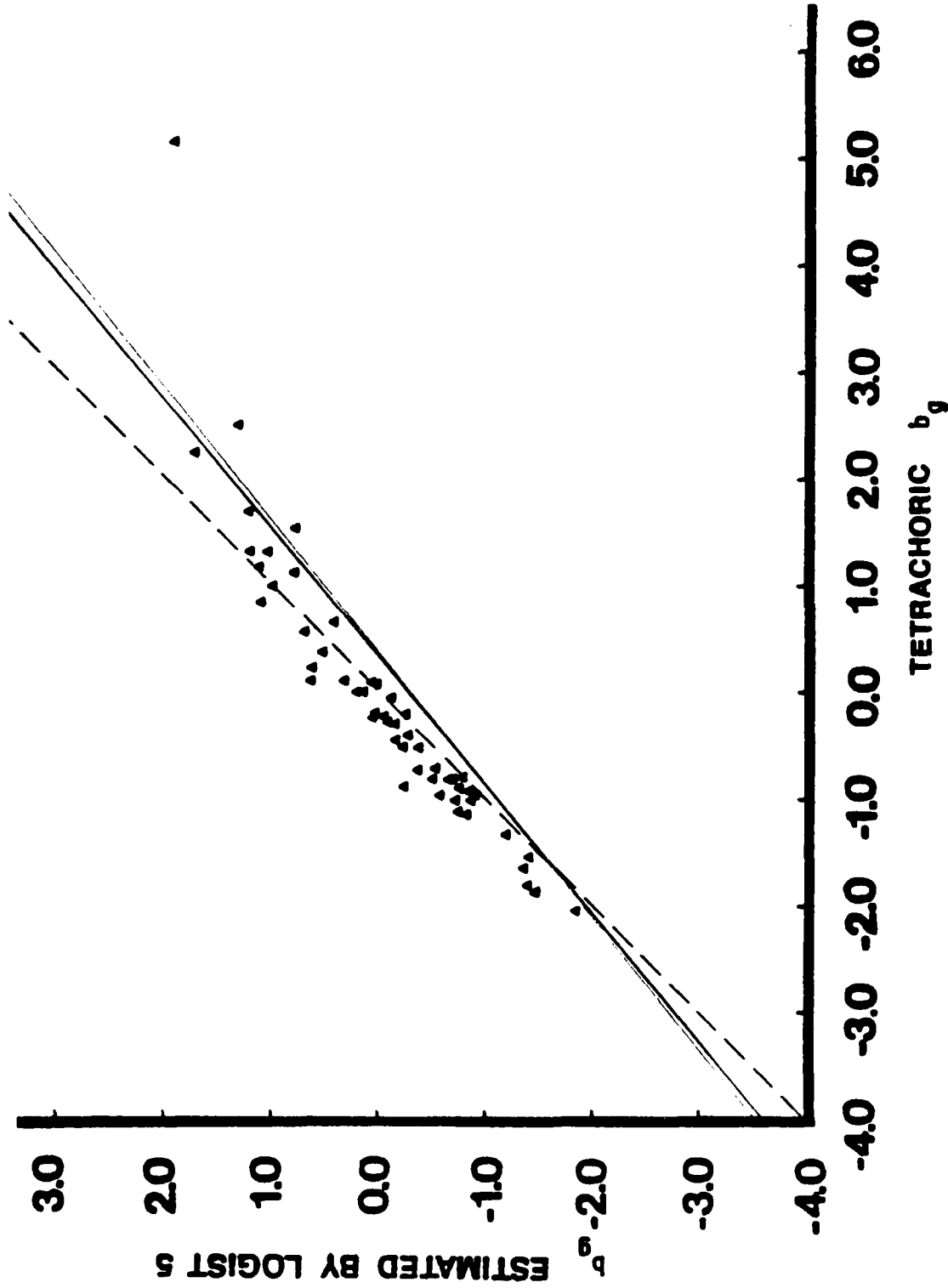


FIGURE 7-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

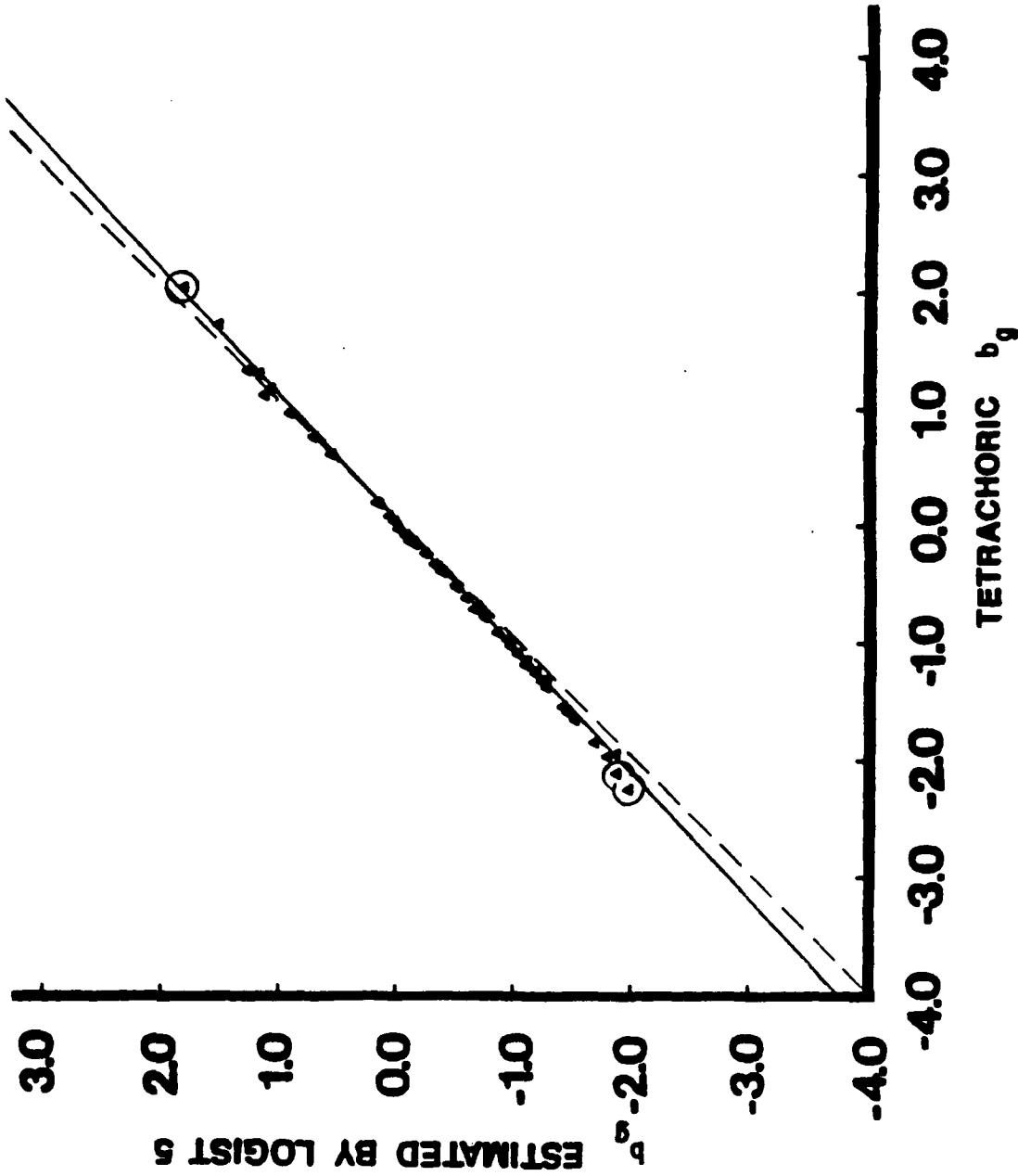


FIGURE 7-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/2259 Case.

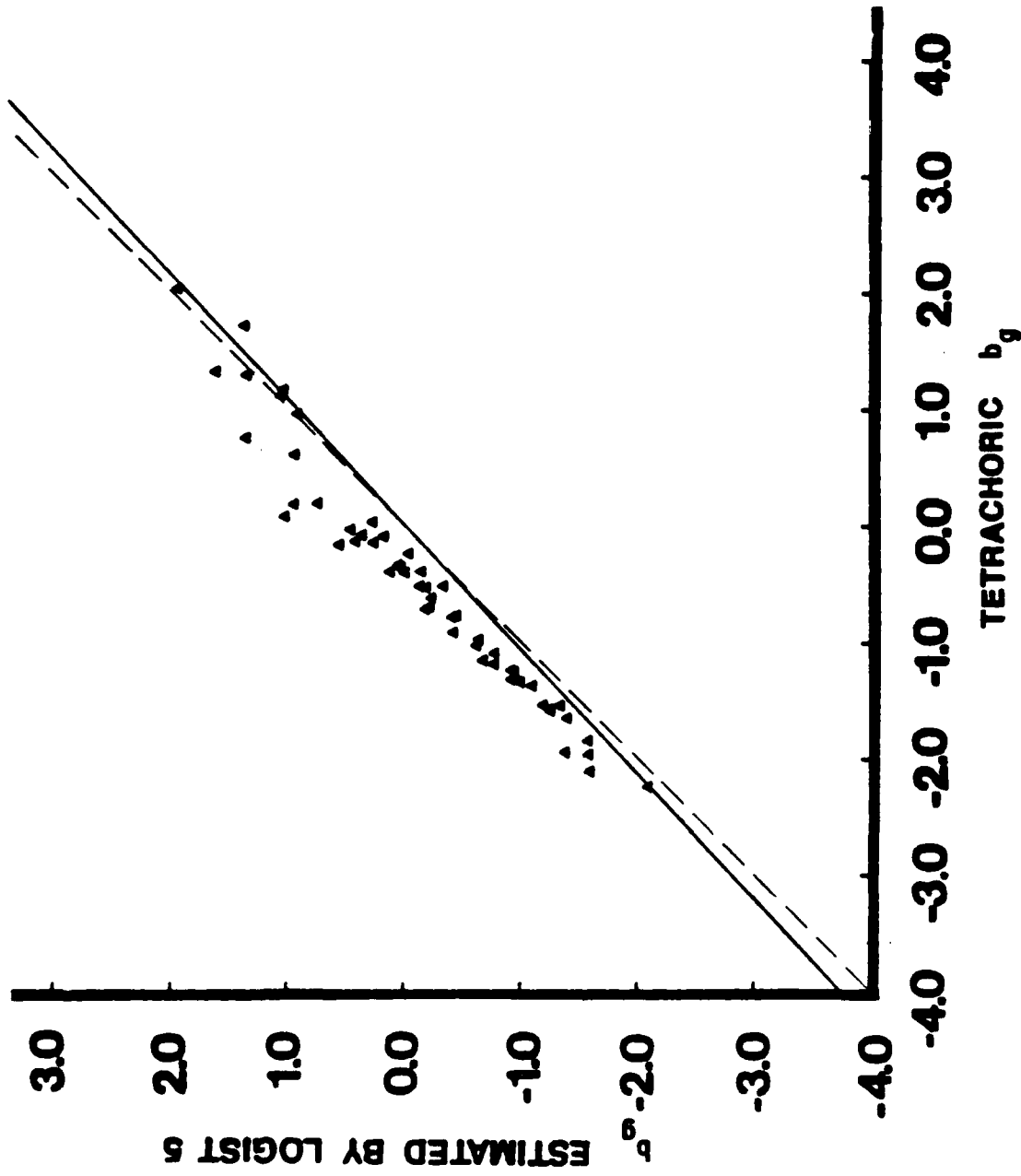
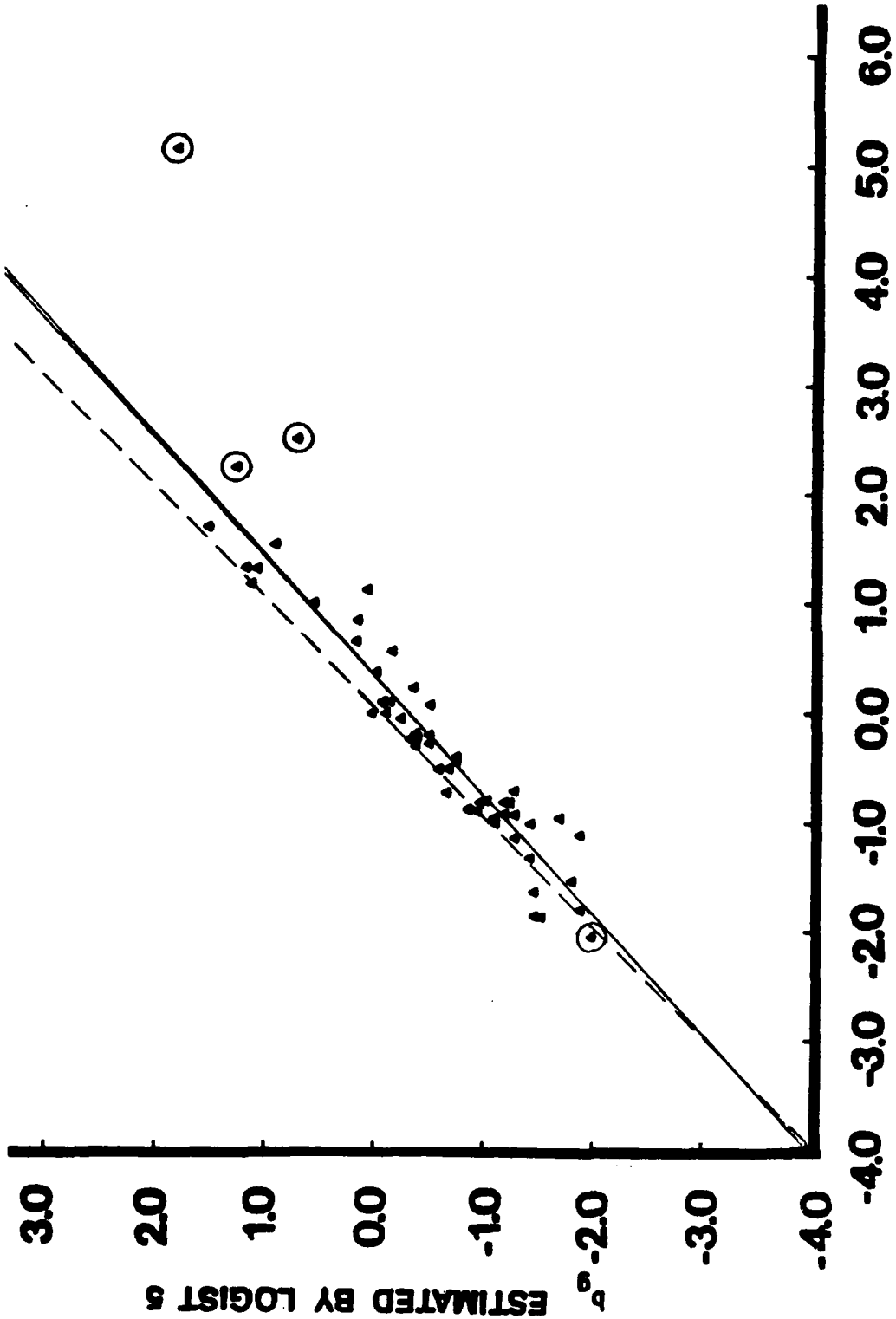


FIGURE 7-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist-5. J1/2259 Case.



TETRACHORIC b_g

FIGURE 7-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

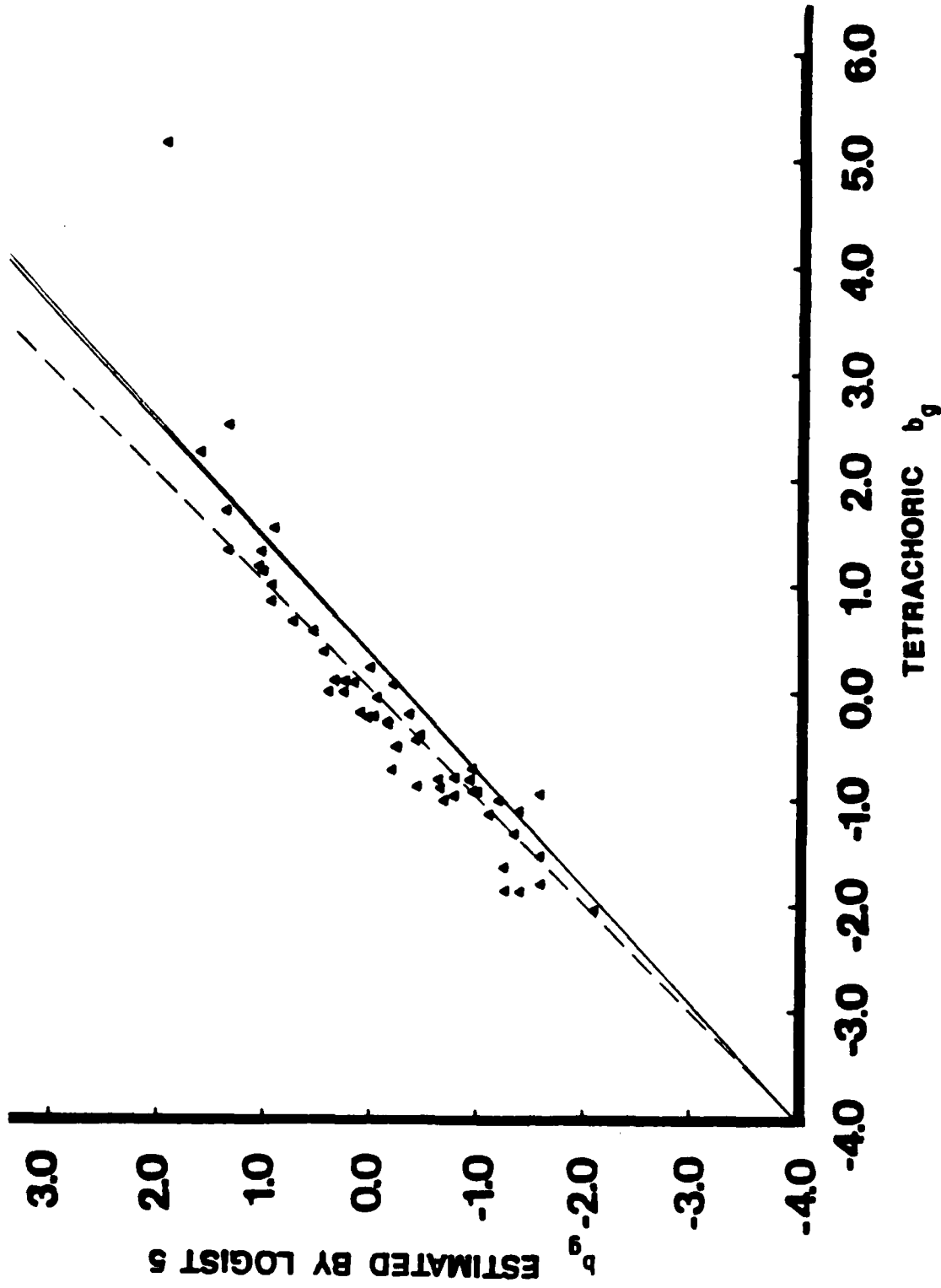


FIGURE 7-6 (Continued)

Three-Parameter Logistic Model Is Assumed In Using Logist 5. J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

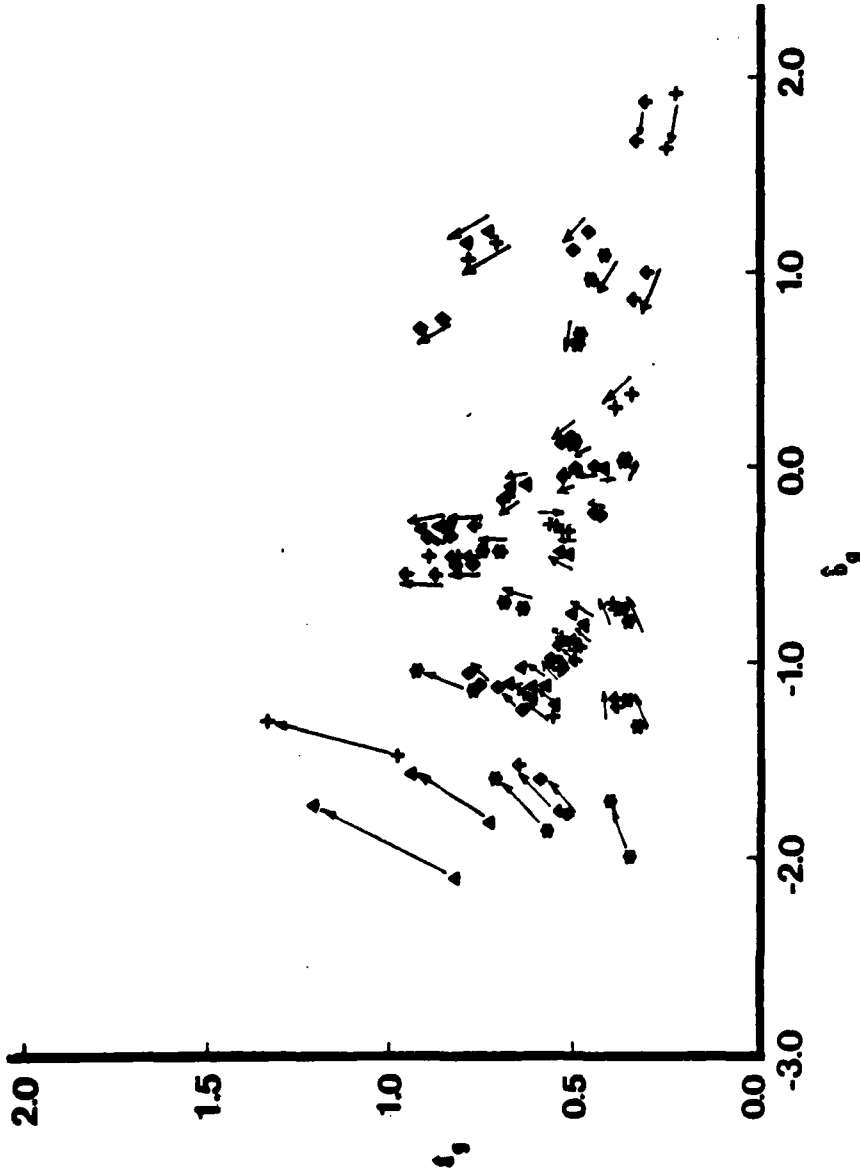


FIGURE 7-7

Estimated Item Discrimination Parameter a_g Plotted against Estimated Difficulty Parameter b_g , Which Were Obtained by the Tetrachoric Method Applied for the J1/1075 Case, And Those Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming (Two-Parameter Logistic Model), for Each of the 55 Items of Test J1. For Each Item, an Arrow Is Drawn from the Tetrachoric Method Result to the Logist 5 Result.

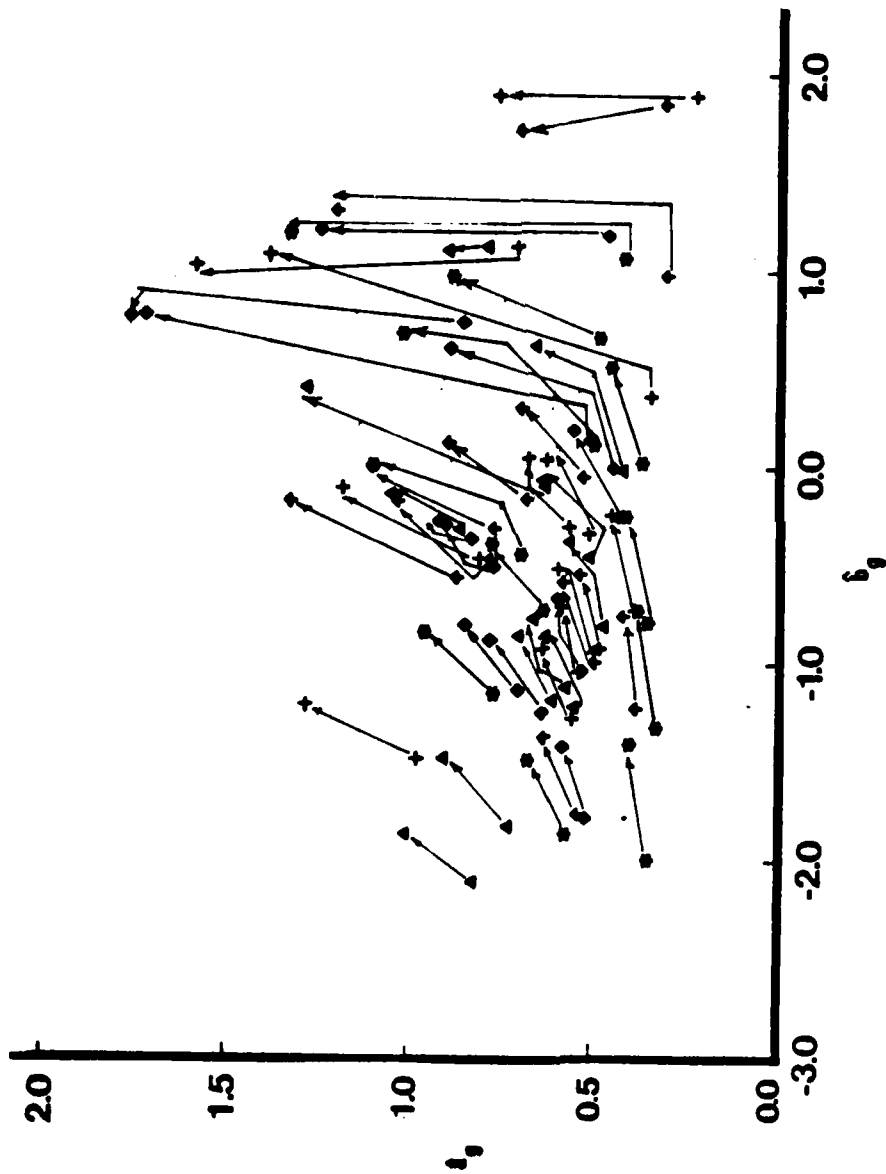


FIGURE 7-7 (Continued)

Estimated Item Discrimination Parameter \hat{a}_g Plotted against Estimated Difficulty Parameter \hat{b}_g , Which Were Obtained by the Tetrachoric Method Applied for the J1/1075 Case, And Those Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming Three-Parameter Logistic Model, for Each of the 55 Items of Test J1. For Each Item, an Arrow Is Drawn from the Tetrachoric Method Result to the Logist 5 Result.

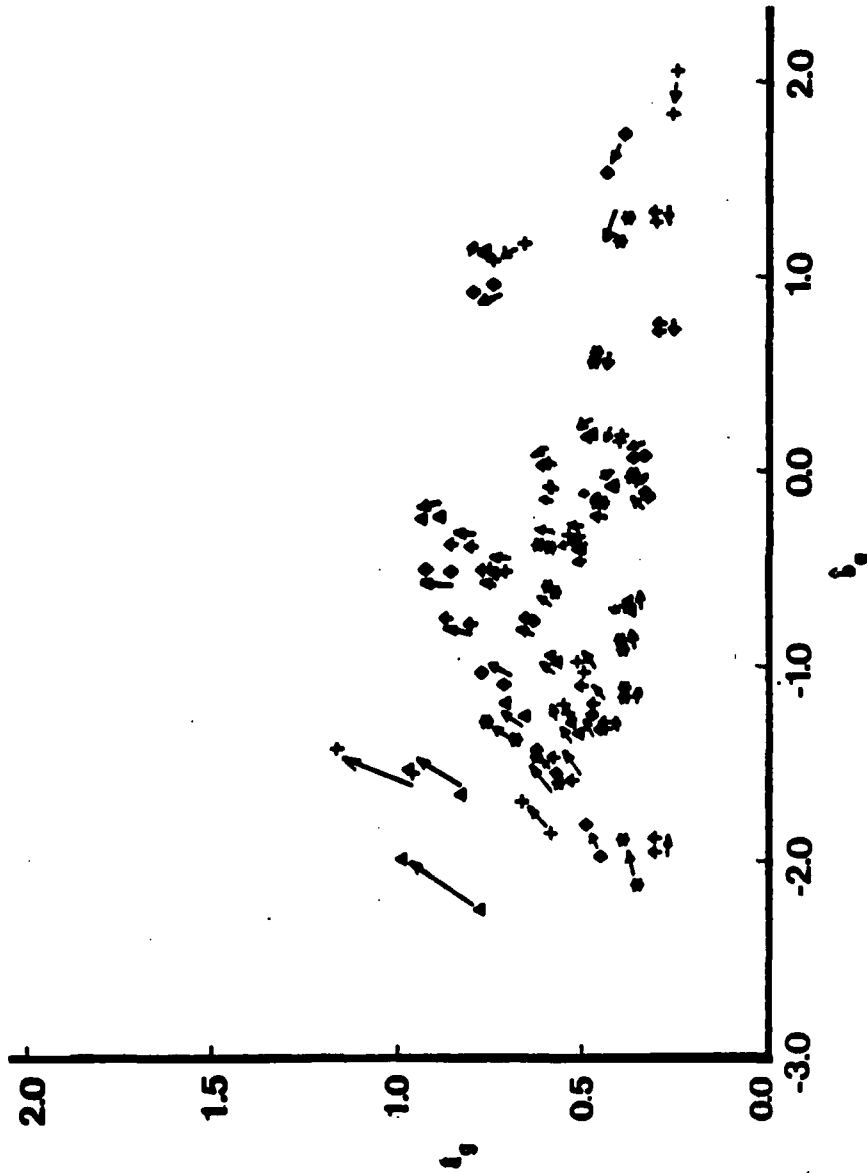


FIGURE 7-7 (Continued)

Estimated Item Discrimination Parameter b_1 Plotted against Estimated Difficulty Parameter b_g , Which Were Obtained by the Tetrachoric Method Applied for the J1/2259 Case, And Those Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming (Two-Parameter) Logistic Model, for Each of the 55 Items of Test J1. For Each Item, an Arrow Is Drawn from the Tetrachoric Method Result to the Logist 5 Result.

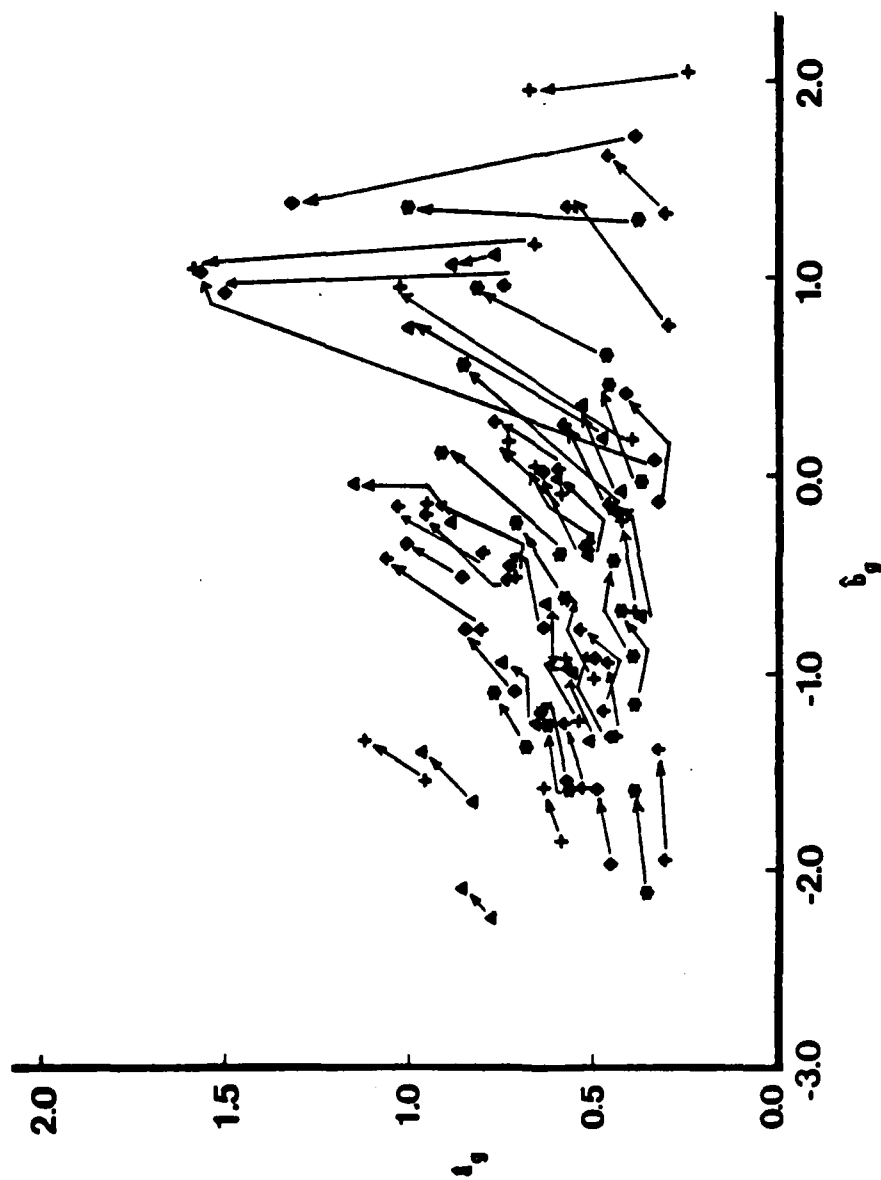


FIGURE 7-7 (Continued)

Estimated Item Discrimination Parameter \hat{a}_g Plotted against Estimated Difficulty Parameter \hat{b}_g , Which Were Obtained by the Tetrachoric Method Applied for the J1/2259 Case, And Those Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming Three-Parameter Logistic Model, for Each of the 55 Items of Test J1. For Each Item, an Arrow Is Drawn from the Tetrachoric Method Result to the Logist 5 Result.

similarly observed in both pairs, where the examinee groups of 1,075 individuals and of 2,259 examinees are involved, respectively.

We assume, tentatively, that the mean and the standard deviation of the distribution of the maximum likelihood estimate $\hat{\theta}$ equals those of θ for each examinee group. We recall that, in the preceding section, we obtained the estimated mean and the standard deviation of the distribution of θ for each of the three combined groups, and they are presented at the bottom of Table 6-3. Thus using the estimated mean and standard deviation of θ for each of the three combined examinee groups, and for each of J1/1075 and J1/2259 Cases, which are presented in Table 6-3 in the preceding section, the scale adjustment was made in the same way as we did for the results of the Tetrachoric Method. The resulting "rescaled" estimated item parameters are shown in Tables 7-13 through 7-24, for each item of Tests A5, A6, J1 and J2, which were originally obtained by Logist 5 in Cases A5-A6, J1-J2, A5-A6-J1-J2, J1/1075: c_g -Zero, J1/1075: c_g -Free, J1/2259: c_g -Zero, and J1/2259: c_g -Free, respectively. Again in these tables, for convenience, extreme values of a_g and b_g in Tables 7-13 through 7-21 and in Table 7-23 are marked with ● in the same way as we did in Tables 6-4 through 6-9. Note that these marks indicate extreme deviation with respect to the origin and unit of the single scale, which are set equal to the mean and standard deviation of the ability distribution of the J1/0614 Case, respectively, while those marks in each of Tables 7-1 through 7-9 and in Table 7-11 do with respect to the origin and unit which are set equal to the mean and

TABLE 7-13

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of \hat{a} Are the Same As Those of θ .

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
A501	0.922	-2.221	A541	0.650	-0.937
A502	0.643	-3.099●	A542	0.552	-1.451
A503	0.733	-3.224●	A543	0.600	-1.145
A504	0.770	-1.999	A544	0.993	-0.561
A505	0.971	-2.301	A545	1.099	-0.717
A506	0.576	-1.984	A546	0.397	0.203
A507	0.614	-0.997	A547	0.354	-0.474
A508	0.948	-1.805	A548	0.583	-0.219
A509	1.768	-1.904			
A510	0.793	-0.986			
A511	0.597	-2.097			
A512	0.851	-1.877			
A513	1.271	-2.636			
A514	1.111	-1.831			
A515	0.590	-2.206			
A516	0.526	0.323			
A517	2.186	-2.243			
A518	0.462	-2.382			
A519	0.868	-1.912			
A520	0.451	-2.965			
A521	0.792	-1.886			
A522	0.503	-0.714			
A523	0.103	4.123●			
A524	0.541	-1.993			
A525	1.239	-1.943			
A526	1.088	-0.883			
A527	0.109	-0.480			
A528	0.526	-0.205			
A529	0.661	-0.638			
A530	0.775	-1.715			
A531	0.036●	35.061●			
A532	0.632	-0.084			
A533	0.978	-1.779			
A534	1.011	-2.091			
A535	0.781	-1.333			
A536	0.819	-1.151			
A537	0.594	-1.359			
A538	1.456	-1.003			
A539	0.877	-1.053			
A540	0.523	-0.745			

Note: The estimated item parameters for items A533 through A548 are the same as those for items A601 through A616 in Table 7-14, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6.

TABLE 7-14

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\delta}$ Are the Same As Those of θ .

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
A601	0.978	-1.779	A641	0.724	0.056
A602	1.011	-2.091	A642	0.758	-1.267
A603	0.781	-1.333	A643	0.843	-0.872
A604	0.819	-1.151	A644	1.322	-0.489
A605	0.594	-1.359	A645	0.561	-0.315
A606	1.456	-1.003	A646	0.573	-0.792
A607	0.877	-1.053	A647	0.618	0.296
A608	0.523	-0.745	A648	1.007	-1.675
A609	0.650	-0.937	A649	0.508	-0.793
A610	0.552	-1.451	A650	0.629	-0.393
A611	0.600	-1.145	A651	0.711	-0.959
A612	0.993	-0.561	A652	0.314	-1.062
A613	1.099	-0.717	A653	0.627	-0.768
A614	0.397	0.203	A654	0.280	1.884
A615	0.354	-0.474	A655	0.988	-0.470
A616	0.583	-0.219	A656	0.575	-1.370
A617	1.147	-1.532			
A618	0.588	-1.193			
A619	0.696	-1.180			
A620	1.051	-0.629			
A621	1.016	-0.960			
A622	0.724	-1.614			
A623	0.529	-1.441			
A624	0.701	-2.068			
A625	0.470	-1.764			
A626	0.602	-1.024			
A627	0.388	-0.492			
A628	0.279	-2.600			
A629	0.752	-0.655			
A630	0.736	-1.017			
A631	0.684	-0.853			
A632	0.744	-1.407			
A633	0.460	-1.157			
A634	1.363	-1.595			
A635	1.090	-2.065			
A636	0.828	-1.576			
A637	0.556	-1.107			
A638	0.525	0.646			
A639	0.064●	10.800●			
A640	0.618	-0.211			

Note: The estimated item parameters for items A601 through A616 are the same as those for items A533 through A548 in Table 7-13, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6.

TABLE 7-15

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of θ Are the Same As Those of θ .

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	0.747	-0.025	J141	0.529	-0.869
J102	0.495	-0.802	J142	0.467	0.396
J103	0.668	-0.933	J143	0.661	-0.170
J104	0.696	-0.868	J144	0.382	-0.544
J105	0.733	-0.201	J145	0.665	-0.105
J106	0.471	-0.666	J146	0.757	-0.160
J107	0.485	-0.025	J147	0.512	0.279
J108	1.064	-1.641	J148	0.545	0.319
J109	0.313	-1.025	J149	0.462	-0.097
J110	0.604	-0.465	J150	0.453	0.057
J111	1.176	-1.148	J151	0.554	0.932
J112	0.445	-0.677	J152	0.426	0.574
J113	0.545	-0.940	J153	0.413	1.680
J114	0.596	0.202	J154	0.364	1.370
J115	0.787	-0.195	J155	0.850	1.046
J116	0.345	-1.005	J156	0.789	1.492
J117	0.326	-0.495			
J118	0.565	-0.982			
J119	0.598	-0.926			
J120	0.299	1.278			
J121	0.477	-0.711			
J122	0.499	-0.784			
J123	0.469	0.258			
J124	0.632	-1.481			
J125	0.522	-1.487			
J126	0.447	-0.528			
J127	0.577	-1.397			
J128	0.819	-0.855			
J129	0.650	1.665			
J130	0.357	-1.611			
J131	0.843	-0.298			
J132	0.398	0.057			
J133	0.824	-1.463			
J134	0.295	2.172			
J135	0.790	-0.091			
J136	0.320	0.364			
J137	0.613	0.024			
J138	0.008 ●	189.417 ●			
J139	0.381	1.611			
J140	0.321	0.325			

Note: The estimated item parameters for items J137 through J156 are the same as those for items J201 through J220 in Table 7-16, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case J1-J2.

TABLE 7-16

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of δ Are the Same As Those of θ .

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J201	0.613	0.024	J241	1.001	0.006
J202	0.008●	189.417●	J242	0.677	0.270
J203	0.381	1.611	J243	0.330	0.452
J204	0.321	0.325	J244	0.243	0.965
J205	0.529	-0.869	J245	0.687	1.219
J206	0.467	0.396	J246	0.220	1.569
J207	0.661	-0.170	J247	0.421	1.127
J208	0.382	-0.544	J248	0.335	-0.679
J209	0.665	-0.105	J249	0.576	1.012
J210	0.757	-0.160	J250	0.589	0.908
J211	0.512	0.279	J251	0.806	0.258
J212	0.545	0.319	J252	0.432	1.333
J213	0.462	-0.097	J253	0.475	1.402
J214	0.453	0.057	J254	0.474	1.353
J215	0.554	0.932	J255	0.908	1.431
J216	0.426	0.574	J256	0.422	2.041
J217	0.413	1.680	J257	0.441	1.022
J218	0.364	1.370	J258	0.340	1.535
J219	0.850	1.046	J259	0.649	1.632
J220	0.789	1.492	J260	0.097●	2.936
J221	0.359	1.821			
J222	0.589	0.590			
J223	0.390	-0.421			
J224	0.575	0.576			
J225	0.624	-0.025			
J226	0.560	0.606			
J227	0.563	0.202			
J228	0.609	-0.188			
J229	0.583	0.135			
J230	0.512	0.153			
J231	1.310	0.007			
J232	0.839	-0.118			
J233	0.256	2.127			
J234	0.297	1.432			
J235	0.855	0.611			
J236	0.780	0.730			
J237	0.226	-0.048			
J238	0.661	2.353			
J239	0.424	1.136			
J240	0.519	1.726			

Note: The estimated item parameters for items J210 through J220 are the same as those for items J137 through J156 in Table 7-15, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case J1-J2.

TABLE 7-17

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ .

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
A501	0.743	-2.579	A541	0.539	-0.988
A502	0.517	-3.672●	A542	0.456	-1.613
A503	0.590	-3.824●	A543	0.496	-1.241
A504	0.622	-2.302	A544	0.816	-0.531
A505	0.787	-2.672	A545	0.903	-0.720
A506	0.465	-2.285	A546	0.326	0.396
A507	0.496	-1.061	A547	0.292	-0.429
A508	0.767	-2.061	A548	0.482	-0.120
A509	1.425	-2.186			
A510	0.641	-1.047			
A511	0.481	-2.426			
A512	0.686	-2.153			
A513	1.025	-3.093●			
A514	0.895	-2.096			
A515	0.475	-2.561			
A516	0.423	0.577			
A517	1.757	-2.607			
A518	0.372	-2.778			
A519	0.702	-2.193			
A520	0.364	-3.501●			
A521	0.639	-2.163			
A522	0.406	-0.710			
A523	0.082●	5.379●			
A524	0.435	-2.297			
A525	1.001	-2.233			
A526	0.877	-0.920			
A527	0.089●	-0.428			
A528	0.424	-0.078			
A529	0.534	-0.616			
A530	0.623	-1.954			
A531	0.026●	47.687●			
A532	0.510	0.071			
A533	0.800	-2.018			
A534	0.828	-2.398			
A535	0.641	-1.472			
A536	0.677	-1.248			
A537	0.488	-1.503			
A538	1.192	-1.067			
A539	0.720	-1.130			
A540	0.431	-0.757			

Note: The estimated item parameters for items A533 through A548 are the same as those for items A601 through A616 in Table 7-18, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6-J1-J2.

TABLE 7-18

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ .

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
A601	0.800	-2.018	A641	0.754	0.049
A602	0.828	-2.398	A642	0.482	-1.007
A603	0.641	-1.472	A643	0.707	-0.850
A604	0.677	-1.248	A644	0.876	-0.595
A605	0.488	-1.503	A645	0.665	-0.206
A606	1.192	-1.067	A646	0.481	-0.661
A607	0.720	-1.130	A647	0.551	0.149
A608	0.431	-0.757	A648	0.984	-1.664
A609	0.539	-0.988	A649	0.362	-0.839
A610	0.456	-1.613	A650	0.615	-0.385
A611	0.496	-1.241	A651	0.981	-1.057
A612	0.816	-0.531	A652	0.395	-0.775
A613	0.903	-0.720	A653	0.577	-0.810
A614	0.326	0.396	A654	0.550	0.421
A615	0.292	-0.429	A655	0.799	-0.220
A616	0.482	-0.120	A656	0.347	-1.205
A617	0.972	-1.683			
A618	0.491	-1.293			
A619	0.591	-1.266			
A620	0.903	-0.615			
A621	0.848	-1.011			
A622	0.609	-1.787			
A623	0.446	-1.581			
A624	0.592	-2.319			
A625	0.398	-1.960			
A626	0.509	-1.084			
A627	0.330	-0.456			
A628	0.236	-2.945			
A629	0.629	-0.650			
A630	0.624	-1.075			
A631	0.579	-0.881			
A632	0.630	-1.535			
A633	0.390	-1.242			
A634	1.146	-1.762			
A635	0.923	-2.313			
A636	0.698	-1.739			
A637	0.470	-1.183			
A638	0.446	0.881			
A639	0.058 ●	12.140 ●			
A640	0.518	-0.122			

Note: The estimated item parameters for items A601 through A616 are the same as those for items A533 through A548 in Table 7-17, respectively since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6-J1-J2. Also The estimated item parameters for items A641 through A656 are the same as those for J101 through J116 in Table 7-19, respectively, since they are overlapping items between Tests A6 and J1.

TABLE 7-19

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of θ Are the Same As Those of θ .

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	0.754	0.049	J141	0.569	-0.753
J102	0.482	-1.007	J142	0.502	0.423
J103	0.707	-0.850	J143	0.711	-0.103
J104	0.876	-0.595	J144	0.412	-0.450
J105	0.665	-0.206	J145	0.716	-0.042
J106	0.481	-0.661	J146	0.817	-0.092
J107	0.551	0.149	J147	0.550	0.314
J108	0.984	-1.664	J148	0.586	0.352
J109	0.362	-0.839	J149	0.498	-0.033
J110	0.615	-0.385	J150	0.488	0.108
J111	0.981	-1.057	J151	0.596	0.921
J112	0.395	-0.775	J152	0.459	0.588
J113	0.577	-0.810	J153	0.445	1.614
J114	0.550	0.421	J154	0.392	1.328
J115	0.799	-0.220	J155	0.916	1.028
J116	0.347	-1.205	J156	0.853	1.440
J117	0.349	-0.406			
J118	0.606	-0.861			
J119	0.643	-0.807			
J120	0.319	1.250			
J121	0.512	-0.606			
J122	0.534	-0.677			
J123	0.505	0.296			
J124	0.678	-1.325			
J125	0.561	-1.329			
J126	0.480	-0.437			
J127	0.619	-1.246			
J128	0.877	-0.743			
J129	0.698	1.607			
J130	0.382	-1.451			
J131	0.903	-0.222			
J132	0.426	0.108			
J133	0.880	-1.314			
J134	0.317	2.079			
J135	0.848	-0.028			
J136	0.343	0.396			
J137	0.659	0.077			
J138	0.007 ●	199.696 ●			
J139	0.410	1.551			
J140	0.345	0.356			

Note: The estimated item parameters for items J101 through J116 are the same as those for items A641 through A656 in Table 7-18, respectively, since they are overlapping items between Tests A6 and J1 and the results are of Case A5-A6-J1-J2. Also the estimated item parameters for items J137 through J156 are the same as those for items J201 through J220 in Table 7-20, respectively, since they are overlapping items between Tests J1 and J2.

TABLE 7-20

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of θ Are the Same As Those of θ .

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J201	0.659	0.077	J241	1.086	0.065
J202	0.007●	199.696●	J242	0.731	0.307
J203	0.410	1.551	J243	0.356	0.473
J204	0.345	0.356	J244	0.262	0.949
J205	0.569	-0.753	J245	0.742	1.184
J206	0.502	0.423	J246	0.237	1.509
J207	0.711	-0.103	J247	0.455	1.100
J208	0.412	-0.450	J248	0.362	-0.572
J209	0.716	-0.042	J249	0.620	0.993
J210	0.817	-0.092	J250	0.637	0.897
J211	0.550	0.314	J251	0.872	0.296
J212	0.586	0.352	J252	0.468	1.290
J213	0.498	-0.033	J253	0.514	1.354
J214	0.488	0.108	J254	0.513	1.309
J215	0.596	0.921	J255	0.980	1.381
J216	0.459	0.588	J256	0.456	1.945
J217	0.445	1.614	J257	0.477	1.002
J218	0.392	1.328	J258	0.368	1.477
J219	0.916	1.028	J259	0.701	1.566
J220	0.853	1.440	J260	0.103	2.789
J221	0.388	1.741			
J222	0.635	0.602			
J223	0.422	-0.332			
J224	0.622	0.590			
J225	0.676	0.036			
J226	0.607	0.618			
J227	0.608	0.243			
J228	0.659	-0.117			
J229	0.631	0.183			
J230	0.553	0.198			
J231	1.416	0.064			
J232	0.908	-0.052			
J233	0.277	2.023			
J234	0.322	1.381			
J235	0.926	0.622			
J236	0.842	0.732			
J237	0.245	0.016			
J238	0.714	2.234			
J239	0.457	1.108			
J240	0.560	1.653			

Note: The estimated item parameters for items J210 through J220 are the same as those for items J137 through J156 in Table 7-19, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case A5-A6-J1-J2.

TABLE 7-21

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 55 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ .

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	0.773	-0.051	J141	0.592	-0.830
J102	0.514	-0.796	J142	0.465	0.402
J103	0.695	-0.923	J143	0.687	-0.182
J104	0.723	-0.860	J144	0.364	-0.468
J105	0.764	-0.218	J145	0.754	-0.262
J106	0.491	-0.664	J146	0.840	-0.067
J107	0.505	-0.048	J147	0.458	0.272
J108	1.114	-1.596	J148	0.492	0.408
J109	0.327	-1.004	J149	0.494	-0.189
J110	0.634	-0.468	J150	0.488	-0.077
J111	1.228	-1.127	J151	0.452	0.952
J112	0.460	-0.679	J152	0.358	0.611
J113	0.564	-0.933	J153	0.462	1.476
J114	0.619	0.170	J154	0.228	2.044
J115	0.822	-0.212	J155	0.845	1.043
J116	0.357	-0.997	J156	0.723	1.427
J117	0.339	-0.501			
J118	0.585	-0.974			
J119	0.621	-0.917			
J120	0.310	1.208			
J121	0.498	-0.705			
J122	0.519	-0.779			
J123	0.488	0.224			
J124	0.659	-1.446			
J125	0.546	-1.448			
J126	0.465	-0.532			
J127	0.599	-1.369			
J128	0.854	-0.847			
J129	0.674	1.581			
J130	0.373	-1.567			
J131	0.879	-0.312			
J132	0.412	0.030			
J133	0.868	-1.420			
J134	0.303	2.084			
J135	0.824	-0.113			
J136	0.333	0.327			
J137	0.638	0.098			
J138	---	---			
J139	0.418	1.315			
J140	0.386	0.273			

TABLE 7-22

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 55 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Three-Parameter Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ .

Item	\hat{a}_g	\hat{b}_g	\hat{c}_g	Item	\hat{a}_g	\hat{b}_g	\hat{c}_g
J101	1.013	0.293	0.146	J141	0.612	-0.543	0.143
J102	0.540	-0.483	0.143	J142	0.940	1.035	0.245
J103	0.722	-0.663	0.143	J143	1.012	0.306	0.201
J104	0.784	-0.579	0.143	J144	0.414	0.028	0.143
J105	0.949	0.105	0.137	J145	0.829	-0.026	0.103
J106	0.550	-0.271	0.143	J146	0.966	0.145	0.087
J107	0.623	0.346	0.143	J147	1.586	1.135	0.338
J108	0.930	-1.734	0.143	J148	0.821	0.954	0.207
J109	0.351	-0.504	0.143	J149	0.587	0.218	0.143
J110	0.717	-0.130	0.143	J150	0.577	0.332	0.143
J111	1.181	-1.022	0.143	J151	0.816	1.354	0.181
J112	0.494	-0.302	0.143	J152	1.277	1.470	0.331
J113	0.582	-0.646	0.143	J153	1.148	1.607	0.167
J114	1.180	0.734	0.234	J154	0.702	2.350	0.249
J115	1.088	0.178	0.173	J155	1.623	1.126	0.089
J116	0.387	-0.533	0.143	J156	1.462	1.409	0.086
J117	0.377	0.019	0.143				
J118	0.588	-0.711	0.143				
J119	0.649	-0.640	0.143				
J120	1.107	1.714	0.278				
J121	0.536	-0.345	0.143				
J122	0.552	-0.438	0.143				
J123	0.640	0.625	0.143				
J124	0.624	-1.324	0.143				
J125	0.537	-1.255	0.143				
J126	0.522	-0.122	0.143				
J127	0.583	-1.199	0.143				
J128	0.886	-0.619	0.143				
J129	0.827	1.496	0.018				
J130	0.370	-1.240	0.143				
J131	1.218	0.105	0.191				
J132	0.509	0.497	0.143				
J133	0.835	-1.316	0.143				
J134	0.645	2.154	0.162				
J135	0.847	-0.003	0.041				
J136	0.416	0.848	0.143				
J137	0.824	0.429	0.131				
J138	---	---	---				
J139	1.225	1.590	0.213				
J140	0.606	0.965	0.218				

TABLE 7-23

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 55 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of δ Are the Same As Those of θ .

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	0.764	-0.219	J141	0.583	-0.658
J102	0.549	-0.908	J142	0.463	0.136
J103	0.622	-1.146	J143	0.617	-0.087
J104	0.769	-0.748	J144	0.376	-0.397
J105	0.848	-0.085	J145	0.651	-0.464
J106	0.513	-0.686	J146	0.928	0.049
J107	0.589	0.211	J147	0.362	0.363
J108	0.978	-1.708	J148	0.521	-0.063
J109	0.386	-0.824	J149	0.500	-0.102
J110	0.591	-0.302	J150	0.537	-0.032
J111	1.155	-1.140	J151	0.470	0.857
J112	0.439	-0.999	J152	0.400	0.447
J113	0.528	-1.003	J153	0.432	1.833
J114	0.488	0.471	J154	0.254	2.132
J115	0.746	-0.212	J155	0.792	1.218
J116	0.303	-1.598	J156	0.738	1.381
J117	0.397	-0.574			
J118	0.660	-1.413			
J119	0.704	-0.904			
J120	0.293	1.015			
J121	0.502	-0.811			
J122	0.472	-0.961			
J123	0.461	0.150			
J124	0.621	-1.183			
J125	0.489	-1.527			
J126	0.375	-0.375			
J127	0.574	-1.180			
J128	0.757	-1.002			
J129	0.757	1.434			
J130	0.389	-1.605			
J131	0.862	-0.465			
J132	0.332	0.186			
J133	0.960	-1.245			
J134	0.298	1.581			
J135	0.917	-0.212			
J136	0.362	0.280			
J137	0.606	0.320			
J138	---	---			
J139	0.397	1.484			
J140	0.415	0.219			

TABLE 7-24

Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 55 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Three-Parameter Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of \hat{a} Are the Same As Those of θ .

Item	\hat{a}_g	\hat{b}_g	\hat{c}_g	Item	\hat{a}_g	\hat{b}_g	\hat{c}_g
J101	0.949	0.098	0.151	J141	0.623	-0.357	0.146
J102	0.571	-0.637	0.146	J142	0.847	0.857	0.267
J103	0.639	-0.913	0.146	J143	0.908	0.410	0.209
J104	0.842	-0.493	0.146	J144	0.422	0.067	0.146
J105	1.026	0.139	0.109	J145	0.721	-0.164	0.146
J106	0.565	-0.337	0.146	J146	1.144	0.253	0.101
J107	0.726	0.466	0.109	J147	1.558	1.328	0.373
J108	0.849	-1.821	0.146	J148	0.632	0.316	0.146
J109	0.421	-0.393	0.146	J149	0.594	0.280	0.146
J110	0.706	0.053	0.146	J150	0.654	0.338	0.146
J111	1.114	-1.059	0.146	J151	0.810	1.247	0.182
J112	0.457	-0.660	0.146	J152	1.018	1.252	0.308
J113	0.551	-0.712	0.146	J153	1.311	1.682	0.156
J114	0.996	1.044	0.245	J154	0.671	2.256	0.212
J115	0.946	0.154	0.172	J155	1.492	1.223	0.085
J116	0.321	-1.102	0.146	J156	1.575	1.346	0.095
J117	0.441	-0.135	0.146				
J118	0.629	-1.300	0.146				
J119	0.743	-0.662	0.146				
J120	0.566	1.667	0.229				
J121	0.531	-0.490	0.146				
J122	0.492	-0.636	0.146				
J123	0.577	0.554	0.146				
J124	0.620	-0.977	0.146				
J125	0.487	-1.307	0.146				
J126	0.430	0.102	0.146				
J127	0.575	-0.968	0.146				
J128	0.765	-0.818	0.146				
J129	0.877	1.367	0.013				
J130	0.385	-1.316	0.146				
J131	1.054	-0.127	0.178				
J132	0.409	0.713	0.146				
J133	0.960	-1.119	0.146				
J134	0.456	1.928	0.146				
J135	1.003	-0.051	0.085				
J136	0.456	0.758	0.146				
J137	0.762	0.566	0.108				
J138	---	---	---				
J139	0.997	1.661	0.193				
J140	0.527	0.656	0.146				

standard deviation of each, separate distribution of $\hat{\theta}$,
respectively.

Close observation of the first and third graph of Figure 7-7 suggests that this assumption of equality of the mean and standard deviation of the distribution of θ and those of the distribution of $\hat{\theta}$ in each examinee group may not be appropriate. We can see in these two graphs that those item parameter estimates obtained by Logist 5 assuming (two-parameter) logistic model tend to be higher in discrimination indices and tend to be regressed to center in difficulty indices compared with the corresponding estimates obtained by the Tetrachoric Method. This fact suggests that the distribution of $\hat{\theta}$ obtained by Logist 5 has a larger standard deviation than that of θ for these two examinee groups.

If the assumption that the mean and the standard deviation of the distribution of the maximum likelihood estimate $\hat{\theta}$ equal those of the distribution of θ in each combined examinee group, then the line specified by

$$(7.1) \quad \hat{\sigma}_u \hat{a}(L) = \hat{\sigma}_c \hat{a}(T) ,$$

where $\hat{\sigma}_c$ and $\hat{\sigma}_u$ are the estimated standard deviations of the distribution of θ of a specified combined group and of an uncombined group which is a part of the combined group, respectively, and $\hat{a}(T)$ and $\hat{a}(L)$ represent the axes of estimated item discrimination parameters by Tetrachoric Method and by Logist 5 , respectively, will

fit the corresponding scatter diagram of the two sets of unadjusted estimated discrimination parameters. The corresponding formula for the scatter diagram of the two sets of estimated difficulty parameters before any scale adjustment is

$$(7.2) \quad \hat{\sigma}_c \hat{b}_{(L)} + \hat{\mu}_c = \hat{\sigma}_u \hat{b}_{(T)} + \hat{\mu}_u ,$$

where $\hat{\sigma}_c$ and $\hat{\sigma}_u$ are as described earlier, $\hat{\mu}_c$ and $\hat{\mu}_u$ are the estimated means of the combined group and of the uncombined group, respectively, and $\hat{b}_{(T)}$ and $\hat{b}_{(L)}$ represent the axes of estimated item difficulty parameters by Tetrachoric Method and by Logist 5, respectively.

The linear relationship specified by (7.1) for the estimated discrimination parameters is drawn by a long dashed line in each graph of Figure 7-1, which includes the two combined groups, i.e., Cases A5-A6 and J1-J2. We can see that the line does not fit to the scatter diagram very well in each of the first three graphs of Figure 7-1, while it does a little better in the other two. The corresponding linear relationship specified by (7.2) for the estimated difficulty parameters is also shown by a long dashed line in each graph of Figure 7-2. The fit of these lines to the corresponding scatter diagrams appears to be fairly good this time, but not to the extent to make us feel unnecessary to search for better linear relationships for these scatter diagrams of estimated difficulty parameters.

Corresponding two sets of linear relationships for the scatter

diagrams of the "unadjusted" item discrimination and difficulty parameters were obtained with respect to Case A5-A6-J1-J2 by using formulae (7.1) and (7.2), and they are shown by long dashed lines in Figures 7-3 and 7-4. We can see that, in these cases, too, the linear relationships do not fit the corresponding scatter diagrams very well.

The same procedure was taken for each of the scatter diagrams of the estimated item discrimination parameters, and of the estimated difficulty parameters, which concern with Case J1/1075: c_g -Zero and with Case J1/2259: c_g -Zero. These resulting linear relationships are drawn by long dashed lines in the corresponding graphs of Figures 7-5 and 7-6. In these results, there is a systematic tendency that for the scatter diagrams of estimated item discrimination parameters these long dashed lines are too steep, and for those of estimated item difficulty parameters the lines are too flat. This fact indicates that both standard deviations of the distribution of $\hat{\theta}$ in Case J1/1075: c_g -Zero and in Case J1/2259: c_g -Zero are larger than the standard deviations of the corresponding distributions of θ . Note that this finding is consistent with the observation made earlier for the first and the third graphs of Figure 7-7. For comparison, the same linear relationship obtained for c_g -Zero is also shown by a long dashed line in the corresponding graph for c_g -Free for each of Cases J1/1075 and J1/2259. We can see that these lines are much farther apart from the corresponding scatter diagrams.

Since the linear relationships specified by (7.1) and (7.2) failed in fitting the corresponding scatter diagrams in many cases,

the iterative method of finding the best fitted lines for both the estimated item discrimination and difficulty parameters, which was introduced and applied for the overlapping test items in Section 6, was also adopted for the present results. Table 7-25 presents the slope and intercept of each of the resulting linear relationships. As before, certain items were excluded in the process of obtaining the best fitted linear relationships since one, or both, of the two estimated difficulty parameters exceeds 2.0 in absolute value. There are 5 items of Test A5 excluded from the first scatter diagrams of Figures 7-1 and 7-2, 6 items of Test A6 from the second scatter diagrams of these two figures, 2 items of Test J1 from the third ones, 4 items of Test J1 from the fourth ones, and 2 items of Test J2 from the fifth ones; there are 9 items of Test A5 excluded from the first scatter diagrams of Figures 7-3 and 7-4, 6 items of Test A6 from the second scatter diagrams of these two figures, 4 items of Test J1 from the third ones, and 2 items of Test J2 from the fourth ones; and there is 1 item of Test J1 excluded from the first scatter diagrams of Figures 7-5 and 7-6, 4 items of Test J1 from the third scatter diagrams of these two figures, 3 items of Test J1 from the fifth ones, and 4 items of Test J1 from the seventh ones. These items are circled in the scatter diagrams of Figures 7-1 through 7-6, unless they are not seen in these figures because of their too extremely deviated estimate values. The linear relationship thus obtained is drawn by a thin, solid line in each graph of Figures 7-1 through 7-4, and in each graph of Figures 7-5 and 7-6 where (two-parameter) logistic model is

TABLE 7-25

Slope And Intercept of Each of the Fitted Linear Relationship between the Two Sets of Estimated Discrimination Parameters, And Also Those of Estimated Difficulty Parameters, of the Common Test Items, Which Were Obtained by the Tetrachoric Method (Examinee Group 1) And by Logist 5 (Examinee Group 2), before Any Scale Adjustment.

Examinee Group 1	Examinee Group 2	a_g		Combined	b_g		Combined	
		Slope	Intercept	Slope	Slope	Intercept	Slope	Intercept
A5/0599	A5-A6	1.222	-0.013	1.214	0.829	-0.267	0.823	-0.270
A6/0412	A5-A6	1.034	-0.008	1.048	0.941	0.331	0.954	0.338
J1/0614	A5-A6	1.012*	-0.018*	0.897*	1.257*	0.937*	1.115*	0.841*
J1/0614	J1-J2	1.339	-0.009	1.377	0.707	-0.572	0.726	-0.566
J2/0758	J1-J2	1.083	-0.012	1.121	0.861	0.446	0.892	0.462
A5/0599	A5-A6-J1-J2	1.567	-0.018	1.555	0.648	-0.921	0.643	-0.923
A6/0412	A5-A6-J1-J2	1.387	-0.009	1.427	0.681	-0.470	0.701	-0.458
J1/0614	A5-A6-J1-J2	1.479	-0.006	1.522	0.638	-0.118	0.657	-0.112
J2/0758	A5-A6-J1-J2	1.234	-0.014	1.277	0.757	0.783	0.783	0.796
J1/1075	J1/1075	1.102	-0.006	1.107	0.899	-0.015	0.903	-0.013
J1/0614	J1/1075	1.162	-0.009	1.202	0.804	-0.256	0.832	-0.247
J1/2259	J1/2259	1.068	-0.005	1.069	0.935	-0.007	0.936	-0.007
J1/0614	J1/2259	1.069	-0.007	1.081	0.915	-0.284	0.925	-0.281

* This is based on only 14 items while all the other results are based on at least 36 items.

assumed in using Logist 5. As before, the two sets of results obtained for the scatter diagram of the estimated item discrimination parameters and for that of the estimated item difficulty parameters were combined in each case, and the result is shown by a thick, solid line in each graph. Again, in the last two figures, for comparison, the same pair of solid lines are drawn in each corresponding graph for the results of the three-parameter logistic model.

VIII. Scale Adjustment II

For the purpose of better visualizing the discrepancies in the mean and standard deviation between the distribution of θ and that of $\hat{\theta}$ for each examinee group, the rescaled item parameters of the items of Tests A5, A6, J1 and J2, which were obtained originally by Logist 5 and shown in Tables 7-13 through 7-24, were plotted against the corresponding rescaled item parameters obtained originally by Tetrachoric Method, which are shown in Tables 6-4 through 6-9. They were paired, arranged and categorized in the same way as we did for the unadjusted parameter estimates in Figures 7-1 through 7-6, and presented as Figures 8-1 through 8-6. We notice that, if the mean and the standard deviation of the distribution of $\hat{\theta}$ are the same as those of the distribution of θ in each examinee group, then the line passing through the origin, (0,0), and converging the abscissa with the angle of 45 degrees will be the best fitting linear relationship in each graph of these figures, except for the situations which concern three-parameter logistic model assumed in using Logist 5.

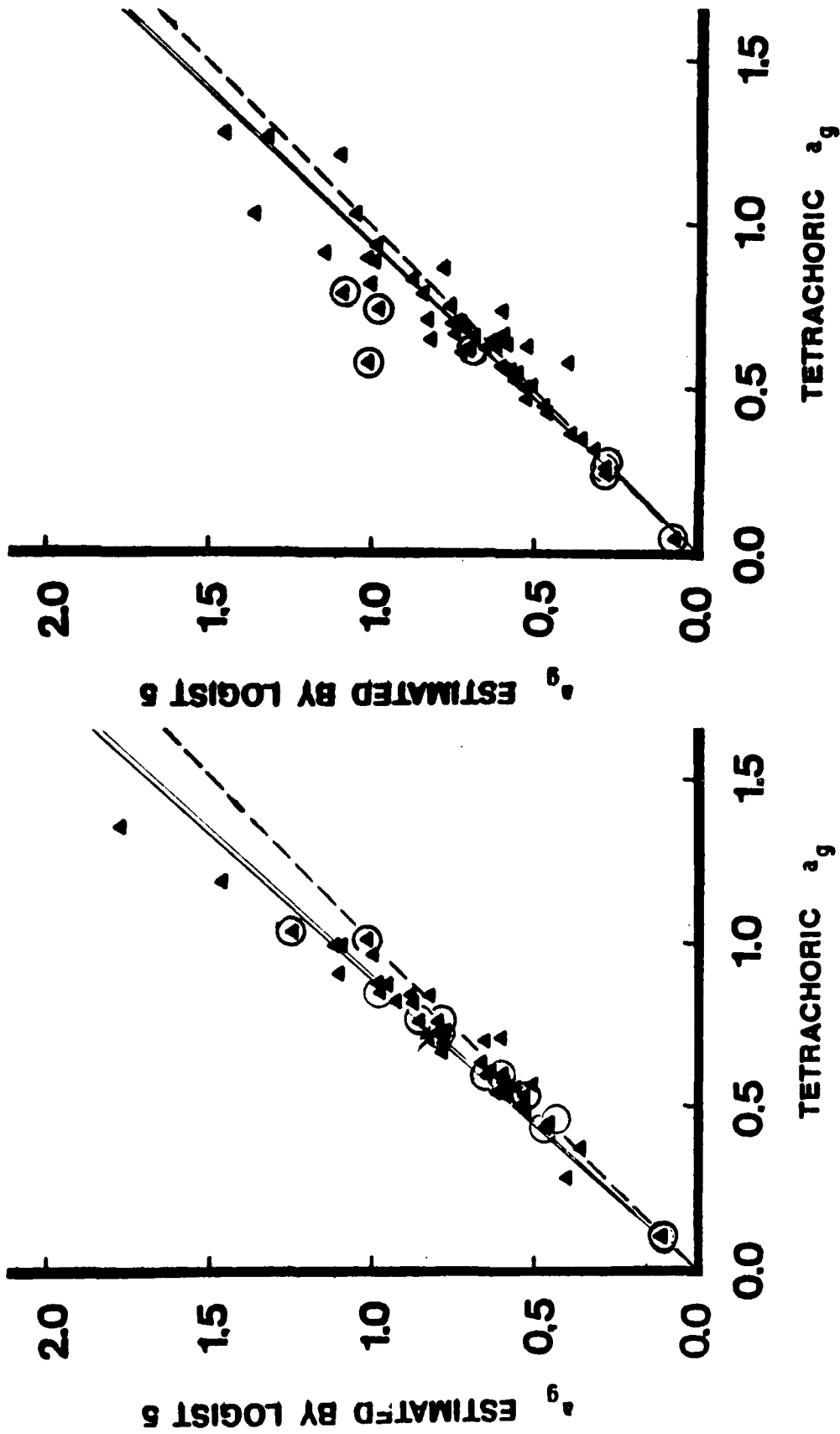


FIGURE 8-1

Estimated Item Discrimination Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment 1. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. The Best Fitted Linear Relationship Is Drawn by a Thin, Solid Line and the One Based upon Both Parameters Are Shown by a Thick, Solid Line. The Graph on the Left Hand Side Is for the 44 Items of Test A5 Excluding Item A531 Based upon the A5/0599 Case on the Abscissa and upon the Case A5-A6 on the Ordinate, While the Graph on the Right Hand Side Is for the 56 Items of Test A6 Based upon the A6/0412 Case on the Abscissa and upon the Case A5-A6 on the Ordinate.

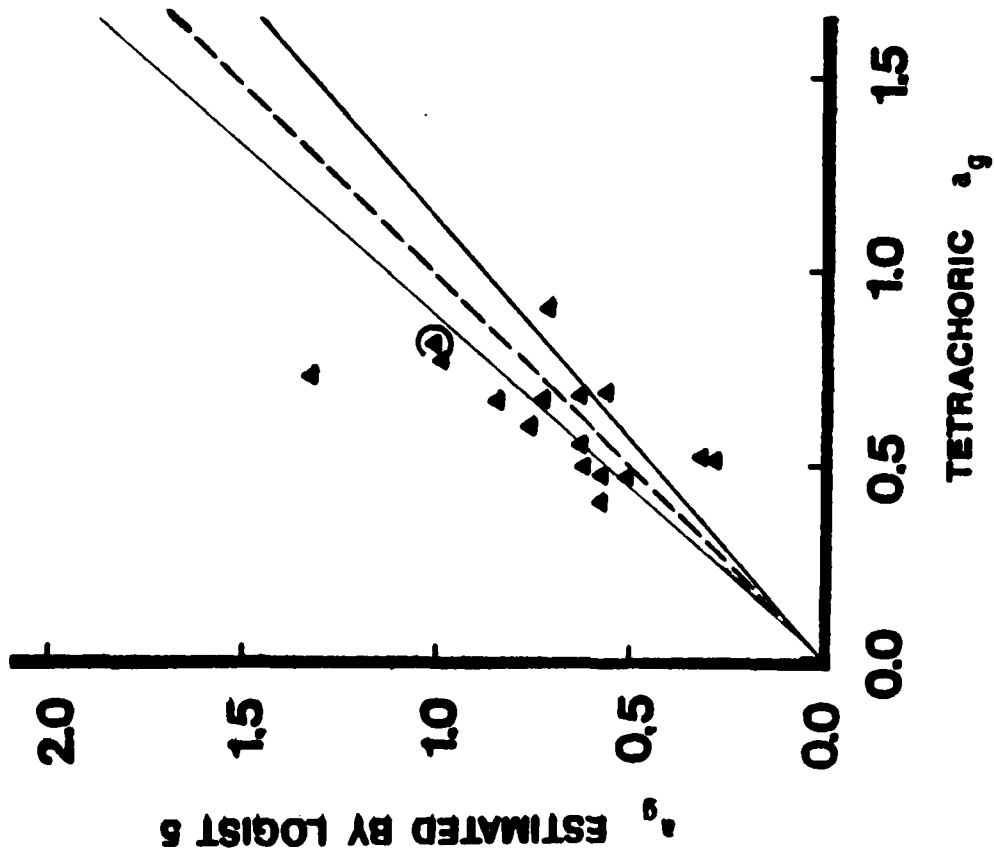


FIGURE 8-1 (Continued)

For the 16 Items Overlapping in Tests A6 and J1 Based upon the J1/0614 Case on the Abscissa and upon the Case A5-A6 on the Ordinate.

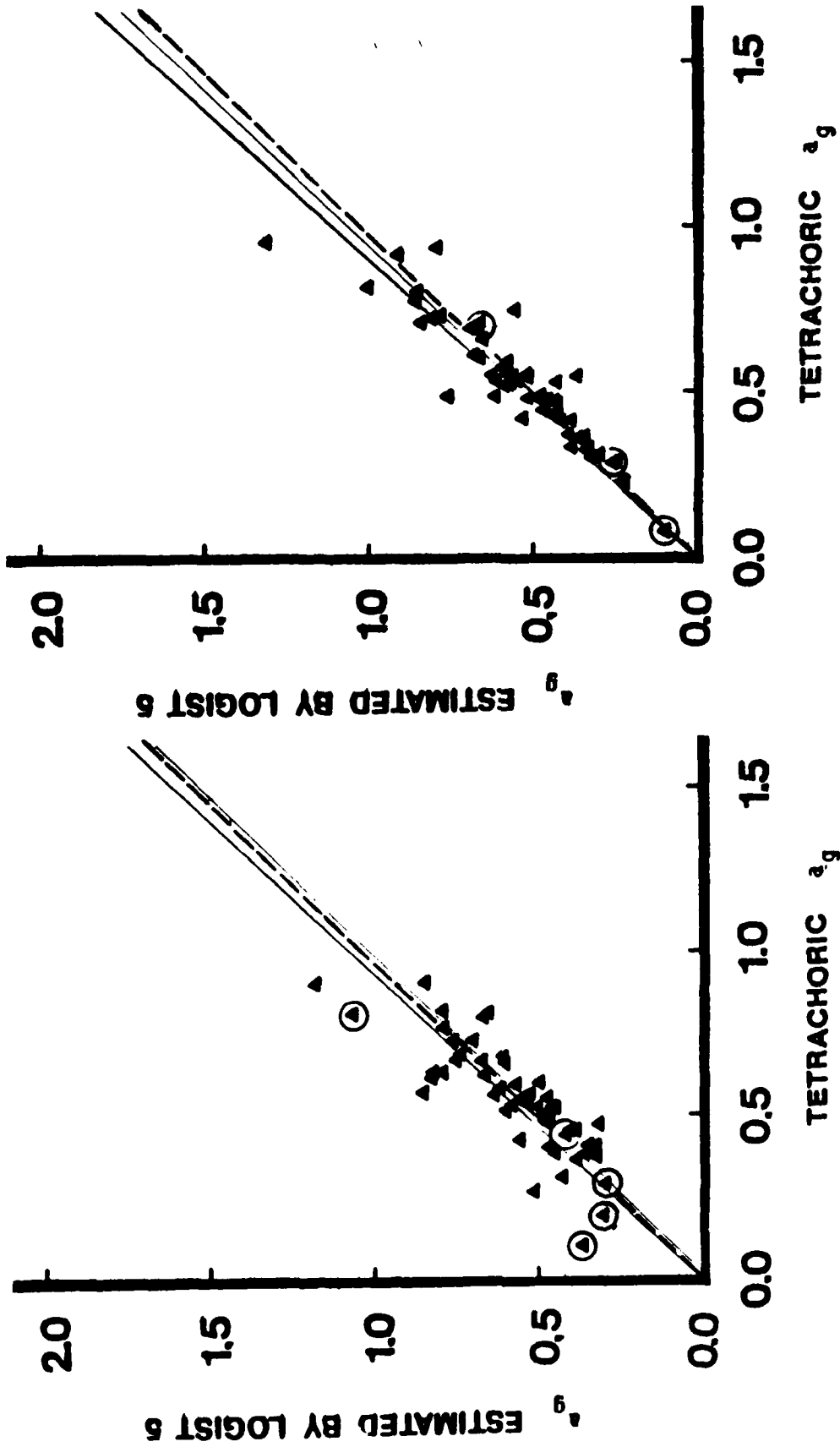


FIGURE 8-1 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

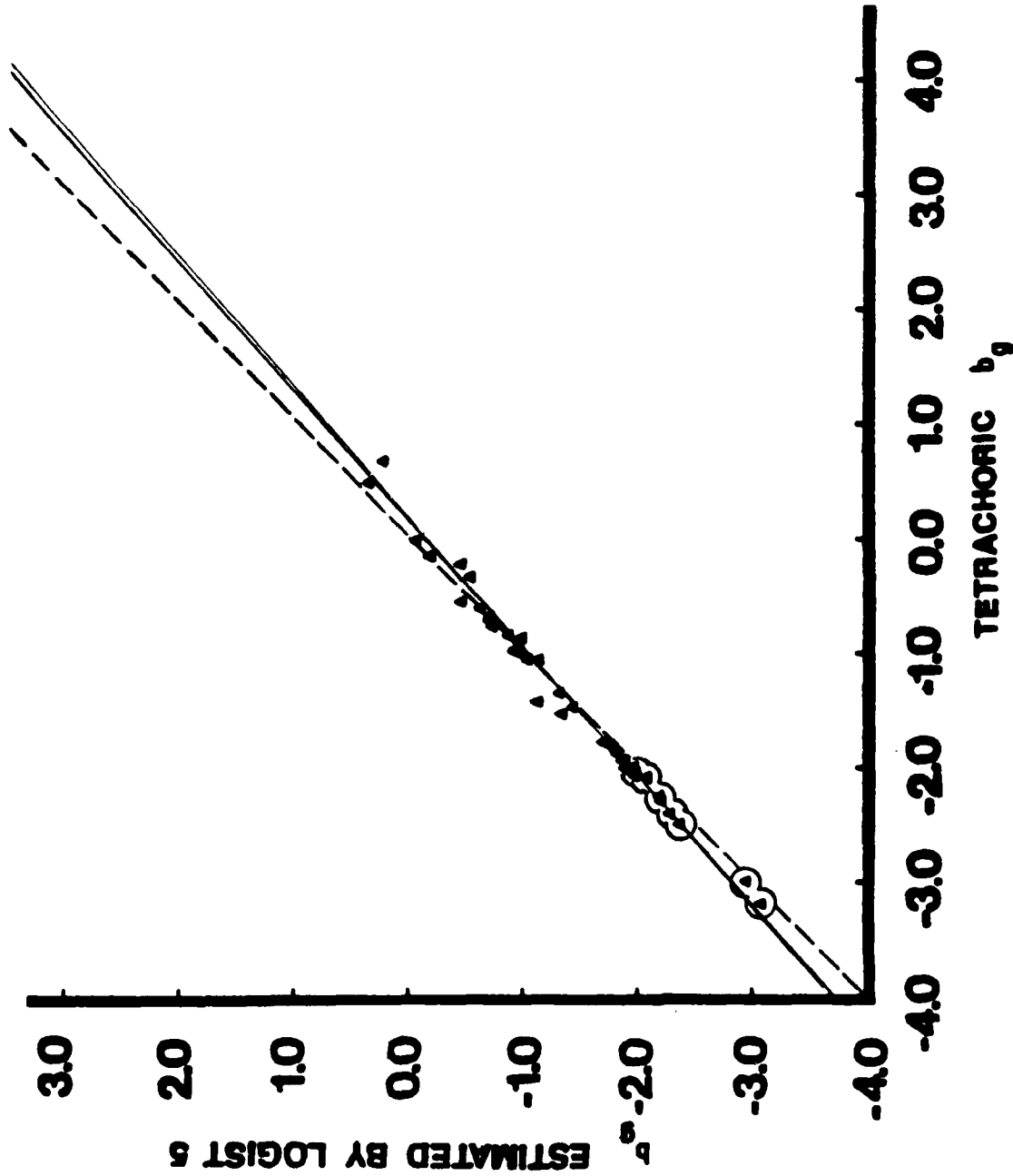


FIGURE 8-2

Estimated Item Difficulty Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment 1. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. The Best Fitted Linear Relationship Is Drawn by a Solid, Thin Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. For the 43 Items of Test A5 Excluding Items A523 And A531 Based upon the A570599 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

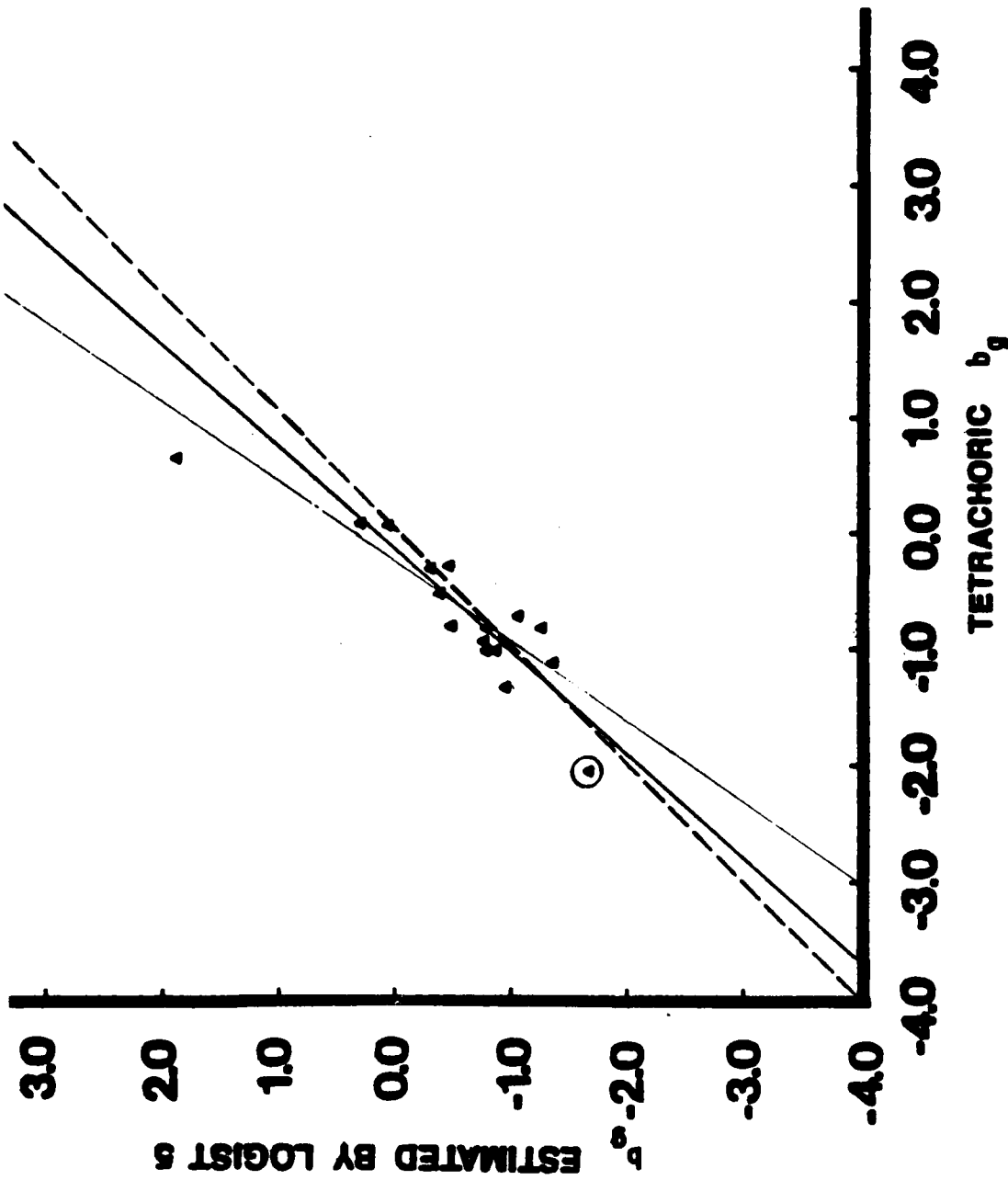


FIGURE 8-2 (Continued)

For the 16 Items Overlapping in Tests A6 And J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

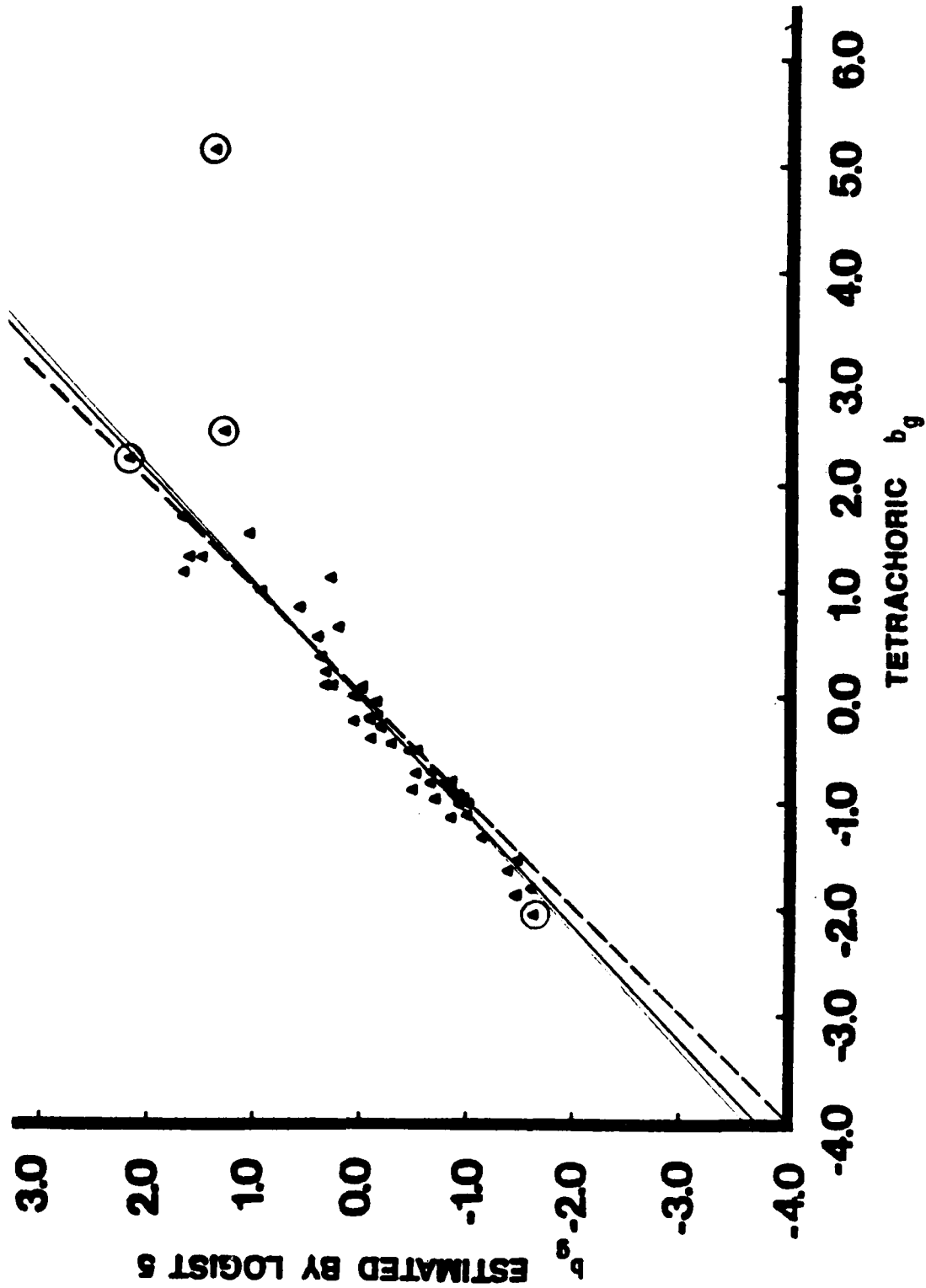


FIGURE 8-2 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

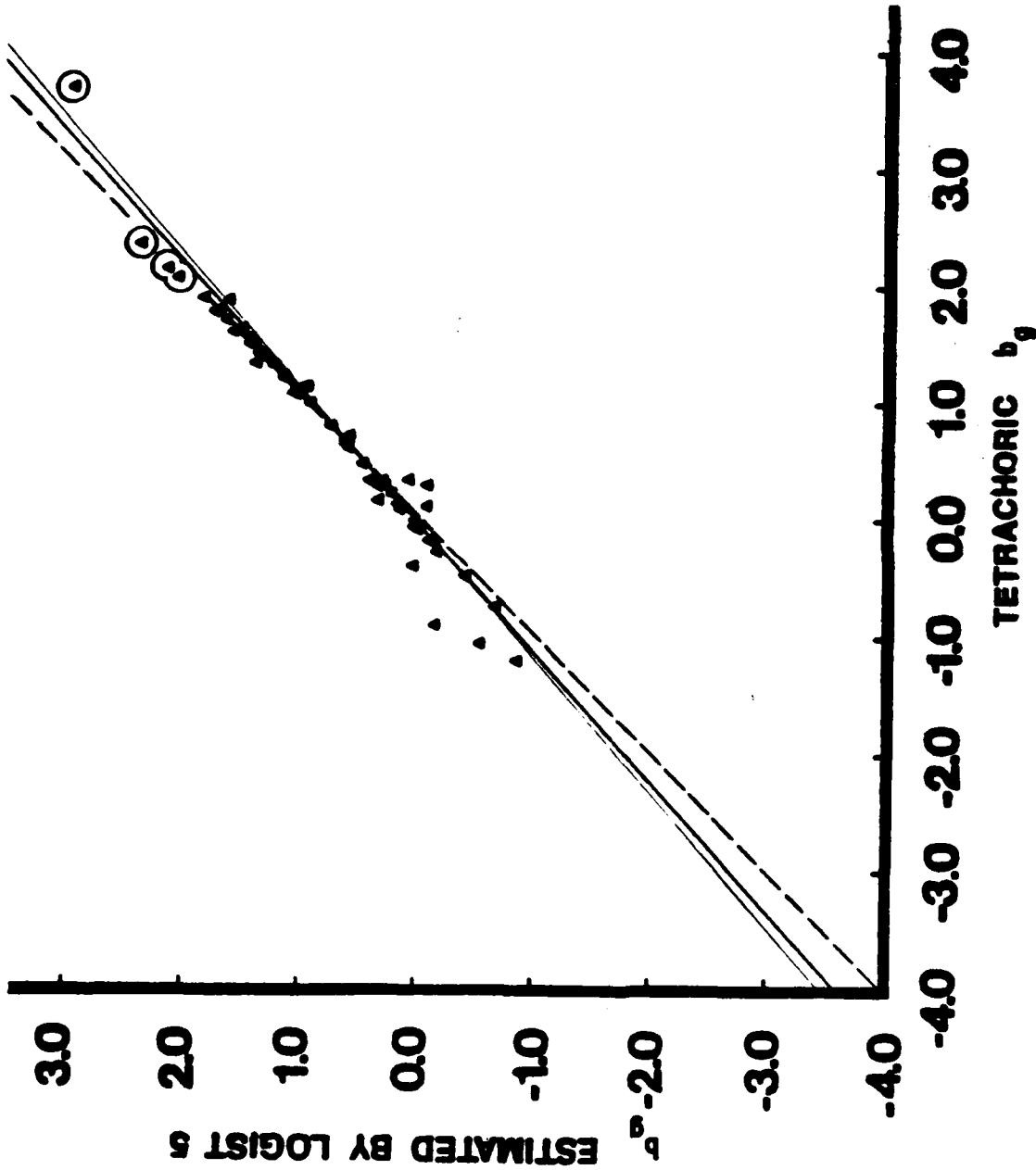


FIGURE 8-2 (Continued)

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

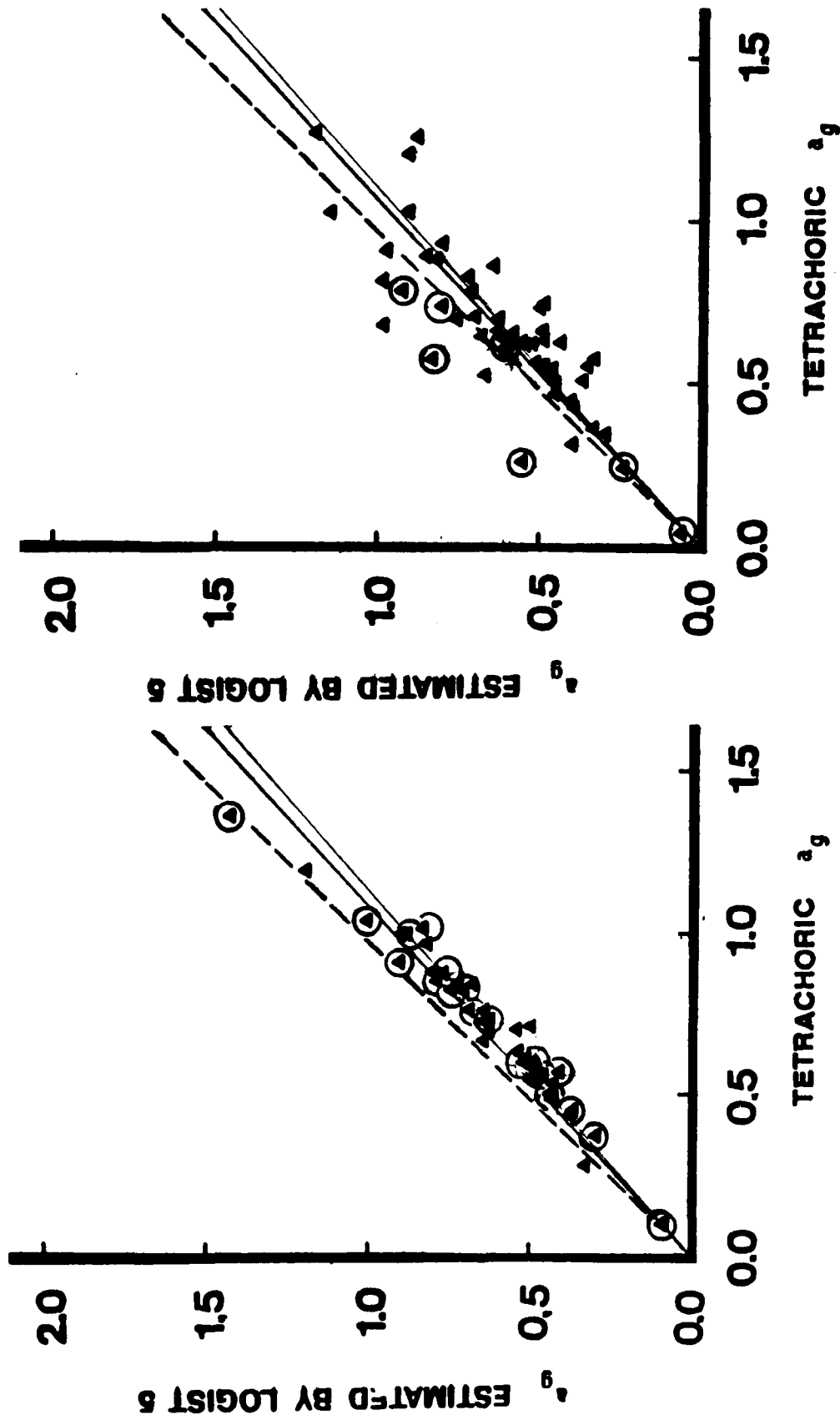


FIGURE 8-3

Estimated Item Discrimination Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment 1. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. The Best Fitted Linear Relationship Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. The Graph on the Left Hand Side Is for the 44 Items of Test A5 Excluding Item A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate, While the Graph on the Right Hand Side Is for the 56 Items of Test A6 Based upon the A6/0412 Case on the Abscissa and upon the Case A5-A6-J1-J2 on the Ordinate.

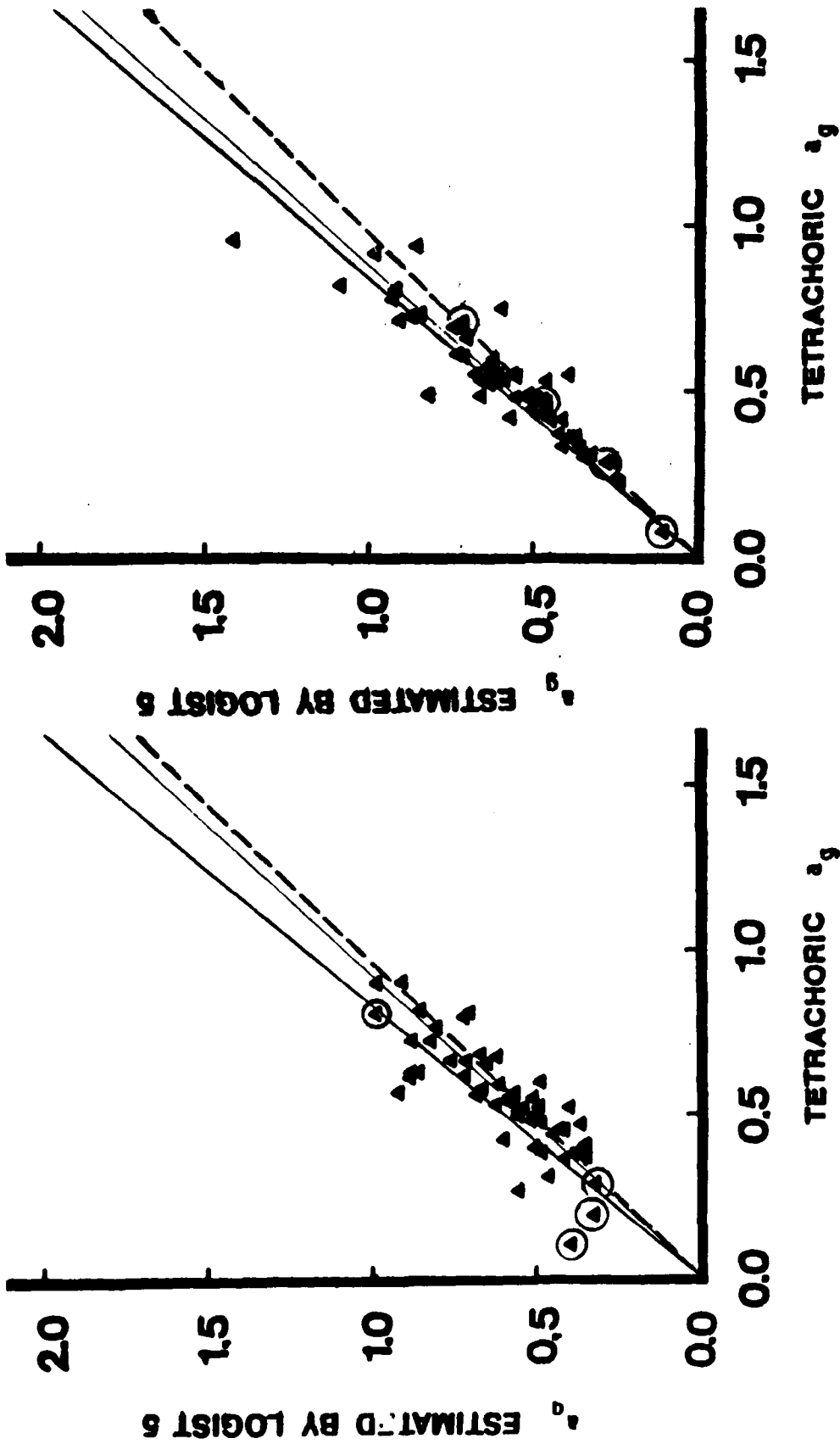


FIGURE 8-3 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

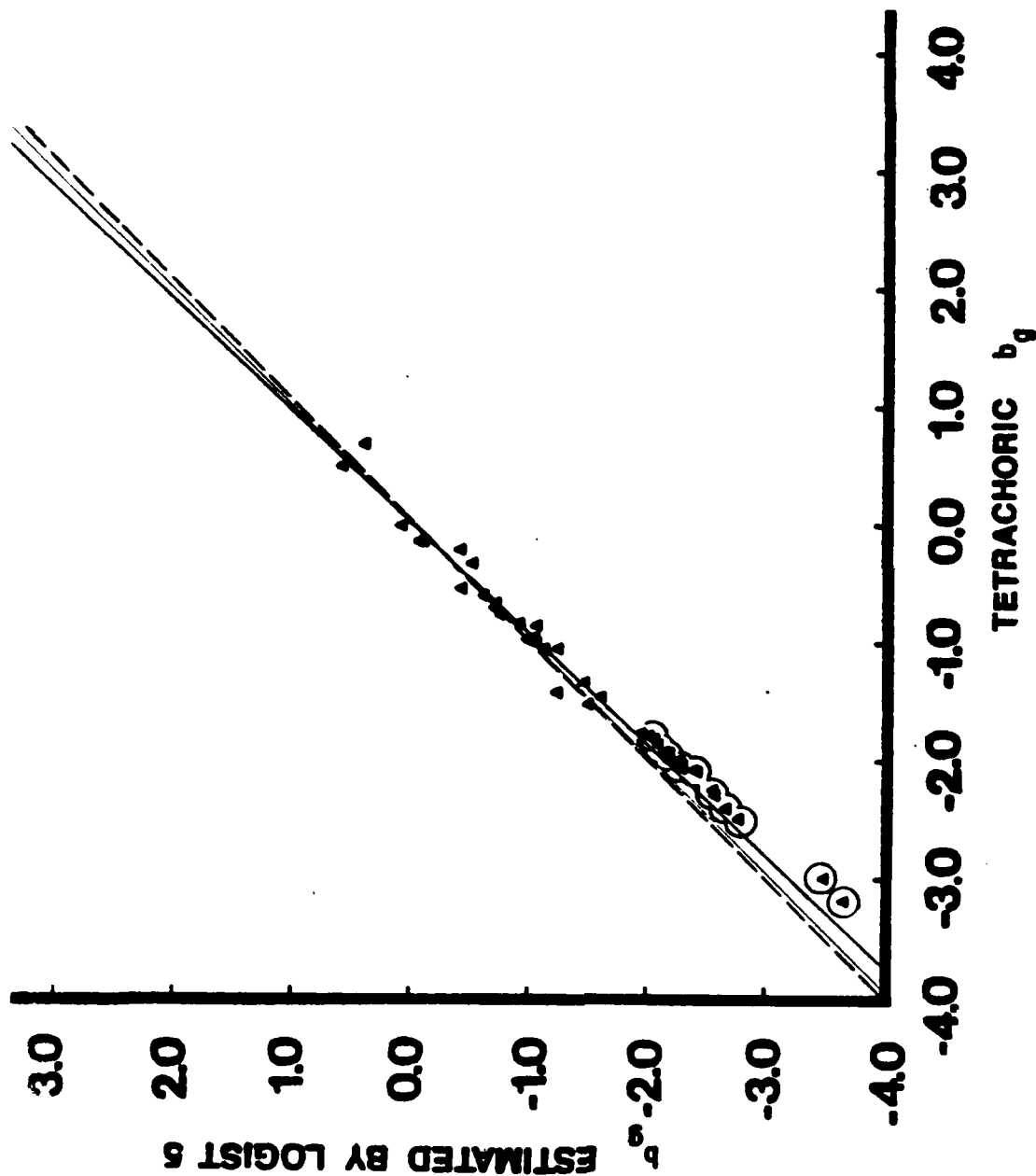


FIGURE 8-4

Estimated Item Difficulty Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment 1. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. For the 43 Items of Test A5 Excluding Items A523 and A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

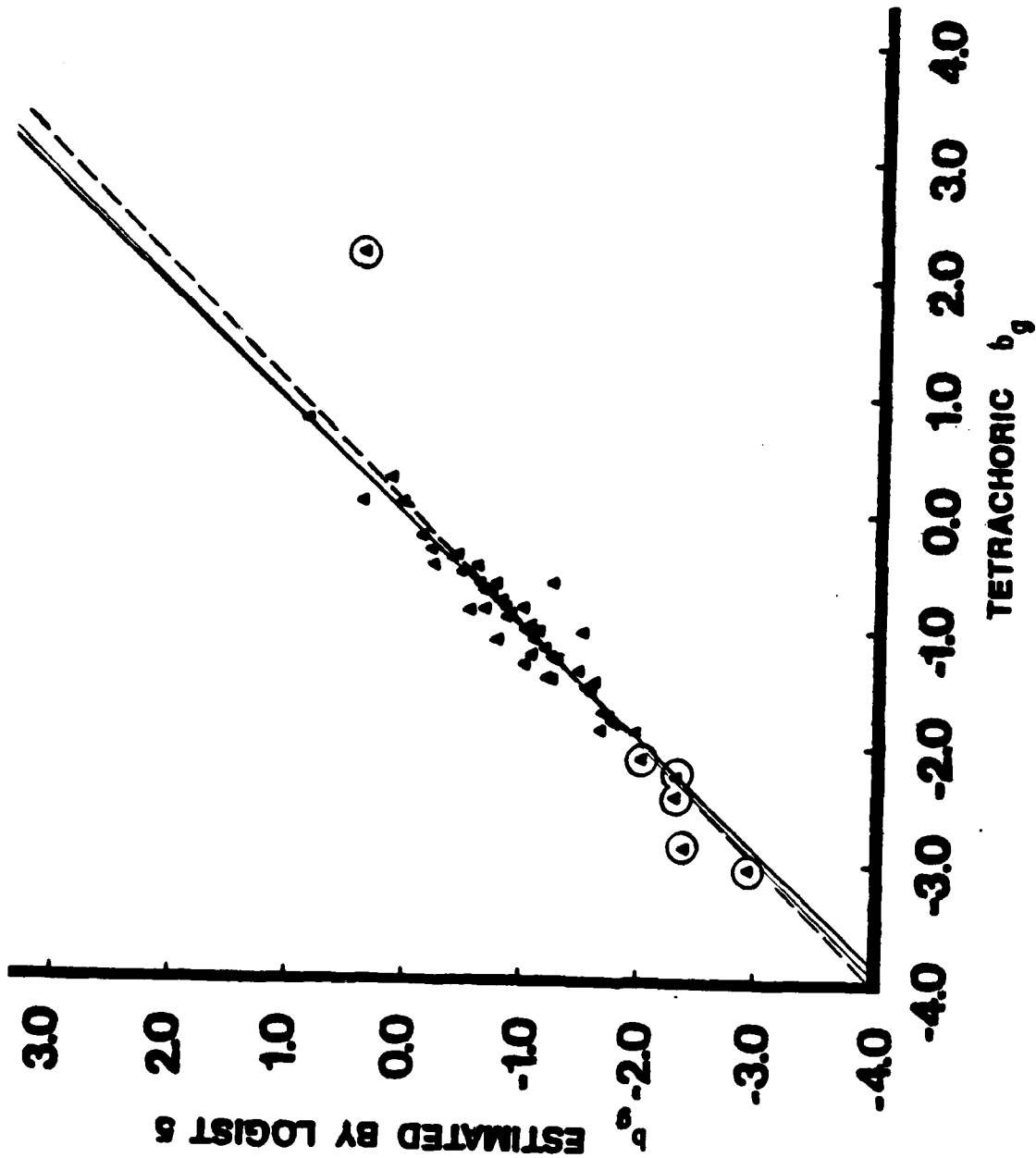


FIGURE 8-4 (Continued)

For the 55 Items of Test A6 Excluding Item A639 Based upon the A6/0412 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

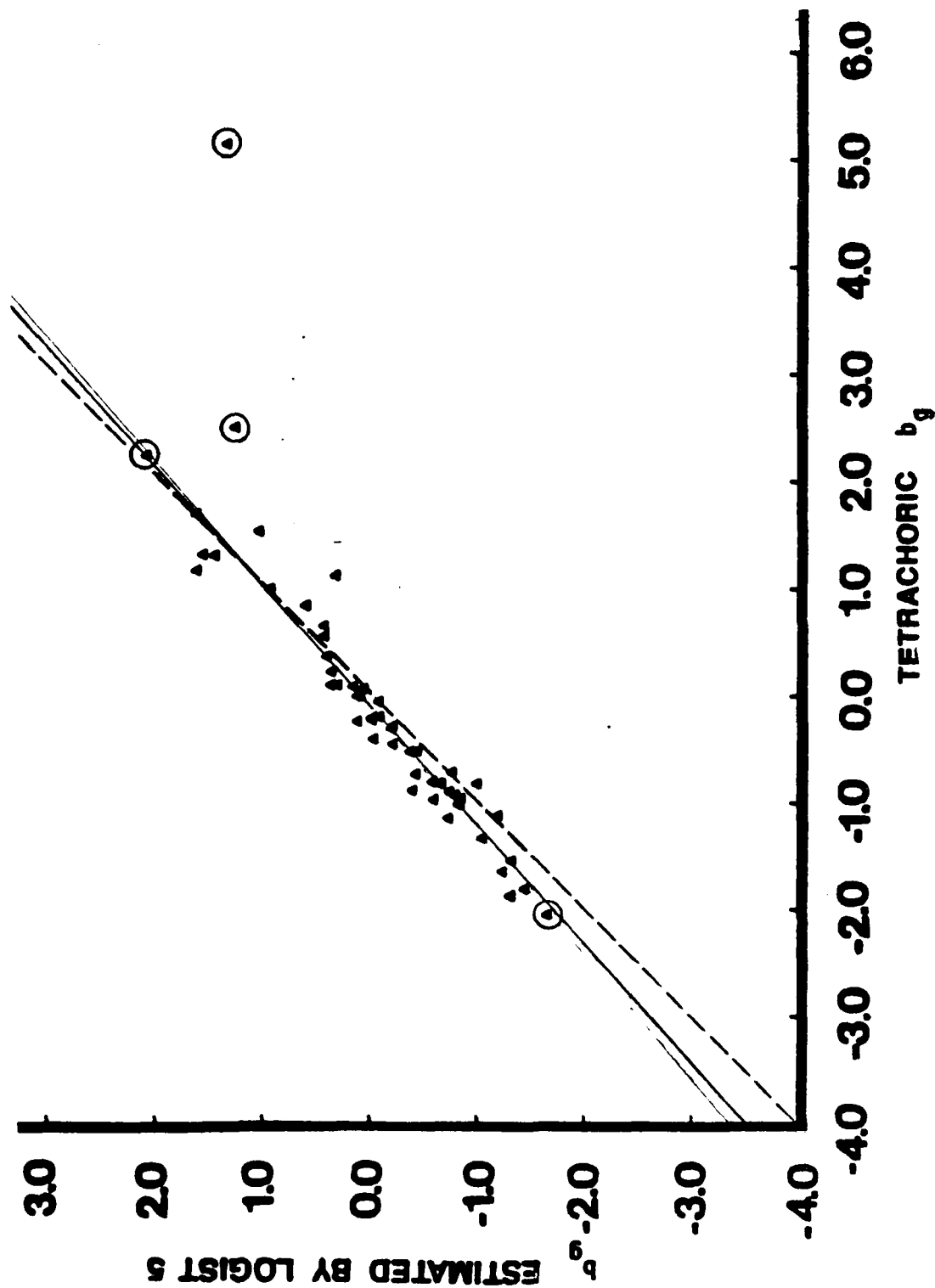
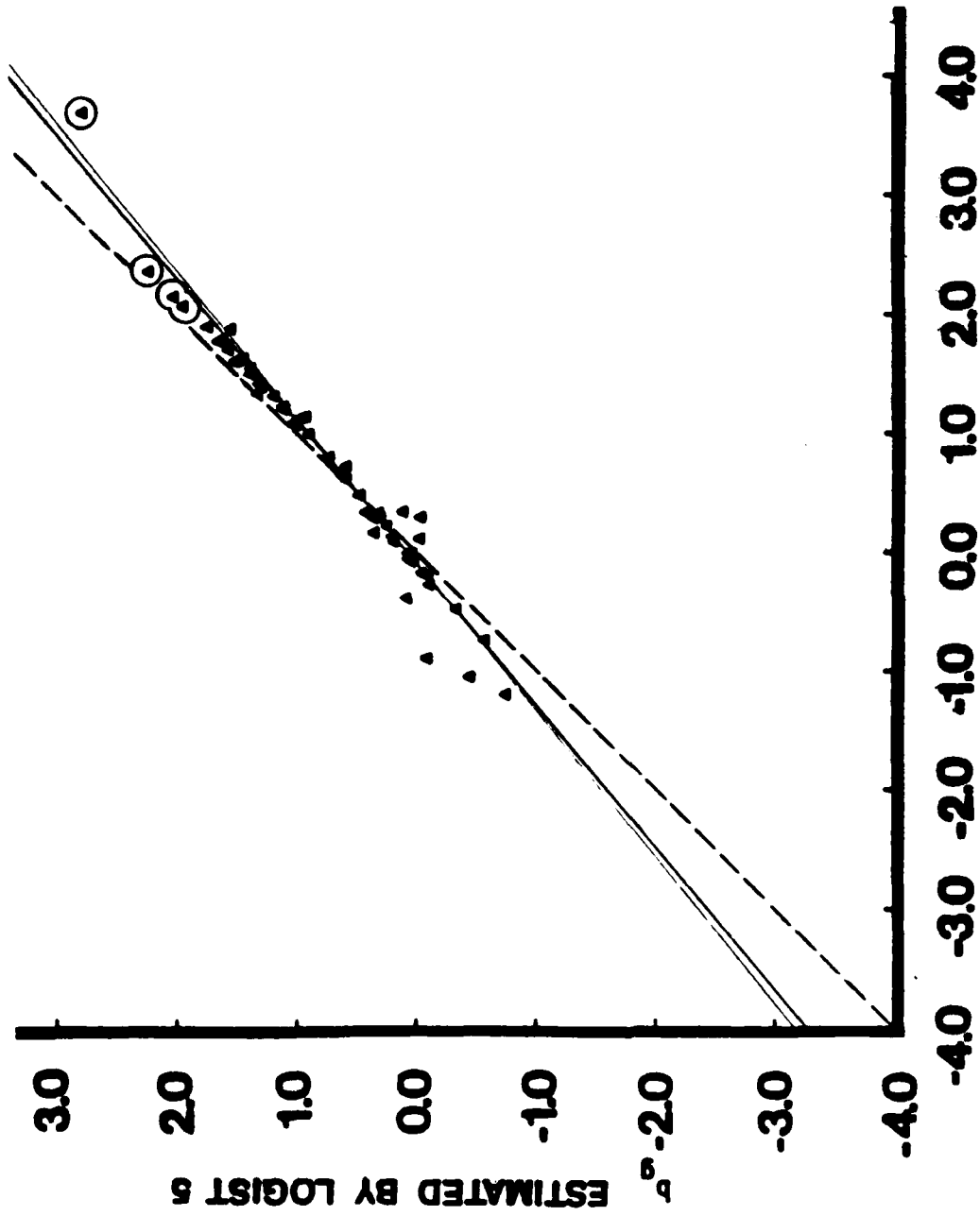


FIGURE 8-4 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.



TETRACHORIC b_g

FIGURE 8-4 (Continued)

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

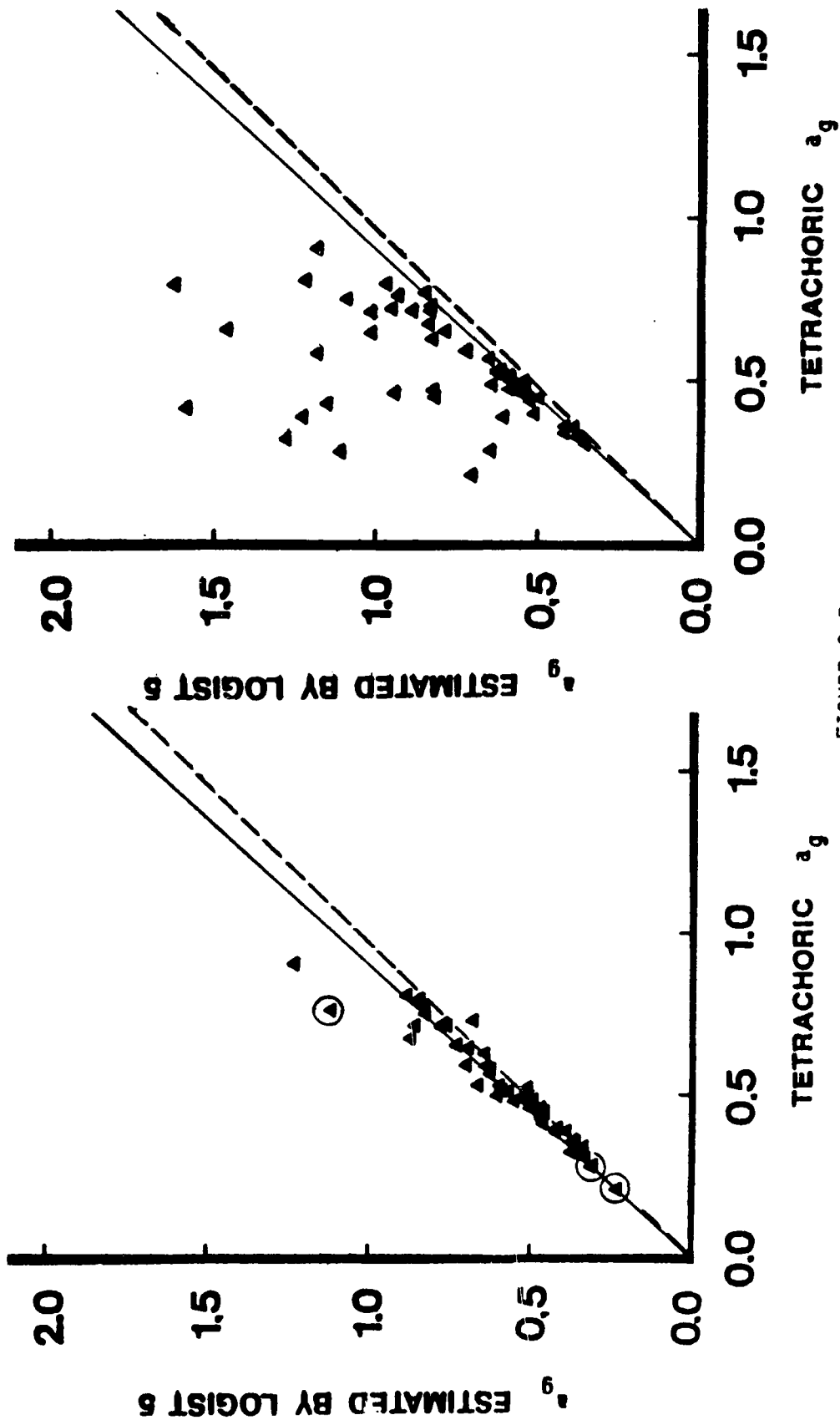


FIGURE 8-5

Estimated Item Discrimination Parameters of the 55 Items of Test J1 Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment 1. In Using Logist 5, Logistic Model Is Assumed in the Graph on the Left Hand Side And Three-Parameter Logistic Model Is Assumed in the Graph on the Right Hand Side. The Best Fitted Linear Relationship When the Logistic Model Is Assumed Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. J1/1075 Case.

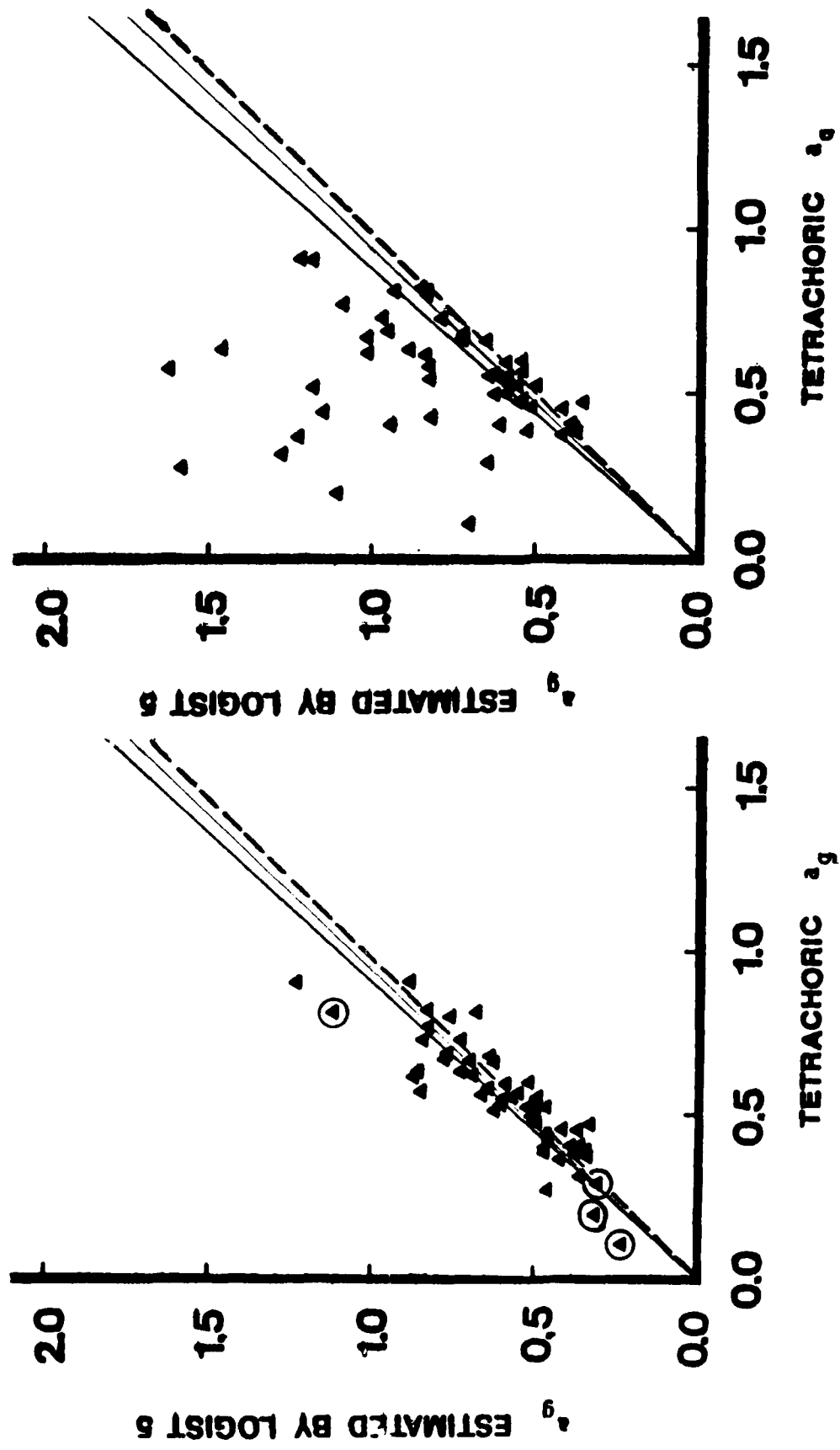


FIGURE 8-5 (Continued)

J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

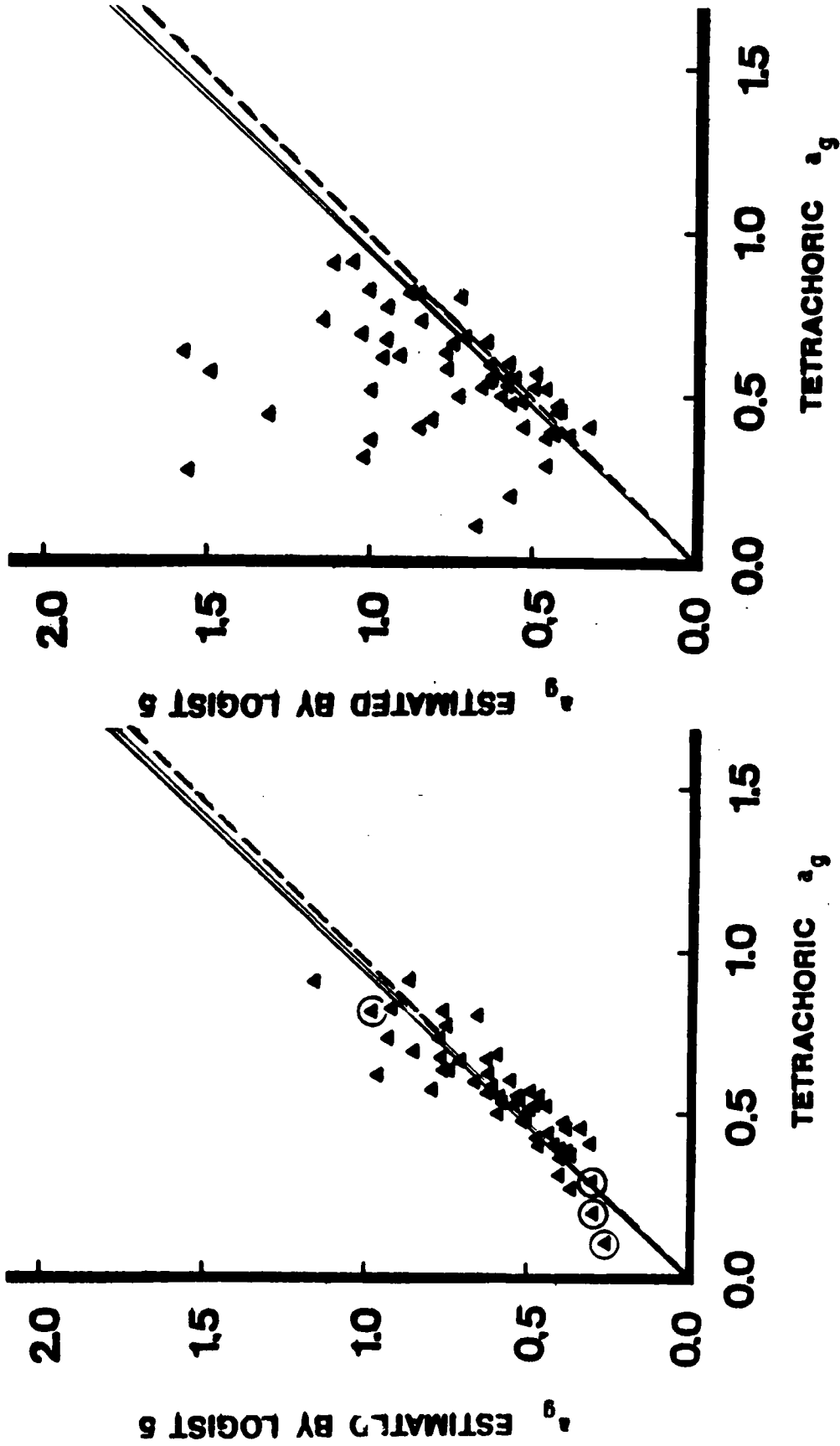


FIGURE 8-5 (Continued)

J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

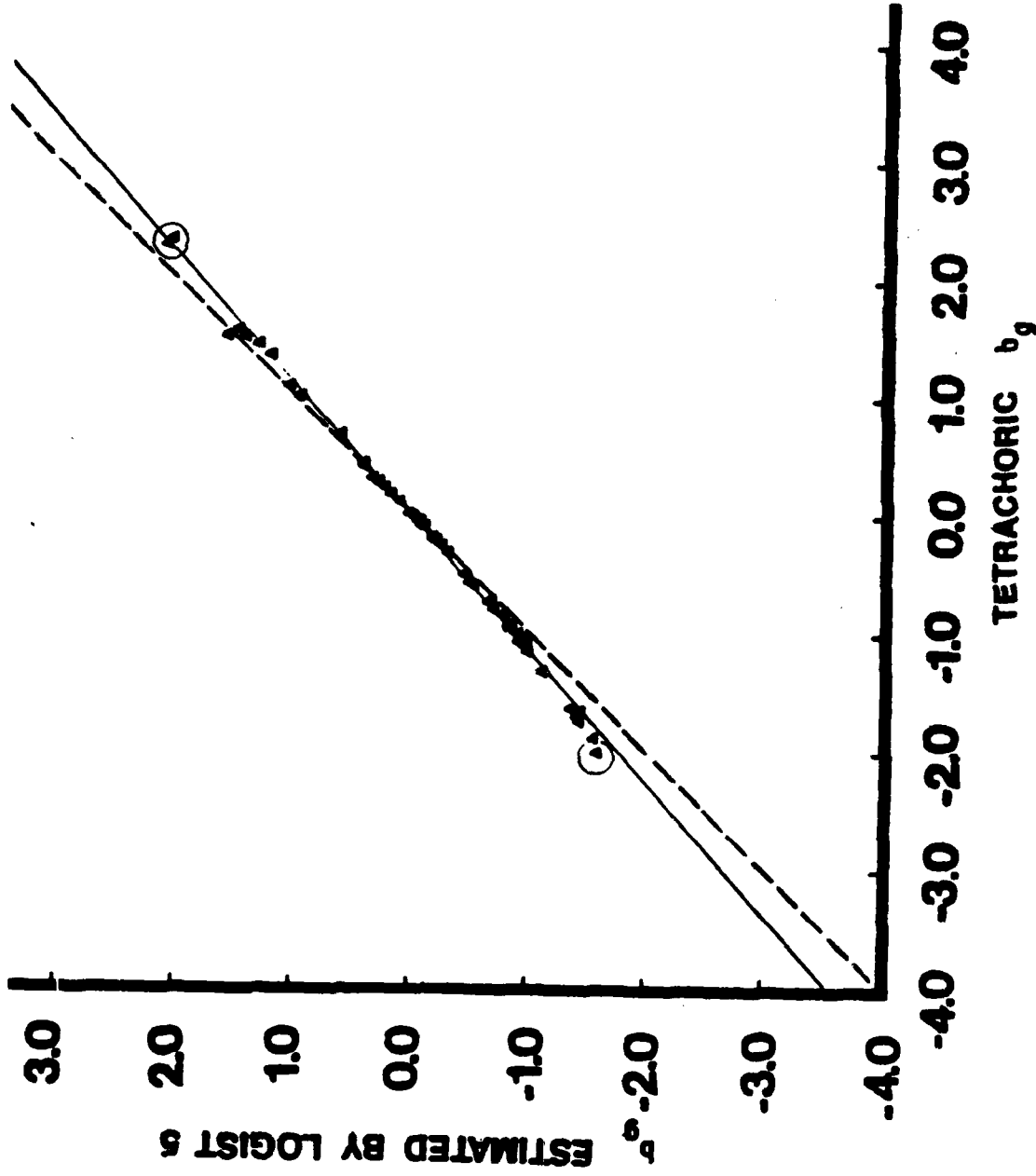


FIGURE 8-6

Estimated Item Difficulty Parameters of the 55 Items of Test J1 Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment 1. The Best Fitted Linear Relationship When the Logistic Model Is Assumed Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. Logistic Model Is Assumed in Using Logist 5. J1/1075 Case.

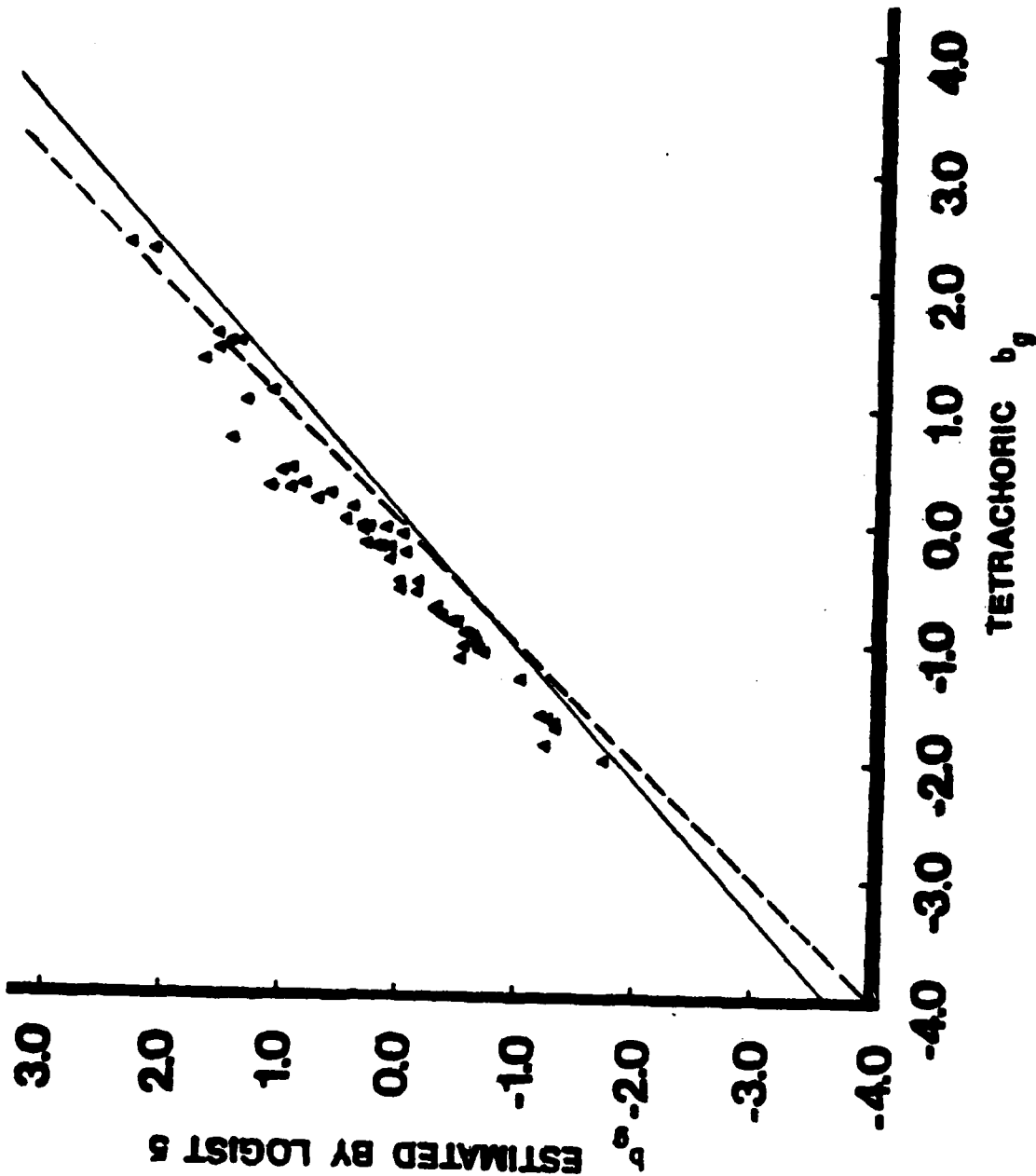
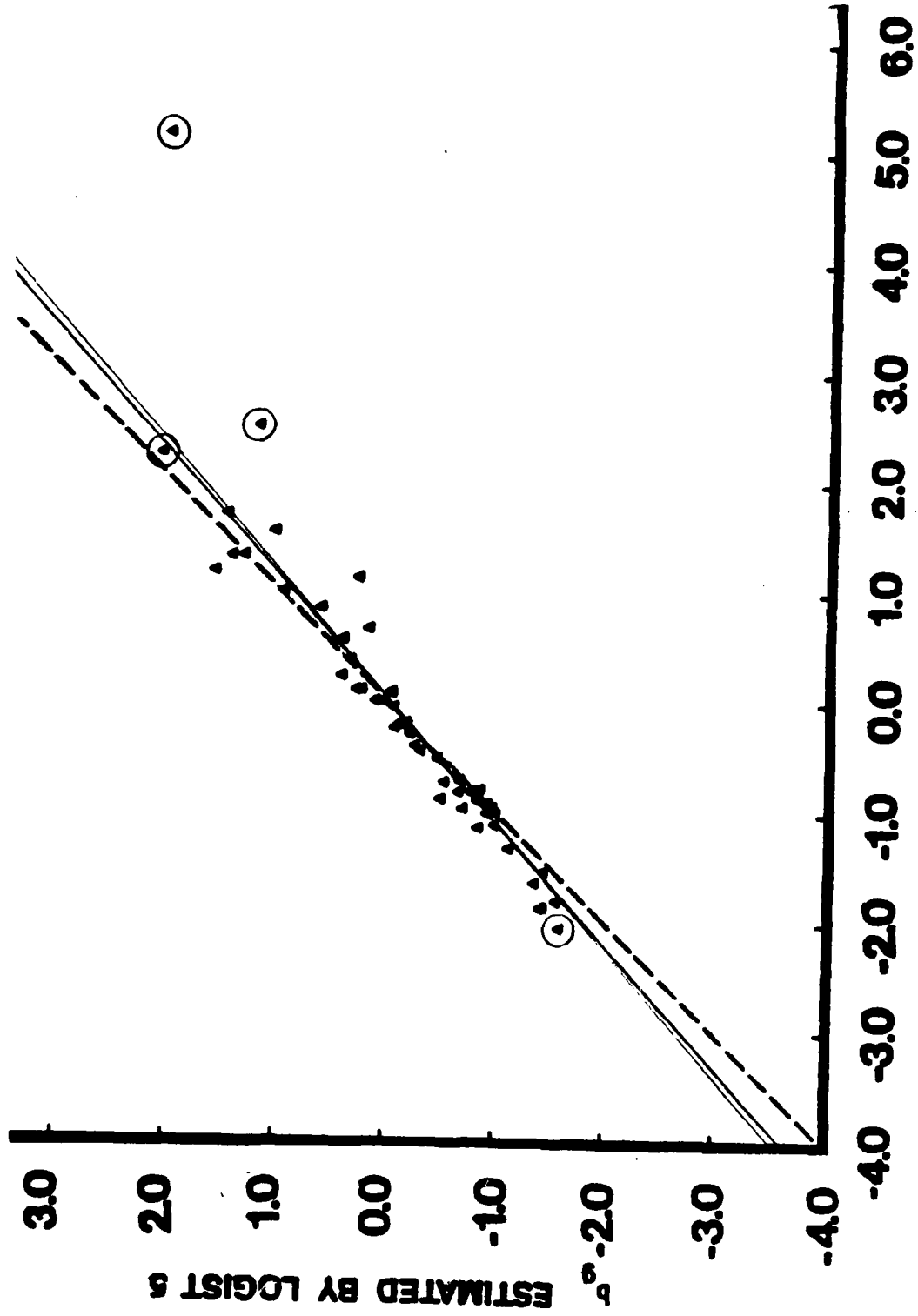


FIGURE 8-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/1075 Case.



TETRACHORIC b_g

FIGURE 8-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

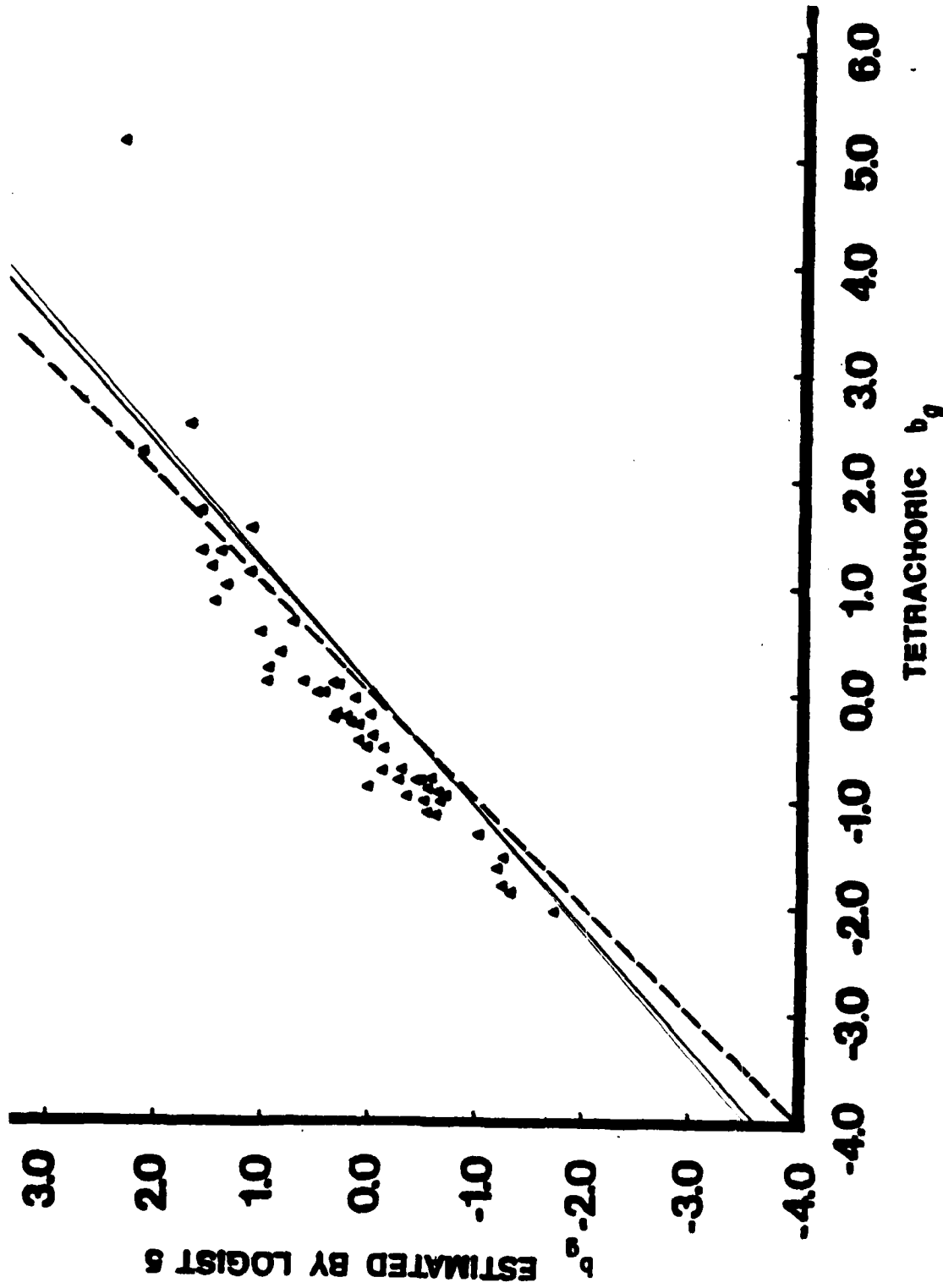


FIGURE 8-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

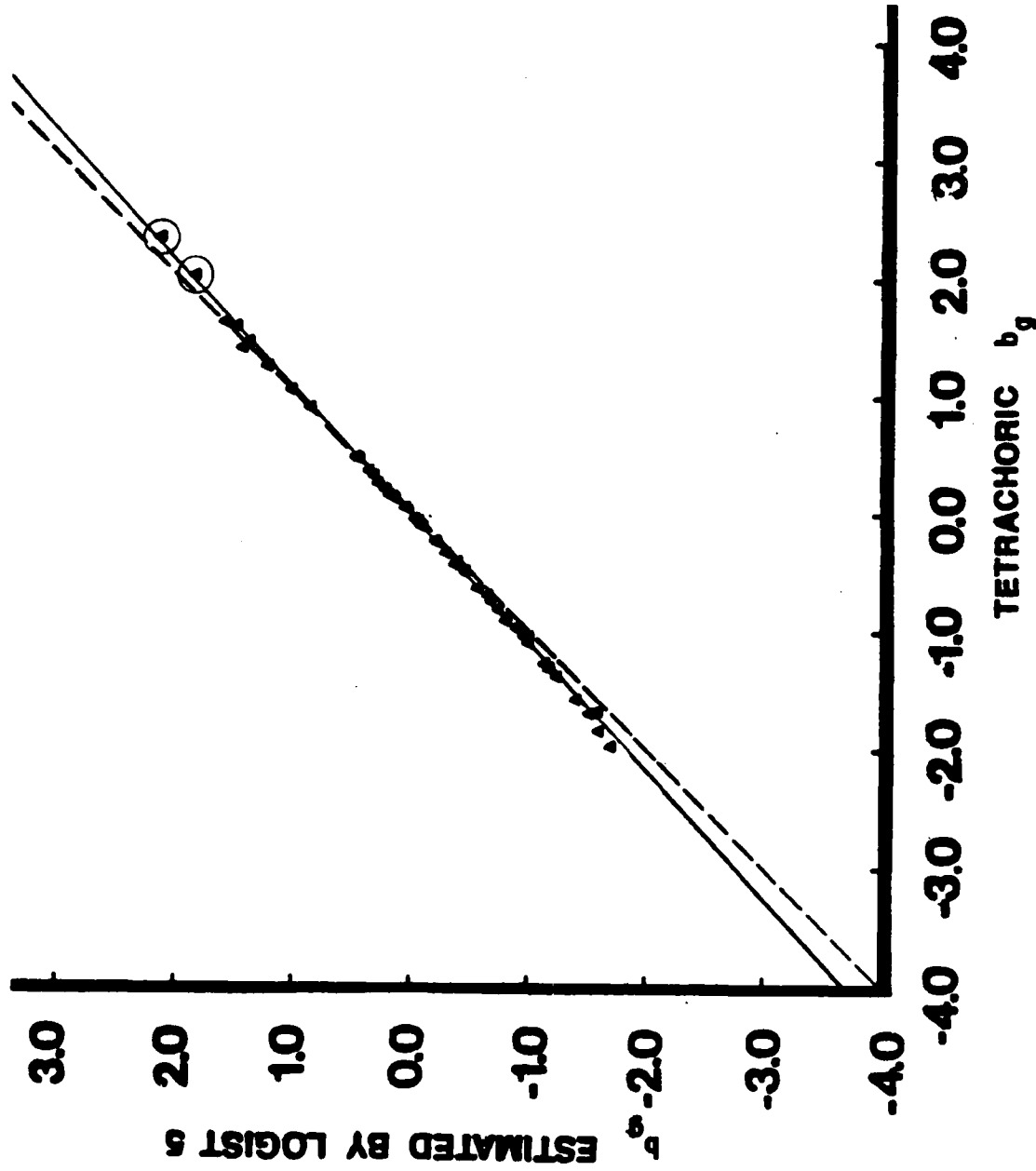
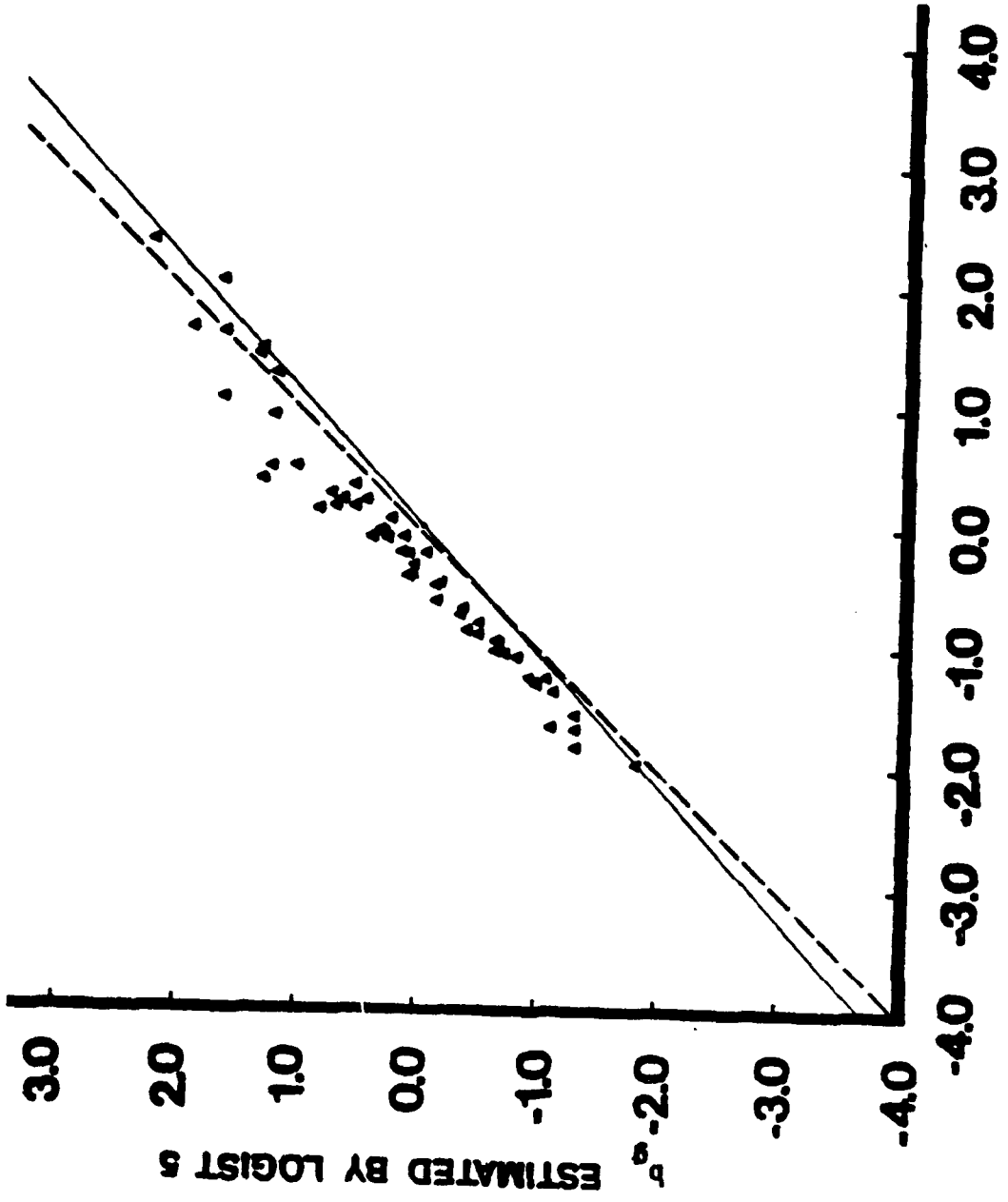


FIGURE 8-6 (Continued)

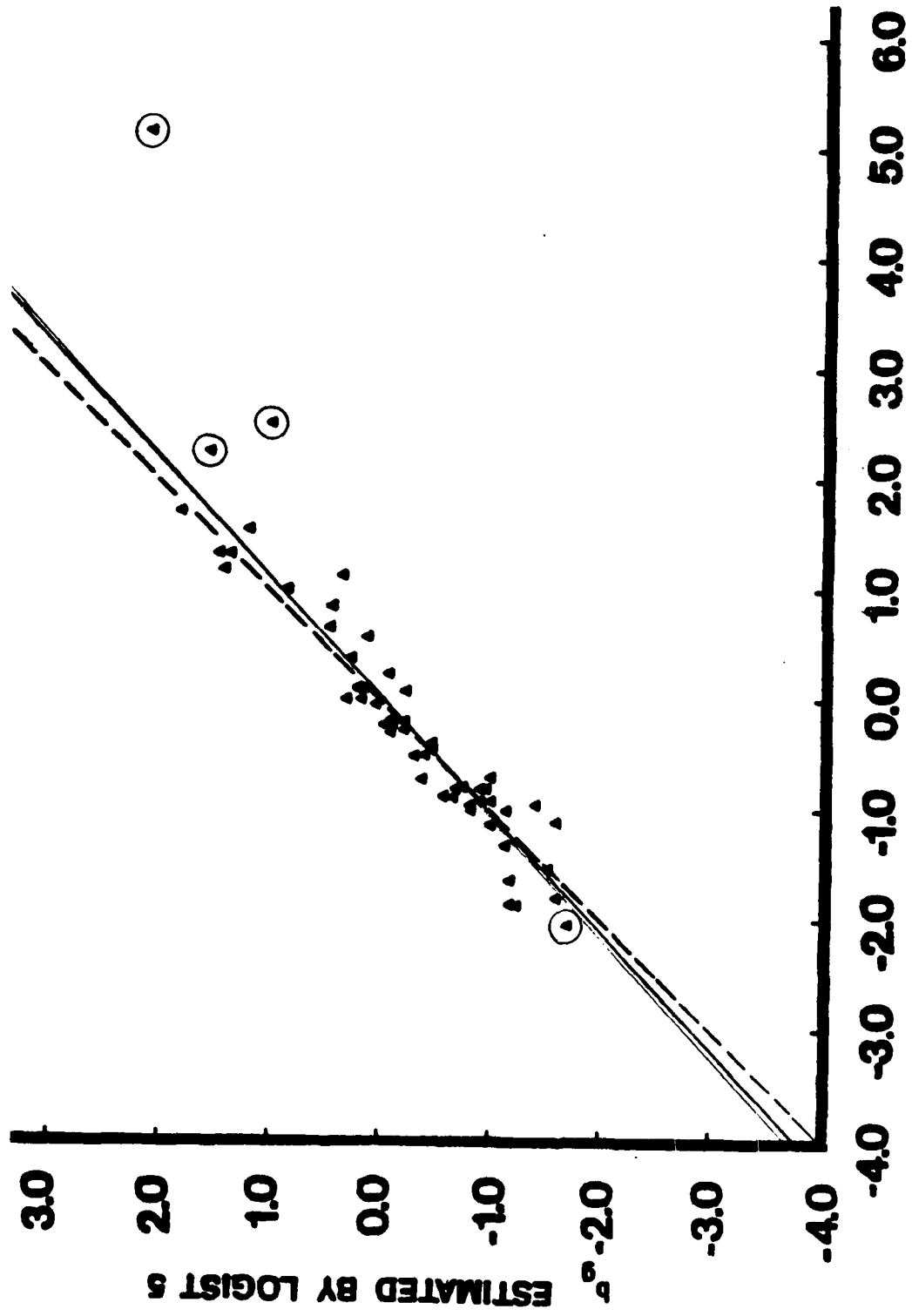
Logistic Model Is Assumed in Using Logist 5. J1/2259 Case.



TETRACHORIC b_g

FIGURE 8-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/2259 Case.



TETRACHORIC b_g

FIGURE 8-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

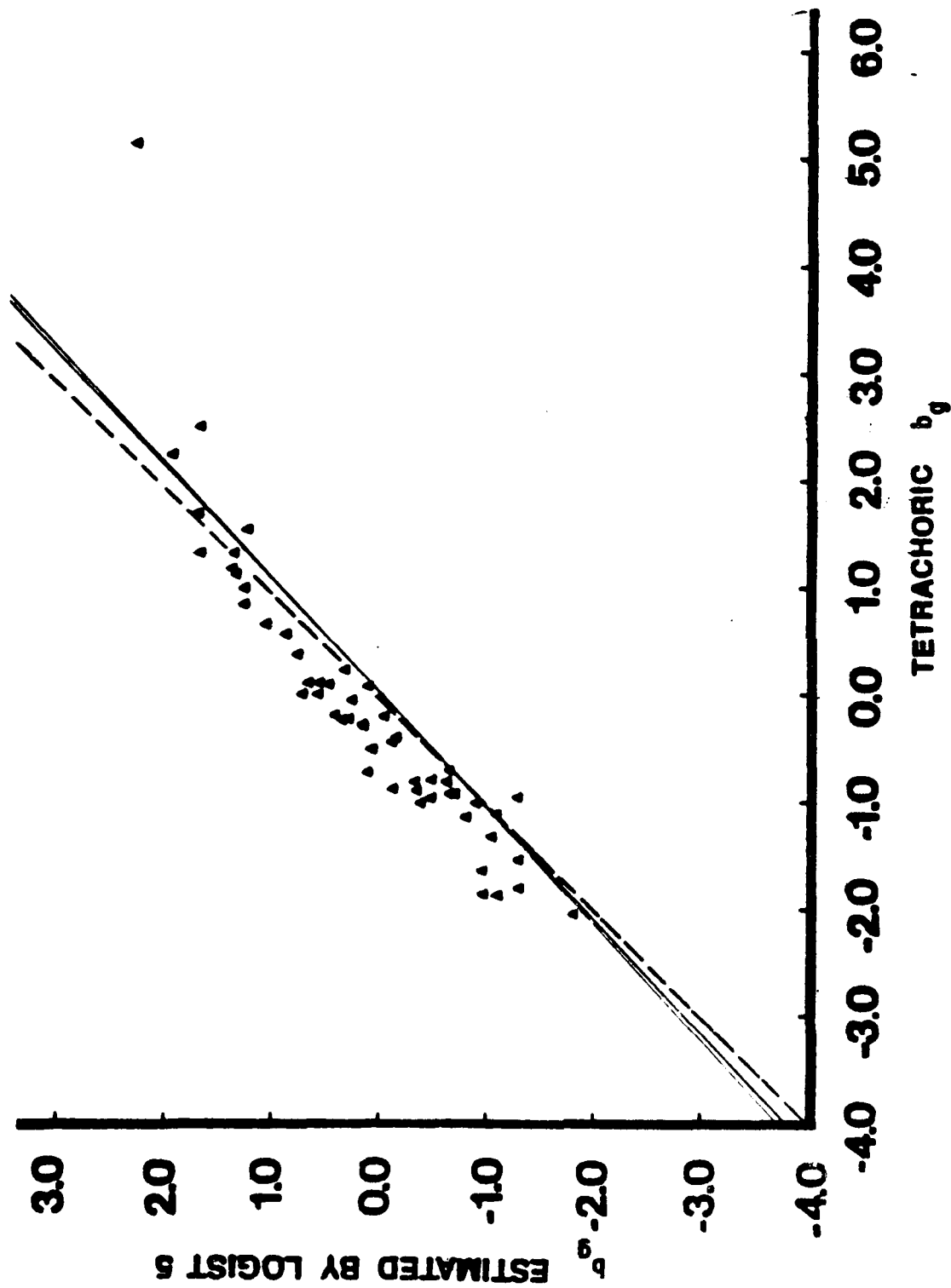


FIGURE 8-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

This line is drawn by a long dashed line in each graph of Figures 8-1 through 8-6. We can see that most of these long dashed lines do not pass through the respective scatter diagrams as we expect best fitted linear relationships do.

For the sake of comparison, the best fitted linear iterative relationship for each scatter diagram of Figures 8-1 through 8-6 was obtained by the same iterative method that was described in Section 6, and also the results for \hat{a}_g and for \hat{b}_g were combined. In so doing, all the items whose rescaled estimated difficulty parameters exceed 2.0 were excluded. Table 8-1 presents the slopes and intercepts of the best fitted linear relationships thus obtained. The resulting linear relationships are shown in each graph of Figures 8-1 through 8-6 by thin and thick solid lines, the former of which indicates the direct result obtained for the specific parameter and the latter indicates the combined result. The circled plots in these figures indicate that these items were excluded in the process of using the iterative method for obtaining the respective best fitted linear relationships. As we can see in these graphs and Table 8-1, the best fitted linear relationship is substantially different from the corresponding long dashed line in most cases.

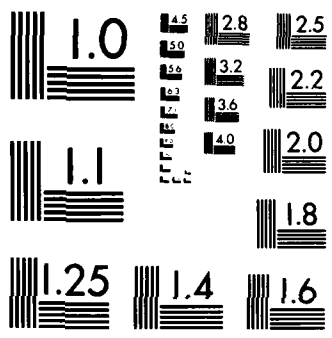
Thus we shall throw away the assumption that the mean and the standard deviation of the distribution of $\hat{\theta}$ are the same as those of the distribution of θ , and go back to Table 7-25, which is presented at the end of the preceding section. Table 8-2 presents the direct estimates of the mean and the standard deviation of the distribution

TABLE 8-1

Slope And Intercept of Each of the Fitted Linear Relationship between the Two Sets of Estimated Discrimination Parameters, And Also Those of Estimated Difficulty Parameters, of the Common Test Items, Which Were Obtained by the Tetrachoric Method (Examinee Group 1) And by Logist 5 (Examinee Group 2), after Scale Adjustment 1.

Examinee Group 1	Examinee Group 2	\hat{a}_g		Combined	\hat{b}_g		Combined	
		Slope	Intercept	Slope	Slope	Intercept	Slope	Intercept
A5/0599	A5-A6	1.106	-0.016	1.120	0.882	-0.149	0.893	-0.138
A6/0412	A5-A6	1.068	-0.009	1.078	0.919	-0.040	0.928	-0.032
J1/0614	A5-A6	1.146*	-0.028*	0.881*	1.476*	0.380*	1.135*	0.180*
J1/0614	J1-J2	1.032	-0.007	1.061	0.917	0.033	0.943	0.041
J2/0758	J1-J2	1.055	-0.009	1.097	0.876	0.062	0.912	0.039
A5/0599	A5-A6-J1-J2	0.878	-0.007	0.926	1.025	-0.044	1.080	-0.005
A6/0412	A5-A6-J1-J2	0.908	-0.007	0.933	1.044	0.055	1.072	0.081
J1/0614	A5-A6-J1-J2	1.080	-0.004	1.112	0.873	0.079	0.899	0.087
J2/0758	A5-A6-J1-J2	1.139	-0.010	1.185	0.811	0.113	0.844	0.093
J1/1075	J1/1075	1.102	-0.006	1.105	0.903	0.016	0.905	0.016
J1/0614	J1/1075	1.067	-0.008	1.104	0.876	0.008	0.906	0.017
J1/2259	J1/2259	1.075	-0.007	1.075	0.931	0.016	0.931	0.016
J1/0614	J1/2259	1.060	-0.009	1.072	0.923	0.008	0.933	0.012

* This is based on only 15 items while all the other results are based on at least 24 items.



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TABLE 8-2

Estimated Mean And Standard Deviation of the Distribution of $\hat{\theta}$ for Each Examinee Group Shown As Examinee Group 2, for Which Logist 5 Was Used. Examinee Group 1 Indicates the Group upon Which Tetrachoric Method Was Applied And Whose Result Was Paired with the Result of Examinee Group 2.

Examinee Group 1	Examinee Group 2	Mean	S.D.
A5/0599	A5-A6	-0.6769062928917D 00	0.9498435120987D 00
A6/0412	A5-A6	-0.7567180593797D 00	0.9441285727625D 00
J1/0614	A5-A6	-0.7540791085704D 00*	0.8971611496158D 00*
Weighted Average		-0.7094309692449D 00	0.9475145753959D 00
J1/0614	J1-J2	0.7790302264265D 00	0.1376714237914D 01
J2/0758	J1-J2	0.8197747749259D 00	0.1406229808384D 01
Weighted Average		0.8015406985566D 00	0.1393020945214D 01
A5/0599	A5-A6-J1-J2	0.1883270334869D 00	0.1216020629981D 01
A6/0412	A5-A6-J1-J2	0.1514122790061D 00	0.1285118299006D 01
J1/0614	A5-A6-J1-J2	0.1704262695468D 00	0.1522456056989D 01
J2/0758	A5-A6-J1-J2	0.1938391161783D 00	0.1601146033909D 01
Weighted Average		0.1790858294478D 00	0.1429425853648D 01
J1/1075	J1/1075	0.3017500674956D 00	0.1205953781811D 01
J1/0614	J1/1075	0.2970263355266D 00	0.1202006556190D 01
Weighted Average		0.3000328552819D 00	0.1204518851952D 01
J1/2259	J1/2259	0.3018676309476D 00	0.1077806694358D 01
J1/0614	J1/2259	0.3031684135164D 00	0.1080768213593D 01
Weighted Average		0.3021456262477D 00	0.1078439612148D 01

* This is based on only 14 items while all the other results are based on at least 36 items. This result was excluded from the computation of the weighted average.

of $\hat{\theta}$ for each of the three examinee groups, A5/0599, A6/0412 and J2/0758 Cases, and also of the two examinee groups, J1/1075 and J1/2259, which was obtained from the combined linear relationship in each case. Since there are more than one way of obtaining these two values in each case, all of these results are presented in Table 8-2. In this table, Examinee Group 1 indicates the group of examinees upon which the item parameters were estimated by Tetrachoric Method, and Examinee Group 2 means the group of individuals upon which they were estimated by Logist 5. Thus the mean and the standard deviation of the distribution of $\hat{\theta}$ of Case J1-J2, for example, can be estimated in two ways, i.e., through the scatter diagrams of the estimated parameters of the items of Test J1, and through those of the items of Test J2. Since the mean and the standard deviation of the distribution of θ for each of J1/0614 Case and J2/0758 Case were already estimated and are shown in Table 6-3, from the slope and the intercept of the combined linear relationship shown in Table 7-25 and by using the method described in Section 6, we can obtain the estimates of the mean and the standard deviation of the distribution of $\hat{\theta}$ of Case J1-J2 in each case. In the same table, the weighted averages of the estimated mean and standard deviation of the distribution of $\hat{\theta}$ are also given for each examinee group. The weight adopted here is the number of the examinees in Examinee Group 1. We can see in these results that most estimates for the same group of examinees are close to each other. One exception is seen in Case A5-A6-J1-J2, however, for which the four estimates of the standard

deviation of the distribution of $\hat{\theta}$ are substantially different from one another.

The estimated item discrimination and difficulty parameters of each of the items of Tests A5, A6, J1 and J2, which are shown in Tables 7-1 through 7-12, were transformed through (6.1) and (6.18) by setting $\mu_1 = 0$ and $\sigma_1 = 1$ and by using the results shown in Table 8-2 as μ_2 and σ_2 . In so doing, each separate set of the estimated mean and standard deviation were used, not their weighted averages. These results are shown in Tables 8-3 through 8-14. As was expected, the two sets of the parameter estimates of Test J1 obtained upon Case J1/1075: c_g -Zero and upon Case J1/2259: c_g -Zero, which are shown in Tables 8-11 and 8-13, respectively, are very close to each other. Note that they are also close to the corresponding two sets of results obtained by Tetrachoric Method, which are shown as Tables 6-8 and 6-9.

IX. Comparison of the Estimated Item Characteristic Functions Obtained As the Results of the Logist 5 and Those Obtained by the Tetrachoric Method

Figures 9-1 through 9-4 present five estimated item characteristic functions for each of the items of Tests A5, A6, J1 and J2. In each graph, the result based upon the estimated item parameters obtained by Tetrachoric Method, which are shown in Tables 6-4 through 6-7, is drawn by a solid line, and all the other four curves of different lengths of dashes concern with those based upon the estimated item parameters by Logist 5. Note that the first

TABLE 8-3

Readjusted Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
A501	0.842	-2.308	A541	0.594	-0.902
A502	0.587	-3.269●	A542	0.505	-1.465
A503	0.669	-3.406●	A543	0.548	-1.130
A504	0.703	-2.065	A544	0.907	-0.491
A505	0.887	-2.395	A545	1.003	-0.661
A506	0.526	-2.049	A546	0.363	0.346
A507	0.561	-0.968	A547	0.324	-0.395
A508	0.866	-1.852	A548	0.533	-0.116
A509	1.614	-1.961			
A510	0.724	-0.955			
A511	0.545	-2.172			
A512	0.777	-1.931			
A513	1.160	-2.763			
A514	1.014	-1.881			
A515	0.539	-2.291			
A516	0.480	0.478			
A517	1.997	-2.332			
A518	0.422	-2.484			
A519	0.793	-1.969			
A520	0.412	-3.122●			
A521	0.723	-1.941			
A522	0.460	-0.658			
A523	0.094●	4.638●			
A524	0.494	-2.058			
A525	1.132	-2.004			
A526	0.994	-0.843			
A527	0.099●	-0.402			
A528	0.481	-0.100			
A529	0.604	-0.574			
A530	0.708	-1.754			
A531	0.033●	38.517●			
A532	0.577	0.032			
A533	0.893	-1.824			
A534	0.923	-2.166			
A535	0.714	-1.336			
A536	0.748	-1.136			
A537	0.542	-1.364			
A538	1.330	-0.974			
A539	0.801	-1.029			
A540	0.477	-0.692			

TABLE 8-4

Readjusted Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
A601	0.899	-1.897	A641	0.666	0.100
A602	0.929	-2.237	A642	0.697	-1.340
A603	0.718	-1.412	A643	0.774	-0.910
A604	0.753	-1.213	A644	1.215	-0.493
A605	0.546	-1.439	A645	0.515	-0.303
A606	1.338	-1.052	A646	0.526	-0.823
A607	0.806	-1.107	A647	0.568	0.362
A608	0.480	-0.771	A648	0.925	-1.784
A609	0.597	-0.980	A649	0.466	-0.823
A610	0.508	-1.540	A650	0.578	-0.389
A611	0.551	-1.207	A651	0.653	-1.005
A612	0.912	-0.572	A652	0.289	-1.116
A613	1.009	-0.741	A653	0.576	-0.797
A614	0.365	0.260	A654	0.257	2.090
A615	0.326	-0.476	A655	0.907	-0.472
A616	0.536	-0.199	A656	0.529	-1.452
A617	1.054	-1.628			
A618	0.540	-1.259			
A619	0.639	-1.244			
A620	0.966	-0.646			
A621	0.933	-1.006			
A622	0.665	-1.718			
A623	0.486	-1.529			
A624	0.644	-2.211			
A625	0.432	-1.881			
A626	0.553	-1.075			
A627	0.356	-0.496			
A628	0.256	-2.790			
A629	0.691	-0.673			
A630	0.676	-1.068			
A631	0.629	-0.889			
A632	0.683	-1.492			
A633	0.423	-1.220			
A634	1.253	-1.697			
A635	1.002	-2.208			
A636	0.761	-1.676			
A637	0.511	-1.165			
A638	0.482	0.742			
A639	0.059●	11.795●			
A640	0.568	-0.190			

TABLE 8-5

Readjusted Estimated Item Discrimination Parameter a_g and Item Difficulty Parameter b_g of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	0.704	-0.070	J141	0.499	-0.965
J102	0.466	-0.894	J142	0.440	0.377
J103	0.630	-1.033	J143	0.623	-0.224
J104	0.656	-0.964	J144	0.360	-0.620
J105	0.691	-0.256	J145	0.627	-0.155
J106	0.444	-0.750	J146	0.714	-0.213
J107	0.458	-0.070	J147	0.483	0.253
J108	1.003	-1.784	J148	0.514	0.295
J109	0.295	-1.131	J149	0.435	-0.147
J110	0.569	-0.537	J150	0.427	0.017
J111	1.109	-1.261	J151	0.522	0.945
J112	0.419	-0.761	J152	0.402	0.565
J113	0.514	-1.040	J153	0.389	1.738
J114	0.562	0.171	J154	0.343	1.409
J115	0.742	-0.250	J155	0.801	1.066
J116	0.325	-1.109	J156	0.744	1.538
J117	0.307	-0.569			
J118	0.533	-1.085			
J119	0.564	-1.026			
J120	0.282	1.312			
J121	0.450	-0.797			
J122	0.471	-0.875			
J123	0.442	0.230			
J124	0.596	-1.614			
J125	0.492	-1.621			
J126	0.422	-0.603			
J127	0.544	-1.525			
J128	0.772	-0.950			
J129	0.613	1.722			
J130	0.336	-1.752			
J131	0.795	-0.359			
J132	0.376	0.017			
J133	0.777	-1.595			
J134	0.278	2.260			
J135	0.745	-0.140			
J136	0.302	0.343			
J137	0.578	-0.018			
J138	0.007●	200.849●			
J139	0.360	1.665			
J140	0.303	0.301			

TABLE 8-6

Readjusted Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J201	0.566	0.005	J241	0.924	-0.013
J202	0.007●	205.179●	J242	0.624	0.272
J203	0.352	1.724	J243	0.305	0.469
J204	0.297	0.332	J244	0.224	1.025
J205	0.488	-0.962	J245	0.634	1.300
J206	0.431	0.409	J246	0.203	1.680
J207	0.610	-0.205	J247	0.388	1.201
J208	0.353	-0.609	J248	0.309	-0.756
J209	0.614	-0.134	J249	0.531	1.076
J210	0.699	-0.193	J250	0.544	0.963
J211	0.472	0.282	J251	0.744	0.259
J212	0.503	0.325	J252	0.399	1.424
J213	0.426	-0.126	J253	0.439	1.498
J214	0.418	0.042	J254	0.438	1.446
J215	0.511	0.989	J255	0.838	1.530
J216	0.393	0.601	J256	0.389	2.191
J217	0.381	1.799	J257	0.407	1.087
J218	0.336	1.463	J258	0.314	1.643
J219	0.784	1.113	J259	0.599	1.747
J220	0.729	1.595	J260	0.089●	3.160●
J221	0.331	1.952			
J222	0.543	0.619			
J223	0.360	-0.477			
J224	0.531	0.604			
J225	0.576	-0.047			
J226	0.517	0.636			
J227	0.520	0.199			
J228	0.562	-0.224			
J229	0.538	0.126			
J230	0.473	0.145			
J231	1.209	-0.013			
J232	0.774	-0.148			
J233	0.236	2.283			
J234	0.274	1.531			
J235	0.790	0.641			
J236	0.720	0.771			
J237	0.209	-0.072			
J238	0.610	2.529			
J239	0.391	1.211			
J240	0.479	1.849			

TABLE 8-7

Readjusted Estimated Item Discrimination Parameter a_g and Item Difficulty Parameter b_g of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
A501	0.837	-2.316	A541	0.606	-0.902
A502	0.582	-3.287●	A542	0.513	-1.457
A503	0.664	-3.422●	A543	0.558	-1.127
A504	0.700	-2.070	A544	0.919	-0.497
A505	0.886	-2.399	A545	1.016	-0.664
A506	0.523	-2.055	A546	0.367	0.327
A507	0.558	-0.967	A547	0.329	-0.406
A508	0.863	-1.856	A548	0.543	-0.132
A509	1.604	-1.967			
A510	0.721	-0.955			
A511	0.542	-2.180			
A512	0.772	-1.937			
A513	1.154	-2.772			
A514	1.008	-1.886			
A515	0.535	-2.300			
A516	0.477	0.488			
A517	1.978	-2.340			
A518	0.419	-2.492			
A519	0.790	-1.973			
A520	0.409	-3.135●			
A521	0.719	-1.946			
A522	0.457	-0.656			
A523	0.092●	4.754●			
A524	0.490	-2.065			
A525	1.127	-2.008			
A526	0.987	-0.842			
A527	0.100	-0.405			
A528	0.477	-0.094			
A529	0.601	-0.572			
A530	0.701	-1.761			
A531	0.030●	42.338●			
A532	0.574	0.038			
A533	0.900	-1.817			
A534	0.932	-2.155			
A535	0.721	-1.332			
A536	0.762	-1.133			
A537	0.549	-1.360			
A538	1.341	-0.972			
A539	0.810	-1.029			
A540	0.485	-0.697			

TABLE 8-8

Readjusted Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
A601	0.852	-1.968	A641	0.803	-0.028
A602	0.882	-2.325	A642	0.513	-1.019
A603	0.682	-1.456	A643	0.753	-0.872
A604	0.721	-1.245	A644	0.933	-0.633
A605	0.520	-1.485	A645	0.708	-0.267
A606	1.269	-1.075	A646	0.513	-0.694
A607	0.766	-1.135	A647	0.587	0.066
A608	0.459	-0.784	A648	1.048	-1.636
A609	0.574	-1.001	A649	0.385	-0.861
A610	0.485	-1.588	A650	0.655	-0.436
A611	0.528	-1.239	A651	1.045	-1.066
A612	0.869	-0.573	A652	0.421	-0.801
A613	0.961	-0.749	A653	0.615	-0.834
A614	0.347	0.298	A654	0.586	0.321
A615	0.312	-0.477	A655	0.851	-0.281
A616	0.514	-0.187	A656	0.369	-1.205
A617	1.035	-1.654			
A618	0.523	-1.288			
A619	0.629	-1.262			
A620	0.962	-0.651			
A621	0.904	-1.023			
A622	0.648	-1.751			
A623	0.475	-1.558			
A624	0.631	-2.251			
A625	0.423	-1.914			
A626	0.542	-1.091			
A627	0.352	-0.502			
A628	0.252	-2.839			
A629	0.670	-0.683			
A630	0.664	-1.083			
A631	0.617	-0.901			
A632	0.671	-1.515			
A633	0.415	-1.239			
A634	1.220	-1.728			
A635	0.983	-2.245			
A636	0.743	-1.706			
A637	0.501	-1.184			
A638	0.475	0.753			
A639	0.061●	11.324●			
A640	0.552	-0.188			

TABLE 8-9

Readjusted Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	0.678	-0.042	J141	0.512	-0.934
J102	0.433	-1.217	J142	0.451	0.375
J103	0.636	-1.042	J143	0.639	-0.210
J104	0.787	-0.758	J144	0.370	-0.597
J105	0.598	-0.325	J145	0.643	-0.143
J106	0.433	-0.832	J146	0.735	-0.198
J107	0.495	0.069	J147	0.494	0.253
J108	0.884	-1.947	J148	0.527	0.295
J109	0.325	-1.029	J149	0.448	-0.133
J110	0.553	-0.525	J150	0.438	0.024
J111	0.882	-1.272	J151	0.536	0.928
J112	0.356	-0.958	J152	0.413	0.558
J113	0.519	-0.997	J153	0.400	1.699
J114	0.495	0.372	J154	0.352	1.380
J115	0.718	-0.341	J155	0.824	1.047
J116	0.312	-1.436	J156	0.767	1.505
J117	0.314	-0.548			
J118	0.545	-1.053			
J119	0.578	-0.993			
J120	0.287	1.294			
J121	0.461	-0.771			
J122	0.480	-0.850			
J123	0.454	0.233			
J124	0.609	-1.570			
J125	0.504	-1.574			
J126	0.431	-0.582			
J127	0.557	-1.482			
J128	0.789	-0.922			
J129	0.628	1.691			
J130	0.343	-1.710			
J131	0.812	-0.343			
J132	0.383	0.024			
J133	0.791	-1.558			
J134	0.285	2.216			
J135	0.763	-0.128			
J136	0.308	0.344			
J137	0.593	-0.010			
J138	0.007●	222.009●			
J139	0.369	1.629			
J140	0.310	0.300			

TABLE 8-10

Readjusted Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J201	0.563	0.004	J241	0.929	-0.011
J202	0.006●	233.498●	J242	0.625	0.272
J203	0.351	1.728	J243	0.304	0.467
J204	0.295	0.330	J244	0.224	1.023
J205	0.487	-0.967	J245	0.635	1.299
J206	0.429	0.409	J246	0.202	1.679
J207	0.608	-0.207	J247	0.389	1.200
J208	0.352	-0.613	J248	0.310	-0.756
J209	0.612	-0.136	J249	0.530	1.075
J210	0.698	-0.194	J250	0.545	0.962
J211	0.470	0.281	J251	0.746	0.259
J212	0.501	0.325	J252	0.400	1.422
J213	0.426	-0.126	J253	0.439	1.497
J214	0.417	0.040	J254	0.438	1.444
J215	0.510	0.991	J255	0.838	1.529
J216	0.392	0.601	J256	0.390	2.188
J217	0.381	1.801	J257	0.408	1.086
J218	0.335	1.466	J258	0.315	1.641
J219	0.783	1.116	J259	0.600	1.746
J220	0.729	1.598	J260	0.088●	3.176●
J221	0.332	1.950			
J222	0.543	0.617			
J223	0.361	-0.475			
J224	0.532	0.604			
J225	0.578	-0.045			
J226	0.519	0.636			
J227	0.520	0.198			
J228	0.563	-0.223			
J229	0.539	0.127			
J230	0.473	0.145			
J231	1.210	-0.012			
J232	0.776	-0.147			
J233	0.237	2.280			
J234	0.275	1.529			
J235	0.792	0.641			
J236	0.720	0.770			
J237	0.210	-0.068			
J238	0.610	2.526			
J239	0.391	1.209			
J240	0.479	1.847			

TABLE 8-11

Readjusted Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	0.698	-0.071	J141	0.535	-0.934
J102	0.464	-0.897	J142	0.420	0.430
J103	0.628	-1.037	J143	0.621	-0.217
J104	0.653	-0.967	J144	0.329	-0.534
J105	0.690	-0.257	J145	0.681	-0.306
J106	0.443	-0.750	J146	0.758	-0.090
J107	0.456	-0.069	J147	0.413	0.286
J108	1.006	-1.783	J148	0.444	0.436
J109	0.295	-1.127	J149	0.446	-0.225
J110	0.573	-0.534	J150	0.441	-0.100
J111	1.109	-1.264	J151	0.409	1.039
J112	0.416	-0.767	J152	0.323	0.661
J113	0.510	-1.049	J153	0.417	1.619
J114	0.559	0.172	J154	0.206	2.247
J115	0.742	-0.251	J155	0.763	1.139
J116	0.322	-1.119	J156	0.653	1.564
J117	0.306	-0.570			
J118	0.528	-1.094			
J119	0.561	-1.031			
J120	0.280	1.322			
J121	0.450	-0.796			
J122	0.469	-0.878			
J123	0.440	0.232			
J124	0.595	-1.617			
J125	0.493	-1.619			
J126	0.420	-0.604			
J127	0.541	-1.532			
J128	0.771	-0.953			
J129	0.609	1.735			
J130	0.337	-1.750			
J131	0.794	-0.361			
J132	0.372	0.017			
J133	0.784	-1.588			
J134	0.274	2.292			
J135	0.744	-0.140			
J136	0.300	0.347			
J137	0.576	0.094			
J138	---	---			
J139	0.378	1.441			
J140	0.348	0.287			

TABLE 8-12

Readjusted Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Three-Parameter Logistic Model.

Item	\hat{a}_g	\hat{b}_g	\hat{c}_g	Item	\hat{a}_g	\hat{b}_g	\hat{c}_g
J101	0.915	0.309	0.146	J141	0.553	-0.617	0.143
J102	0.488	-0.550	0.143	J142	0.849	1.130	0.245
J103	0.652	-0.750	0.143	J143	0.914	0.323	0.201
J104	0.708	-0.657	0.143	J144	0.374	0.015	0.143
J105	0.857	0.100	0.137	J145	0.749	-0.045	0.103
J106	0.497	-0.316	0.143	J146	0.873	0.145	0.087
J107	0.563	0.367	0.143	J147	1.432	1.241	0.338
J108	0.839	-1.935	0.143	J148	0.742	1.041	0.207
J109	0.317	-0.574	0.143	J149	0.530	0.226	0.143
J110	0.648	-0.159	0.143	J150	0.521	0.352	0.143
J111	1.066	-1.147	0.143	J151	0.737	1.483	0.181
J112	0.446	-0.350	0.143	J152	1.154	1.612	0.331
J113	0.525	-0.731	0.143	J153	1.037	1.764	0.167
J114	1.066	0.797	0.234	J154	0.634	2.587	0.249
J115	0.982	0.182	0.173	J155	1.466	1.232	0.089
J116	0.349	-0.606	0.143	J156	1.320	1.544	0.086
J117	0.341	0.006	0.143				
J118	0.531	-0.803	0.143				
J119	0.586	-0.724	0.143				
J120	1.000	1.882	0.278				
J121	0.484	-0.398	0.143				
J122	0.499	-0.500	0.143				
J123	0.578	0.676	0.143				
J124	0.563	-1.482	0.143				
J125	0.485	-1.405	0.143				
J126	0.471	-0.151	0.143				
J127	0.527	-1.343	0.143				
J128	0.800	-0.700	0.143				
J129	0.747	1.641	0.018				
J130	0.334	-1.388	0.143				
J131	1.100	0.101	0.191				
J132	0.460	0.535	0.143				
J133	0.754	-1.472	0.143				
J134	0.582	2.370	0.162				
J135	0.765	-0.019	0.041				
J136	0.375	0.923	0.143				
J137	0.744	0.459	0.131				
J138	---	---	---				
J139	1.107	1.745	0.213				
J140	0.547	1.053	0.218				

TABLE 8-13

Readjusted Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Logistic Model.

Item	\hat{a}_g	\hat{b}_g	Item	\hat{a}_g	\hat{b}_g
J101	0.715	-0.247	J141	0.545	-0.716
J102	0.514	-0.983	J142	0.433	0.132
J103	0.582	-1.238	J143	0.577	-0.106
J104	0.719	-0.812	J144	0.352	-0.437
J105	0.793	-0.104	J145	0.609	-0.508
J106	0.480	-0.746	J146	0.868	0.039
J107	0.551	0.212	J147	0.339	0.375
J108	0.915	-1.839	J148	0.487	-0.080
J109	0.361	-0.893	J149	0.468	-0.122
J110	0.553	-0.336	J150	0.503	-0.047
J111	1.080	-1.231	J151	0.440	0.903
J112	0.410	-1.081	J152	0.374	0.465
J113	0.494	-1.085	J153	0.404	1.946
J114	0.456	0.490	J154	0.238	2.266
J115	0.698	-0.240	J155	0.741	1.289
J116	0.283	-1.721	J156	0.690	1.463
J117	0.372	-0.626			
J118	0.617	-1.523			
J119	0.659	-0.979			
J120	0.274	1.072			
J121	0.469	-0.879			
J122	0.442	-1.040			
J123	0.431	0.147			
J124	0.581	-1.278			
J125	0.457	-1.645			
J126	0.350	-0.414			
J127	0.537	-1.274			
J128	0.708	-1.083			
J129	0.708	1.519			
J130	0.364	-1.728			
J131	0.806	-0.509			
J132	0.310	0.186			
J133	0.898	-1.343			
J134	0.279	1.676			
J135	0.858	-0.240			
J136	0.339	0.286			
J137	0.567	0.329			
J138	---	---			
J139	0.372	1.573			
J140	0.389	0.221			

TABLE 8-14

Readjusted Estimated Item Discrimination Parameter \hat{a}_g and Item Difficulty Parameter \hat{b}_g of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Three-Parameter Logistic Model.

Item	\hat{a}_g	\hat{b}_g	\hat{c}_g	Item	\hat{a}_g	\hat{b}_g	\hat{c}_g
J101	0.888	0.092	0.151	J141	0.583	-0.395	0.146
J102	0.534	-0.694	0.146	J142	0.793	0.903	0.267
J103	0.598	-0.989	0.146	J143	0.849	0.425	0.209
J104	0.788	-0.540	0.146	J144	0.395	0.059	0.146
J105	0.960	0.136	0.109	J145	0.674	-0.189	0.146
J106	0.529	-0.374	0.146	J146	1.070	0.258	0.101
J107	0.680	0.485	0.109	J147	1.458	1.407	0.373
J108	0.795	-1.959	0.146	J148	0.592	0.325	0.146
J109	0.394	-0.433	0.146	J149	0.556	0.286	0.146
J110	0.661	0.044	0.146	J150	0.612	0.348	0.146
J111	1.042	-1.144	0.146	J151	0.758	1.320	0.182
J112	0.427	-0.718	0.146	J152	0.952	1.325	0.308
J113	0.516	-0.774	0.146	J153	1.227	1.784	0.156
J114	0.932	1.103	0.245	J154	0.628	2.398	0.212
J115	0.886	0.151	0.172	J155	1.396	1.294	0.085
J116	0.301	-1.191	0.146	J156	1.474	1.426	0.095
J117	0.412	-0.157	0.146				
J118	0.589	-1.402	0.146				
J119	0.695	-0.720	0.146				
J120	0.530	1.769	0.229				
J121	0.497	-0.536	0.146				
J122	0.461	-0.692	0.146				
J123	0.540	0.579	0.146				
J124	0.580	-1.057	0.146				
J125	0.456	-1.409	0.146				
J126	0.402	0.097	0.146				
J127	0.538	-1.047	0.146				
J128	0.716	-0.887	0.146				
J129	0.821	1.448	0.013				
J130	0.360	-1.419	0.146				
J131	0.987	-0.149	0.178				
J132	0.383	0.749	0.146				
J133	0.898	-1.208	0.146				
J134	0.427	2.048	0.146				
J135	0.938	-0.067	0.085				
J136	0.426	0.797	0.146				
J137	0.713	0.592	0.108				
J138	---	---	---				
J139	0.933	1.762	0.193				
J140	0.493	0.688	0.146				

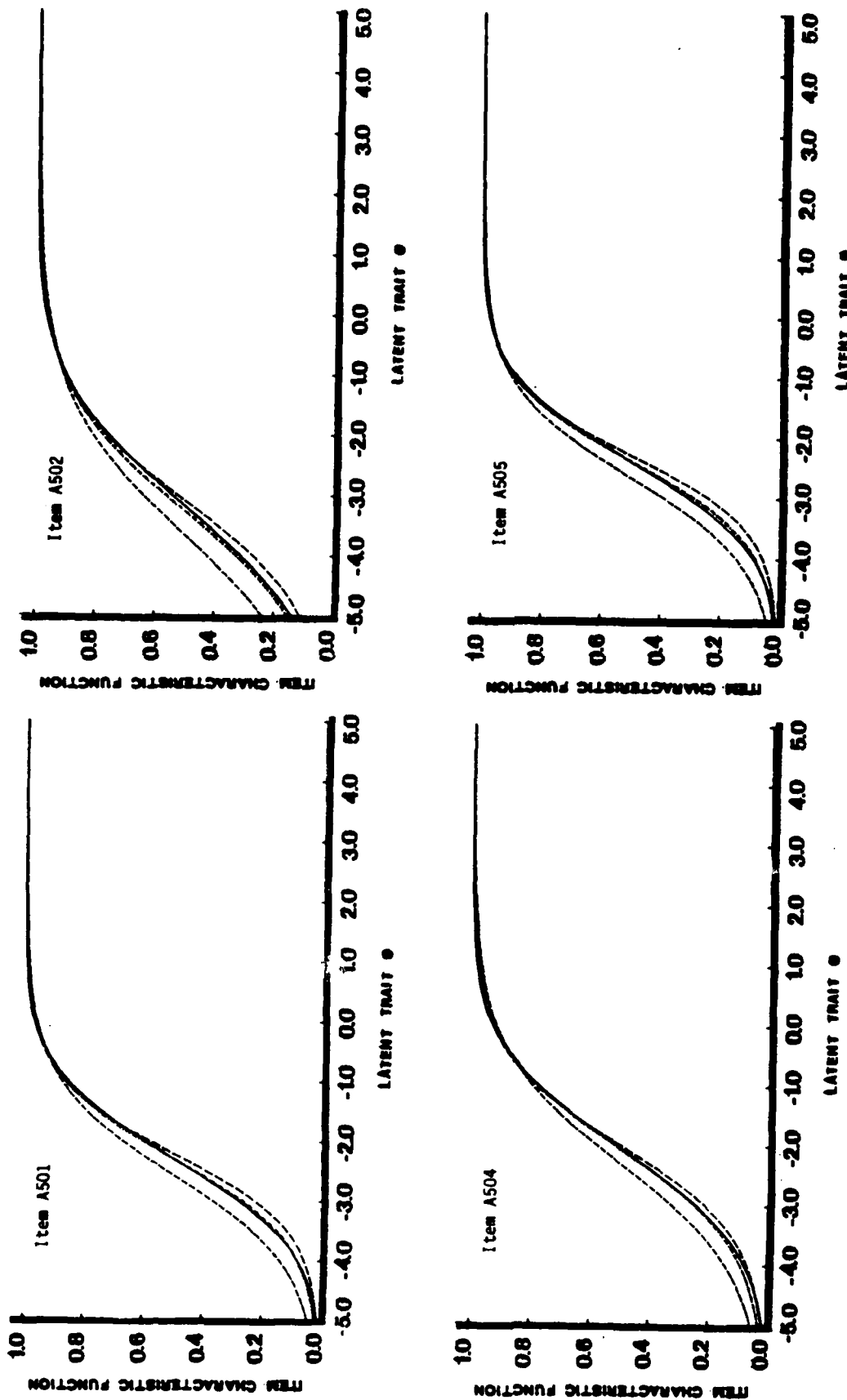


FIGURE 9-1

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Four Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Two of Which Are the Results of the A5-A6 Case Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), and the Other Two of Which Are the Results of the A5-A6-J1-J2 Case Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test A5.

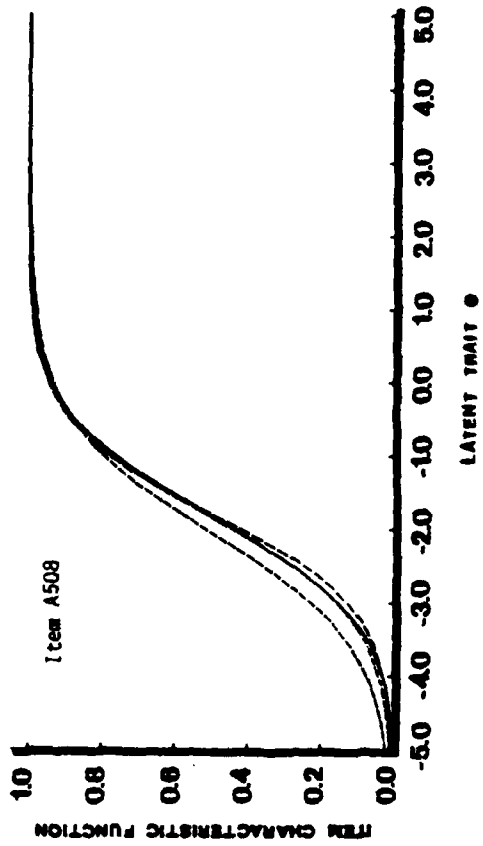
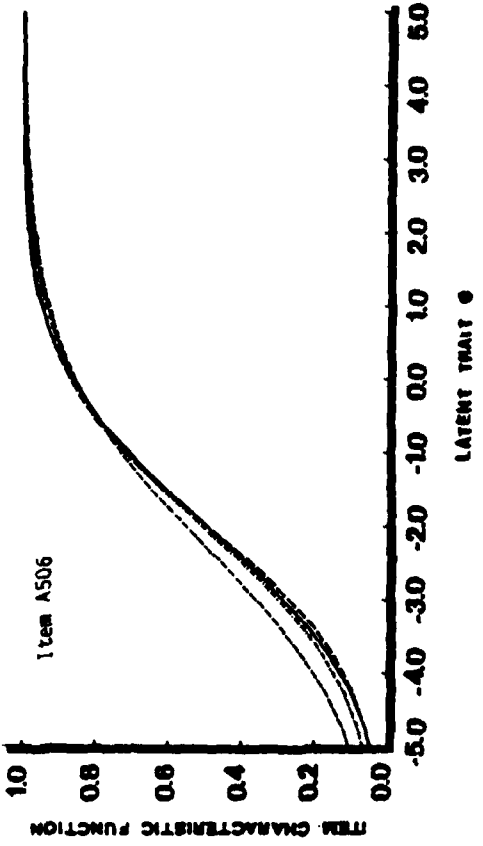
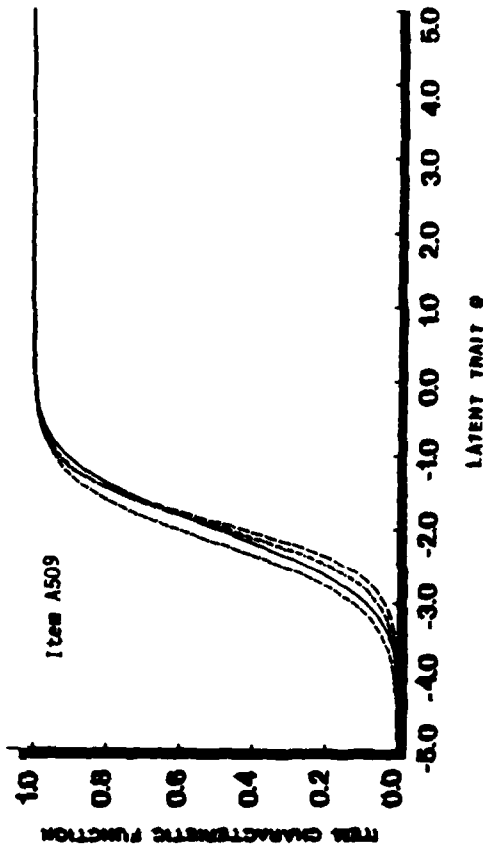
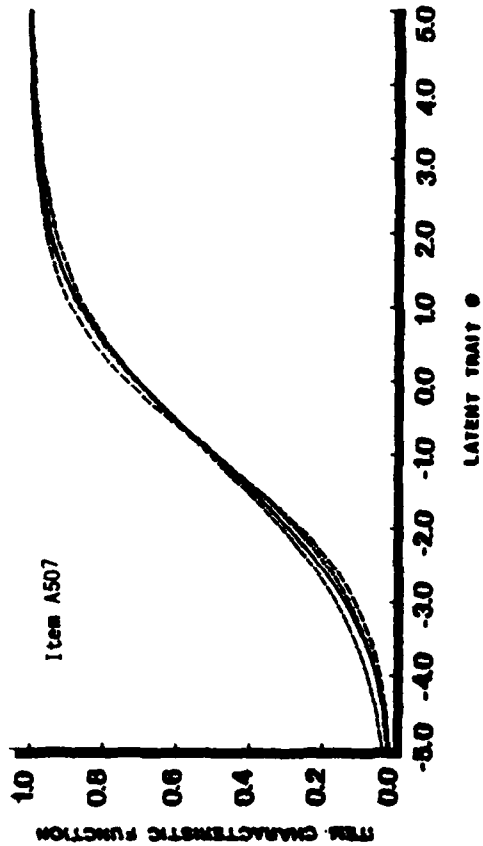


FIGURE 9-1 (Continued)

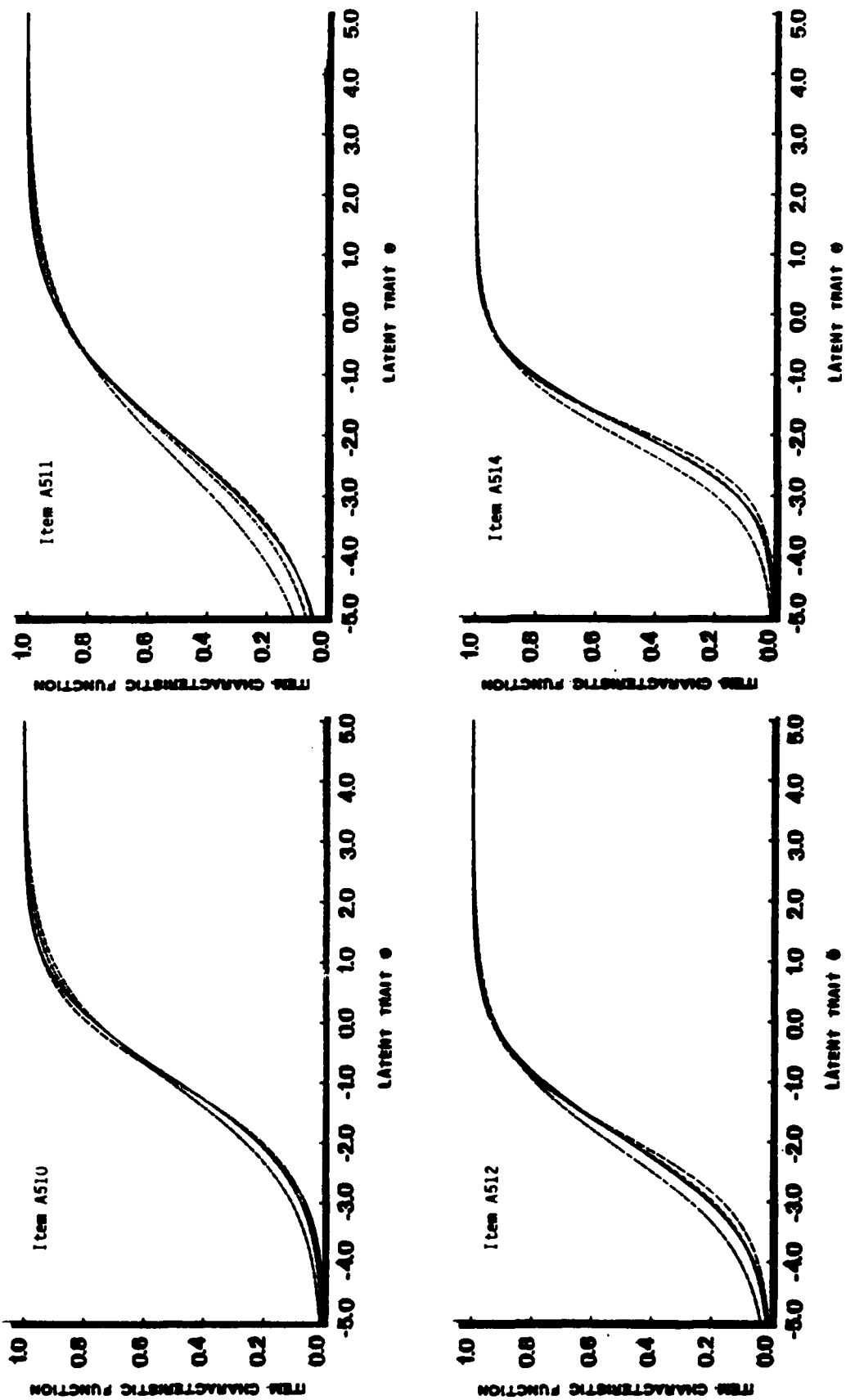


FIGURE 9-1 (Continued)

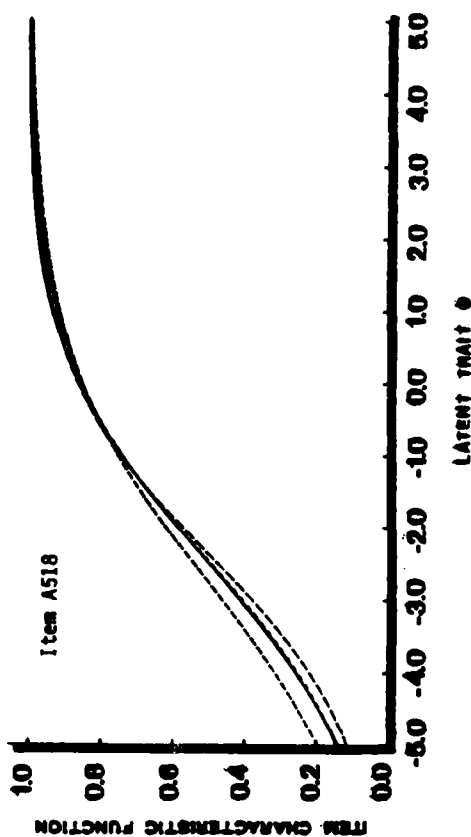
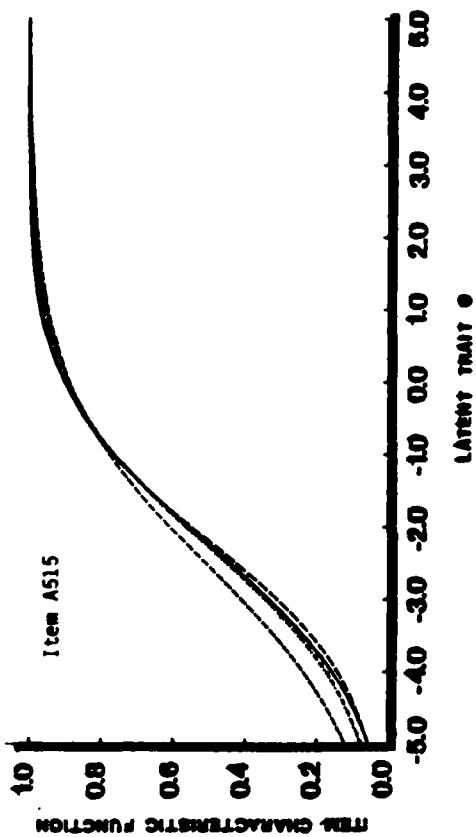
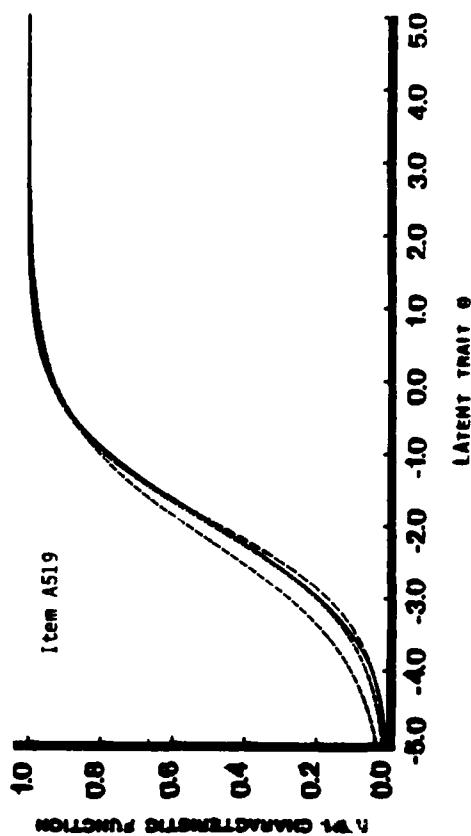
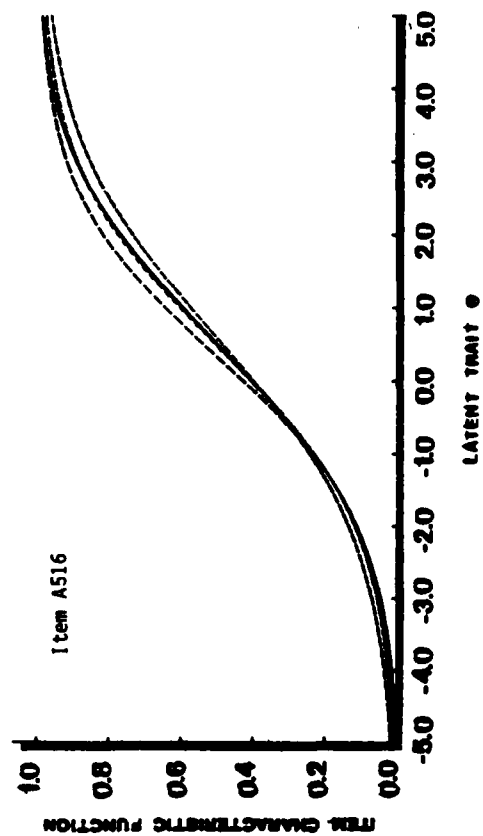


FIGURE 9-1 (Continued)

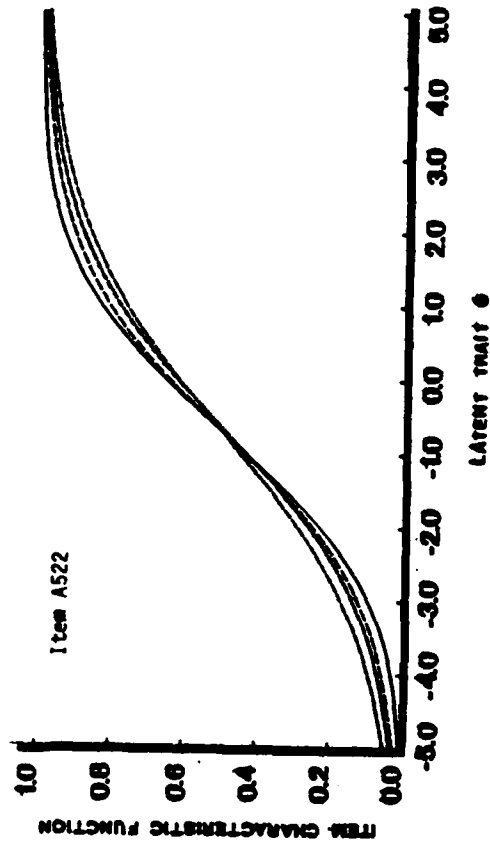
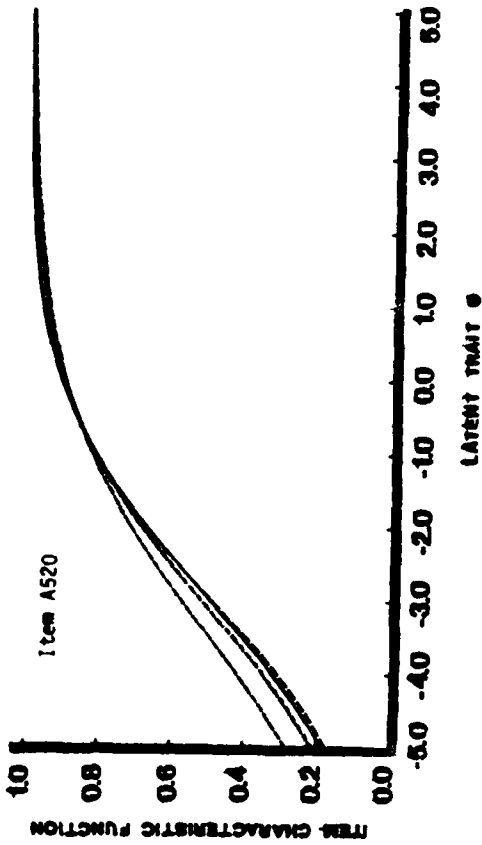
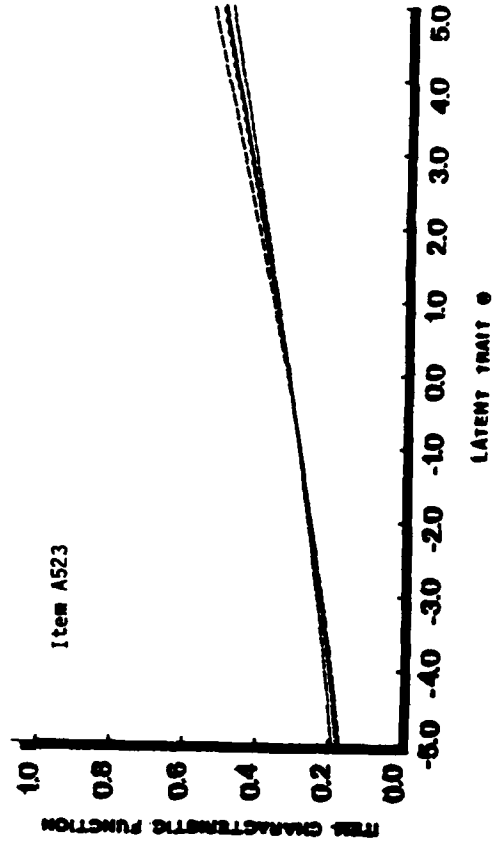
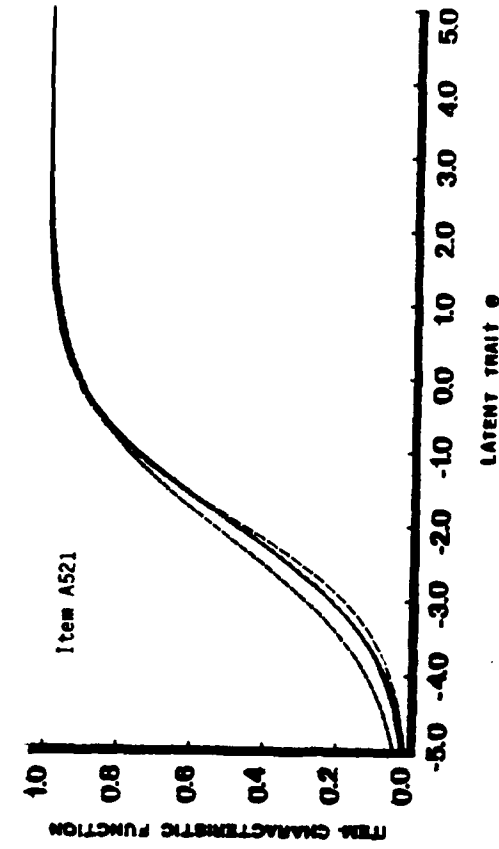


FIGURE 9-1 (Continued)

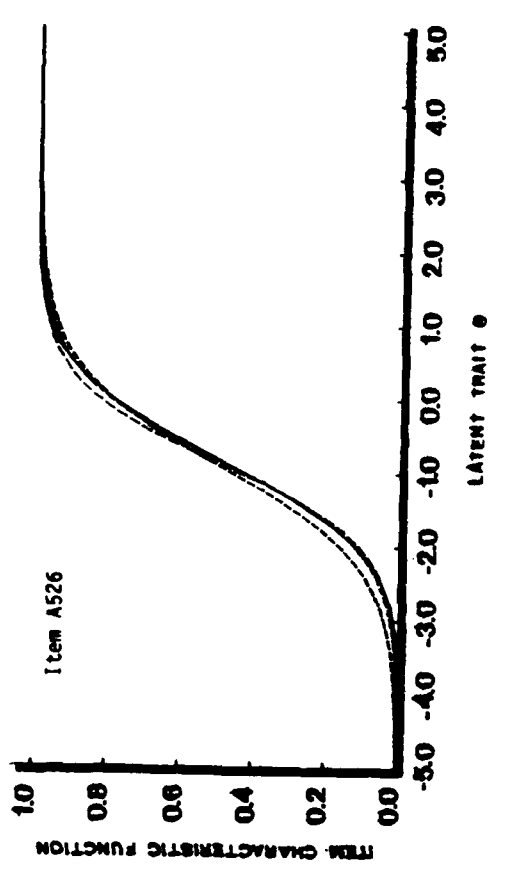
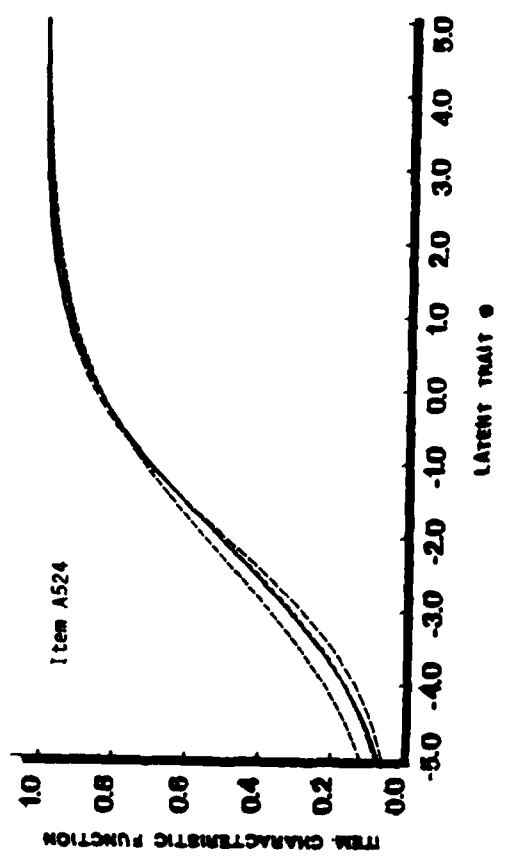
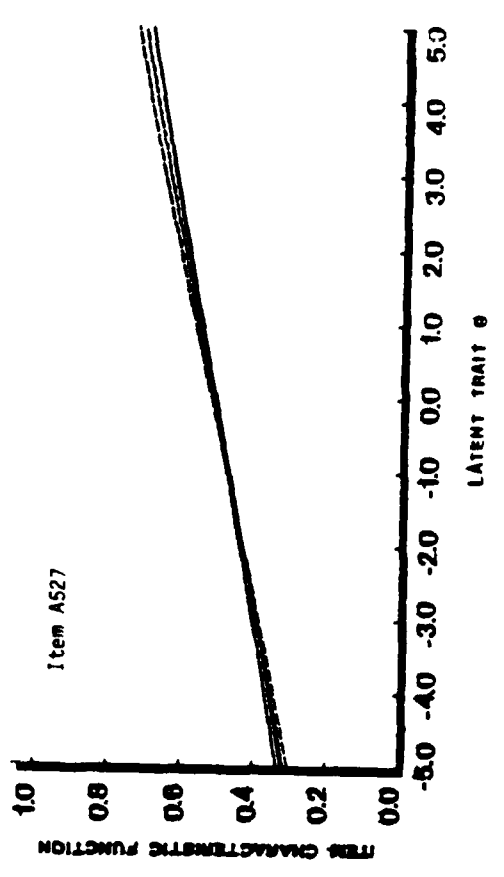
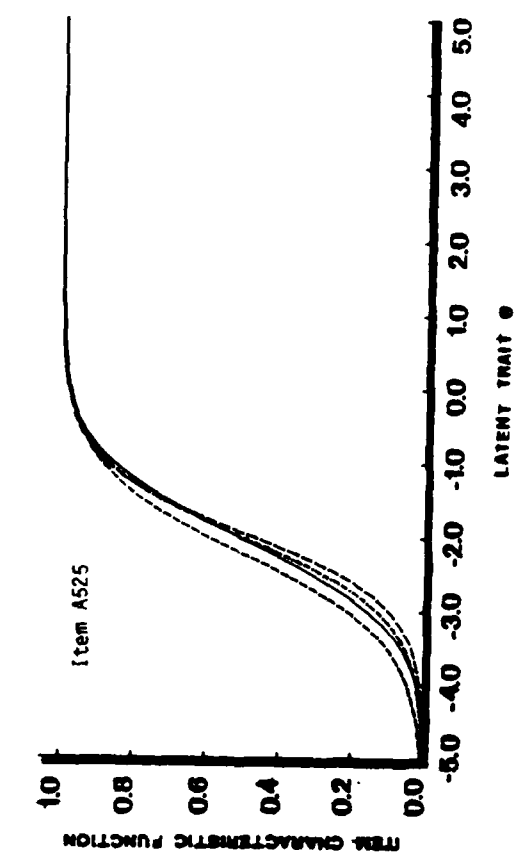


FIGURE 9-1 (Continued)

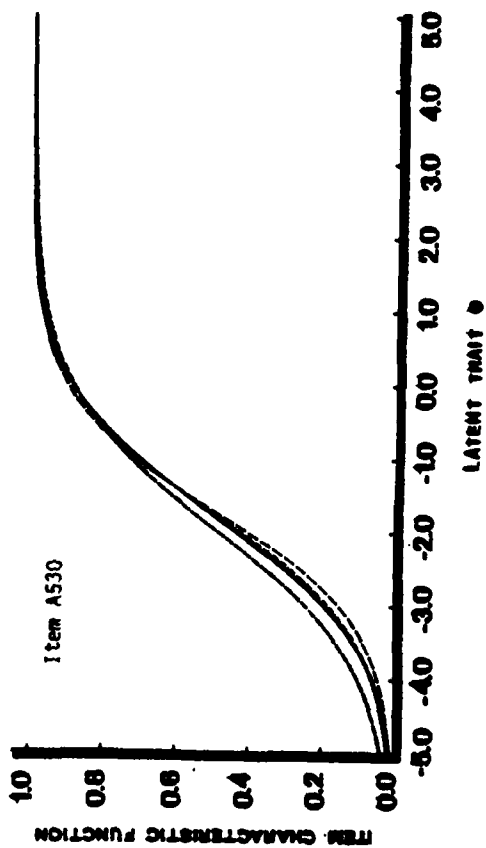
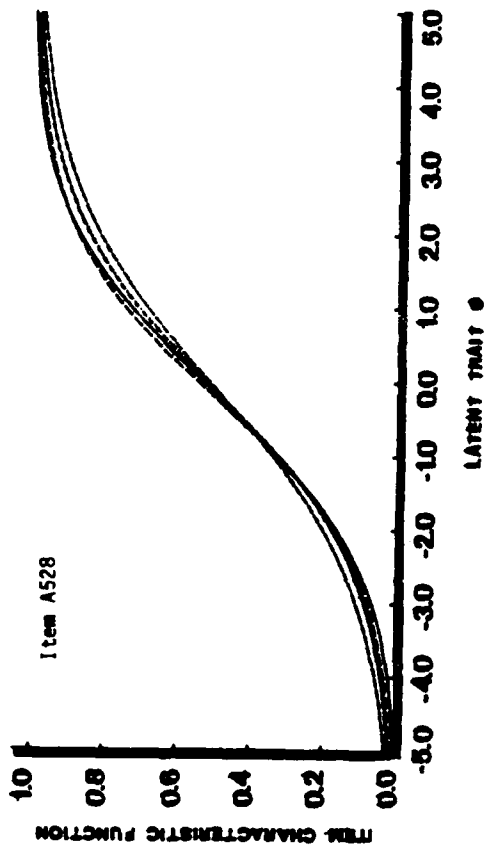
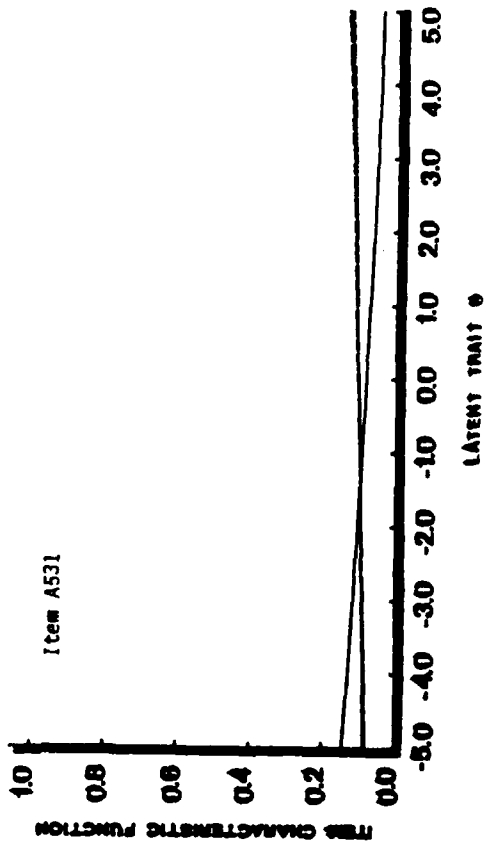
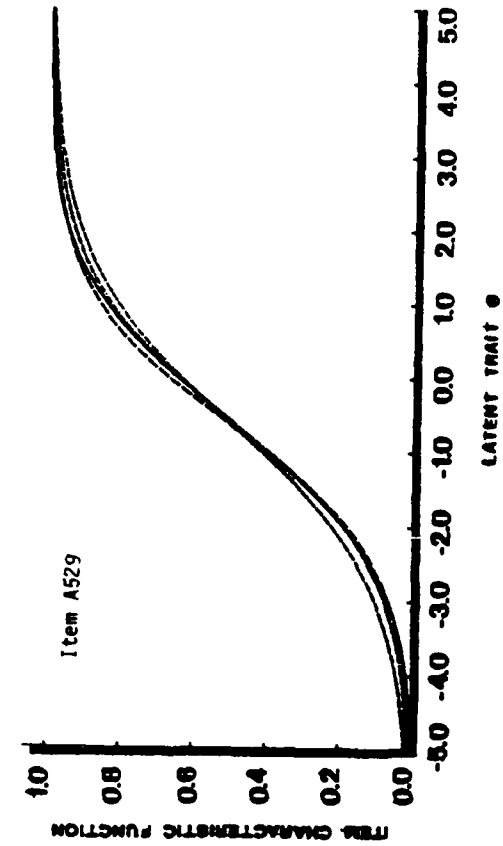


FIGURE 9-1 (Continued)

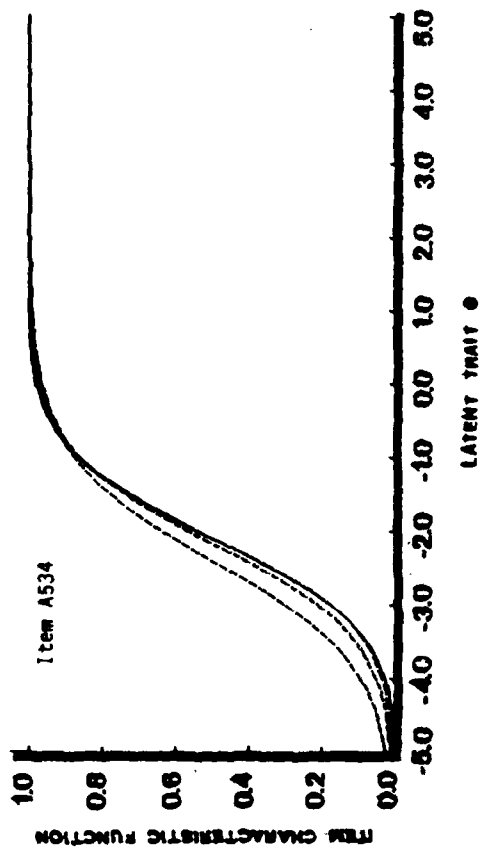
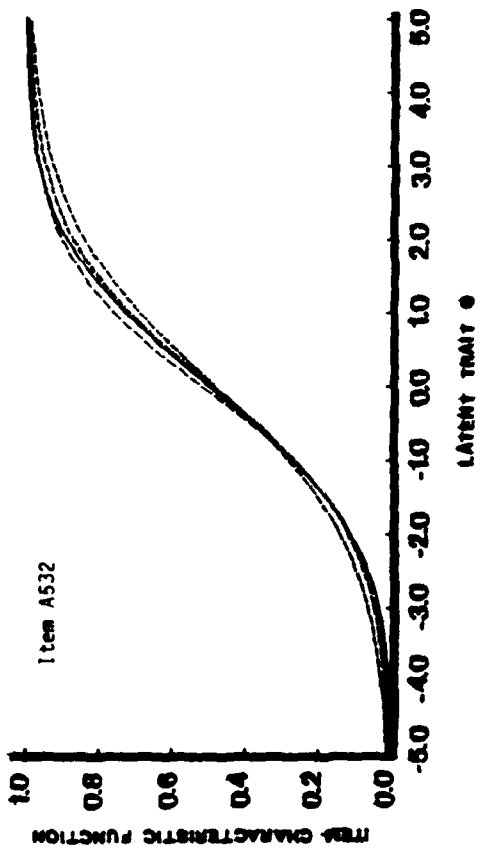
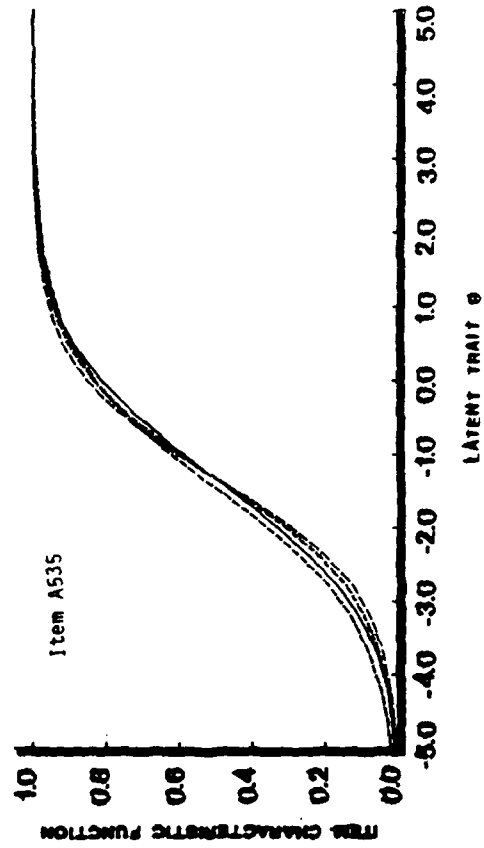
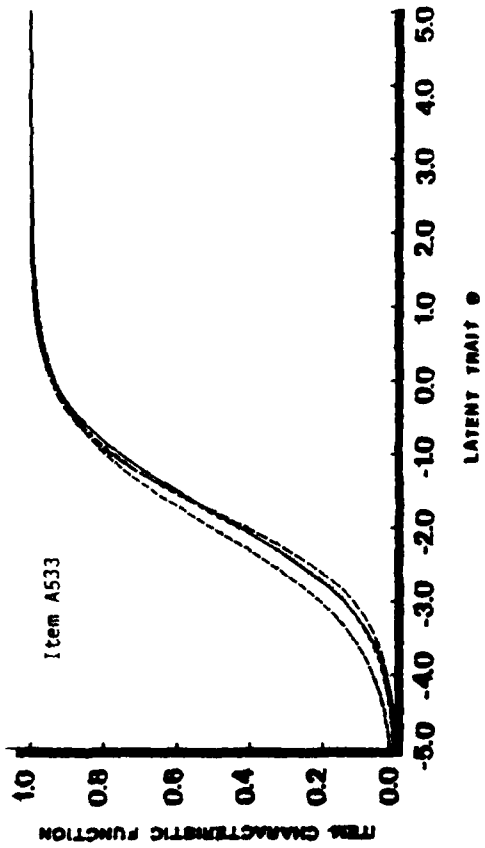


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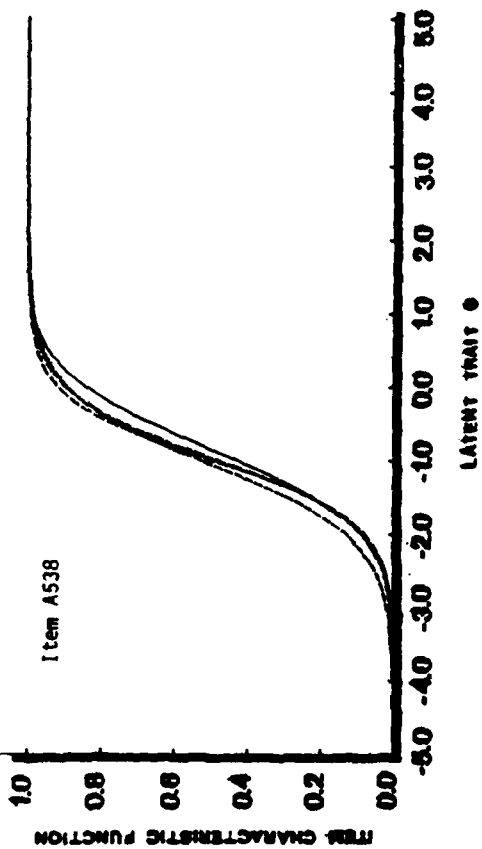
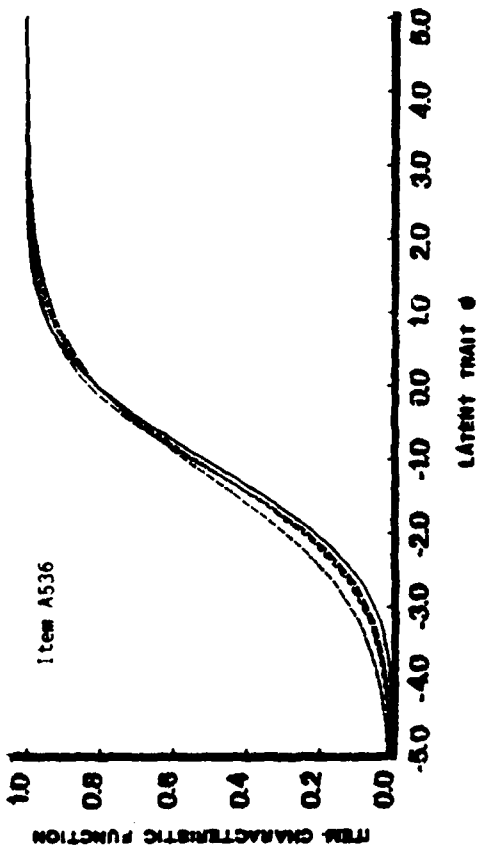
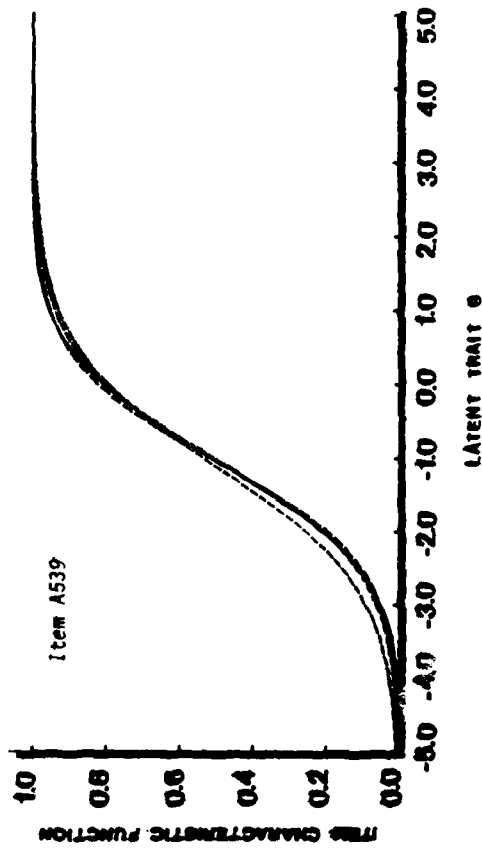
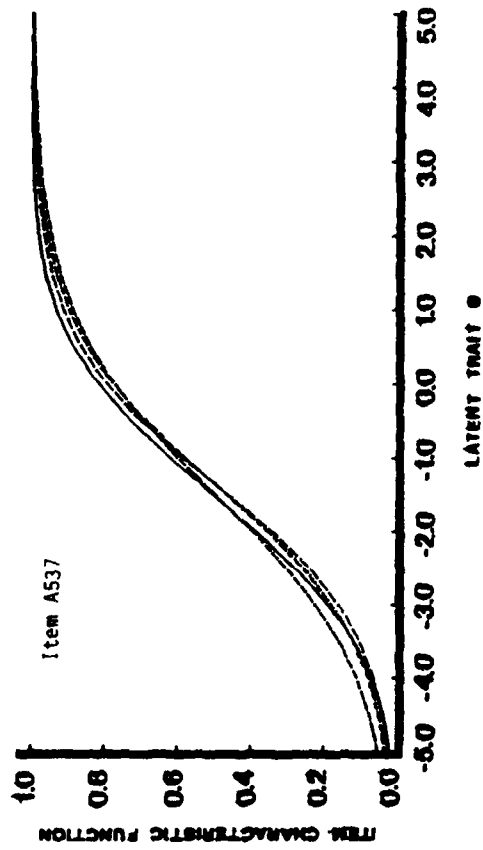


FIGURE 9-1 (Continued)

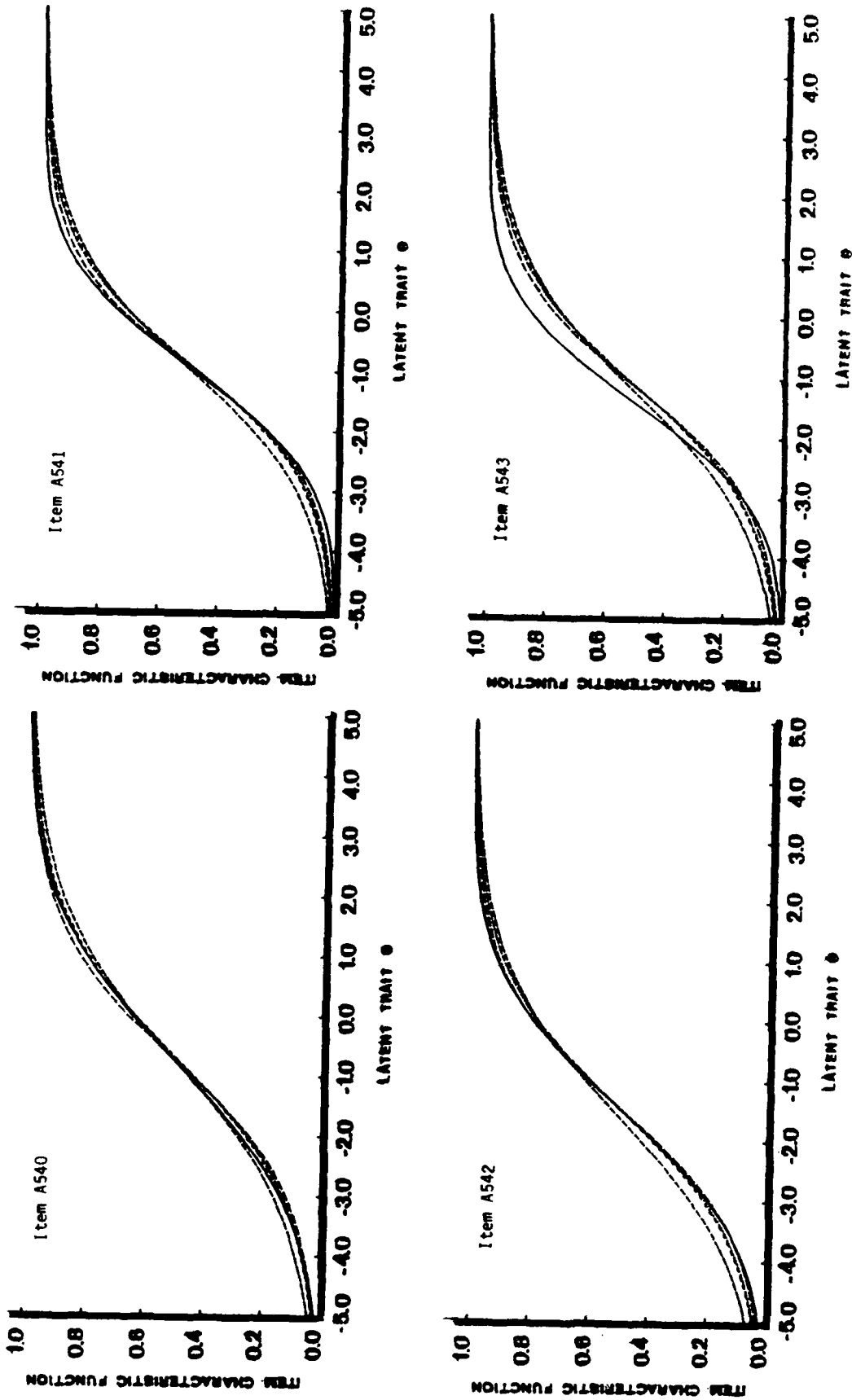


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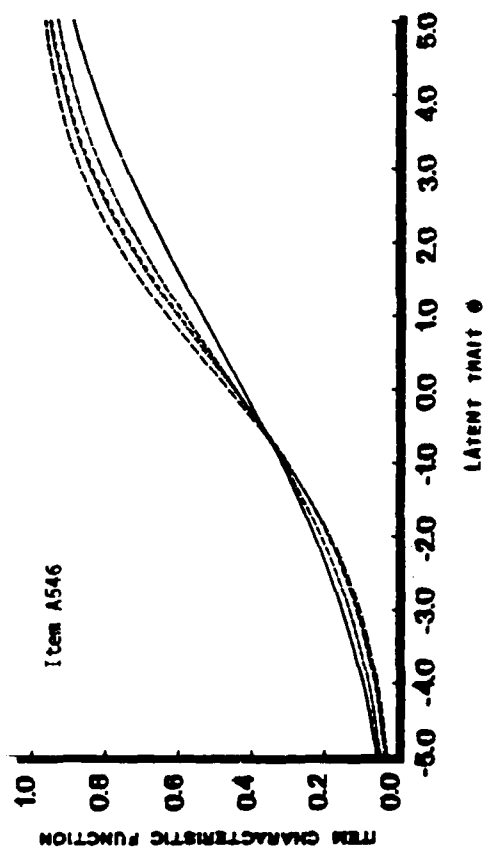
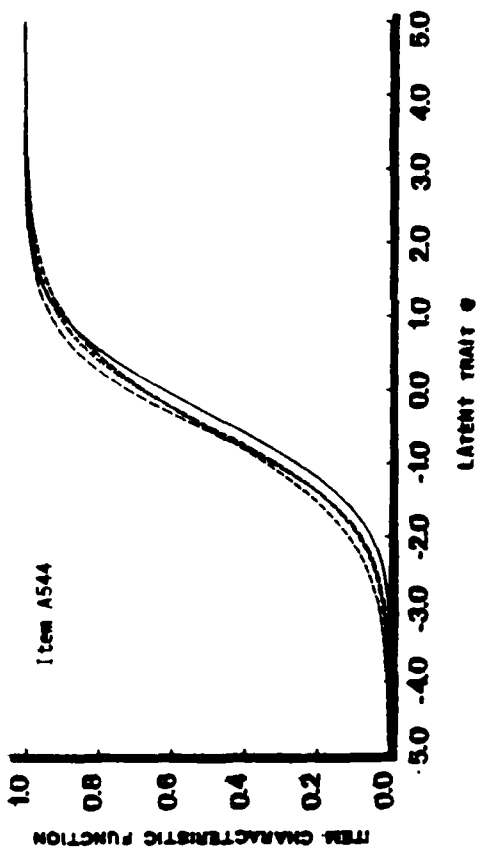
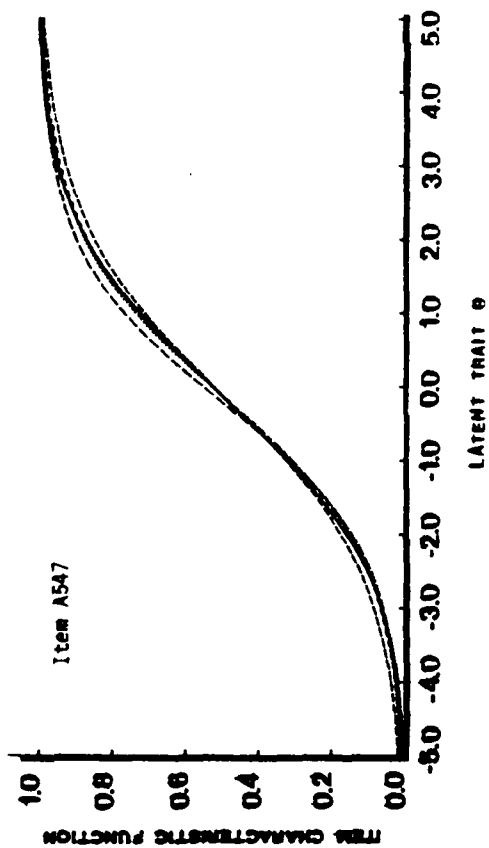
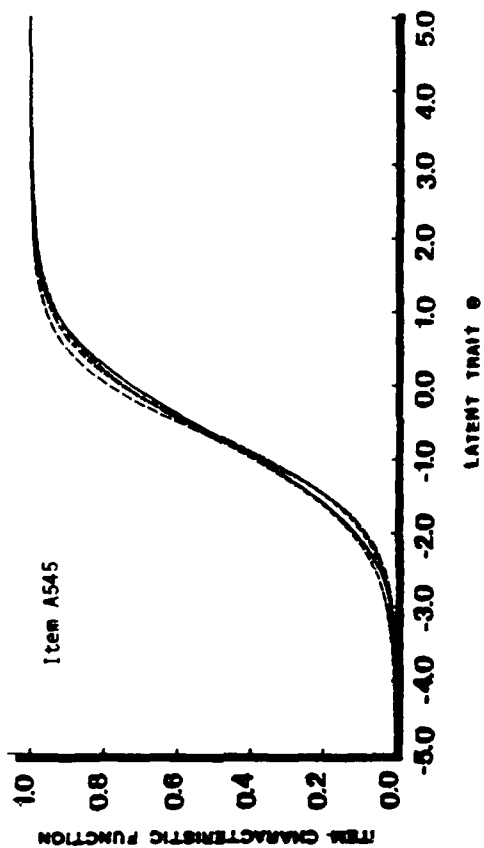


FIGURE 9-1 (Continued)

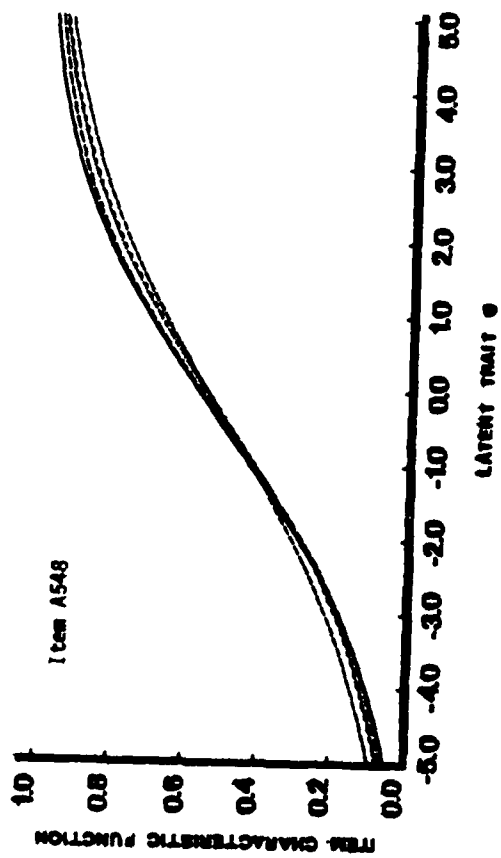


FIGURE 9-1 (Continued)

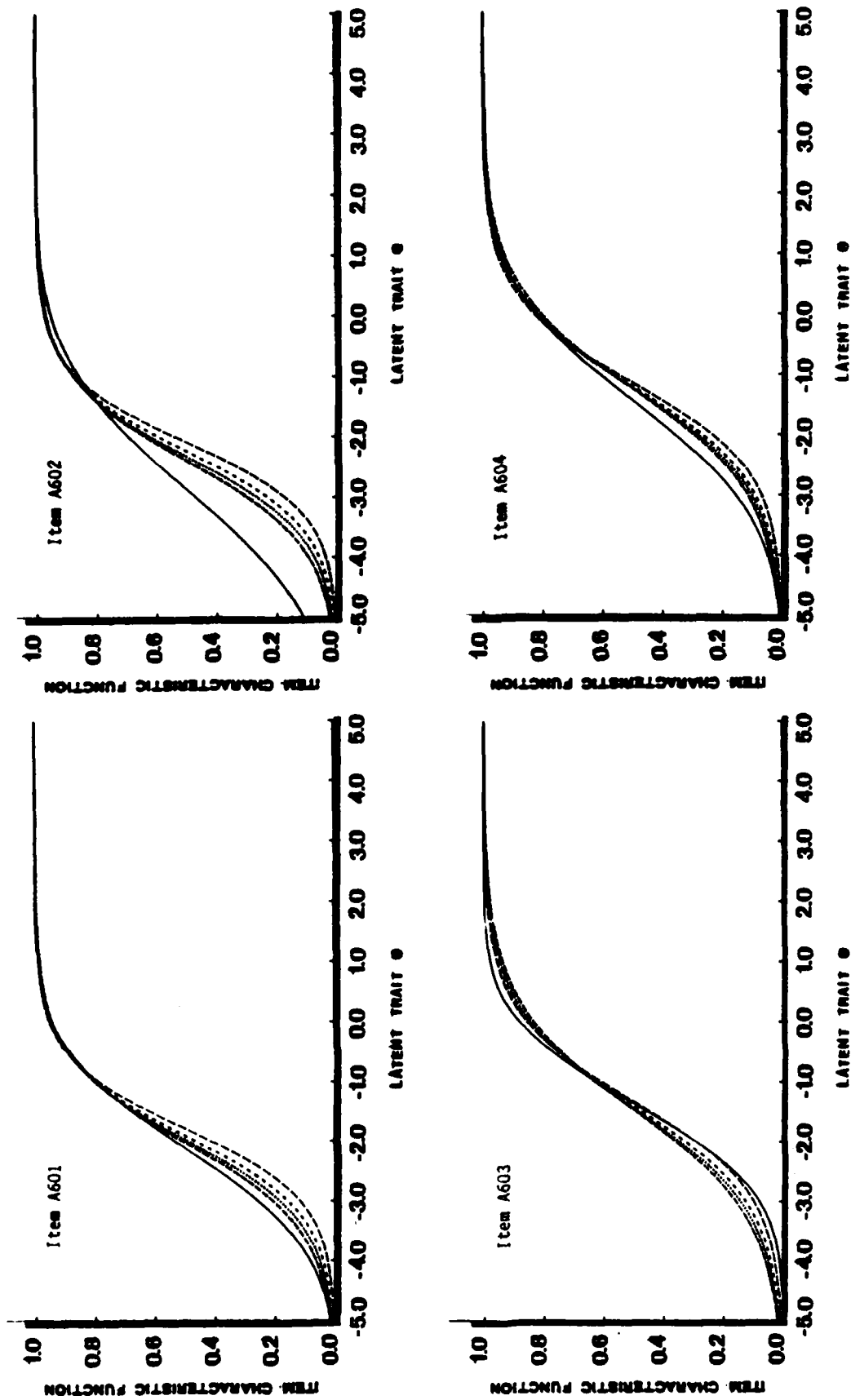


FIGURE 9-2

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Four Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Two of Which Are the Results of the A5-A6 Case Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), And the Other Two of Which Are the Results of the A5-A6-J1-J2 Case Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test A6.

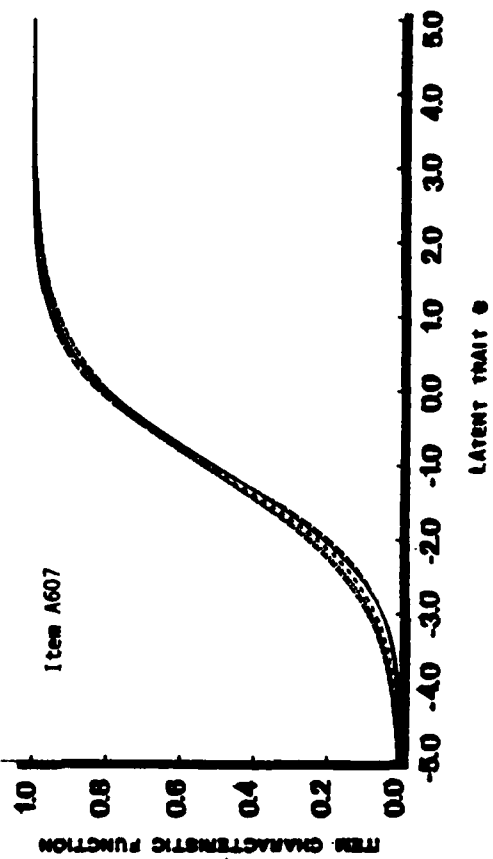
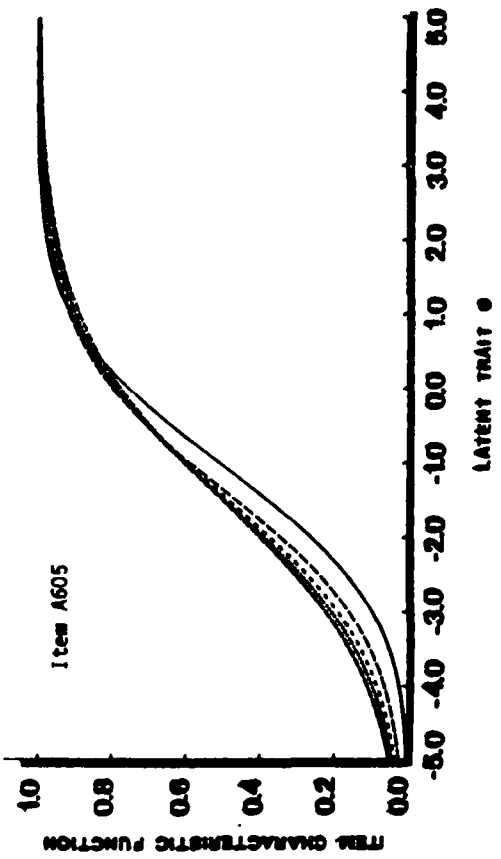
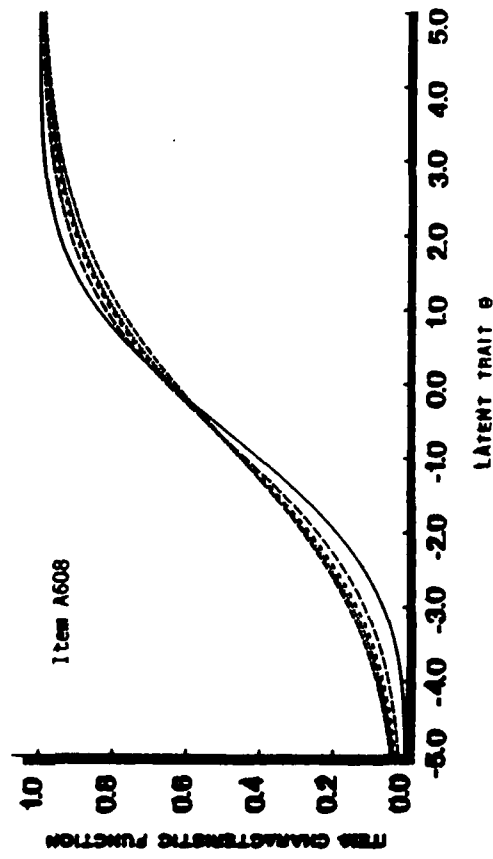
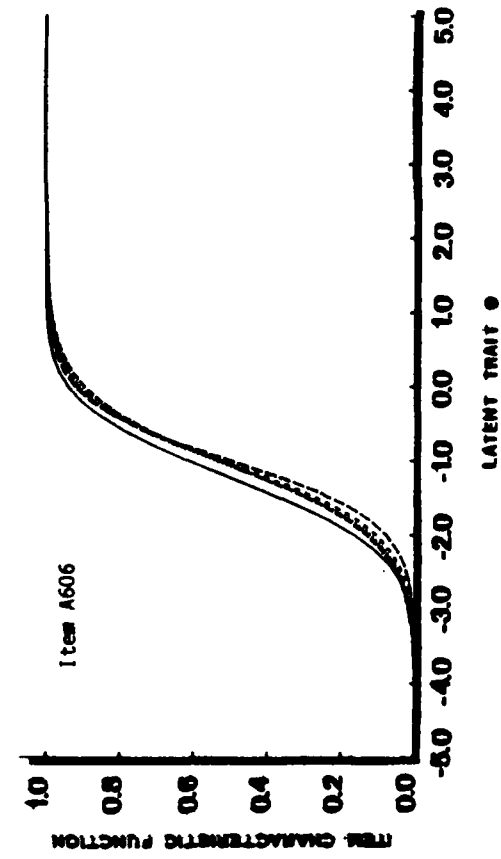


FIGURE 9-2 (Continued)

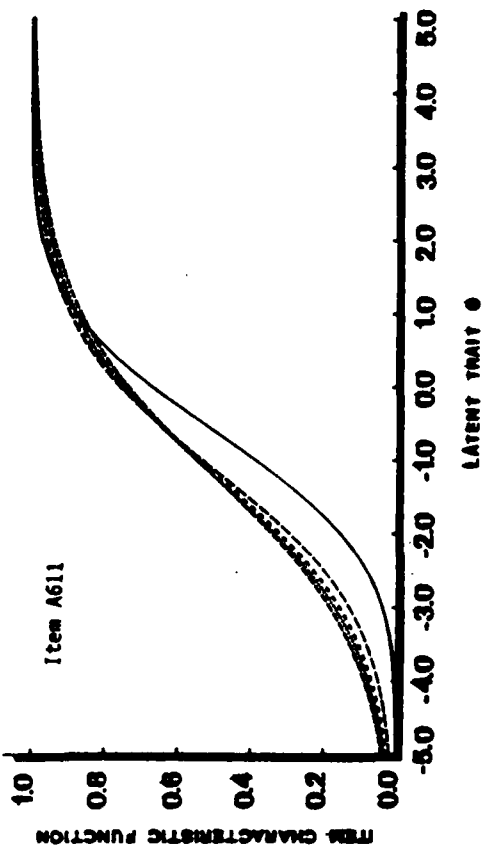
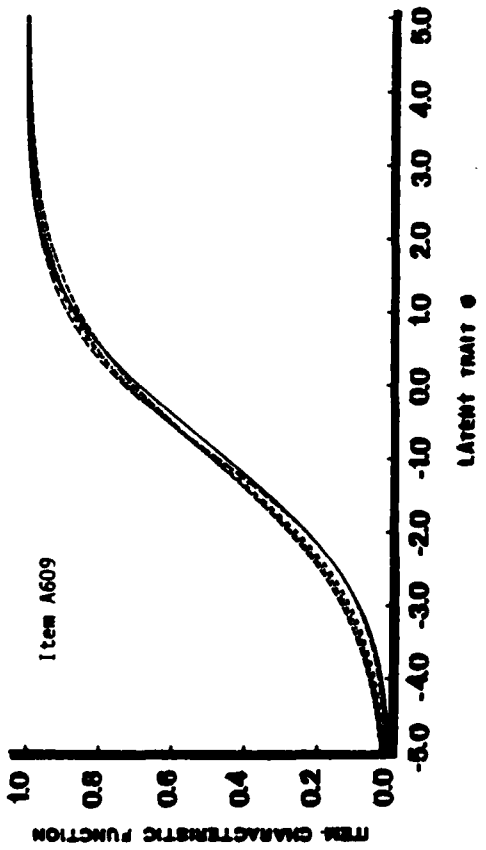
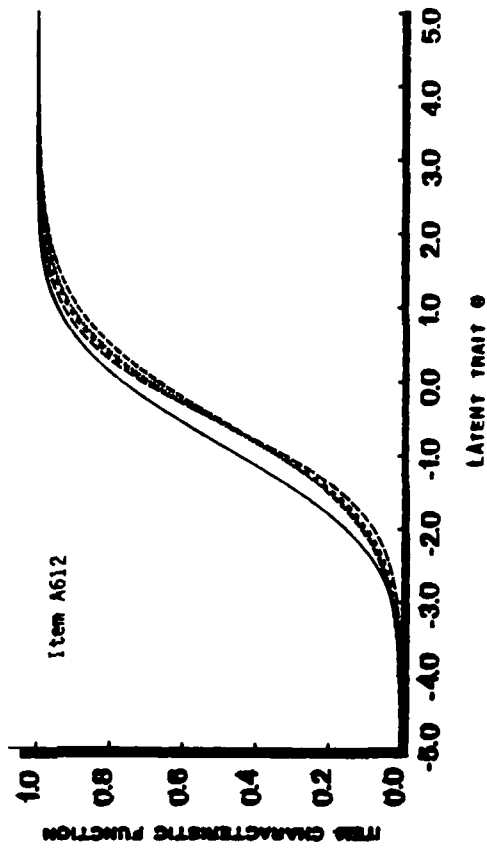
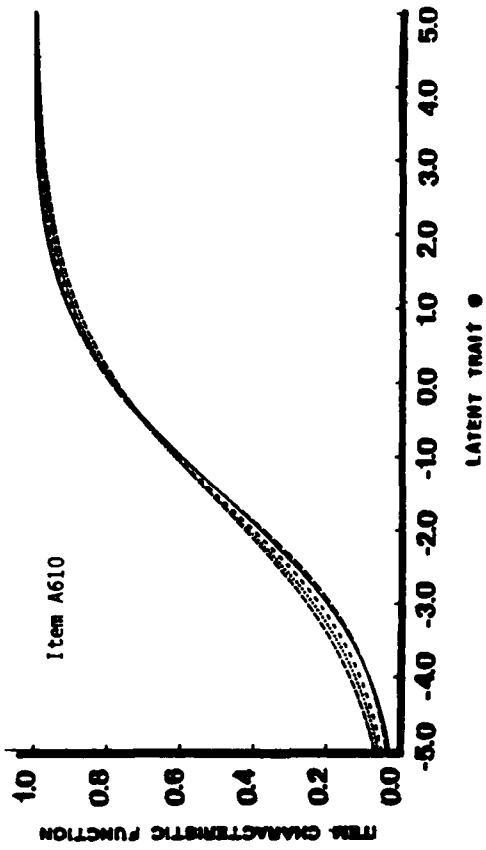


FIGURE 9-2 (Continued)

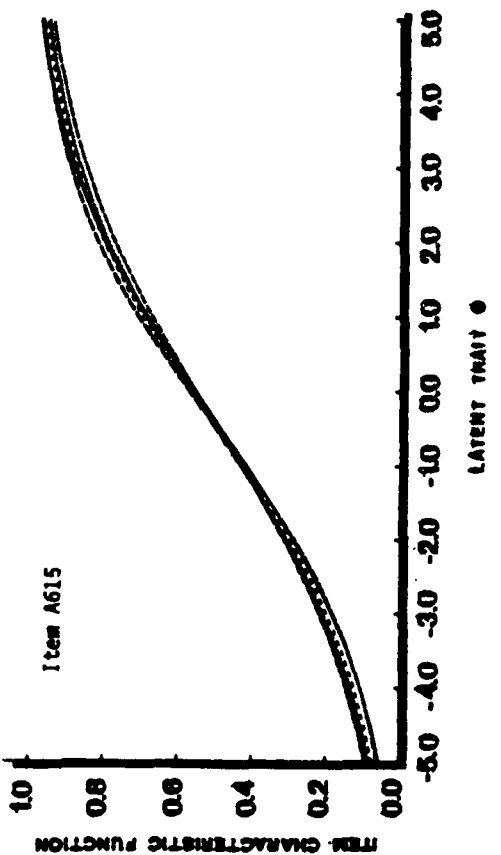
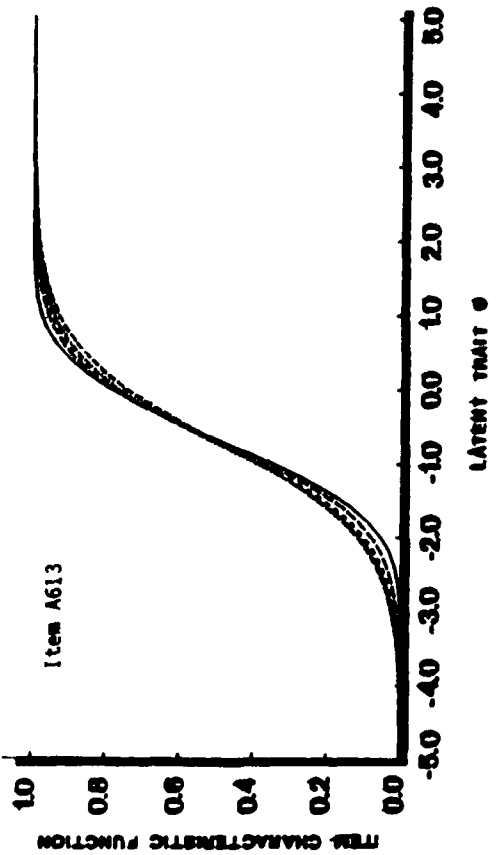
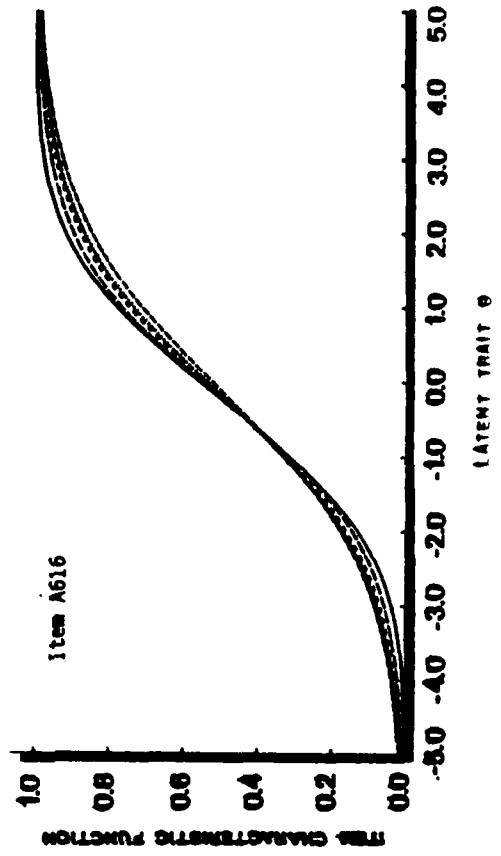
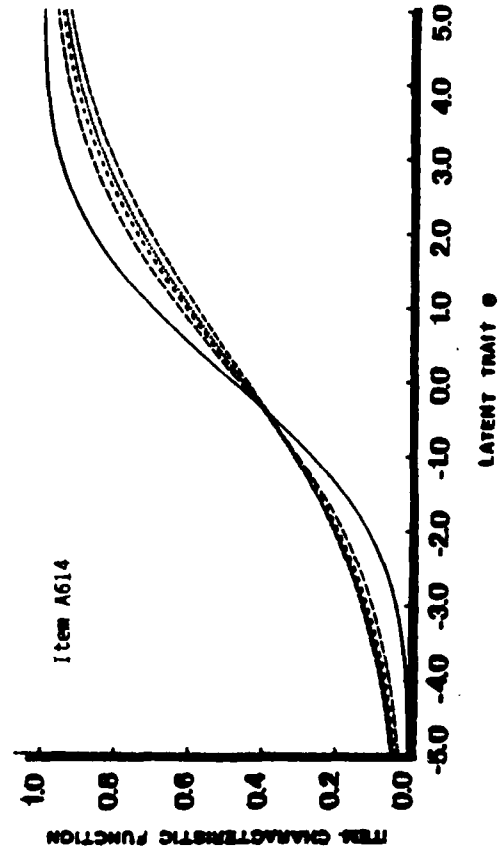


FIGURE 9-2 (Continued)

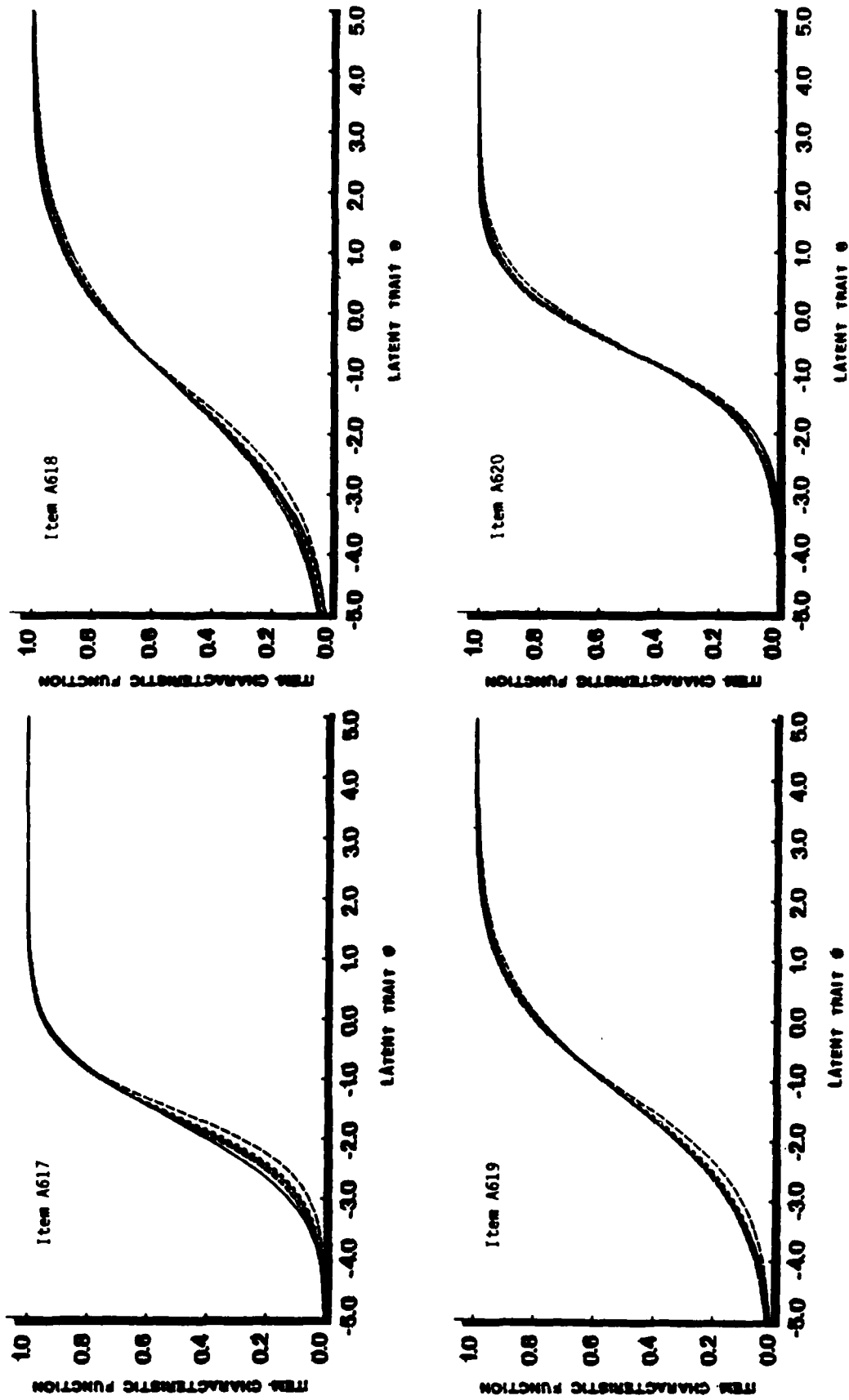


FIGURE 9-2 (Continued)

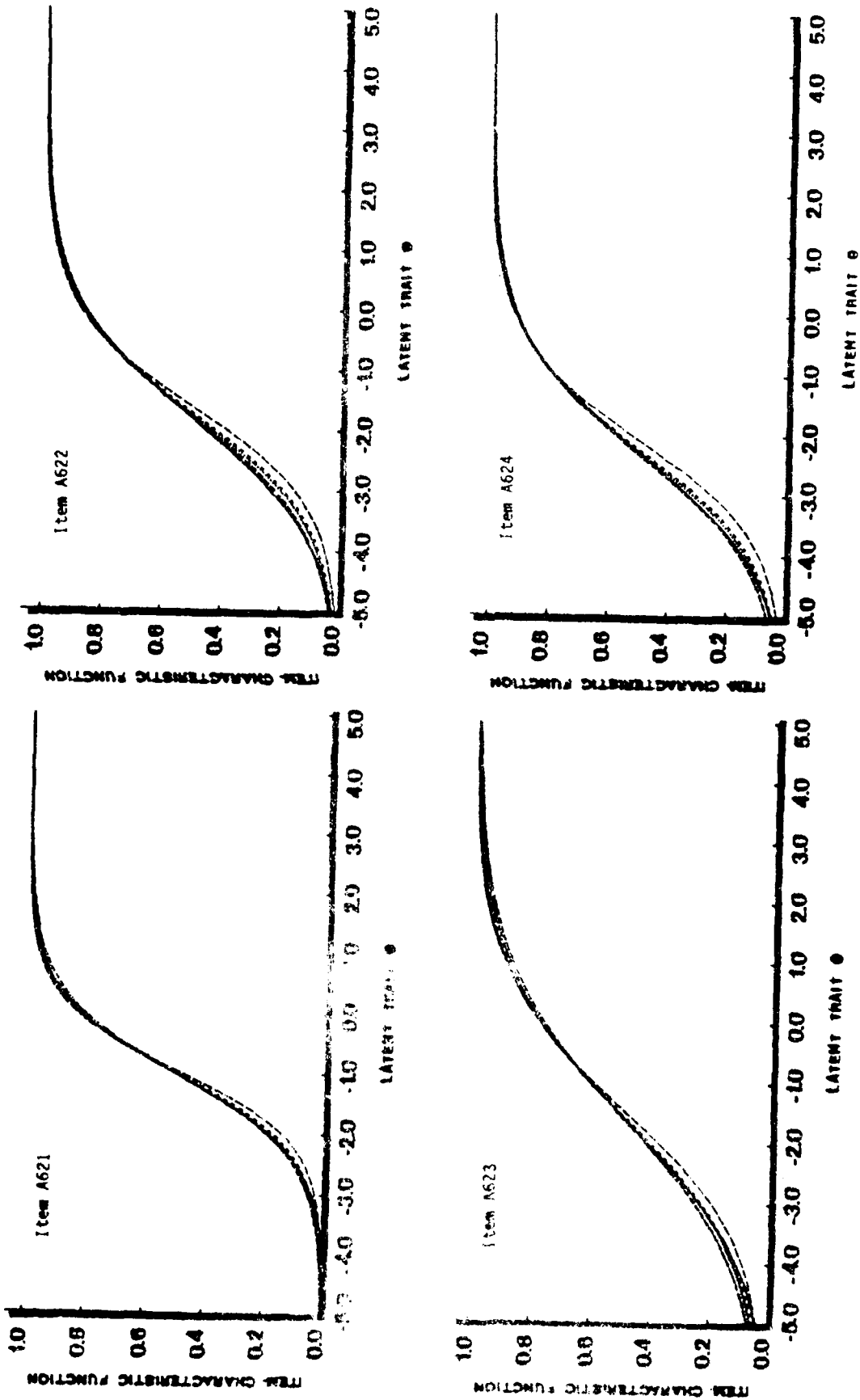


FIGURE 9-2 (Continued)

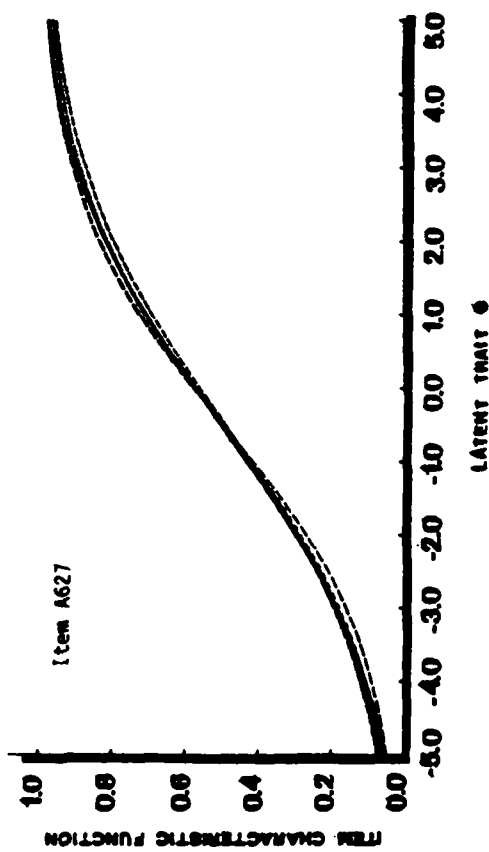
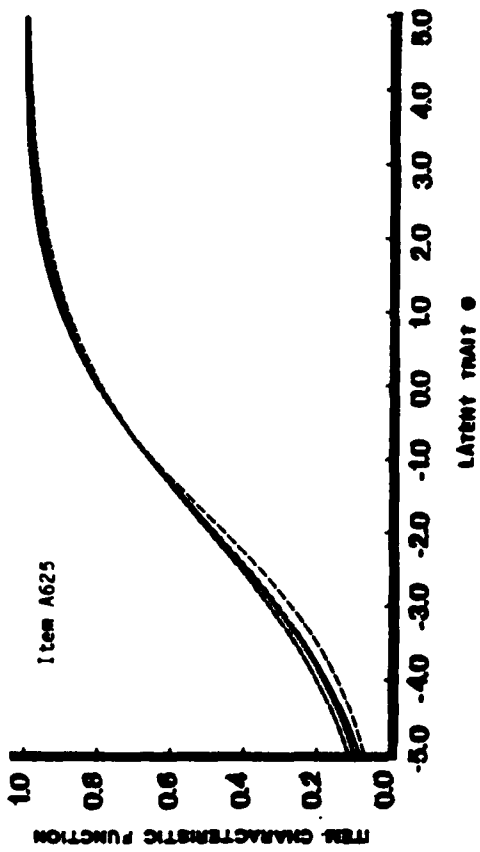
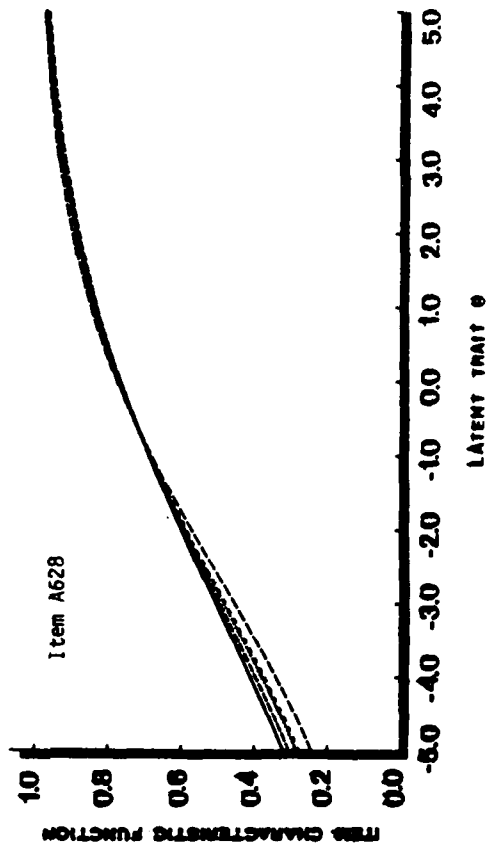
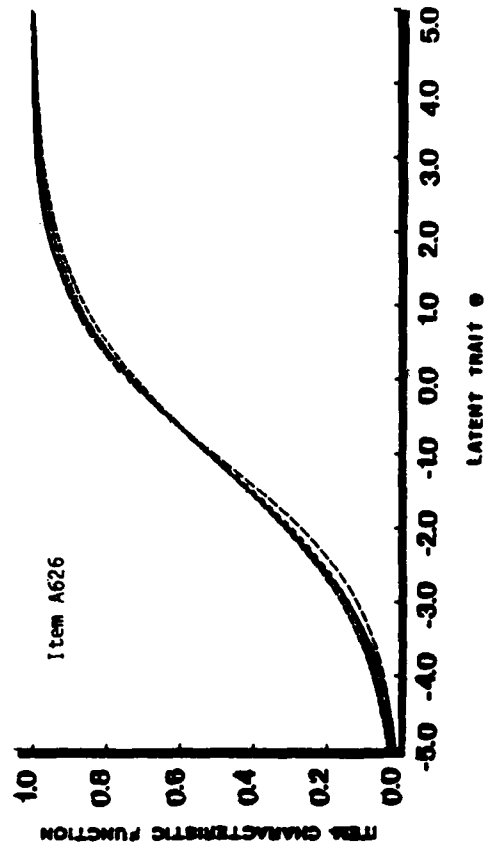


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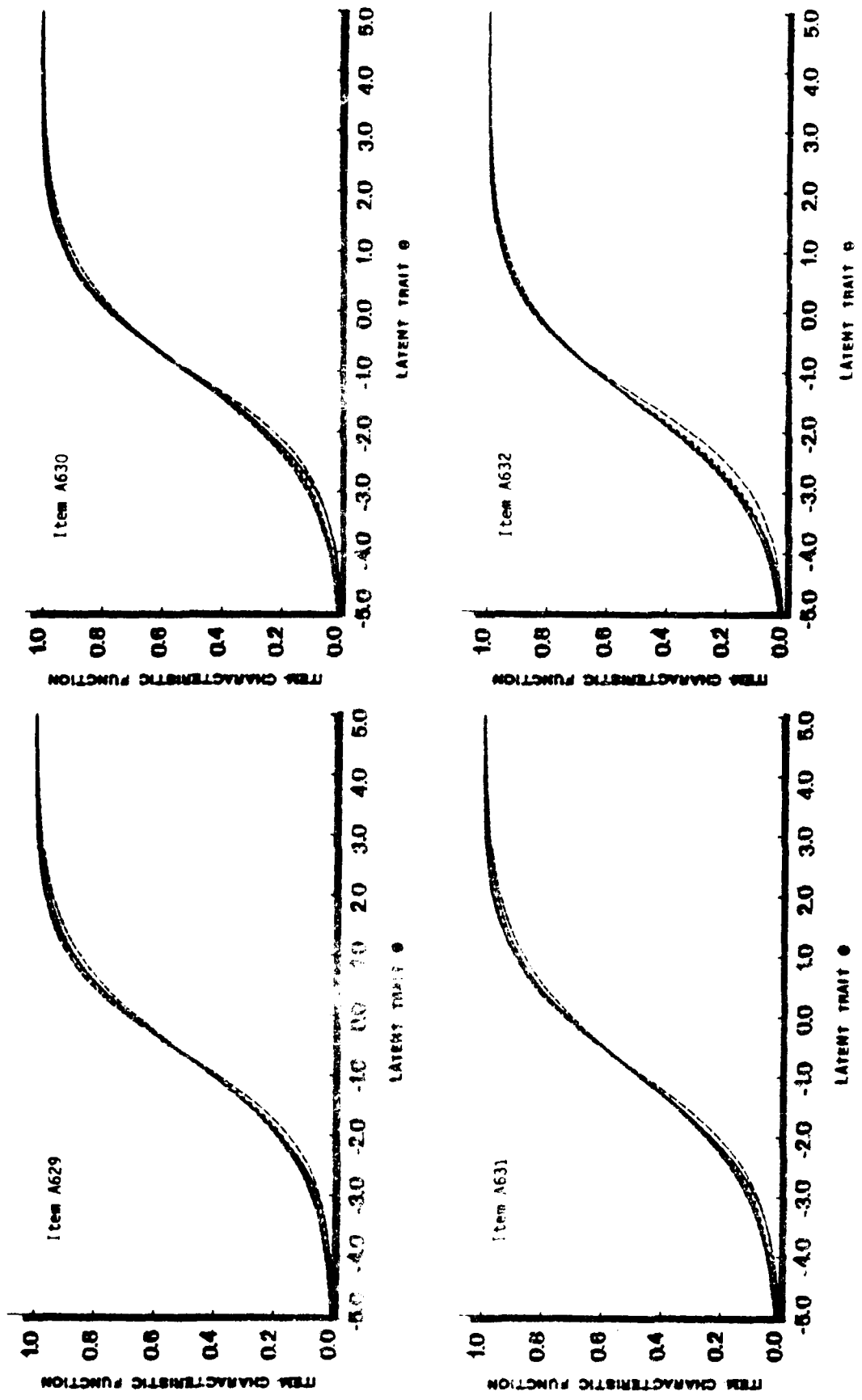


FIGURE 9-2 (Continued)

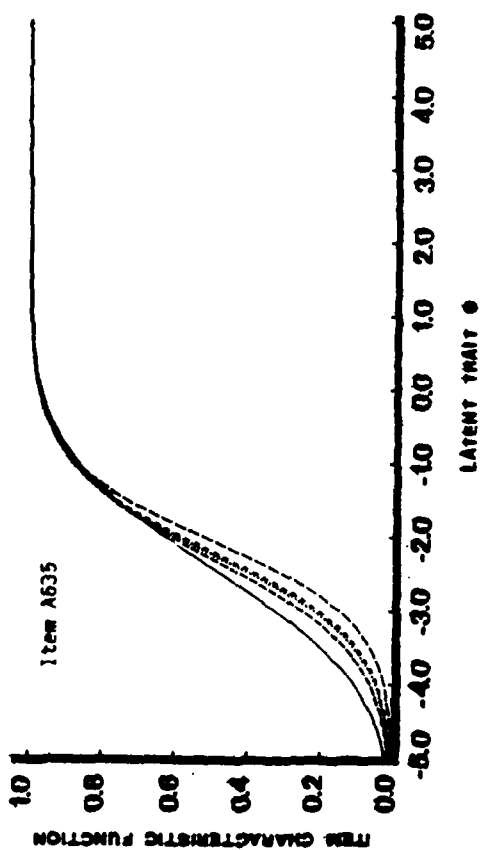
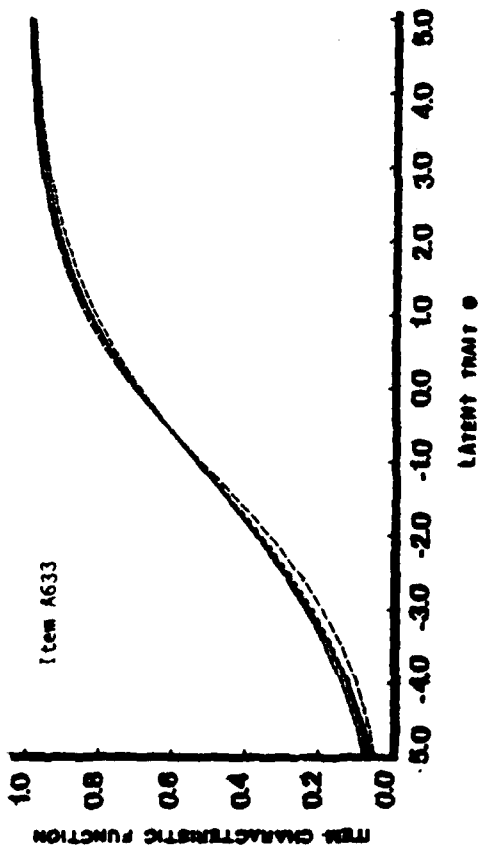
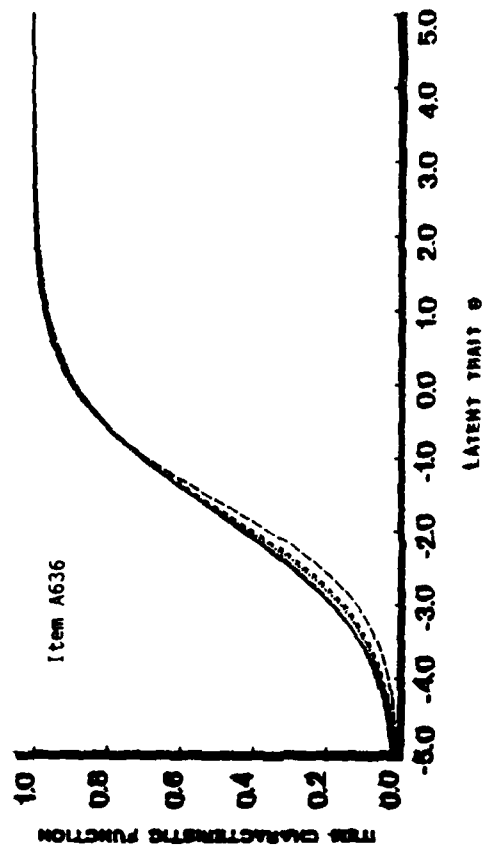
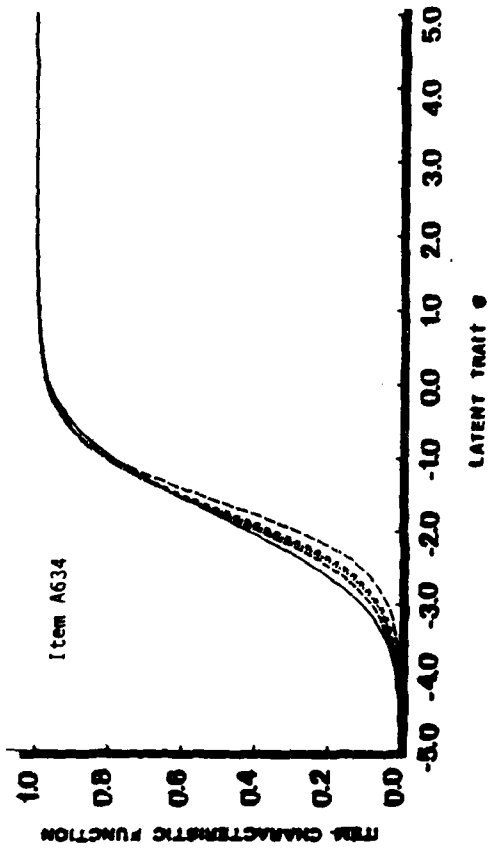


FIGURE 9-2 (Continued)

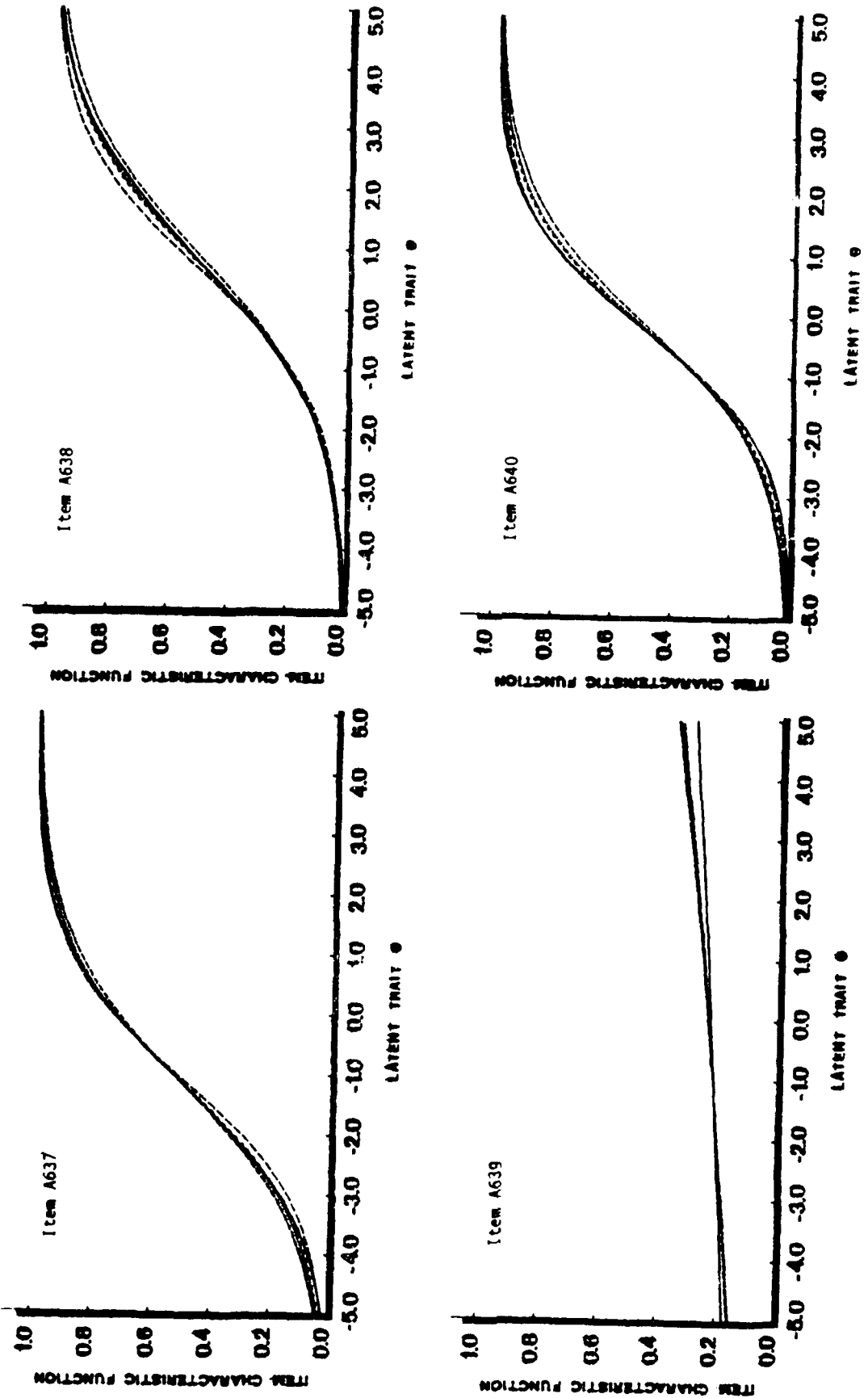


FIGURE 9-2 (Continued)

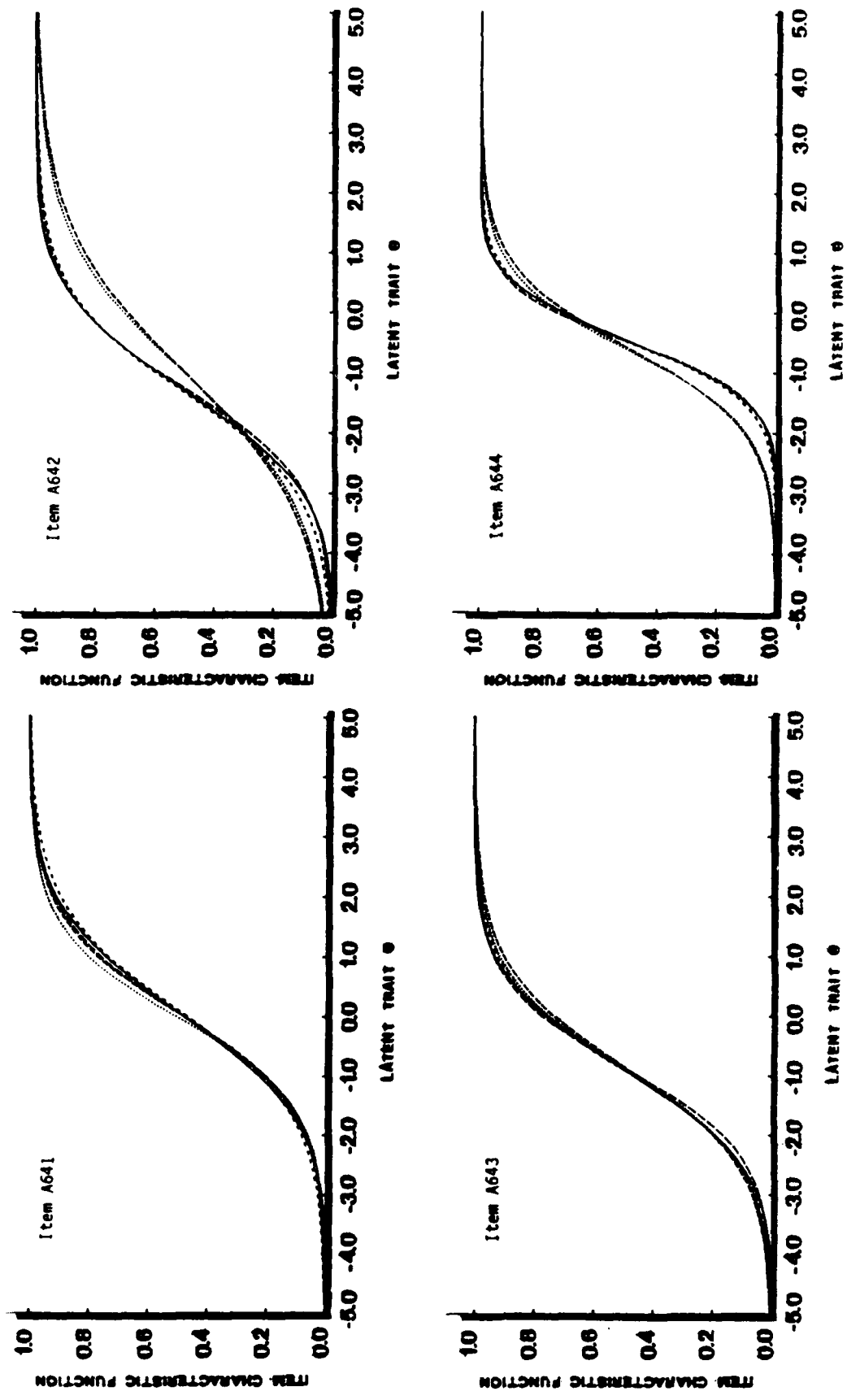


FIGURE 9-2 (Continued)

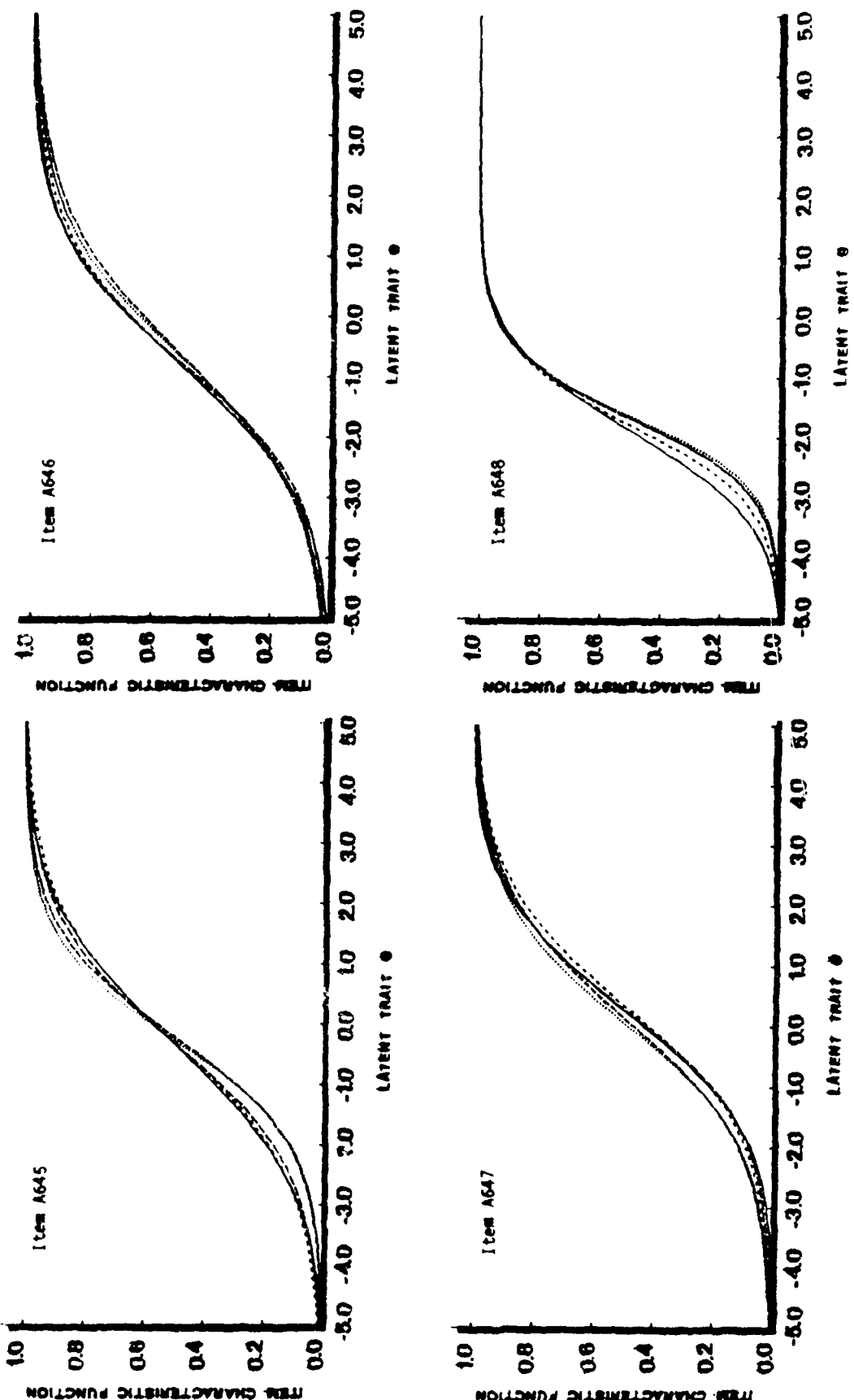


FIGURE 9-2 (Continued)

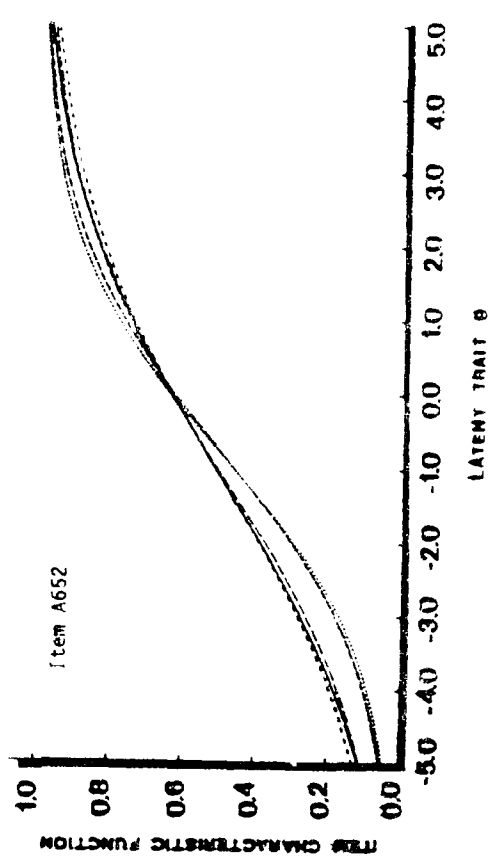
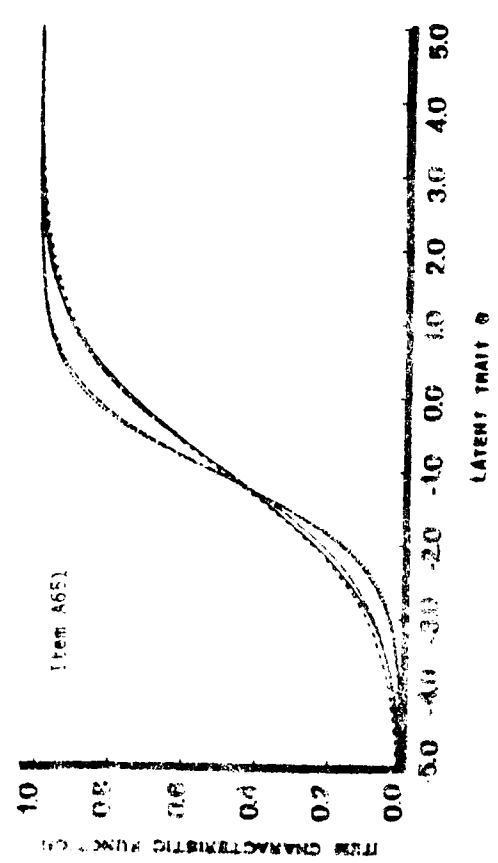
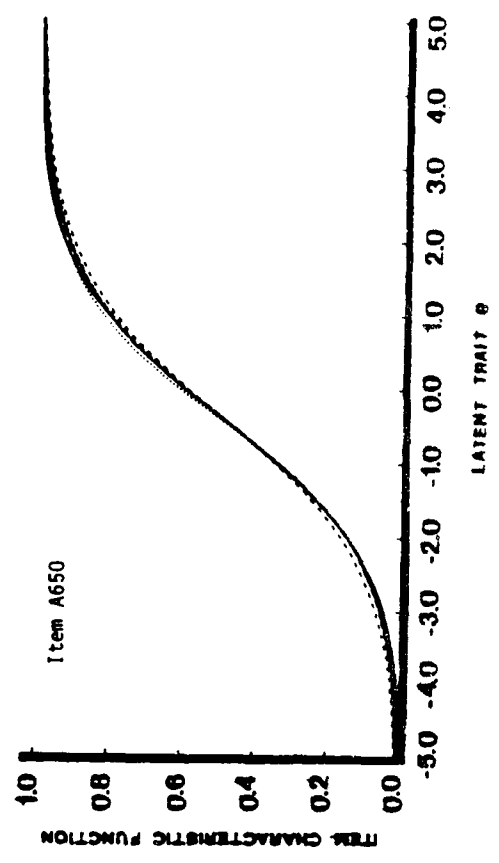
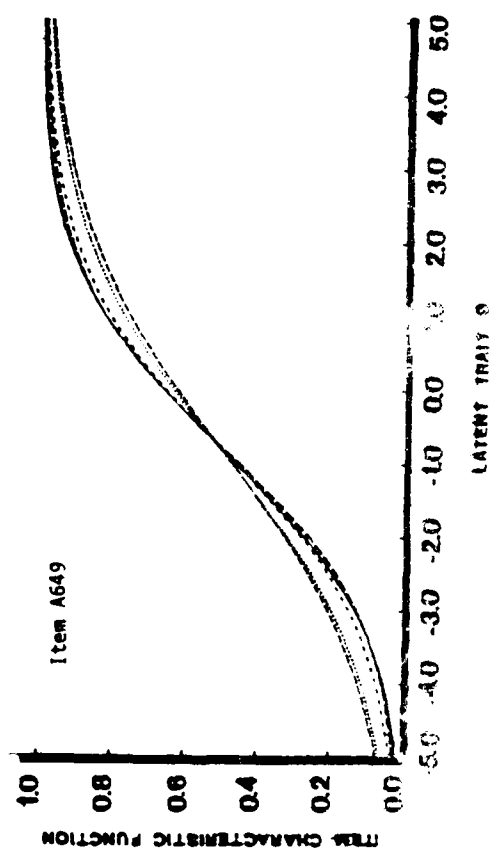


FIGURE 9-2 (Continued)

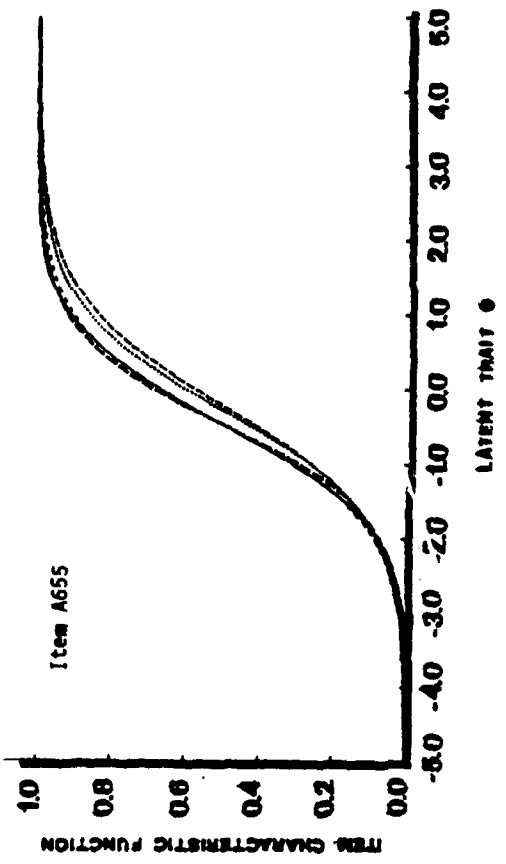
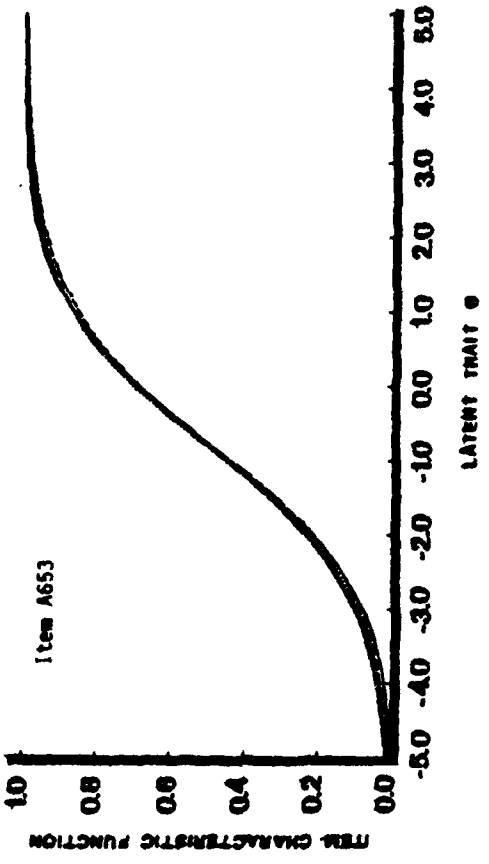
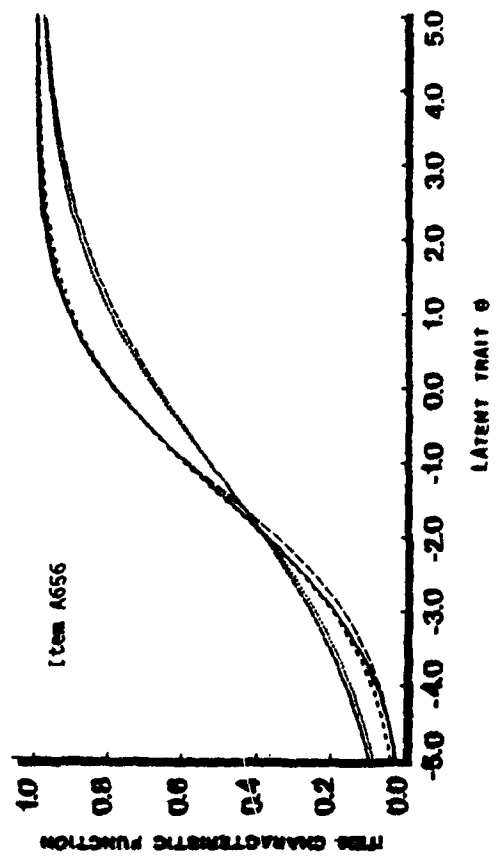
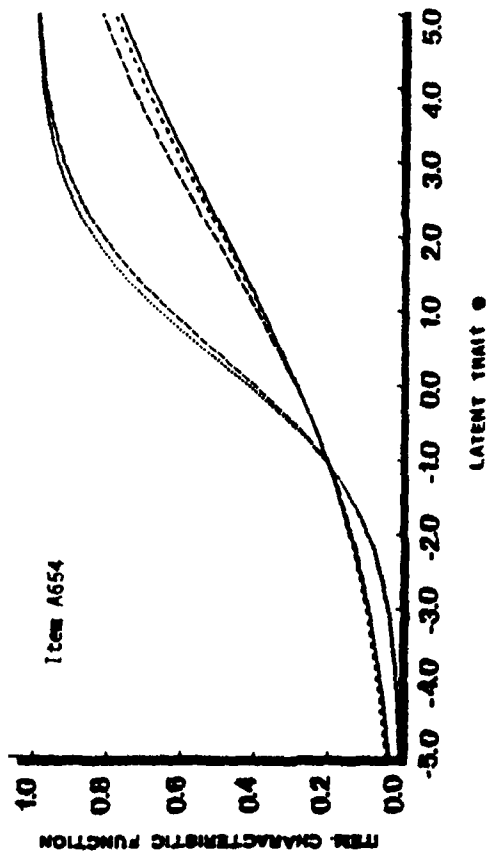


FIGURE 9-2 (Continued)

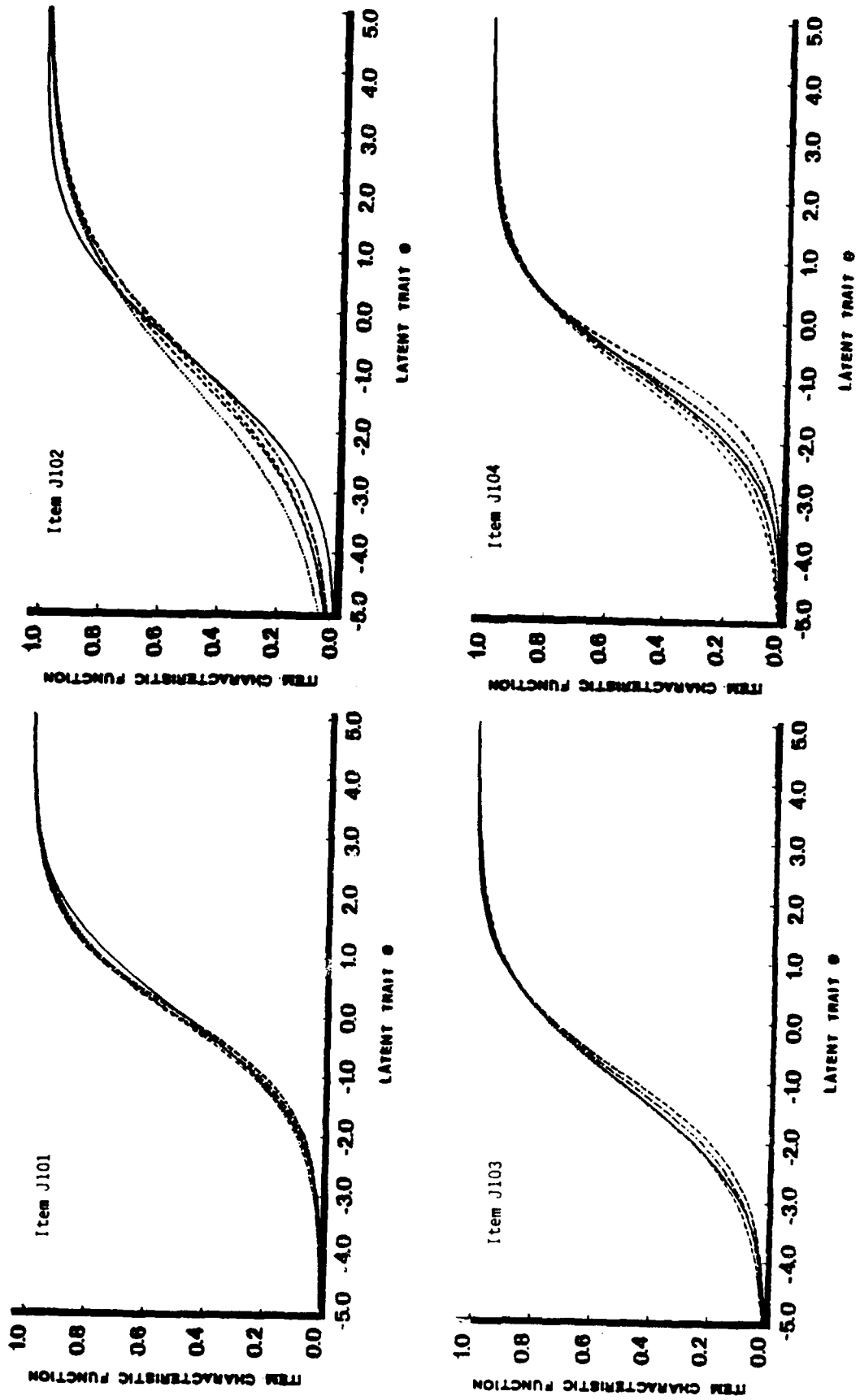


FIGURE 9-3

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Four Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Two of Which Are the Results of the J1-J2 Case Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), and the Other Two of Which Are the Results of the A5-A6-J1-J2 Case Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test J1.

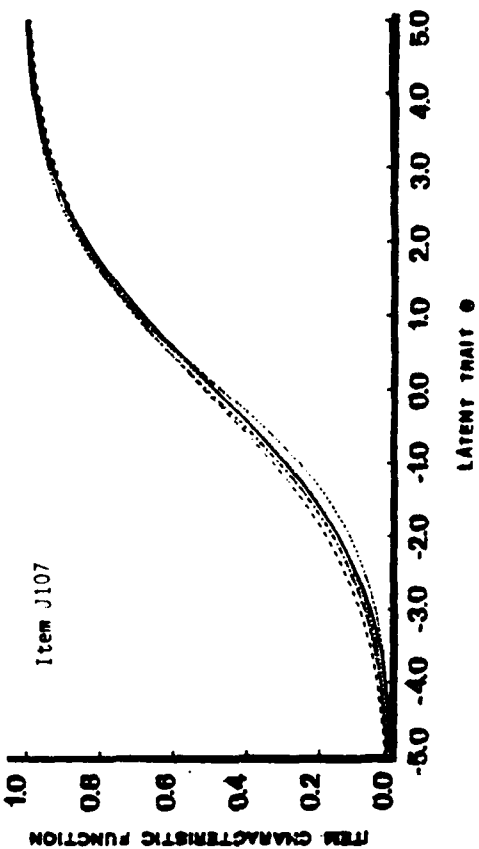
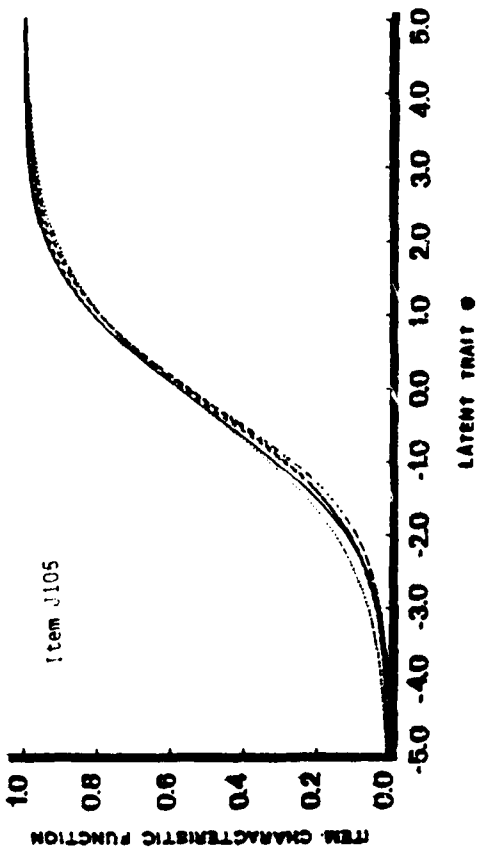
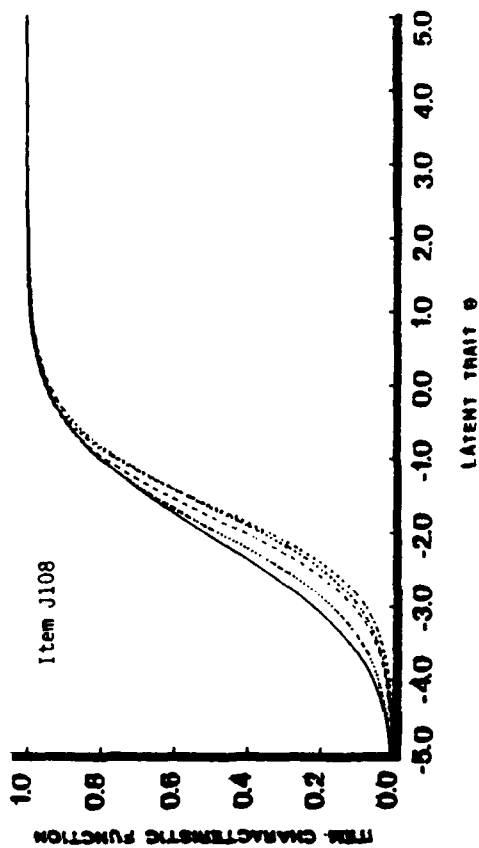
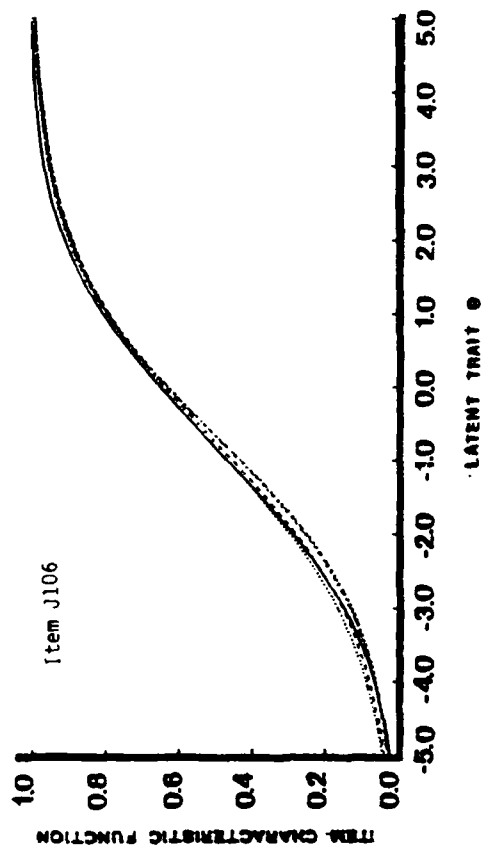


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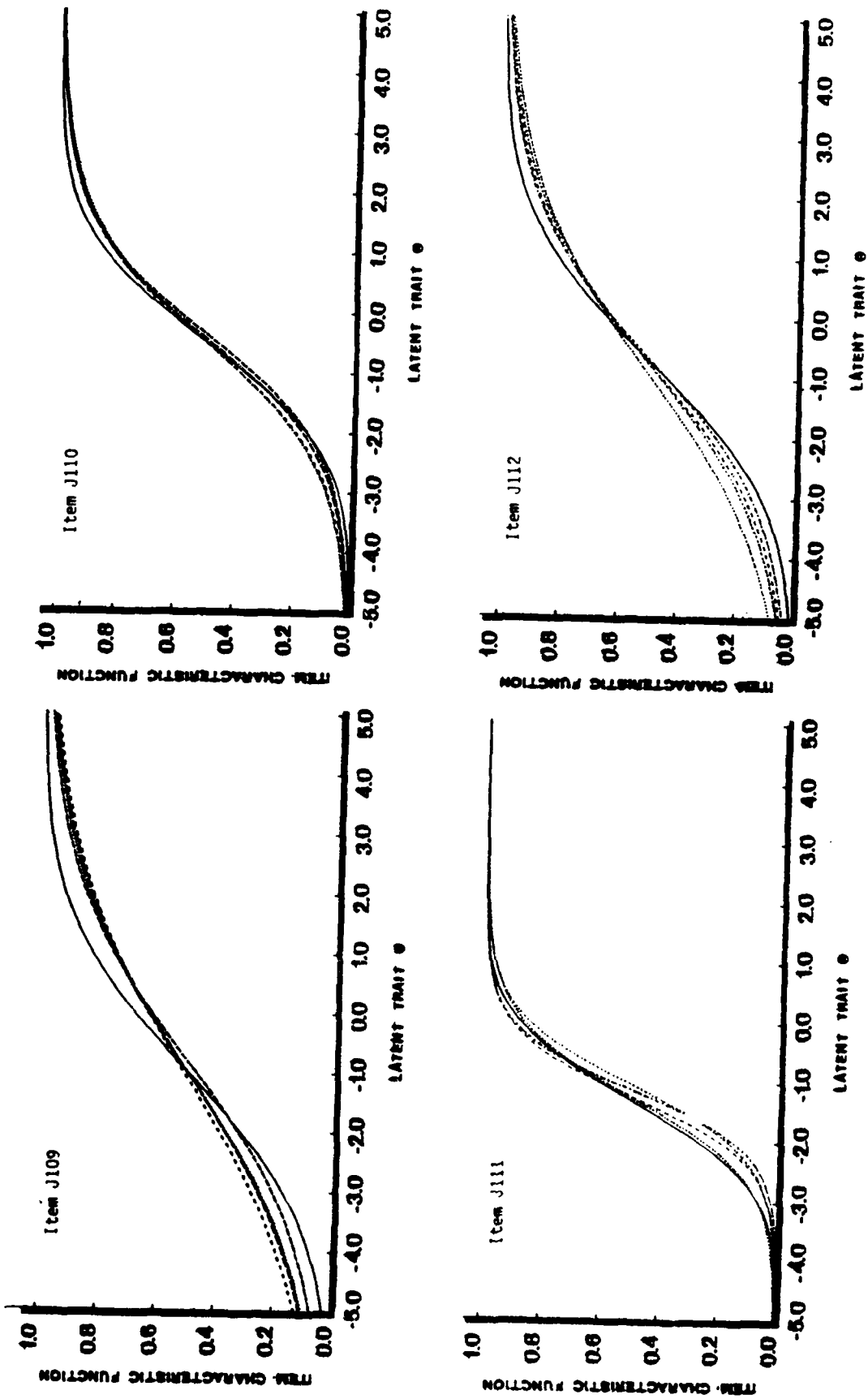


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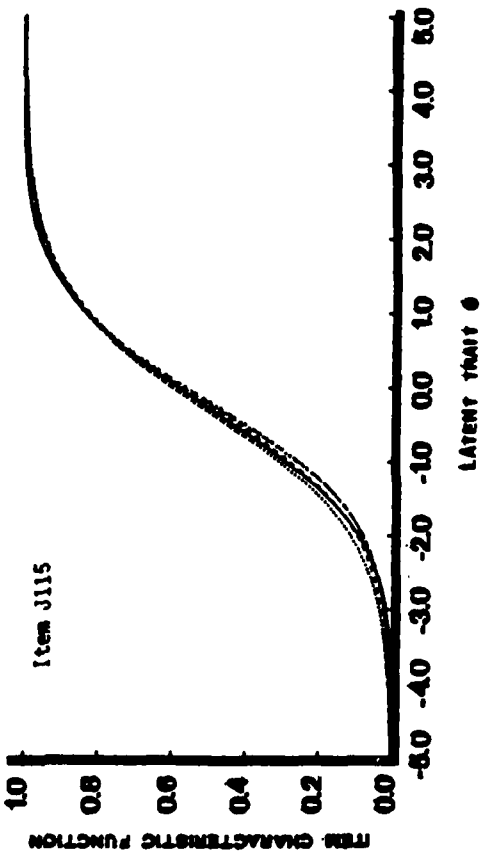
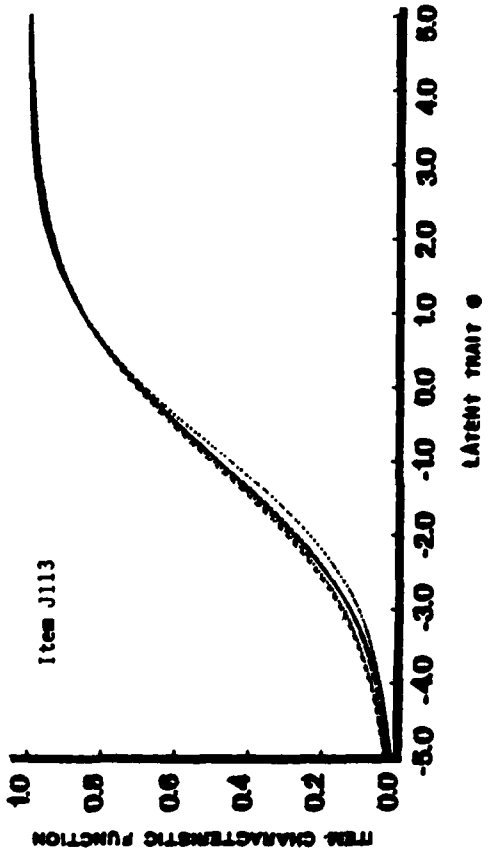
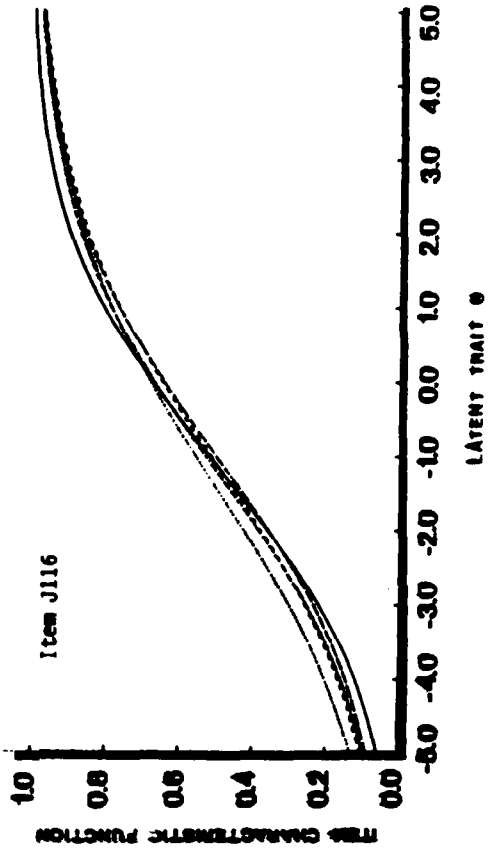
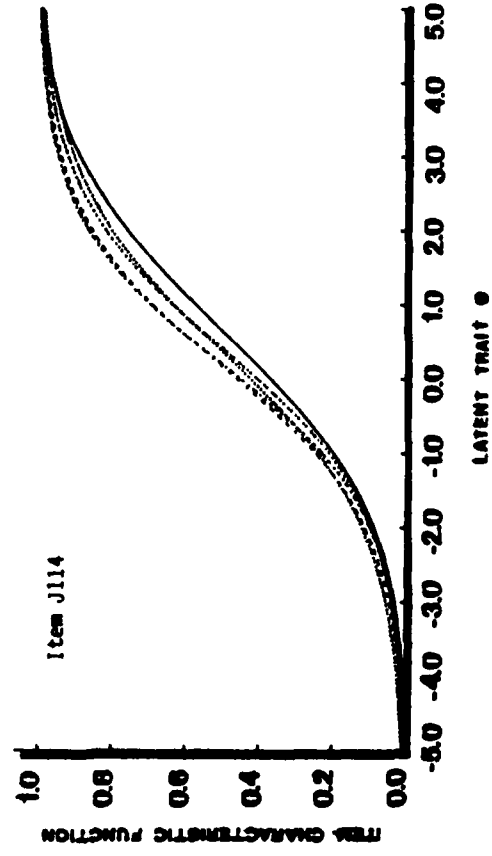


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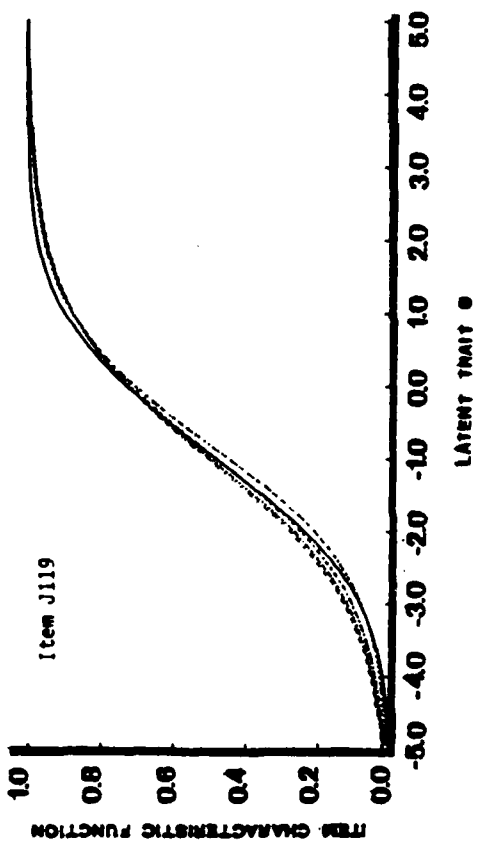
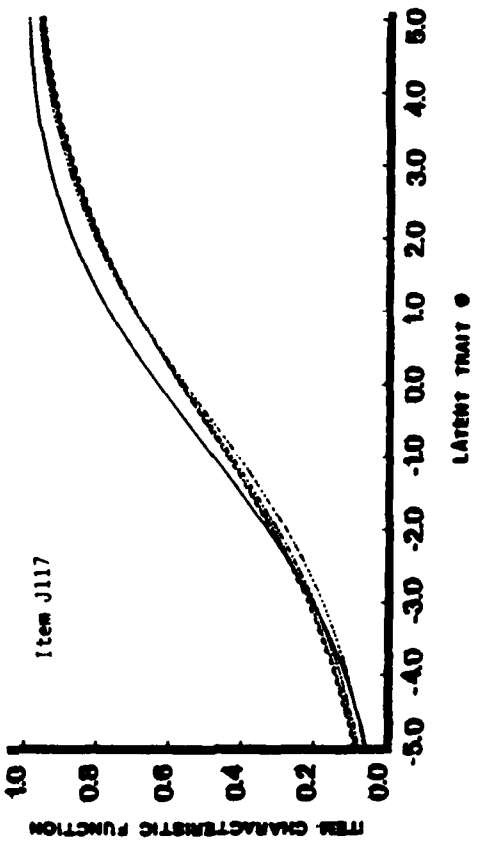
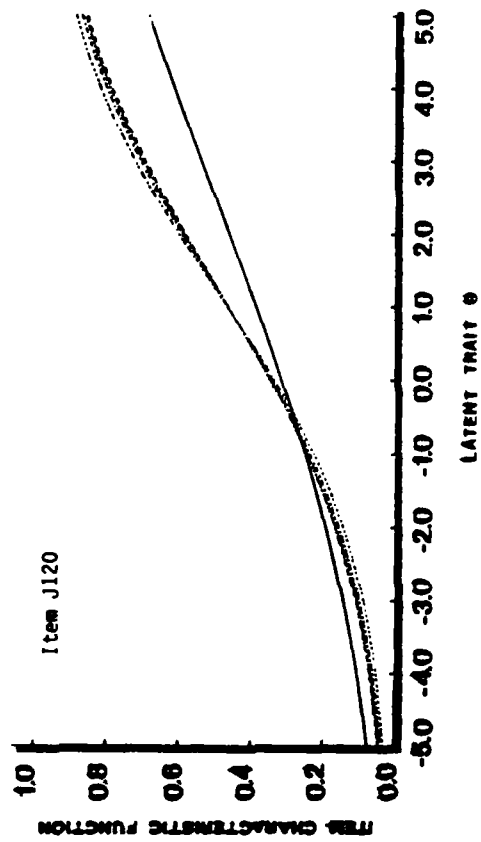
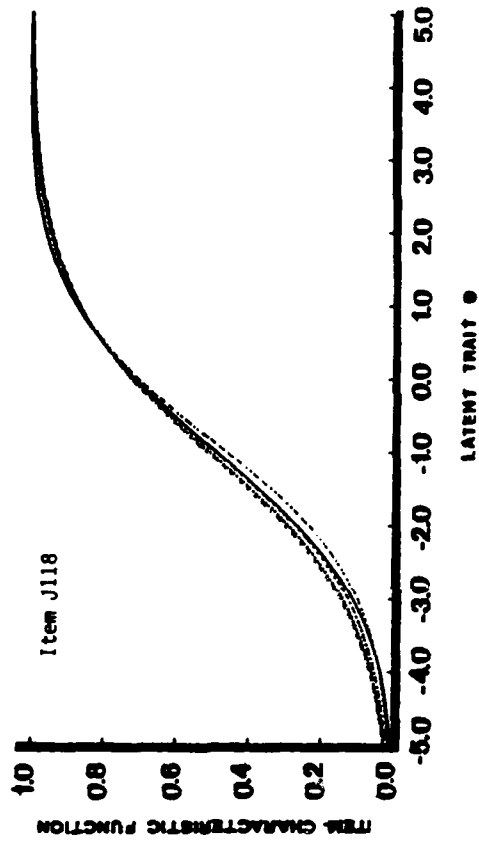


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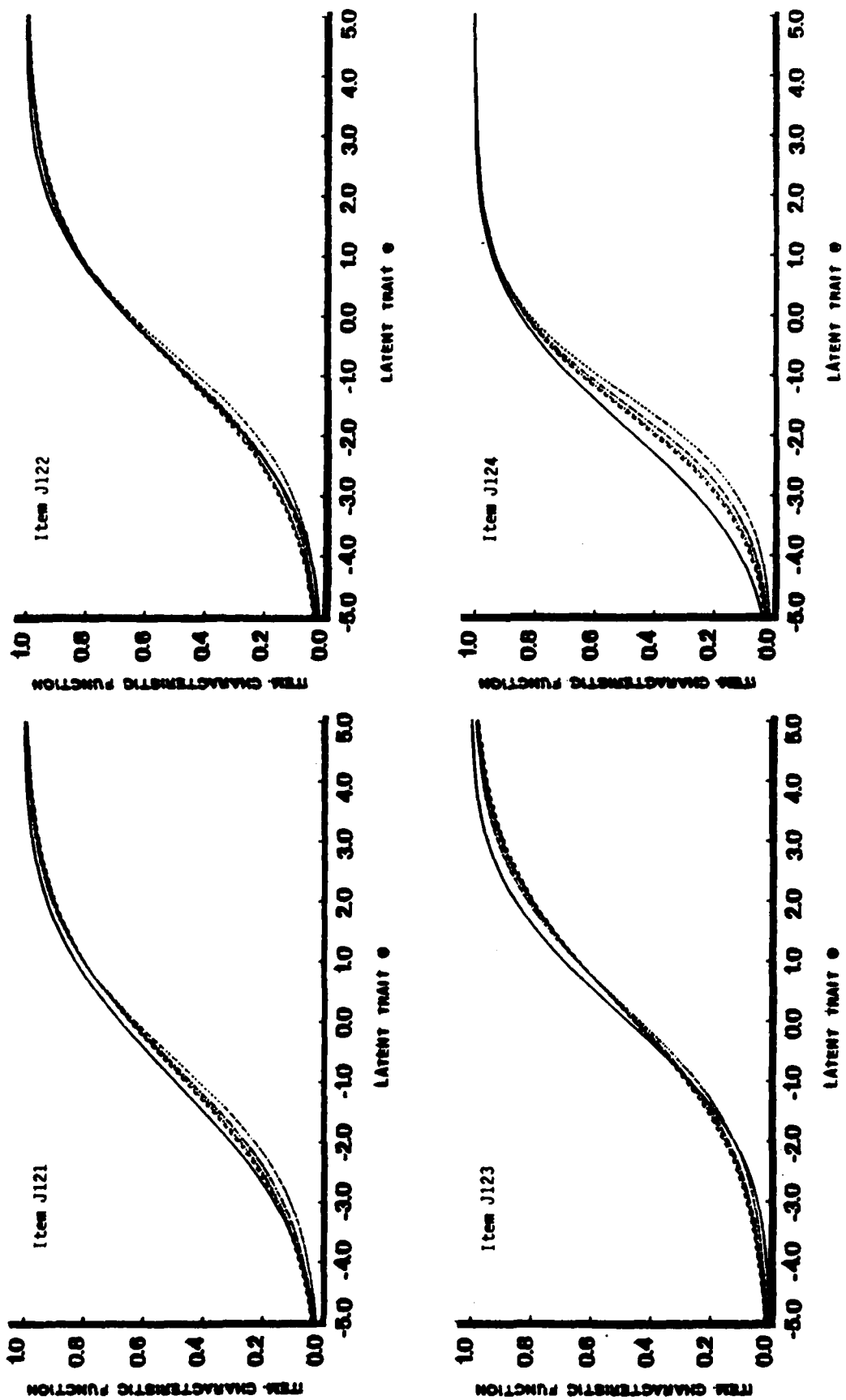


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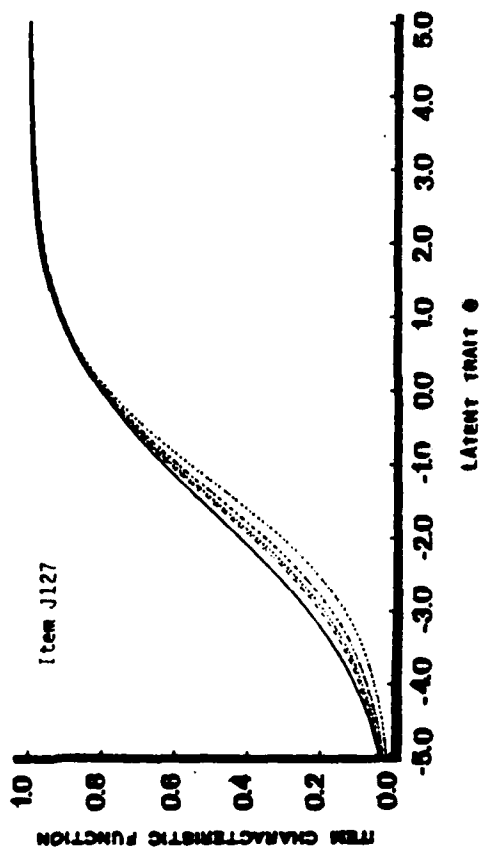
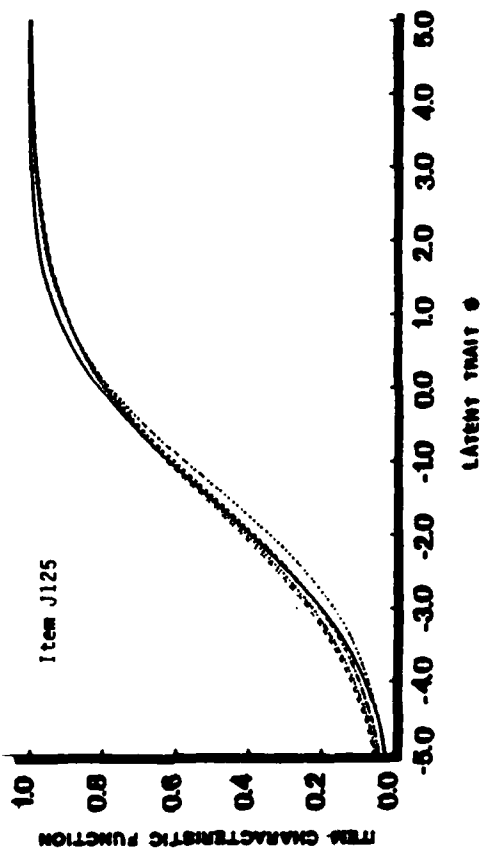
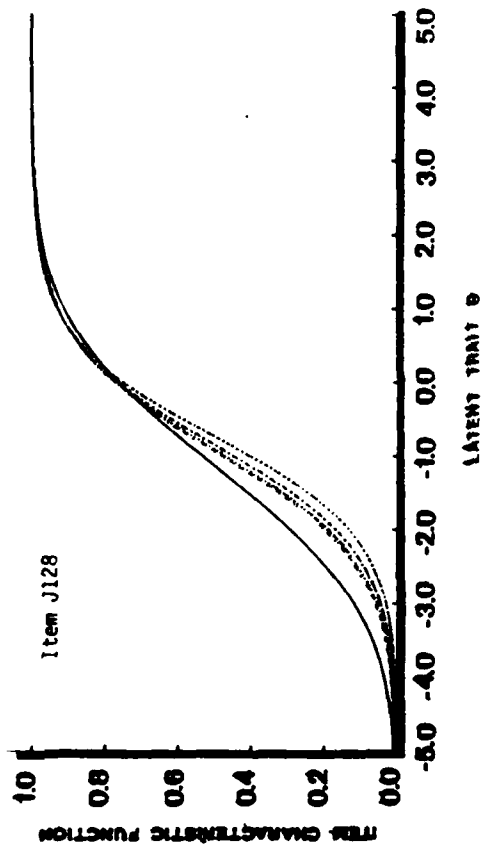
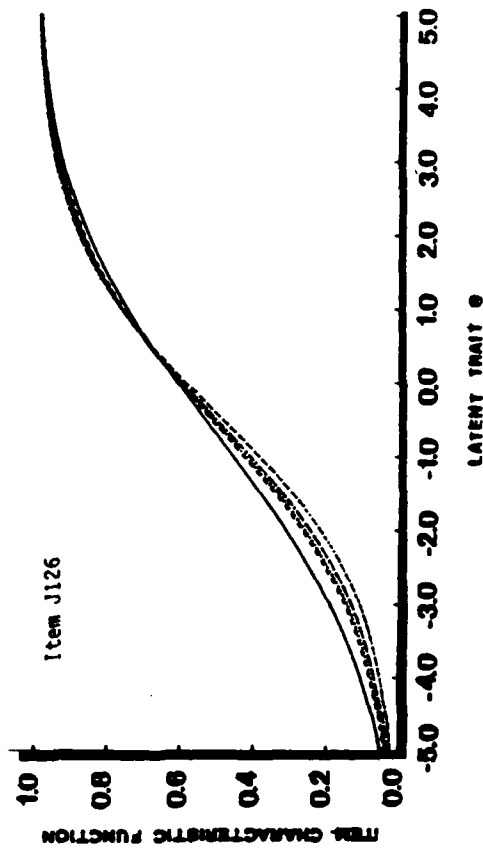


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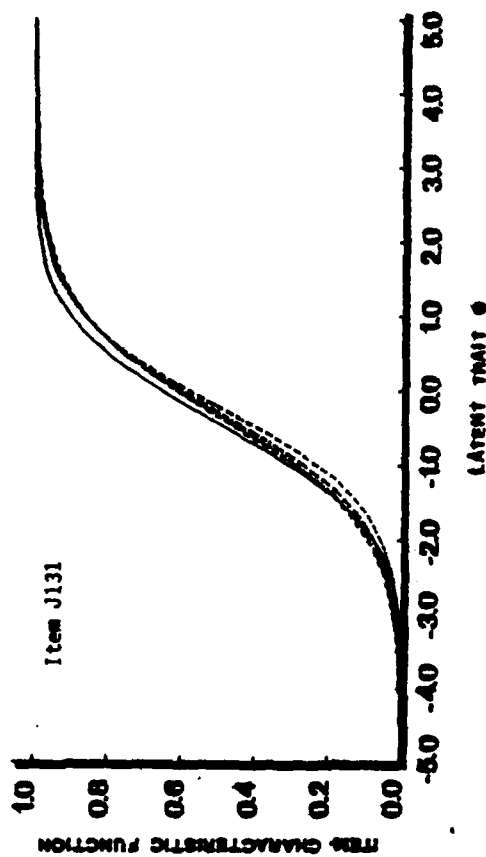
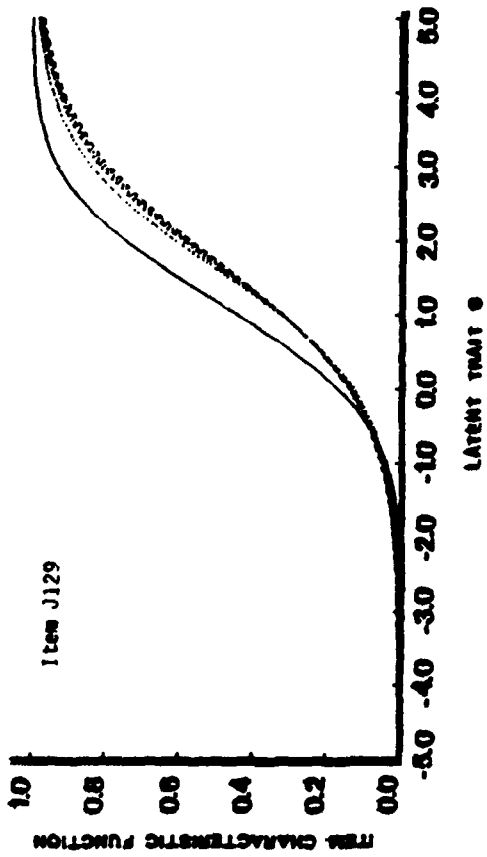
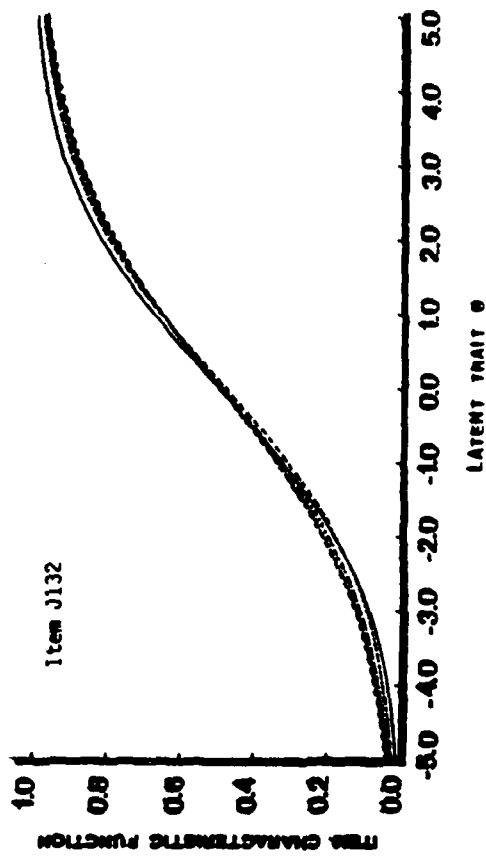
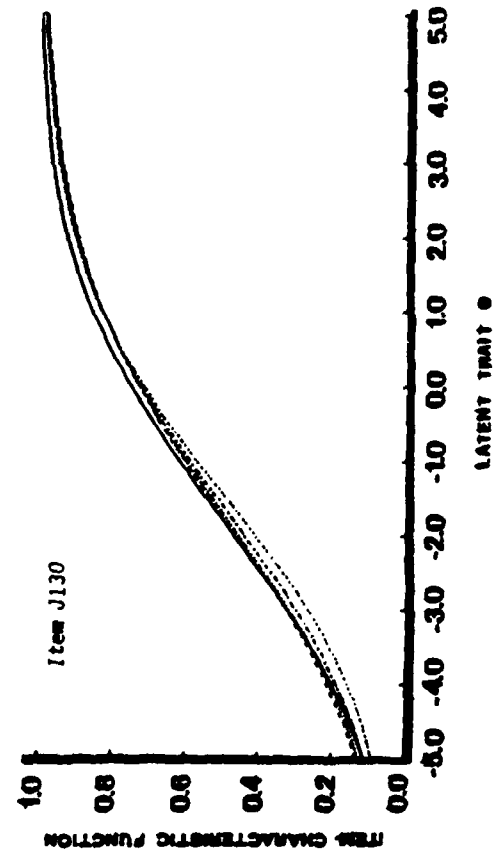


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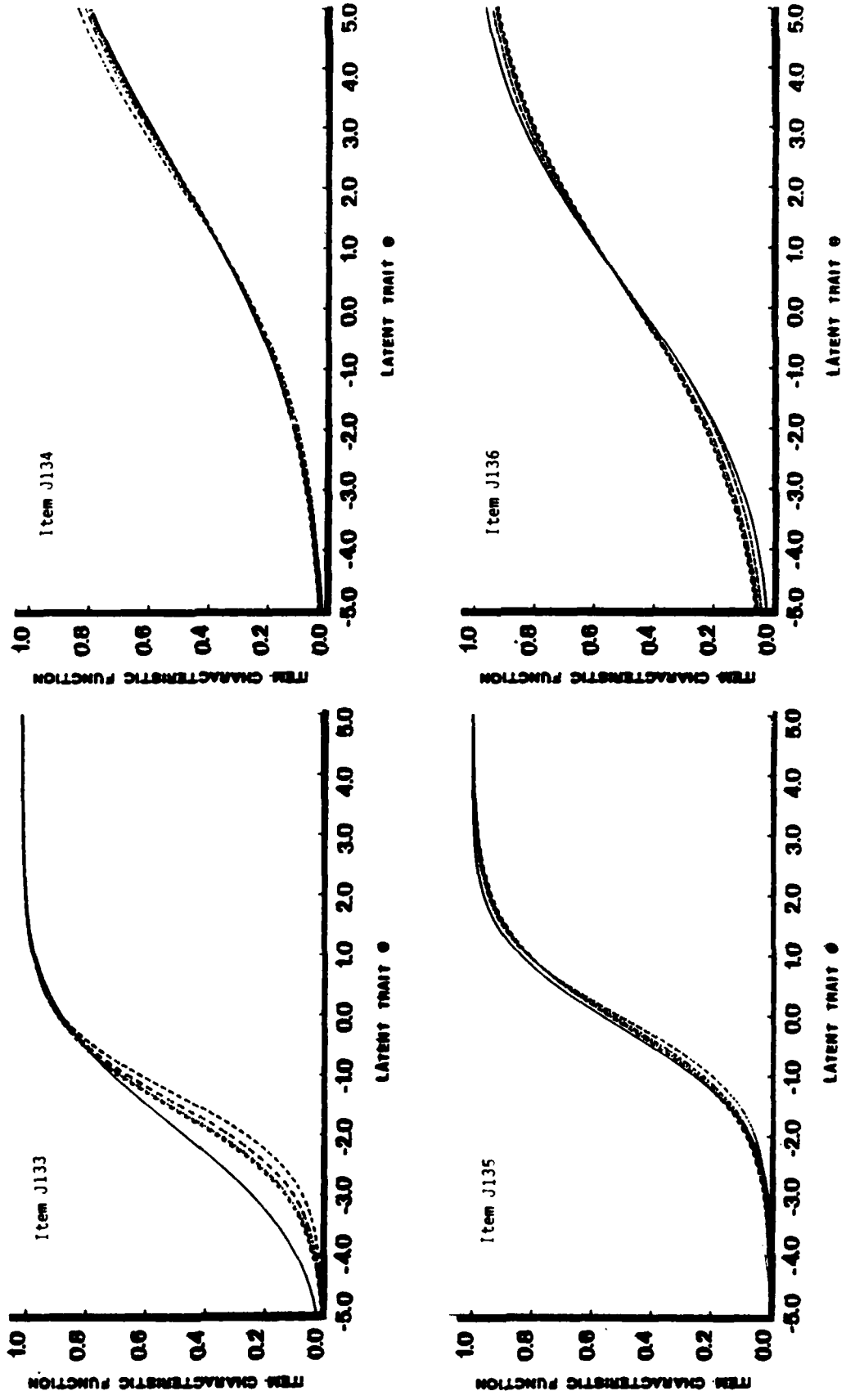


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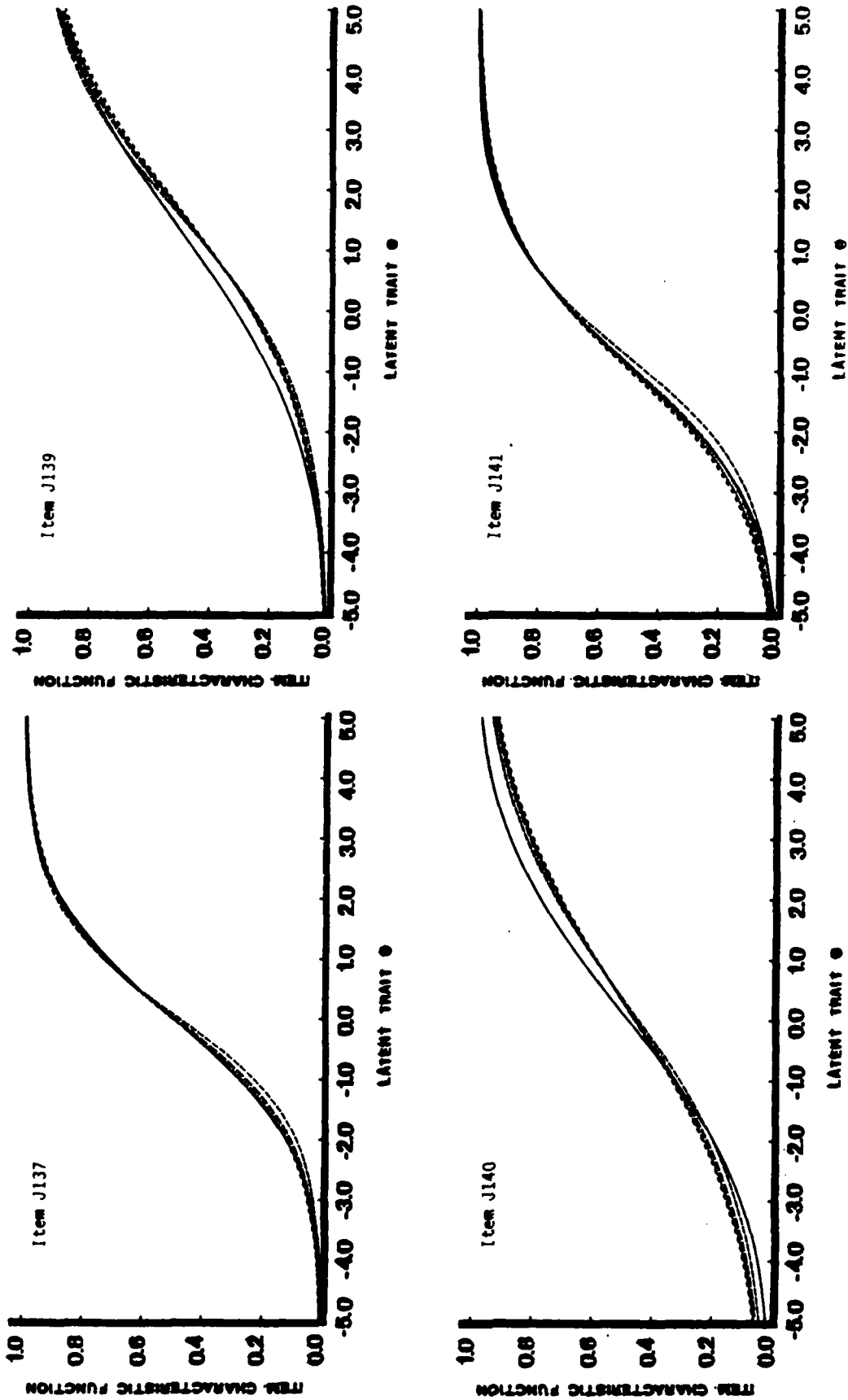


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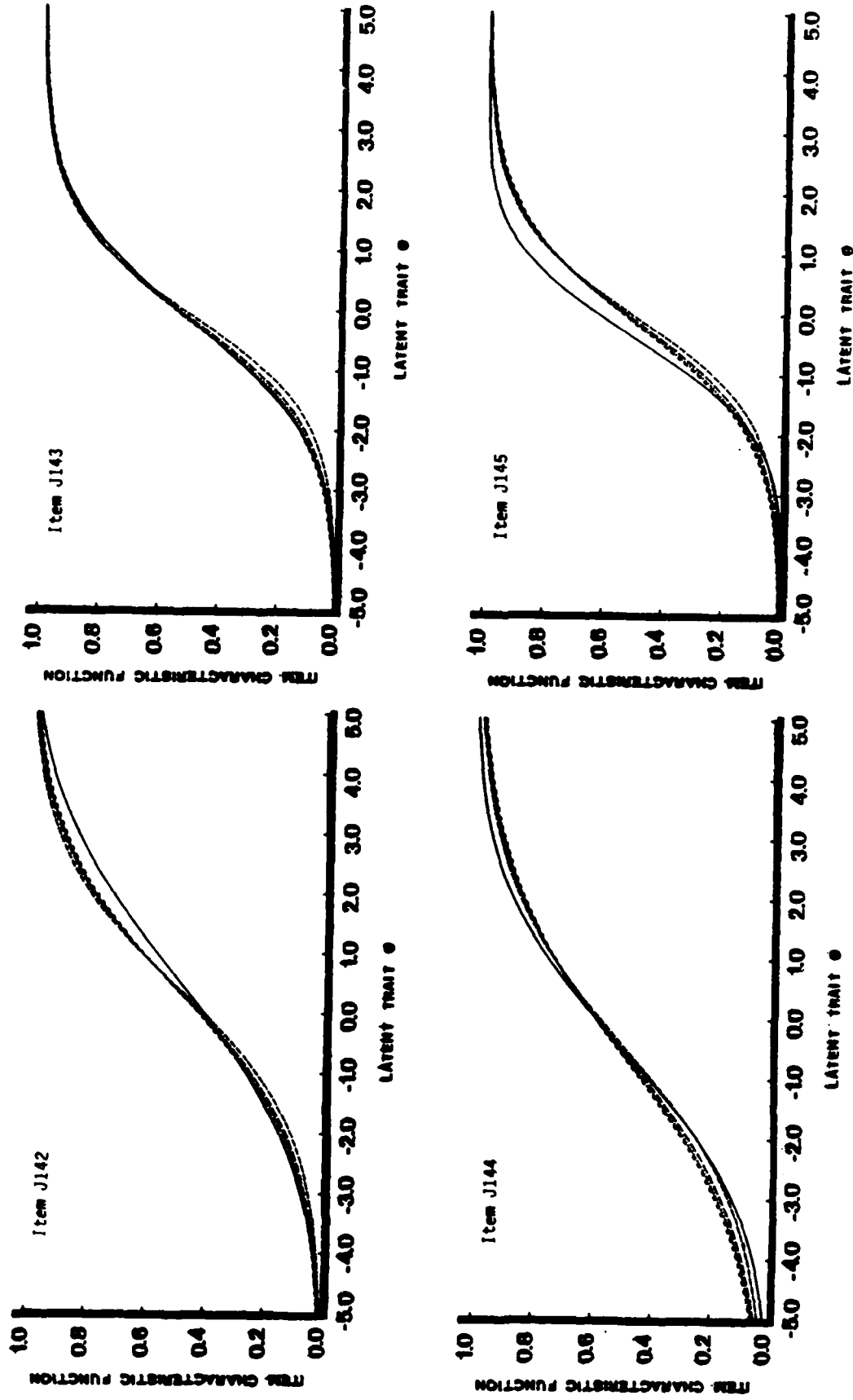


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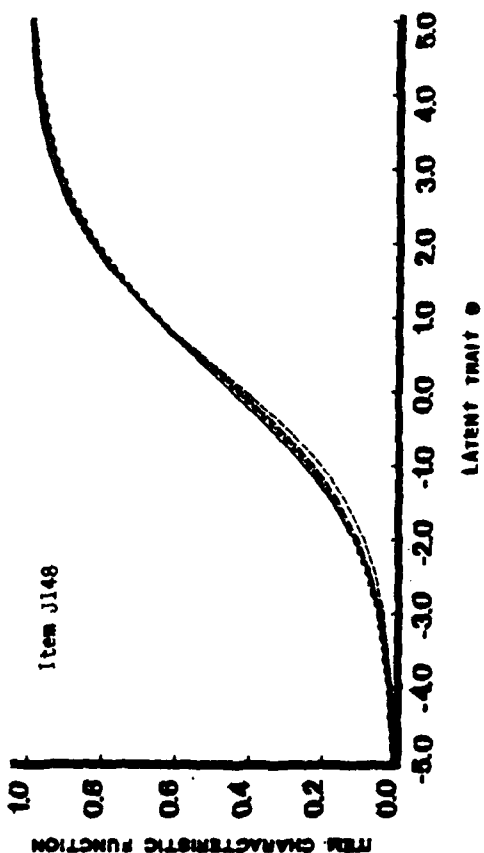
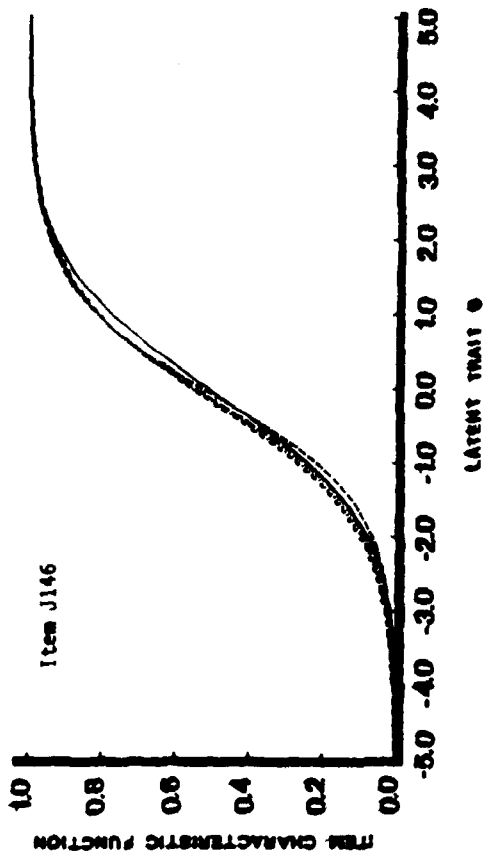
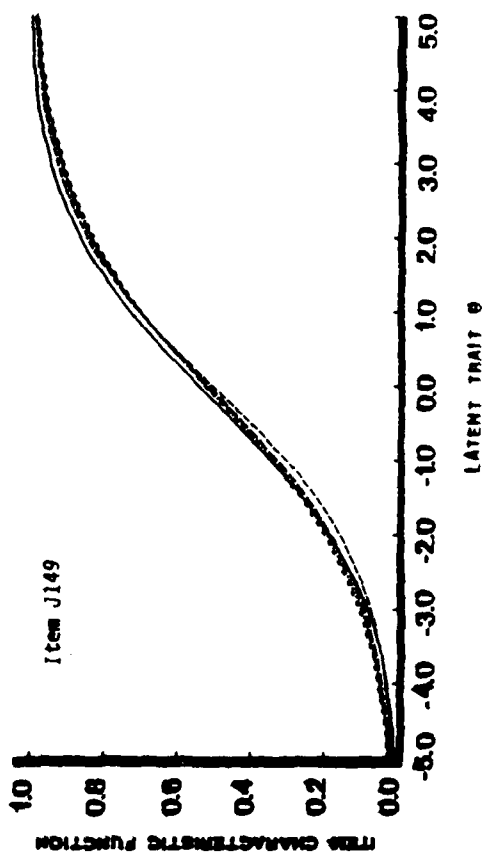
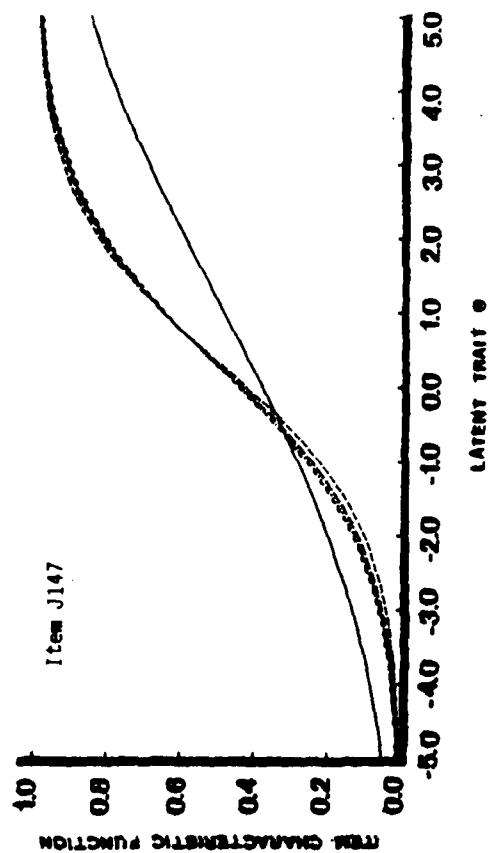


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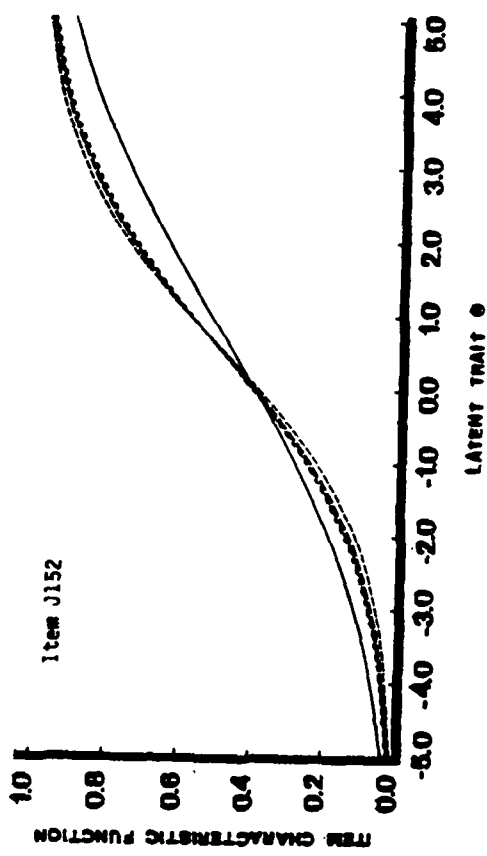
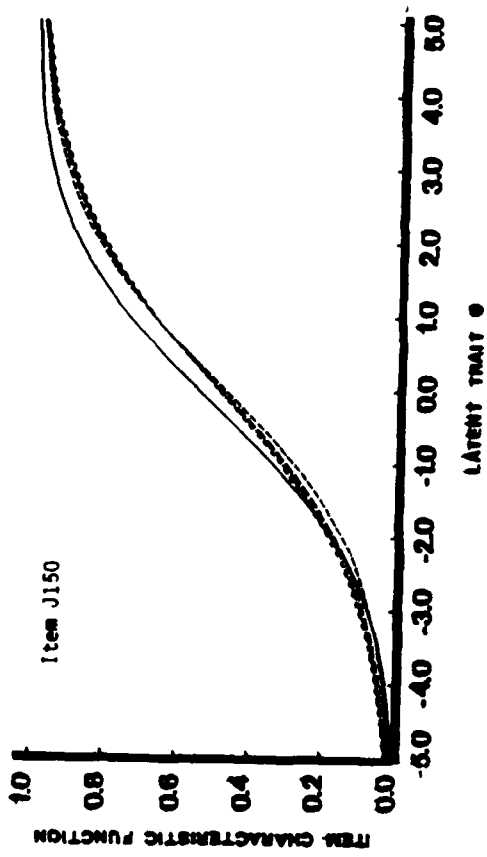
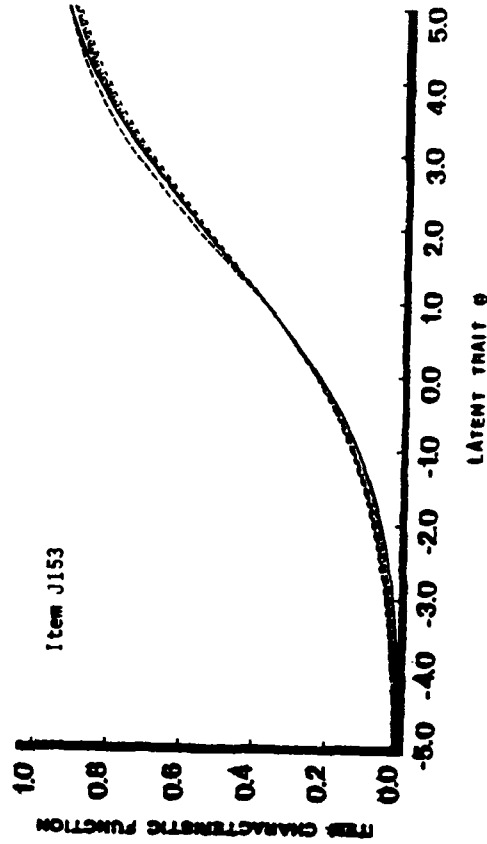
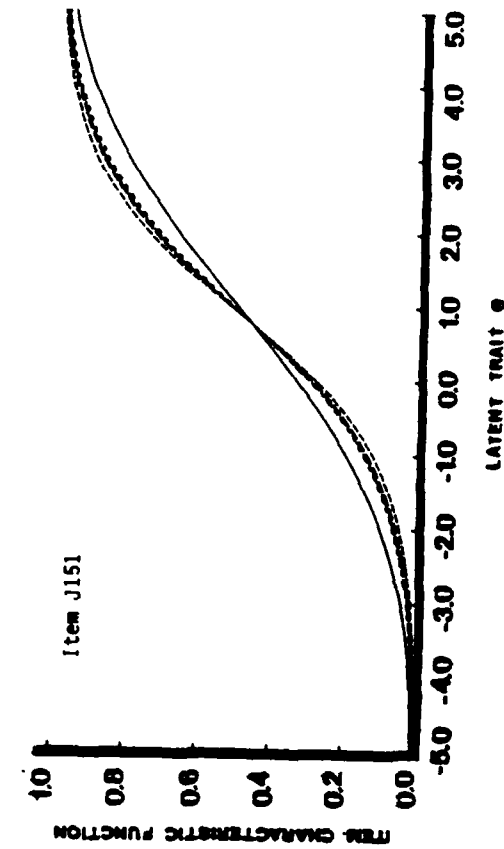


FIGURE 9-3 (Continued)

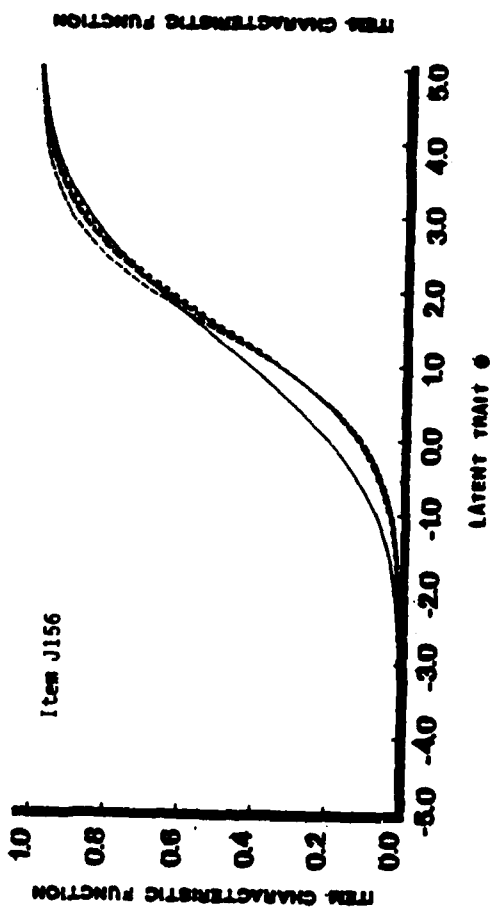
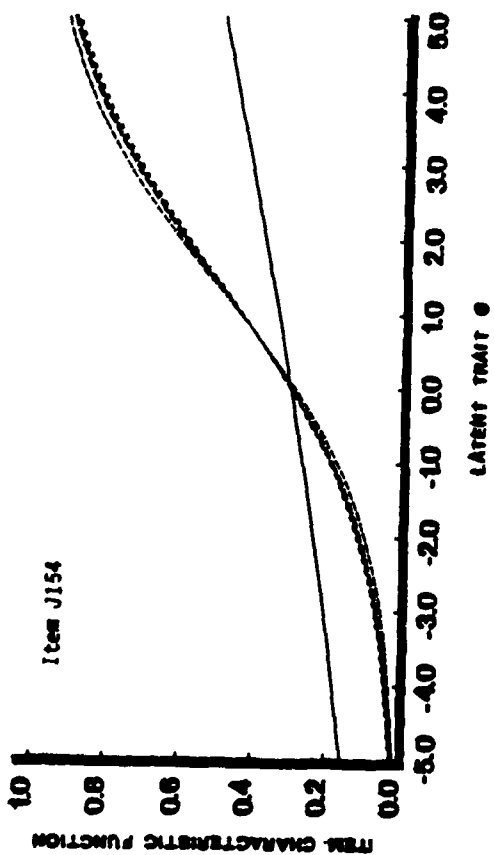
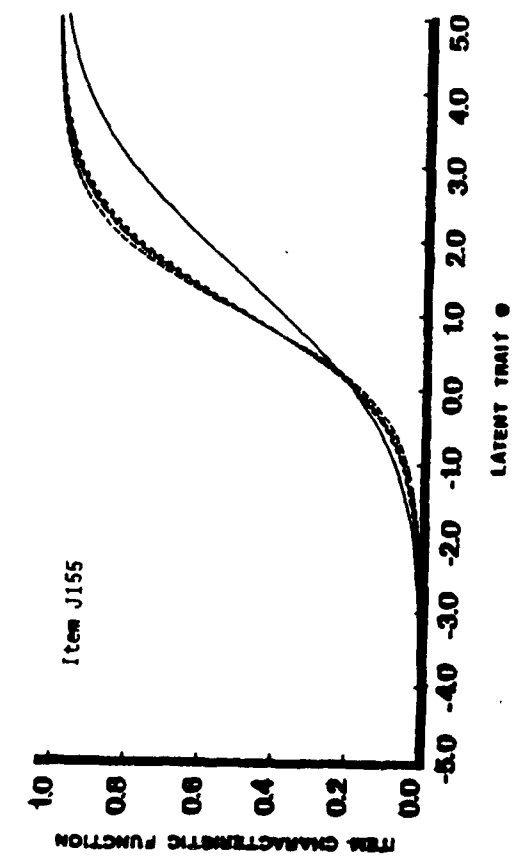


FIGURE 9-3 (Continued)

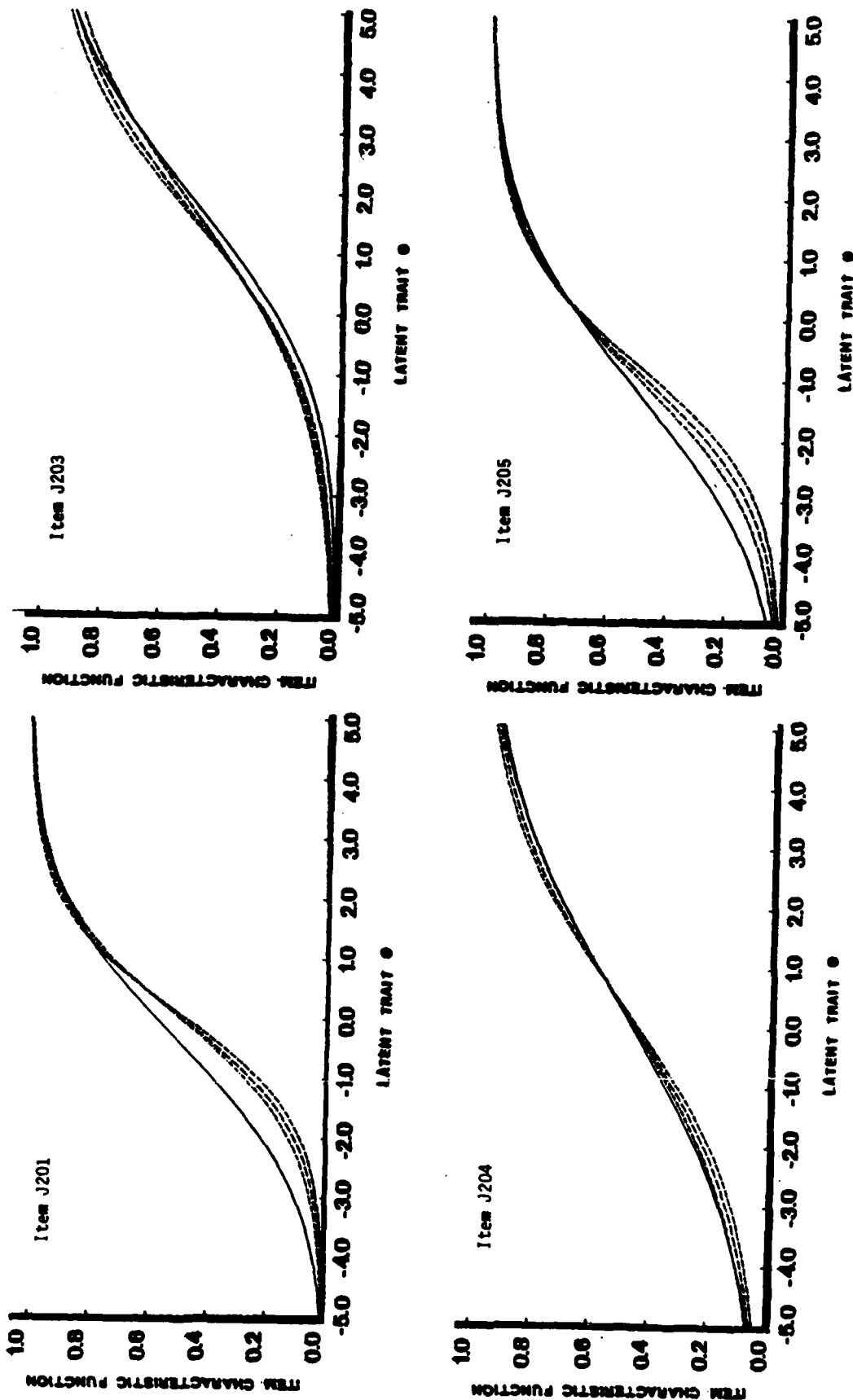


FIGURE 9-4

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Four Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Two of Which Are the Results of the J1-J2 Case Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), And the Other Two of Which Are the Results of the A5-A6-J1-J2 Case Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test J2.

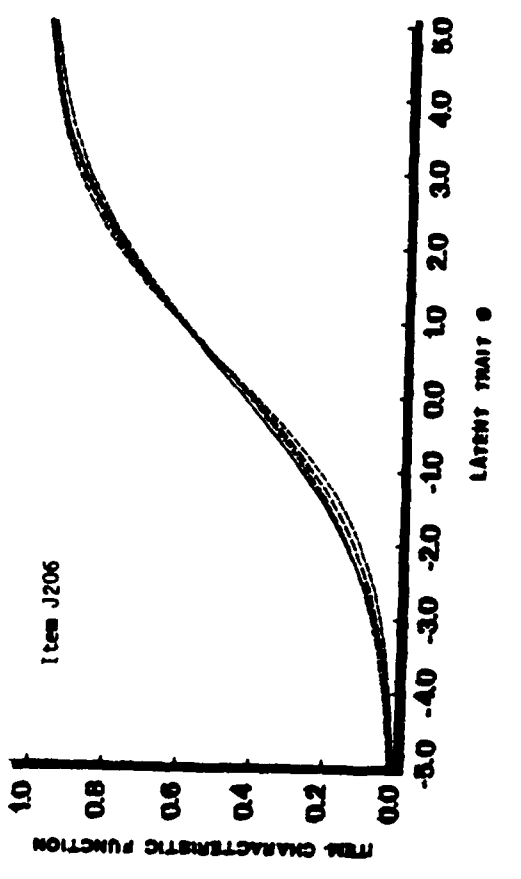
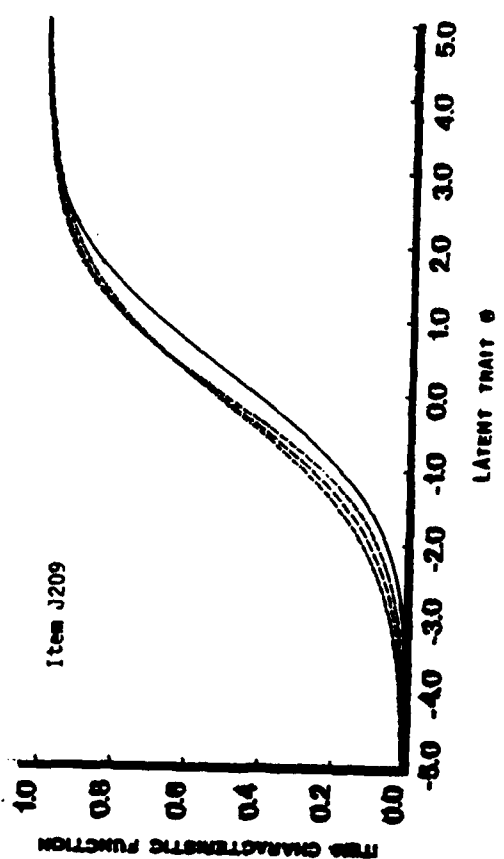
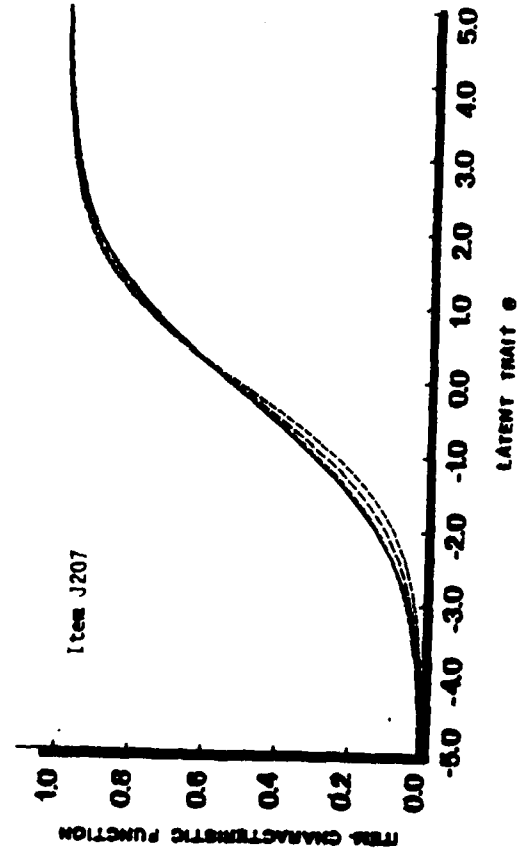


FIGURE 9-4 (Continued)

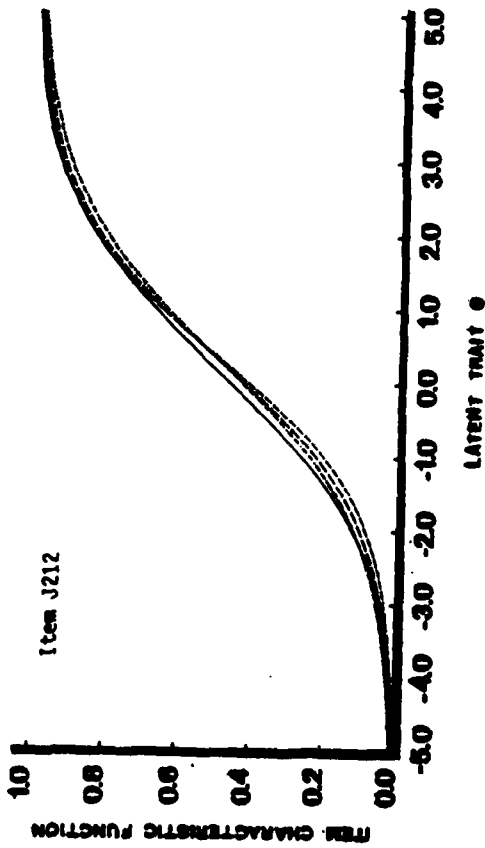
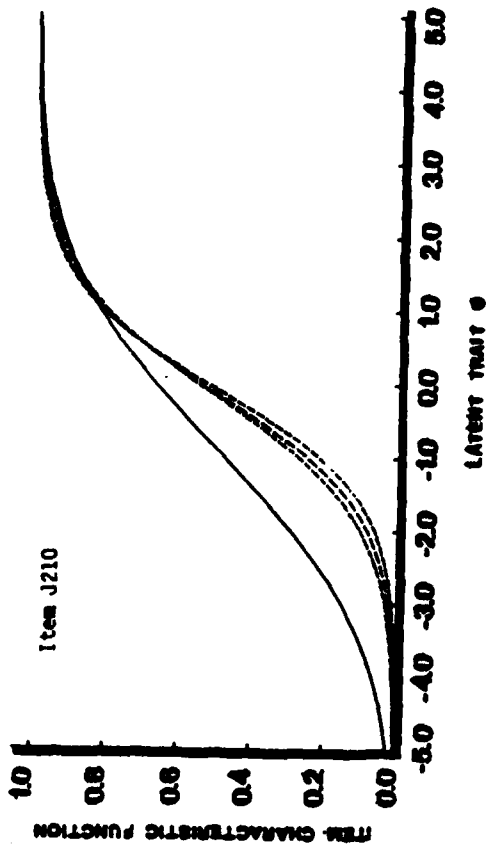
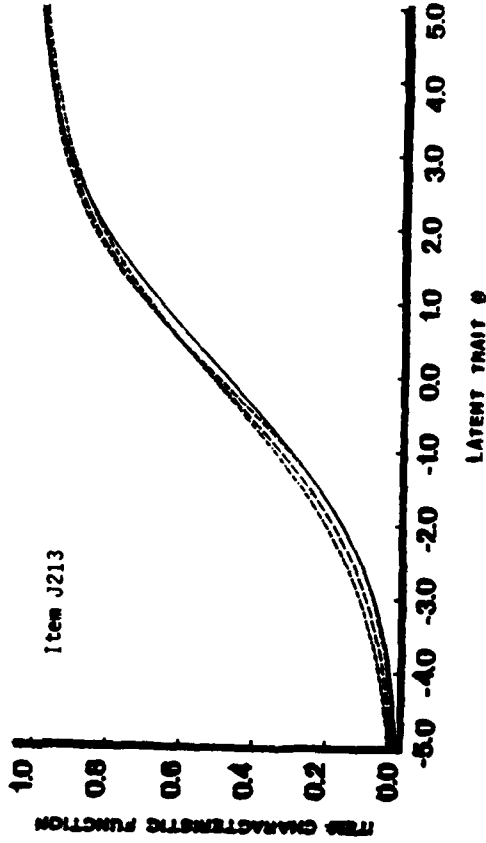
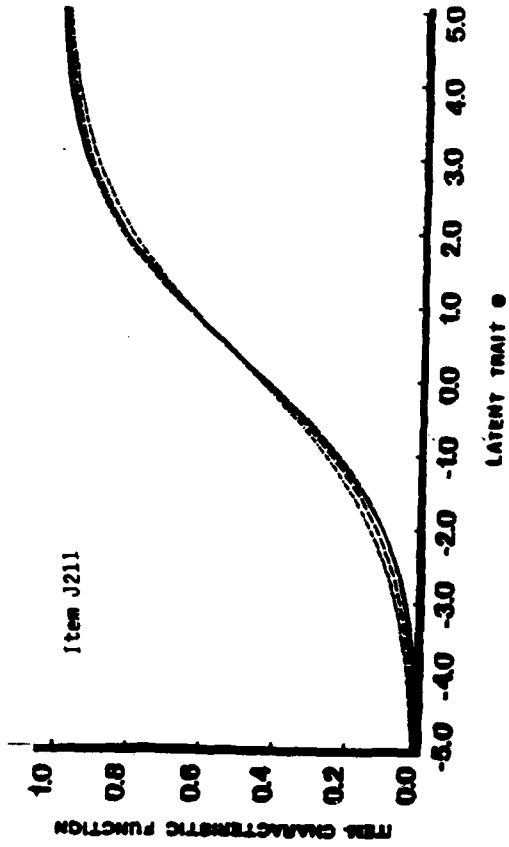


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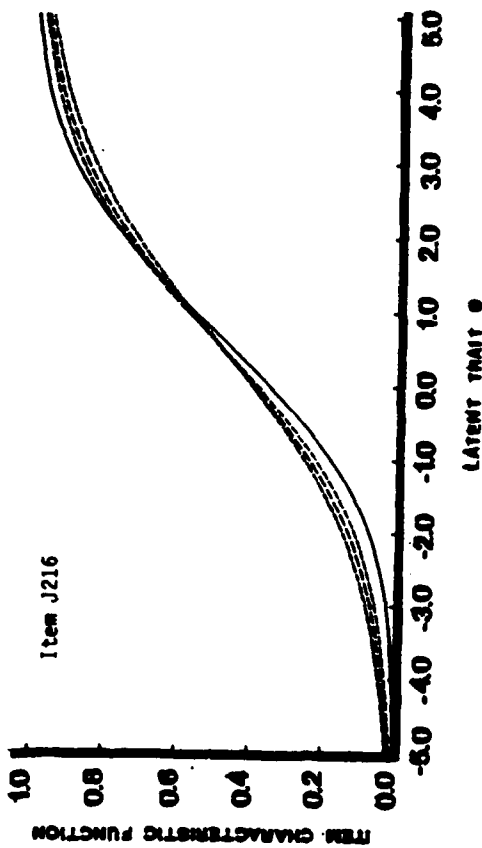
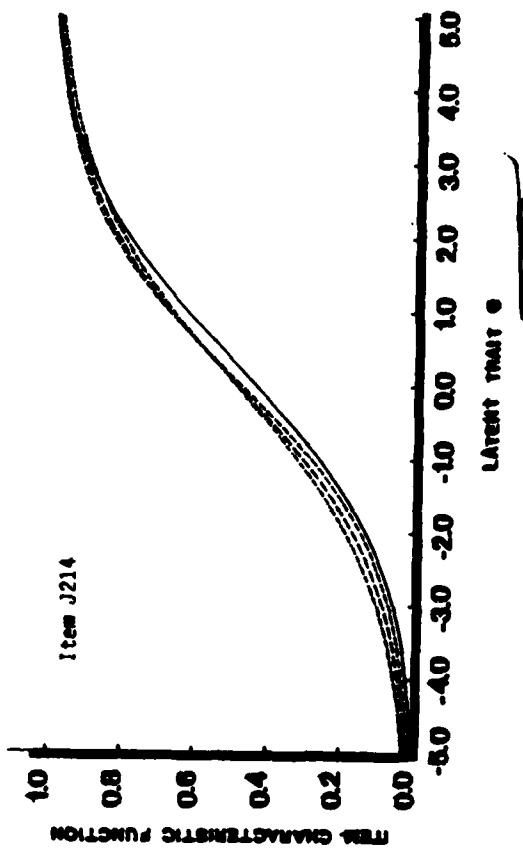
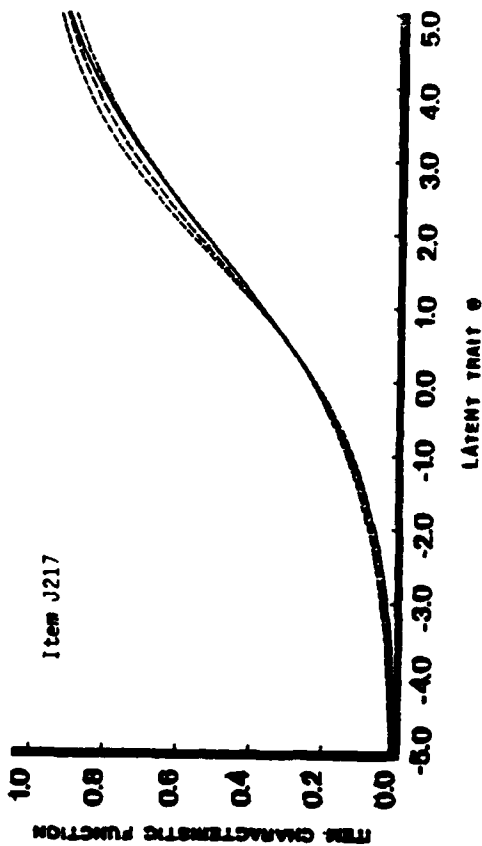
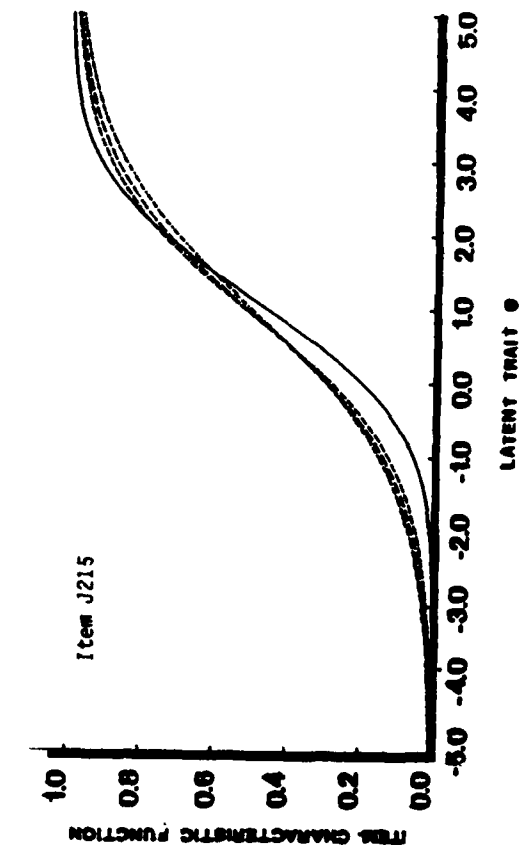


FIGURE 9-4 (Continued)

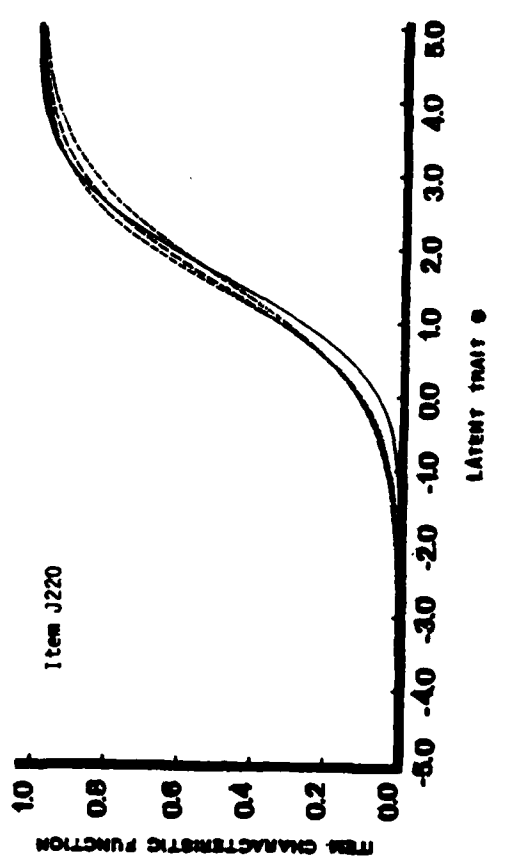
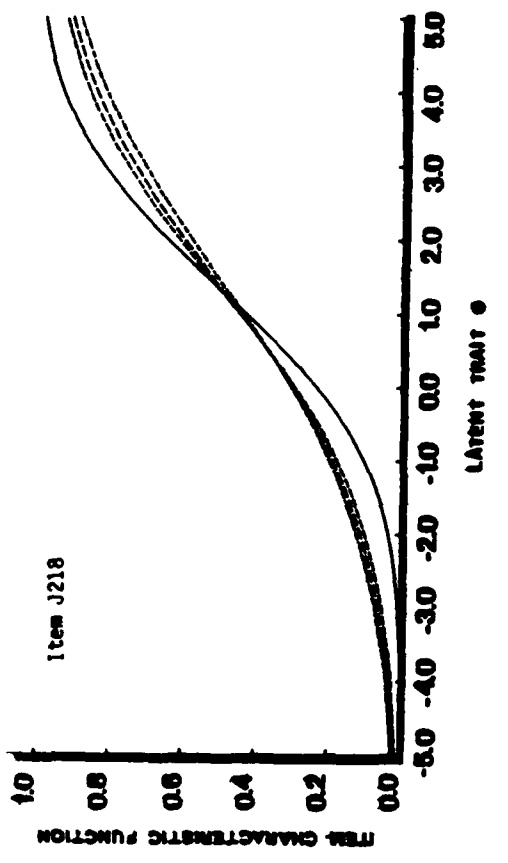
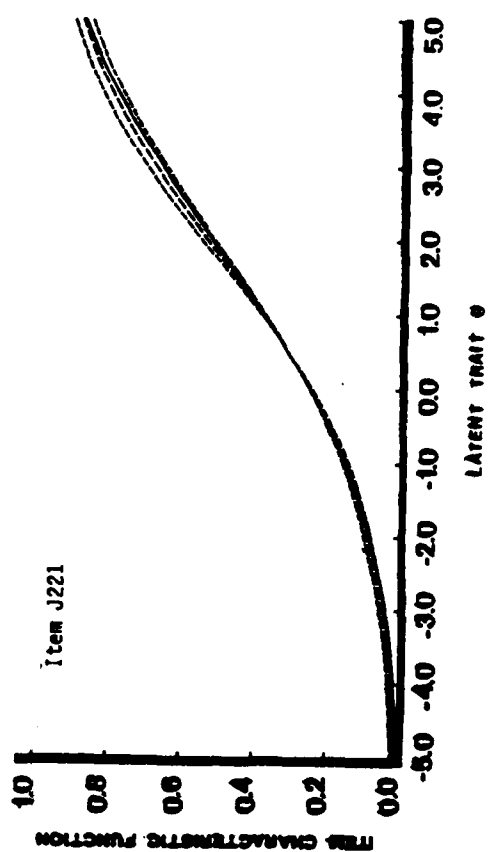
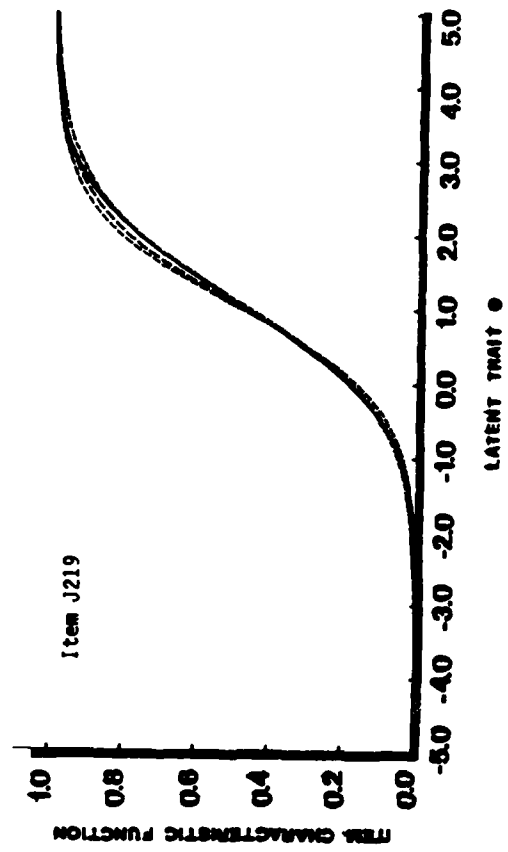


FIGURE 9-4 (Continued)

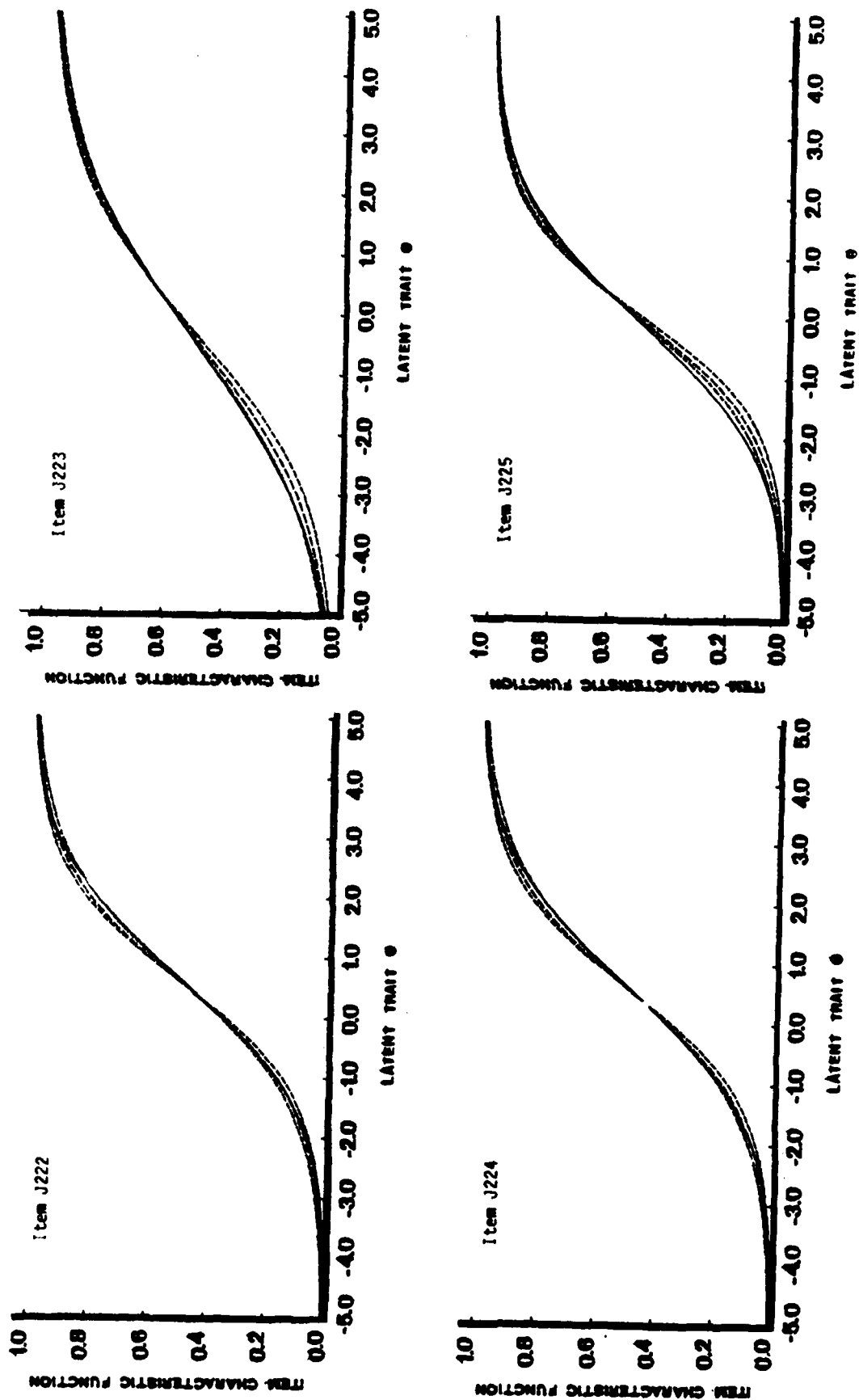


FIGURE 9-4 (Continued)

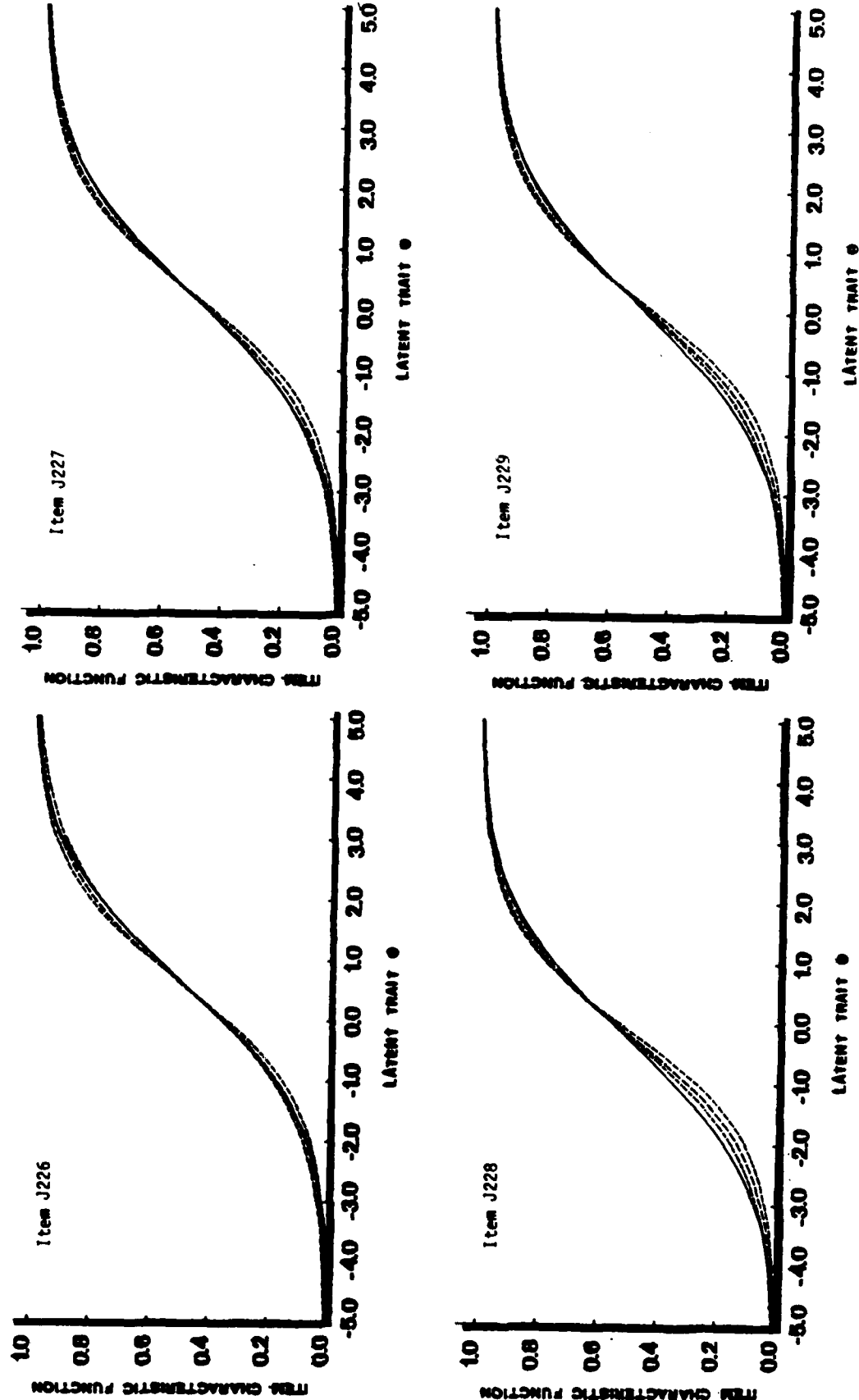


FIGURE 9-4 (Continued)

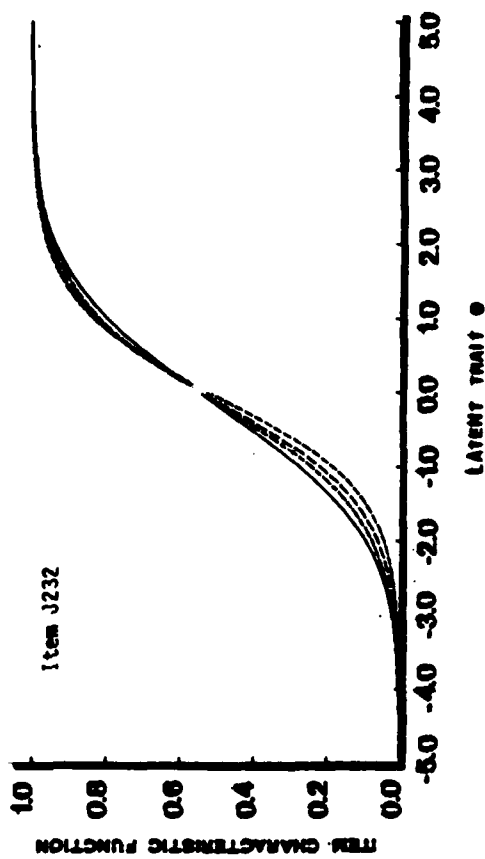
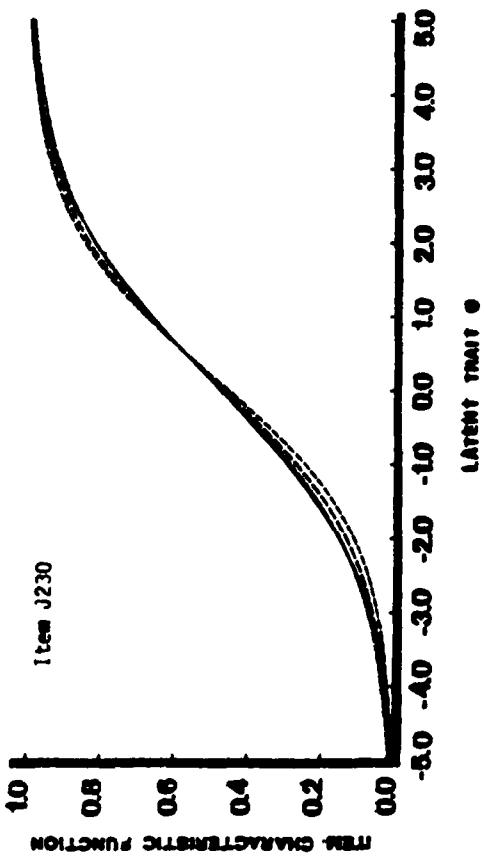
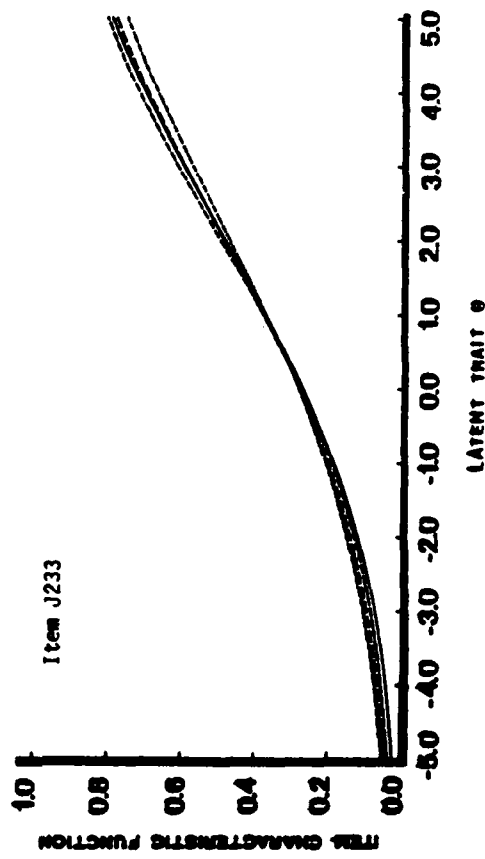
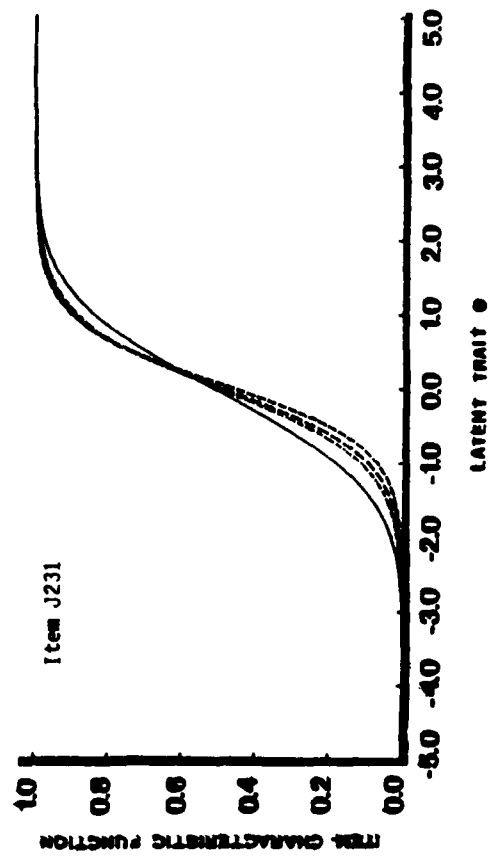


FIGURE 9-4 (Continued)

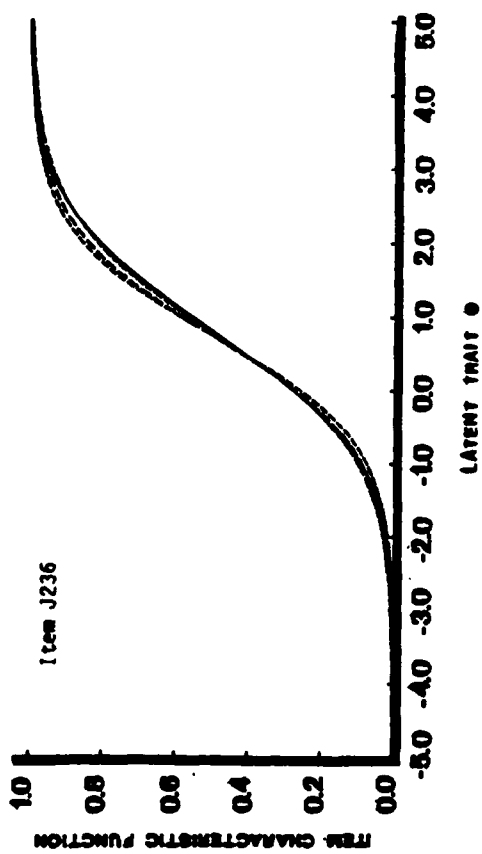
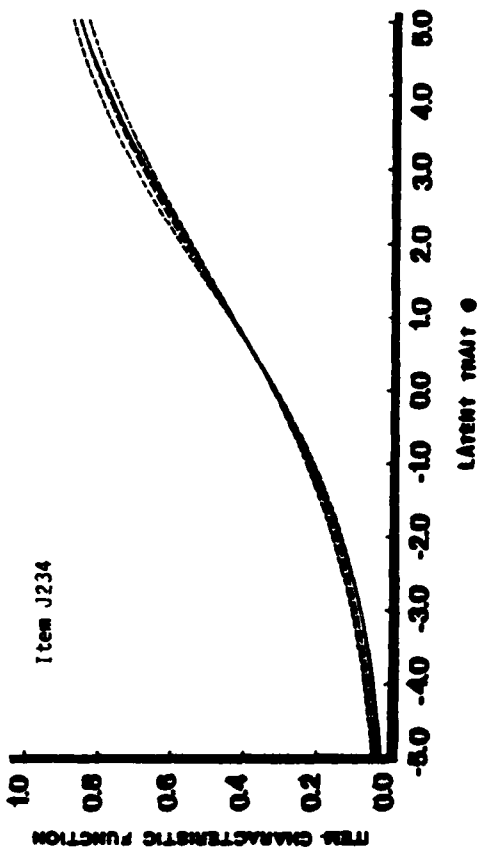
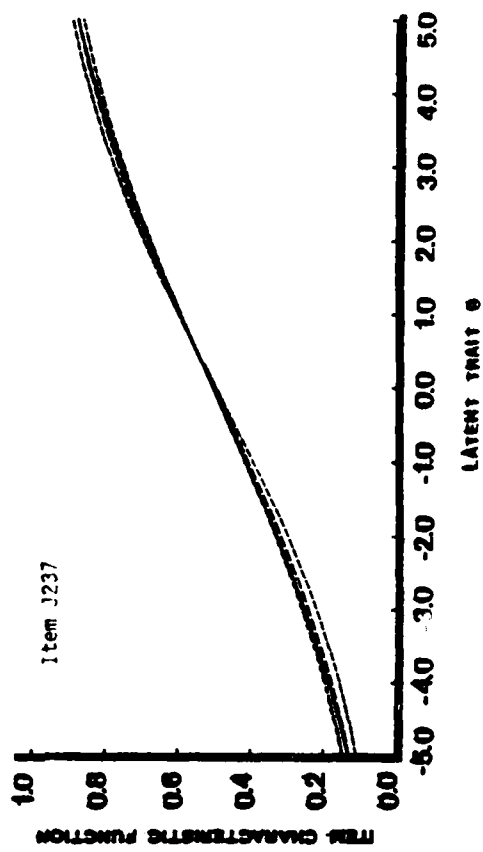
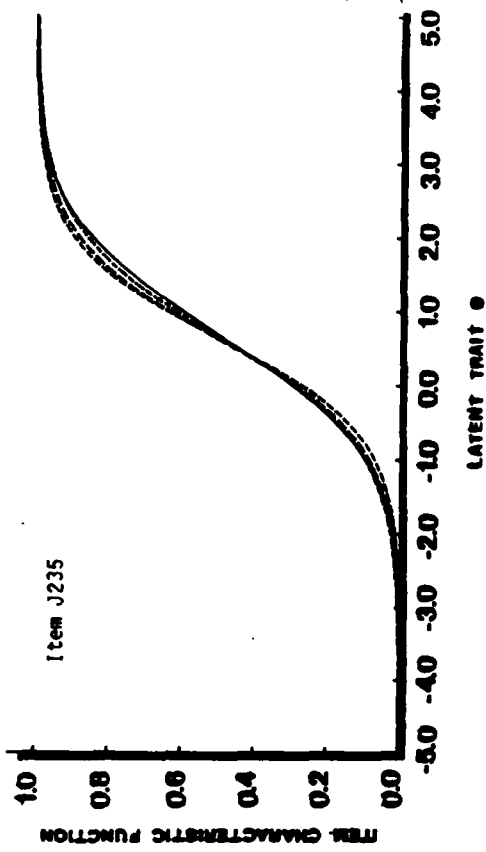


FIGURE 9-4 (Continued)

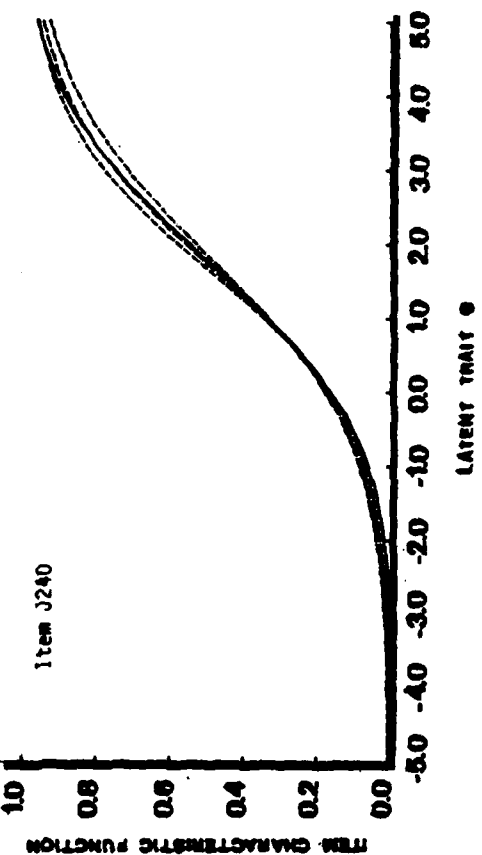
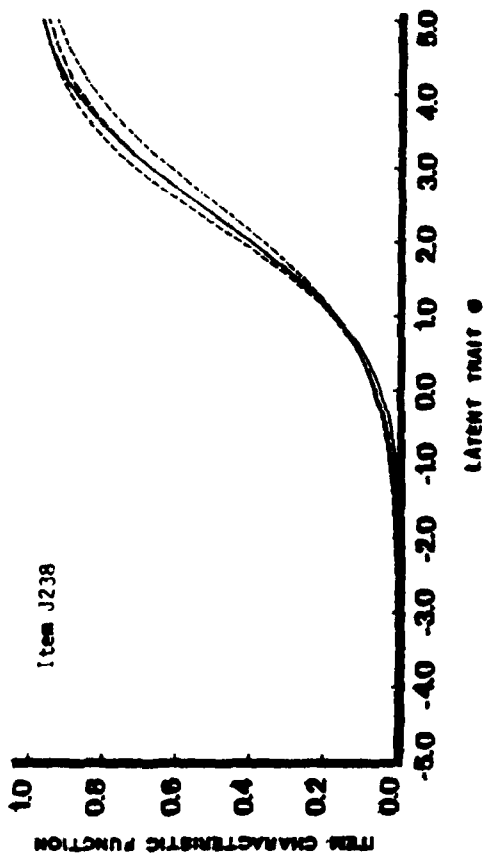
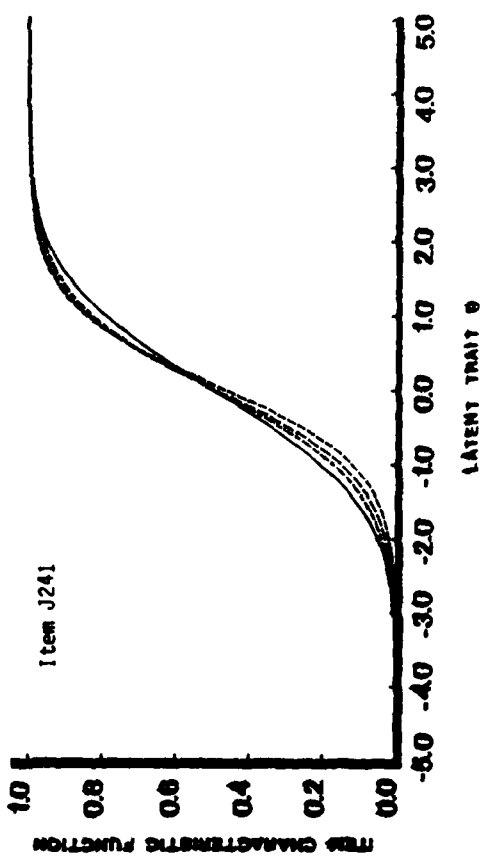
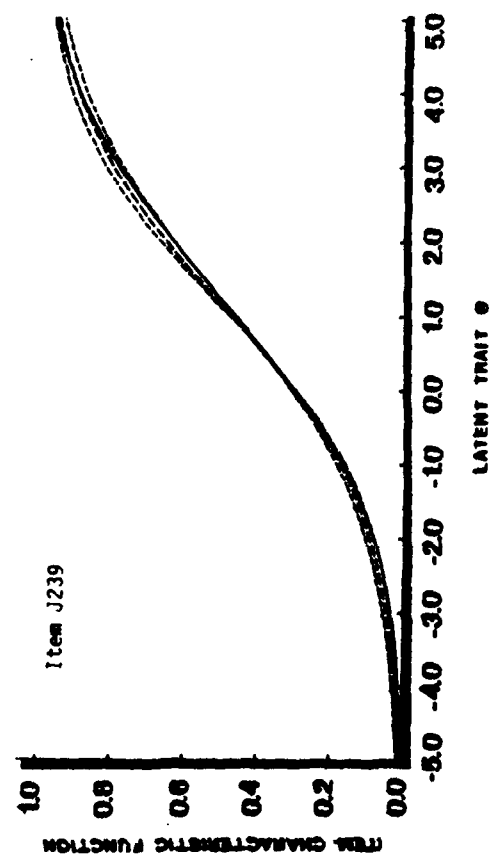


FIGURE 9-4 (Continued)

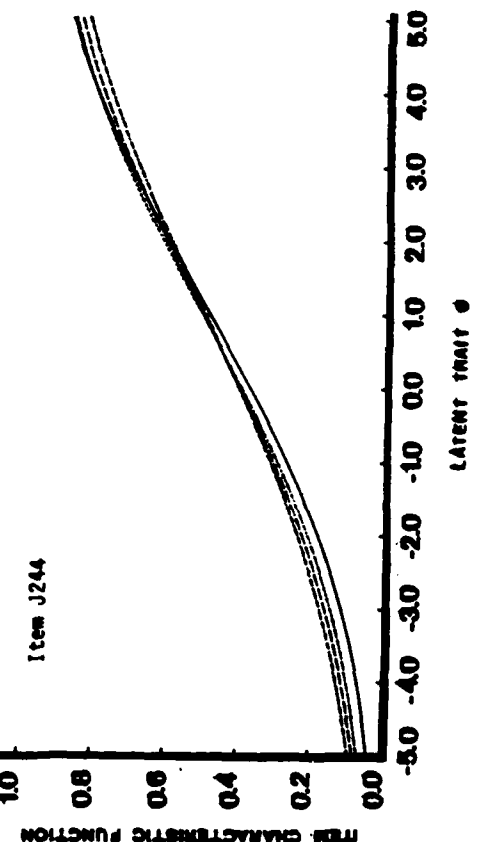
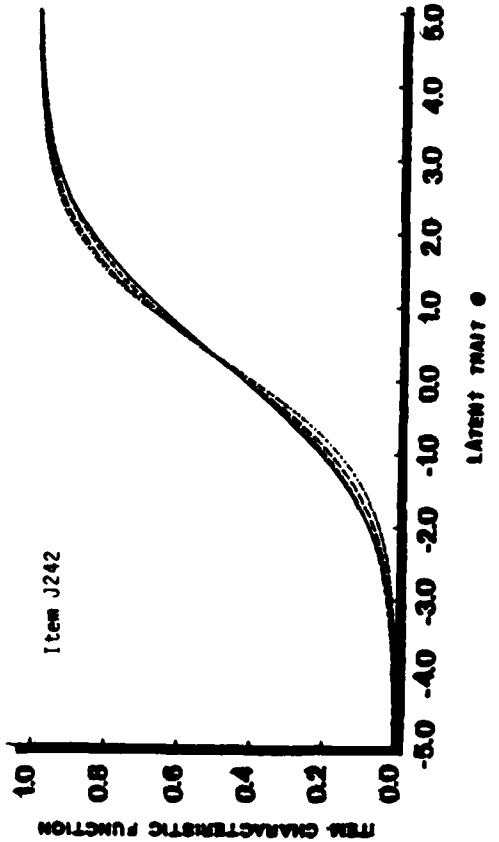
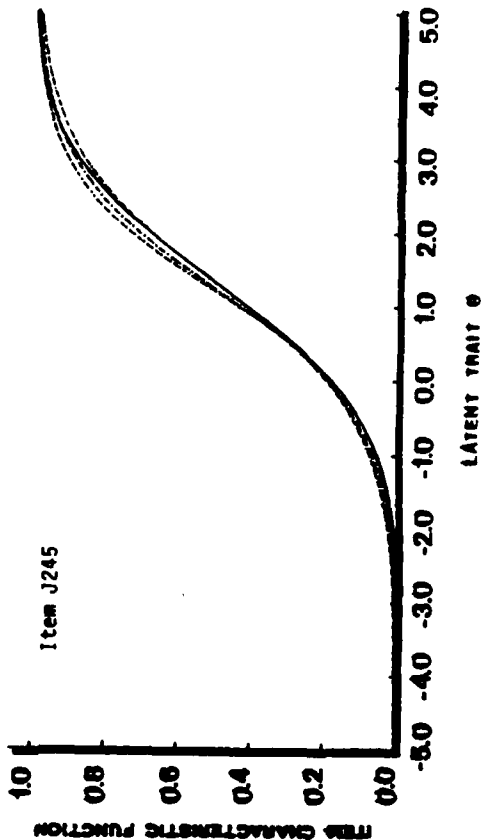
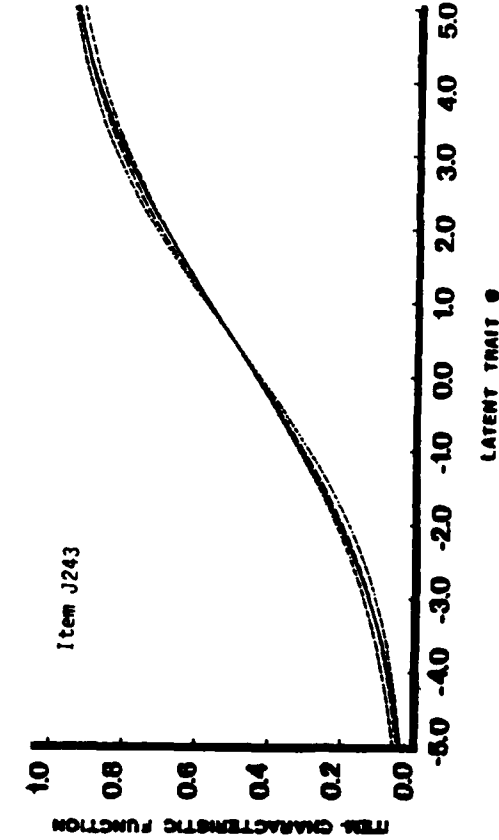


FIGURE 9-4 (Continued)

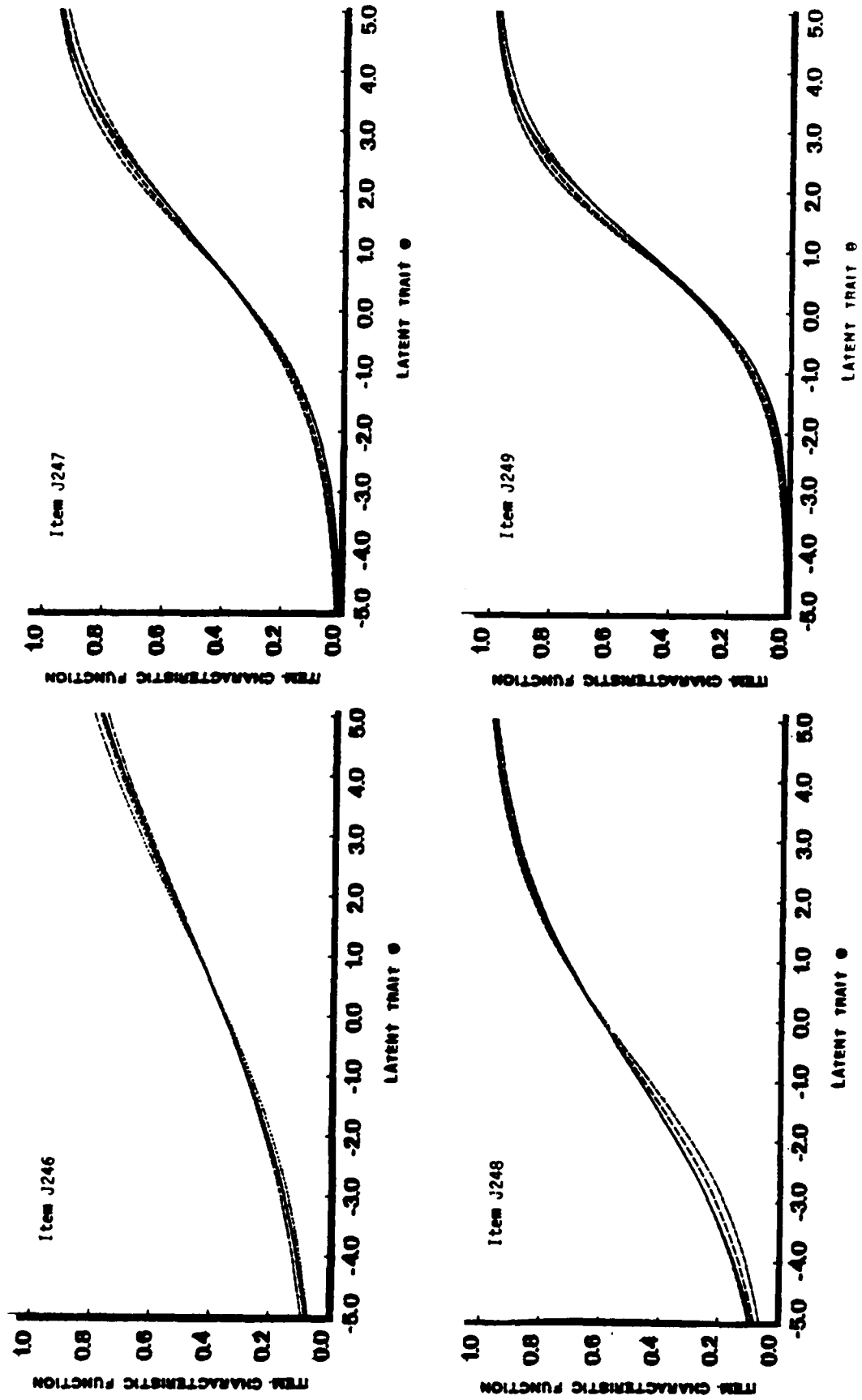


FIGURE 9-4 (Continued)

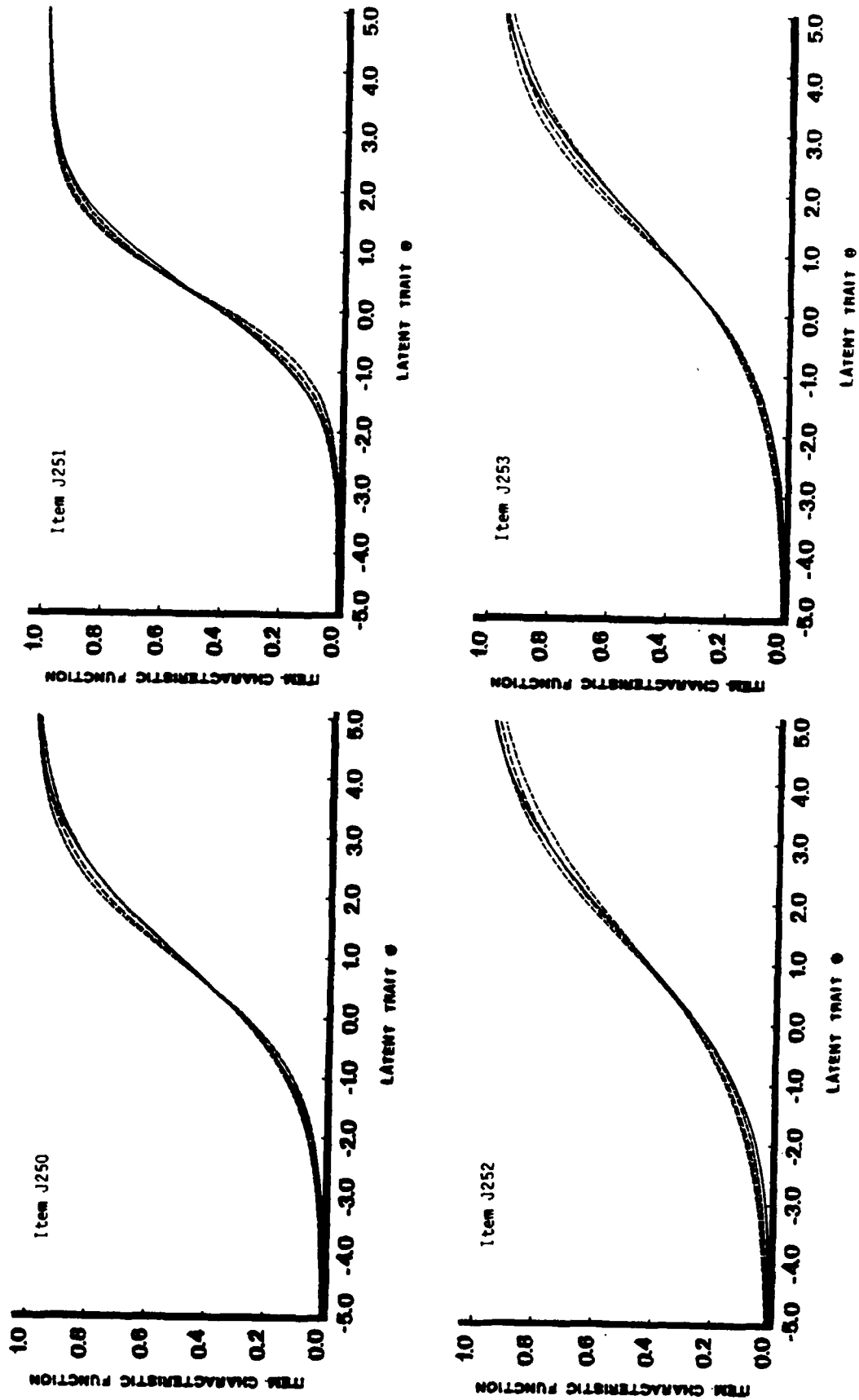


FIGURE 9-4 (Continued)

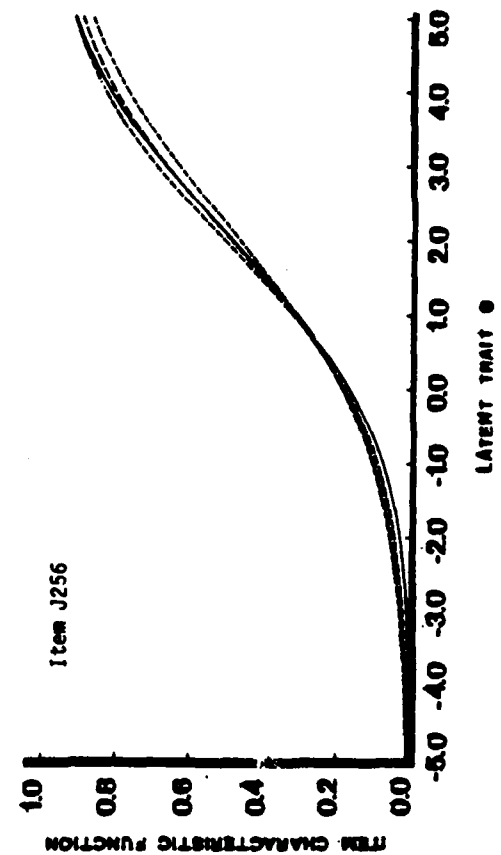
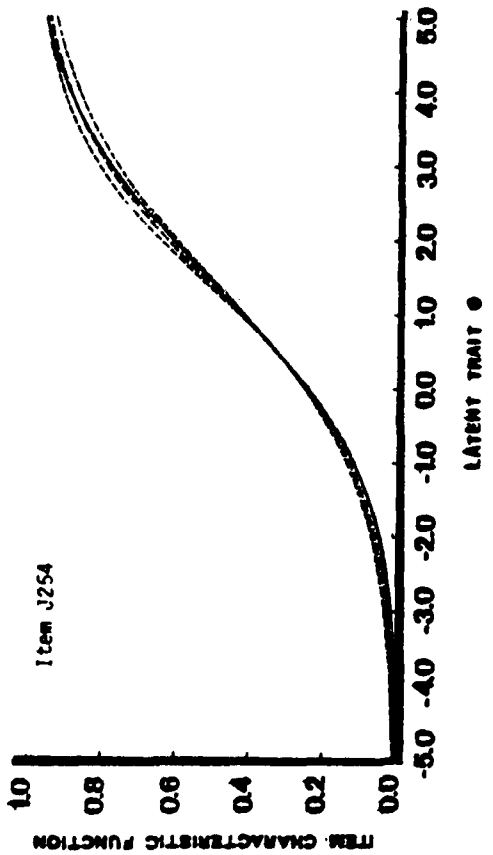
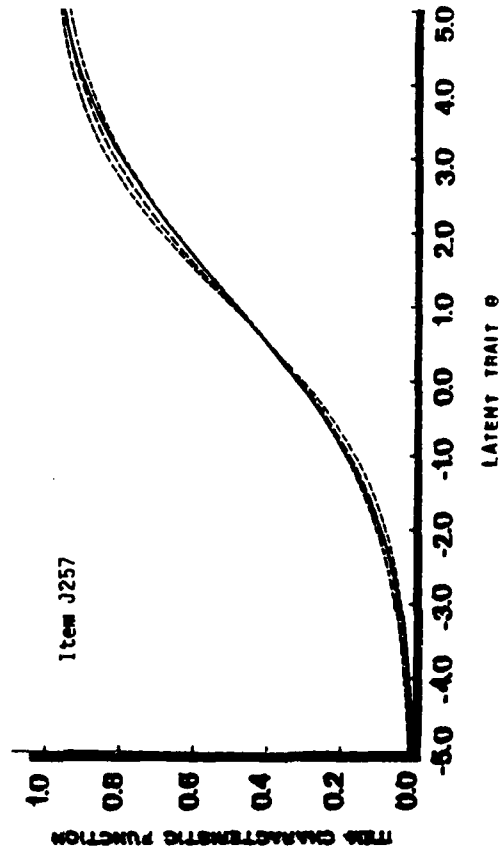
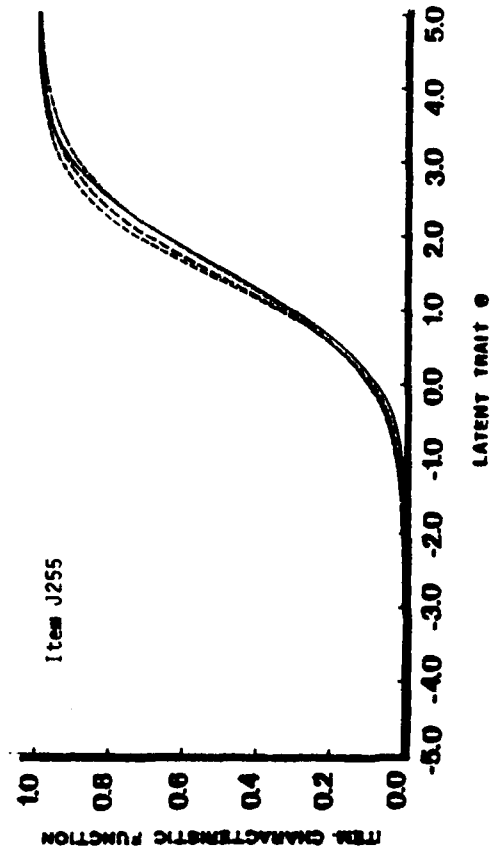


FIGURE 9-4 (Continued)

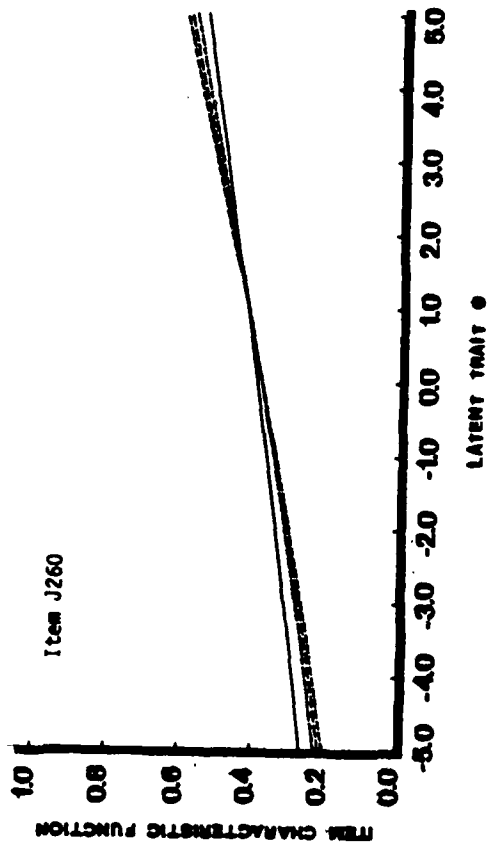
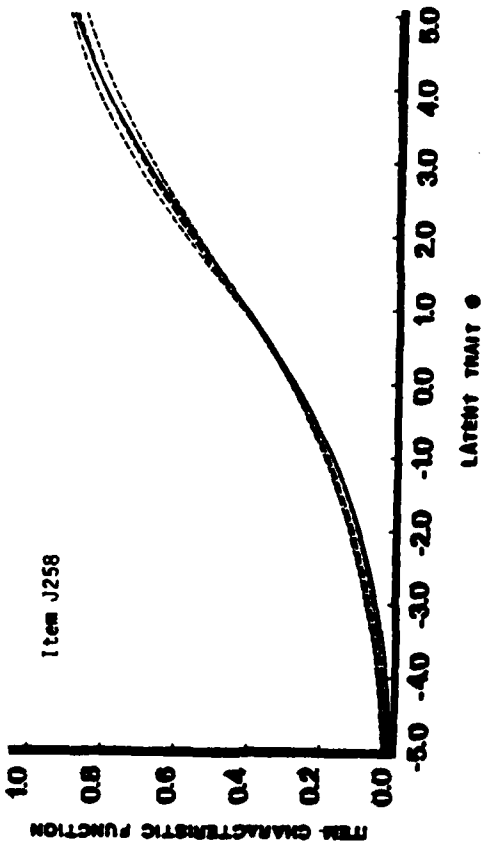
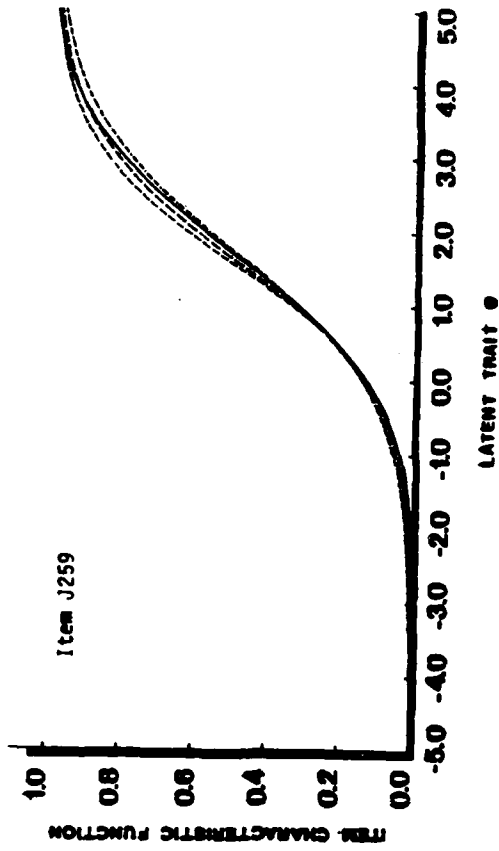


FIGURE 9-4 (Continued)

estimated item characteristic function is in the normal ogive model, and the other four are in the (two-parameter) logistic model. We notice that there are basically two sets of estimated item parameters which were obtained by Logist 5, i.e., one based upon either Case A5-A6 or Case J1-J2 and the other upon Case A5-A6-J1-J2. For brevity, hereafter, we shall call the former approach Method A and the latter Method B. In each of these two cases the estimated item parameters were adjusted twice, i.e., first on the assumption that the mean and the standard deviation of the distribution of $\hat{\theta}$ are the same as those of the distribution of θ , and, secondly, without this assumption. These adjusted estimated item parameters in the first situation are given in Tables 7-13 through 7-20, and those in the second situation are shown in Tables 8-3 through 8-10, respectively, for the items of Tests A5, A6, J1 and J2. In each graph of Figures 9-1 through 9-4, the results based upon Method A and upon the first and the second scale adjustments are drawn by a long dashed line and a short dashed line, respectively, and those based upon Method B and upon the first and the second adjustments are shown by a dashed line of medium length and dotted line, respectively.

From these results, we can say the following.

- (1) For many items, the two Logist 5 results based upon the second scale adjustment are close to each other, while those based upon the first scale adjustment are substantially different from each other.
- (2) In addition to the above, the two Logist 5 results based upon

the second scale adjustment also tend to be closer to the result of Tetrachoric Method.

These two findings seem to justify the second scale adjustment, and also to support the consistency in the results of the two methods, i.e., Tetrachoric Method and Logist 5 .

Figures 9-5 and 9-6 present the results of J1/1075 and J1/2259 Cases for each item of Test J1. Again in each of these graphs a solid curve represents the estimated item characteristic function in the normal ogive model, whose item parameters were originally obtained by Tetrachoric Method and then adjusted, and presented in Tables 6-8 and 6-9. The other four curves are based upon the estimated item parameters obtained by Logist 5 , with two of them by assuming (two-parameter) logistic model and the other two by assuming three-parameter logistic model. The results in the (two-parameter) logistic model with the first and the second scale adjustments, whose estimated item parameters are shown in Tables 7-21 or 7-23 and in Table 8-11 or 8-13, are drawn by a long dashed line and a short dashed line, respectively; the results obtained by assuming three-parameter logistic model with the first and second scale adjustments, whose estimated item parameters are presented in Table 7-22 or 7-24, and in Table 8-12 or 8-14, are shown by a dashed line of medium length and a dotted line, respectively.

From these results we can find the following.

- (3) For many items the logistic curve obtained with the second scale adjustment, which is shown by a short dashed line, is very

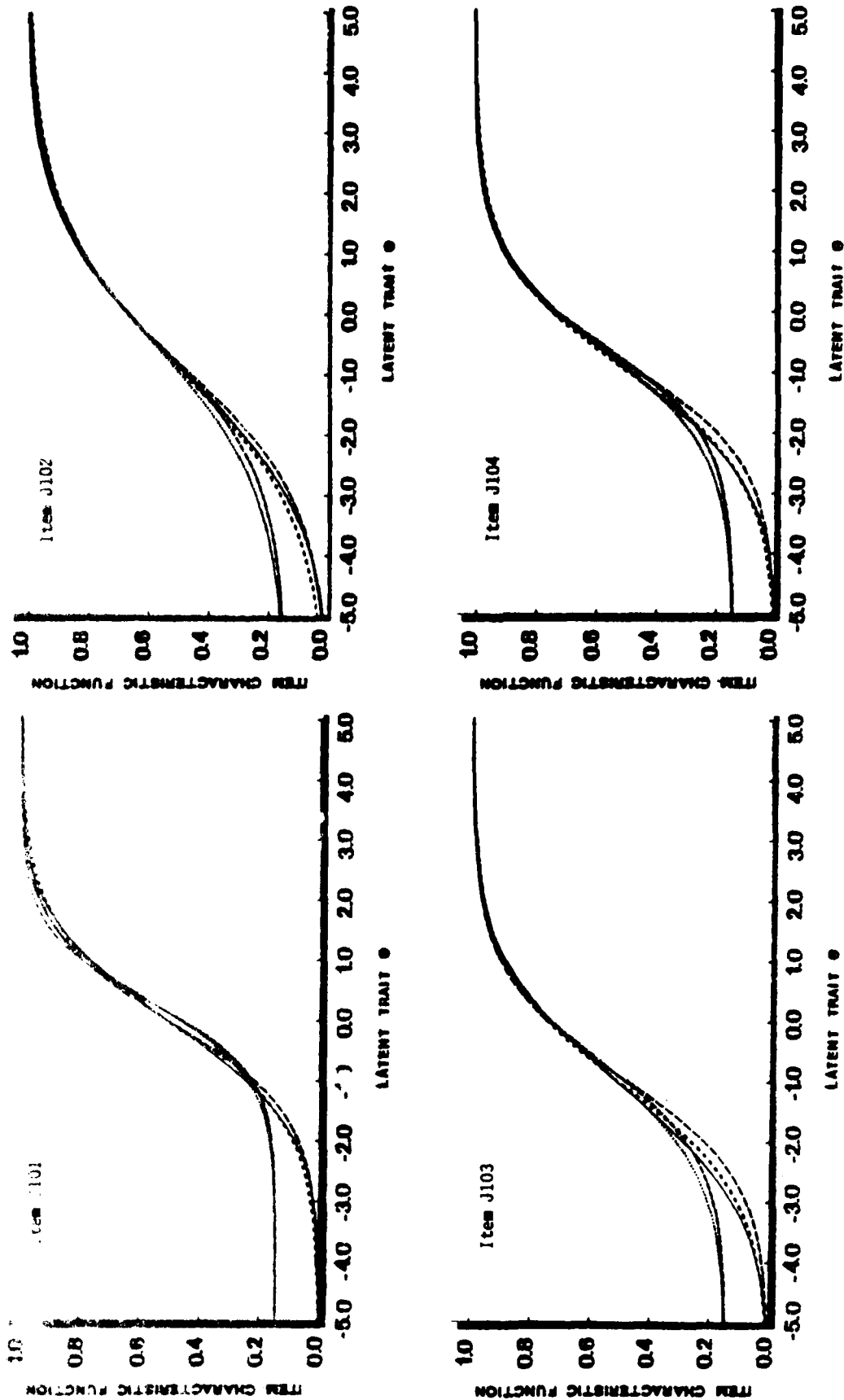


FIGURE 9-5

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Two Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Which Are Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), and Two Estimated Item Characteristic Functions Following the Three-Parameter Logistic Model Obtained by Using LOGIST 5, Which Are Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test J1. Results of the J1/1075 Case.

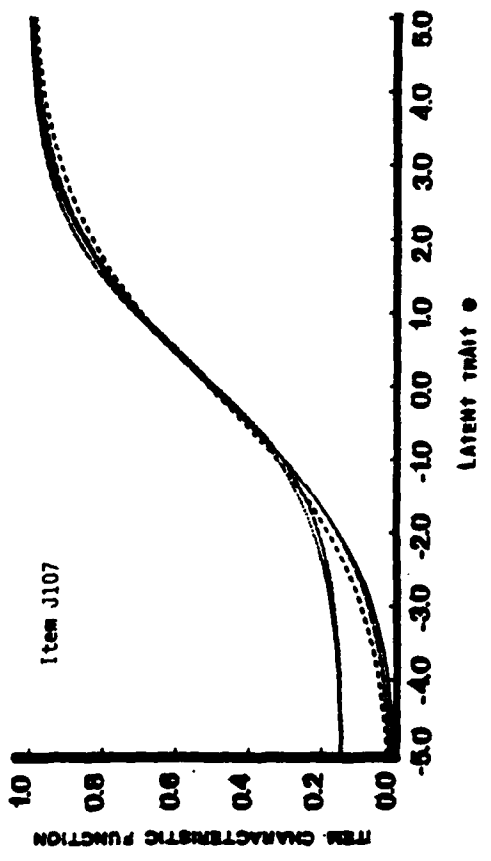
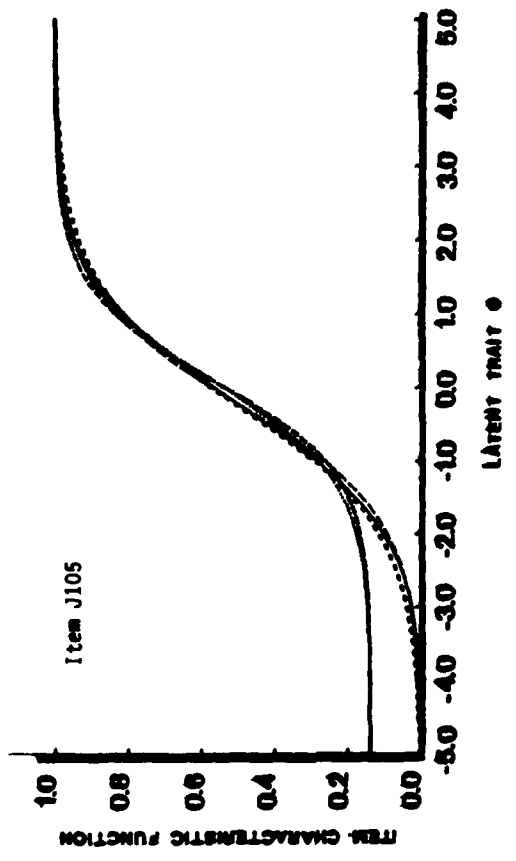
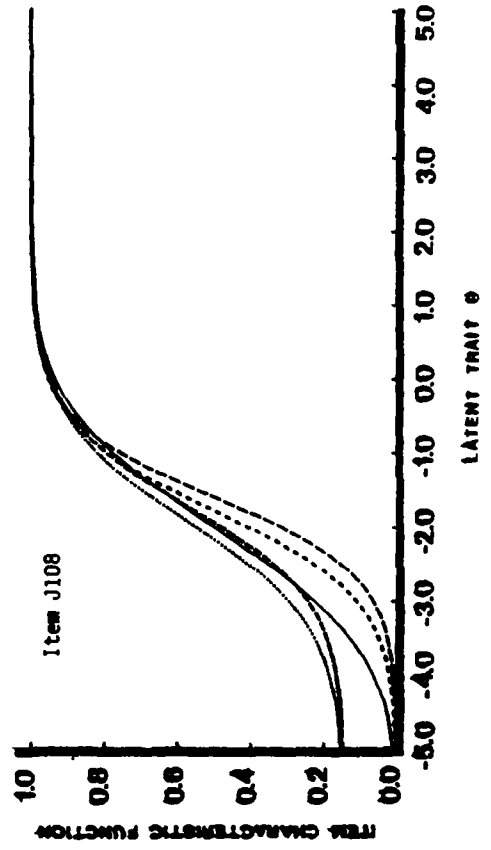
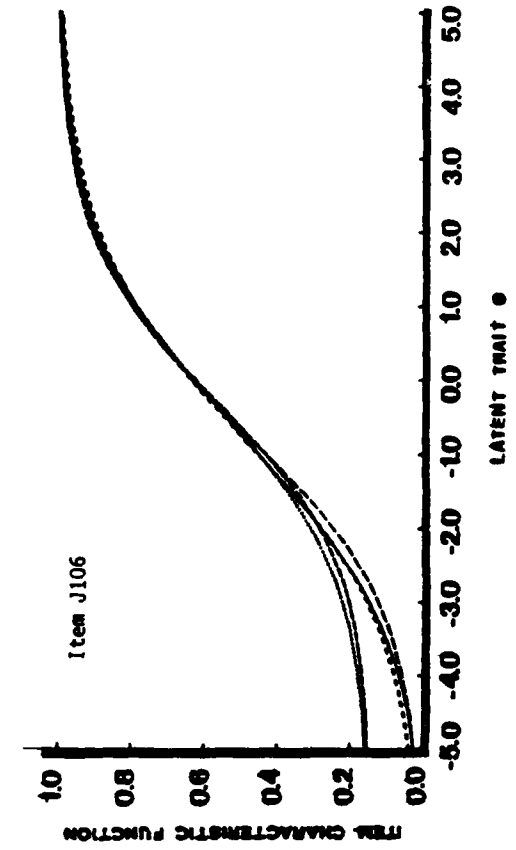


FIGURE 9-5 (Continued)

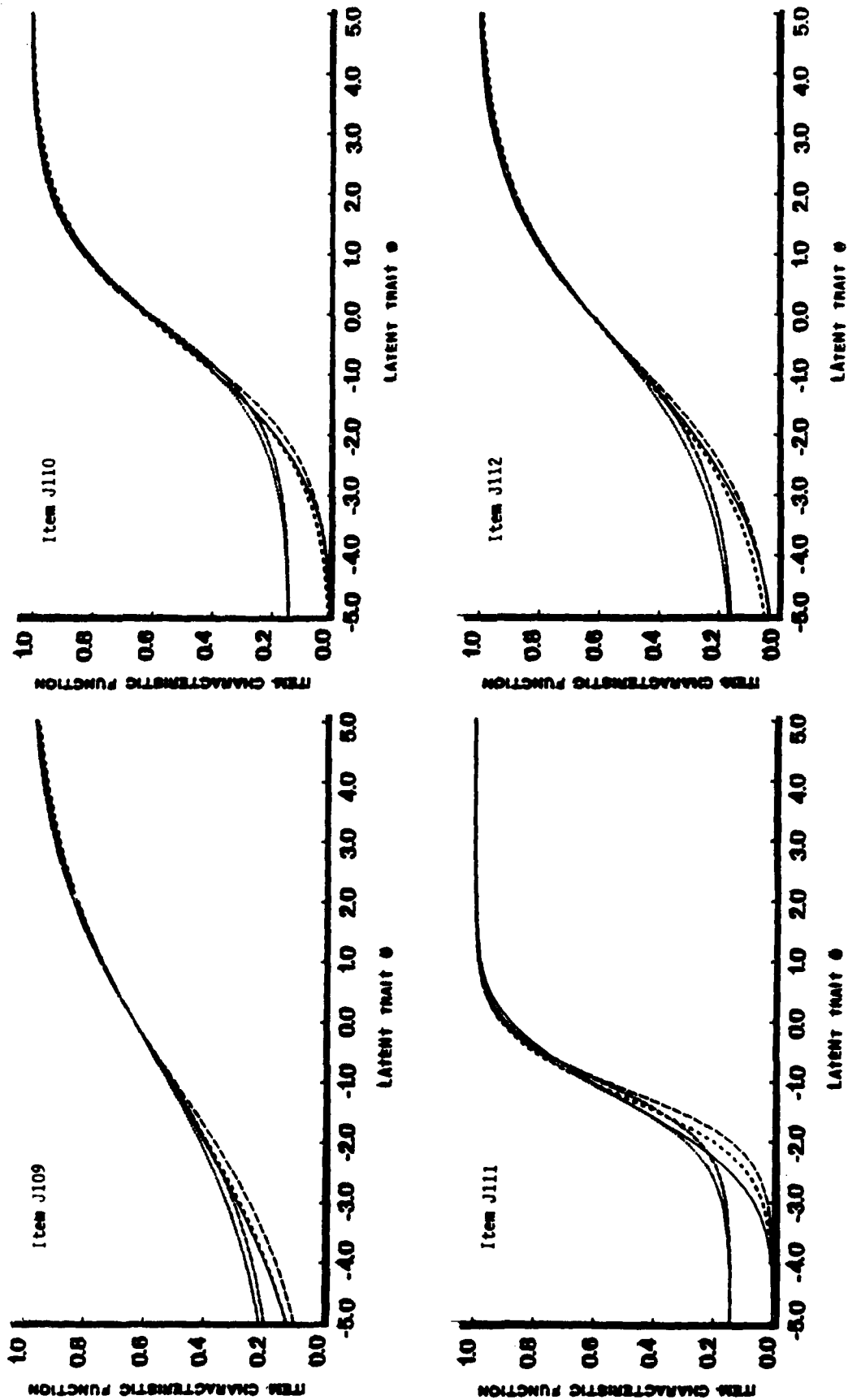


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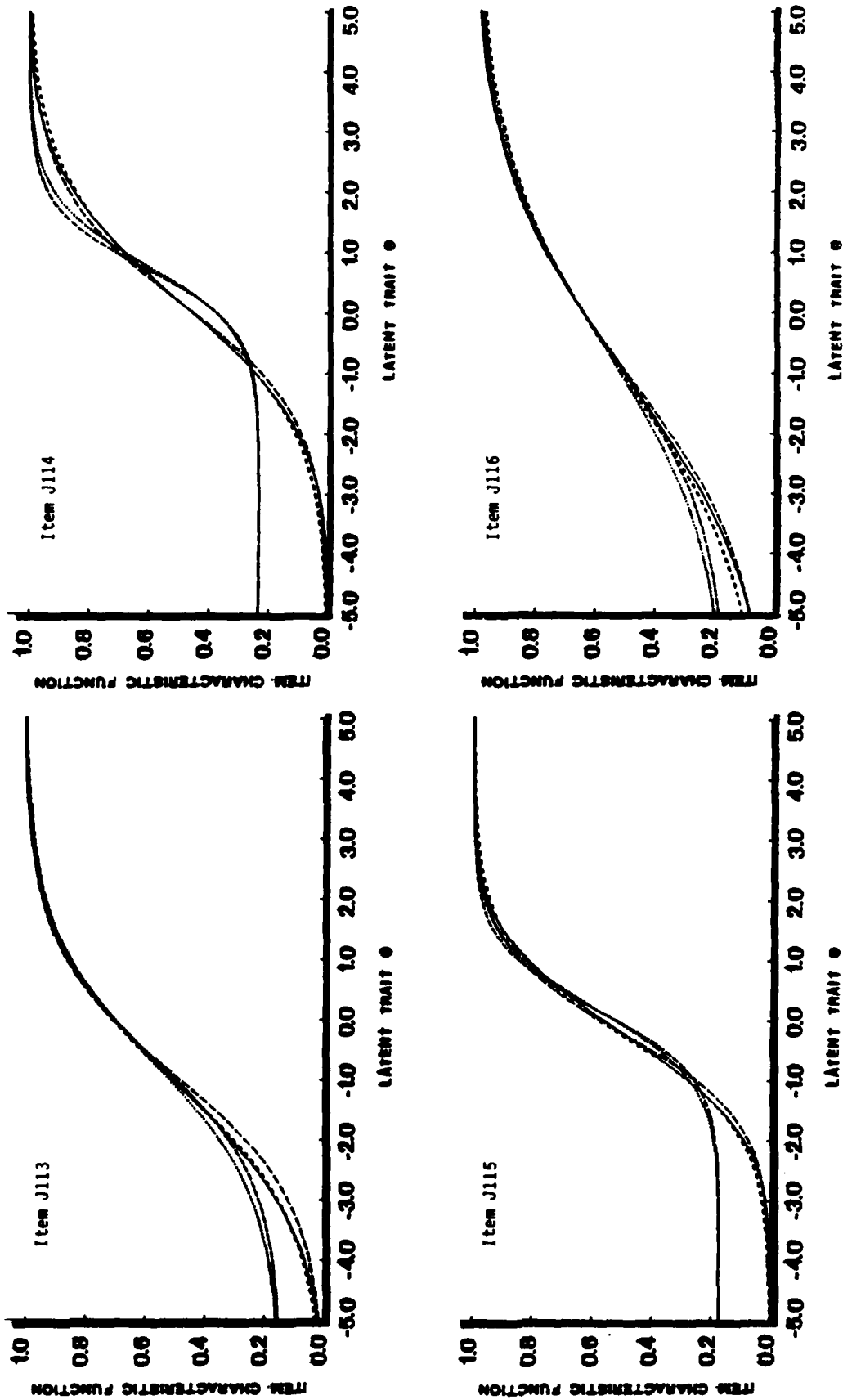


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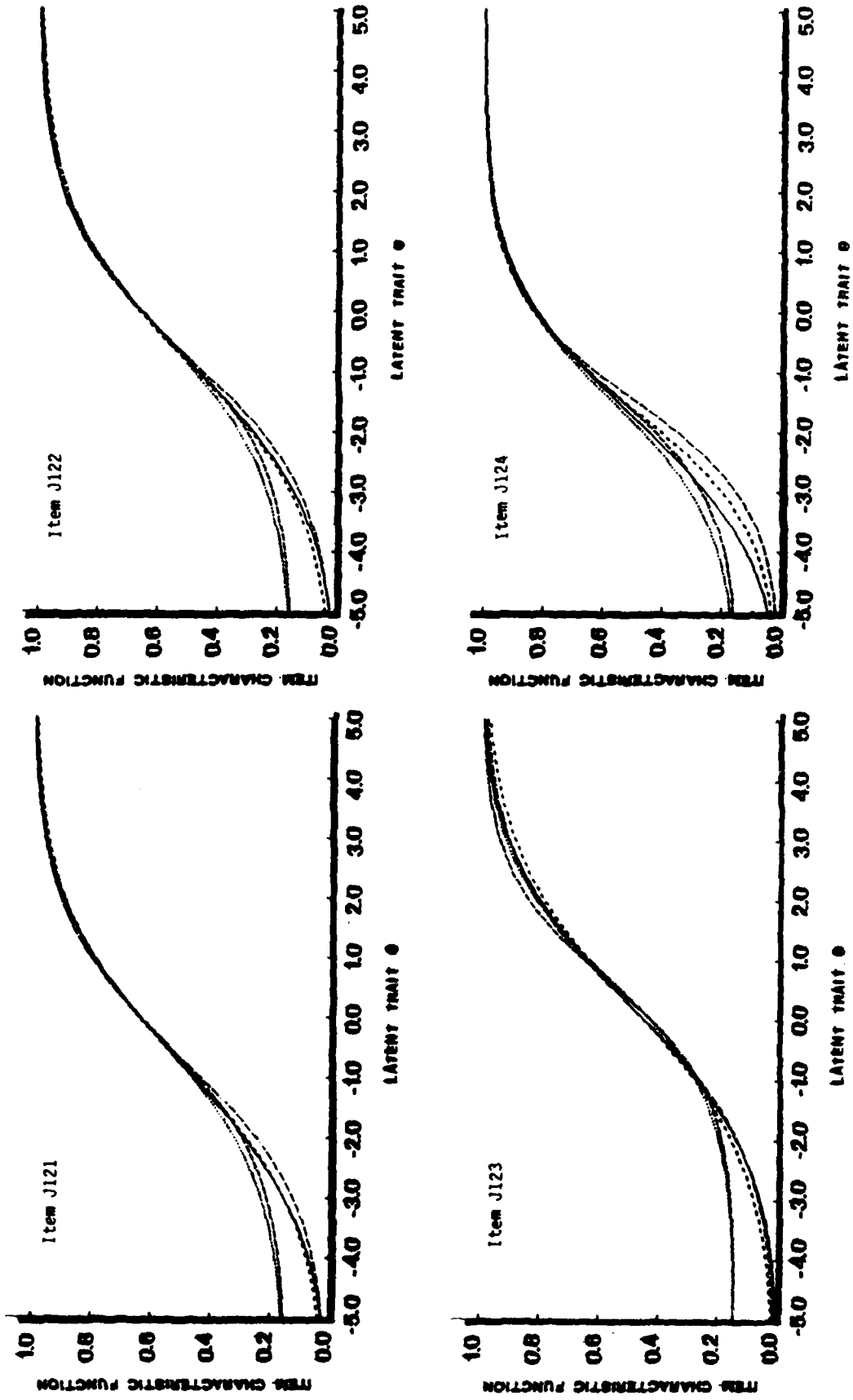


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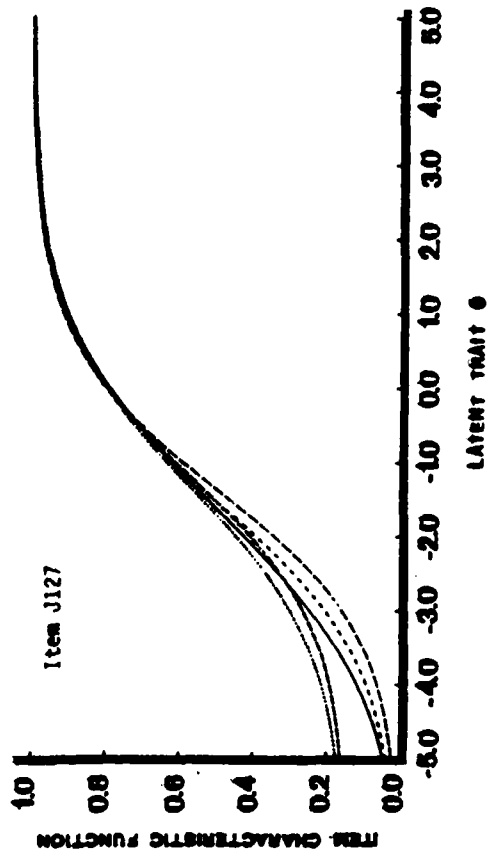
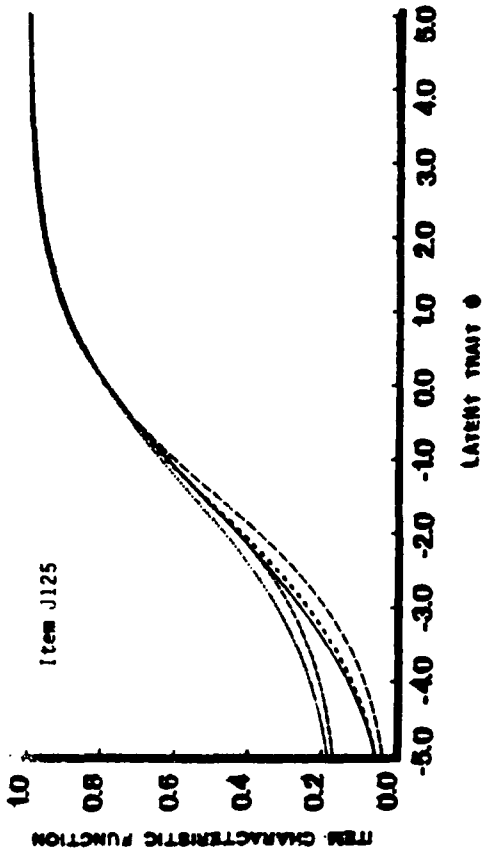
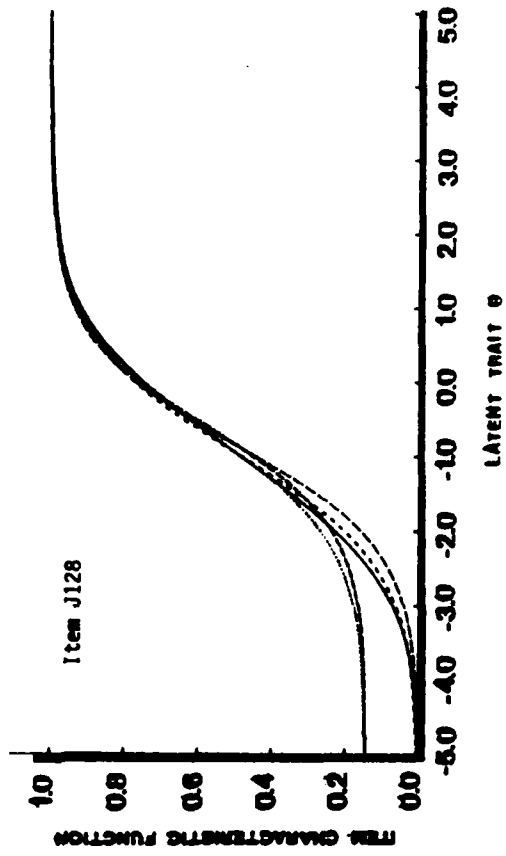
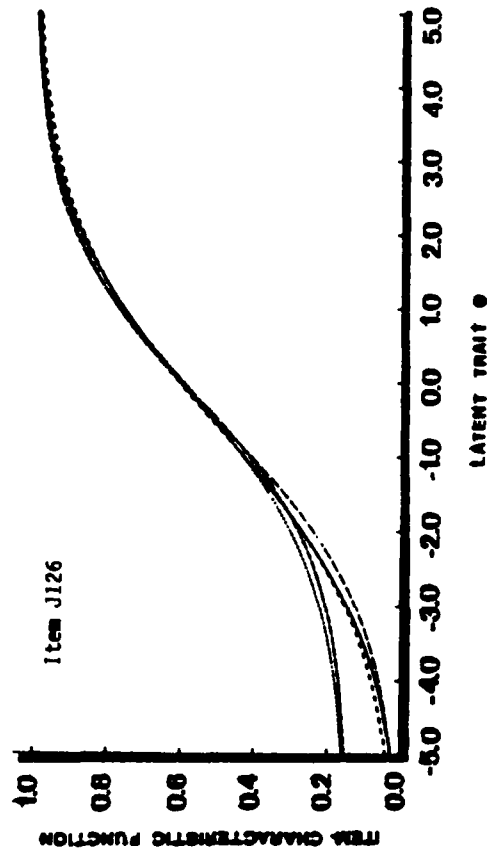


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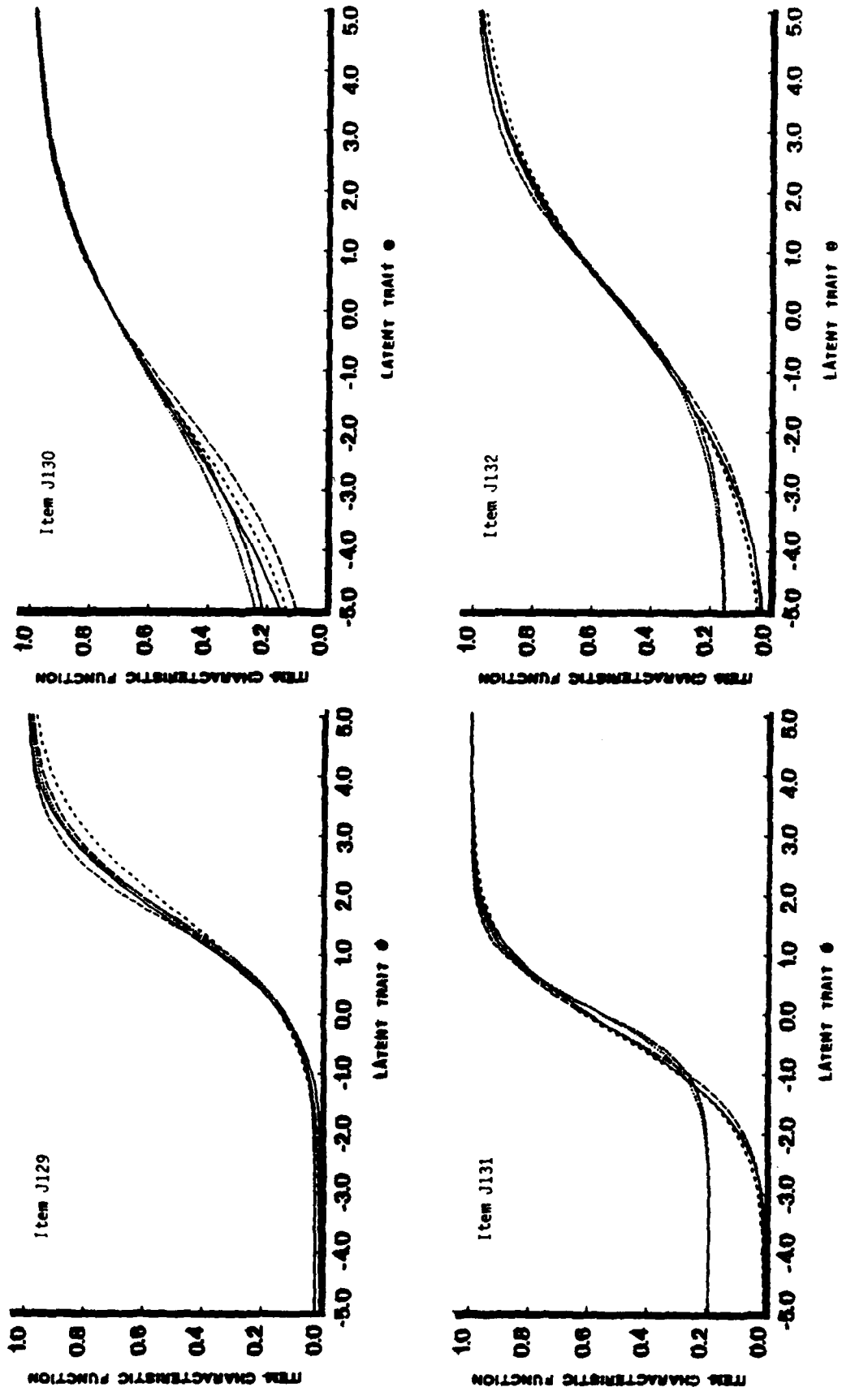


FIGURE 9-5 (Continued)

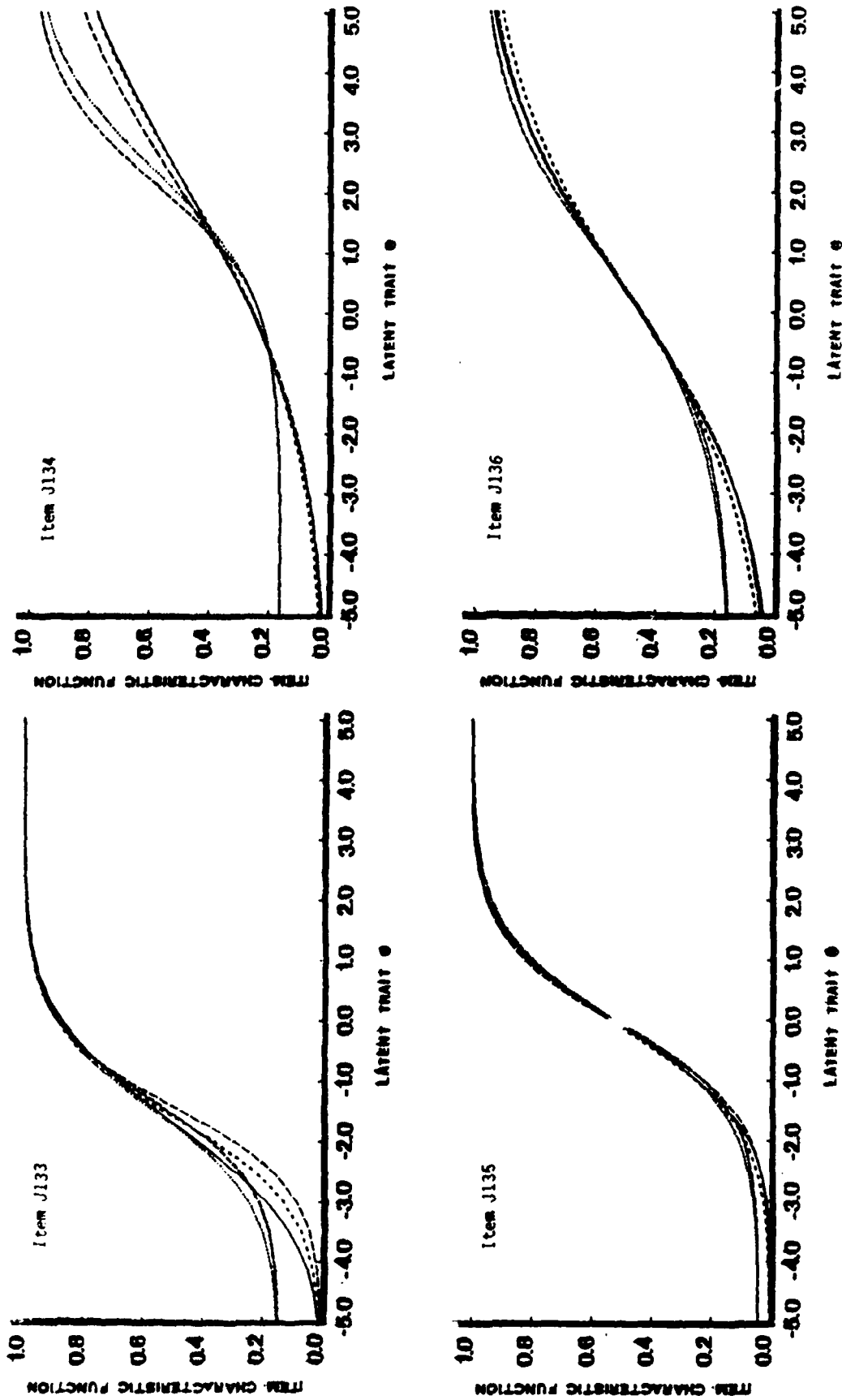


FIGURE 9-5 (Continued)

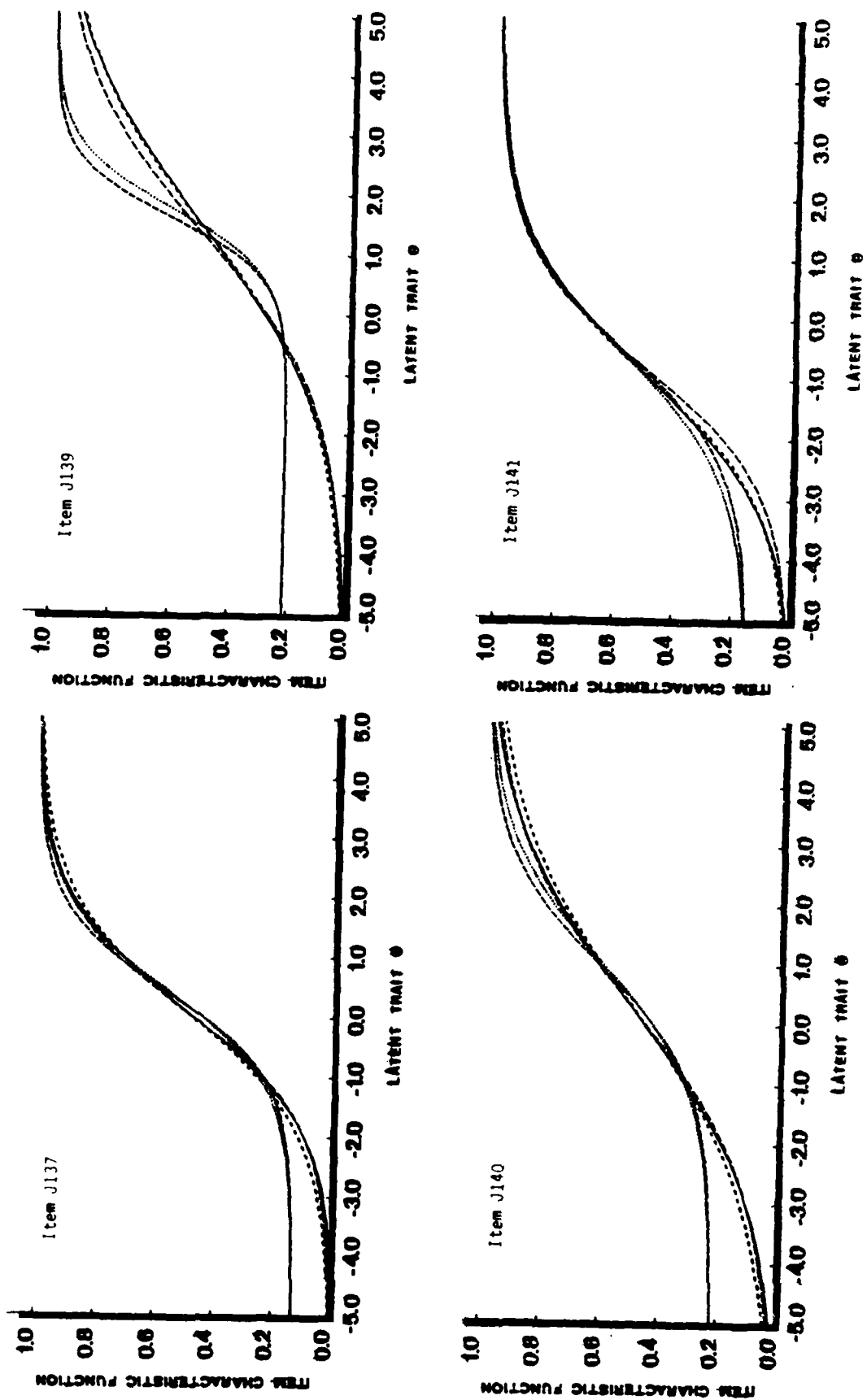


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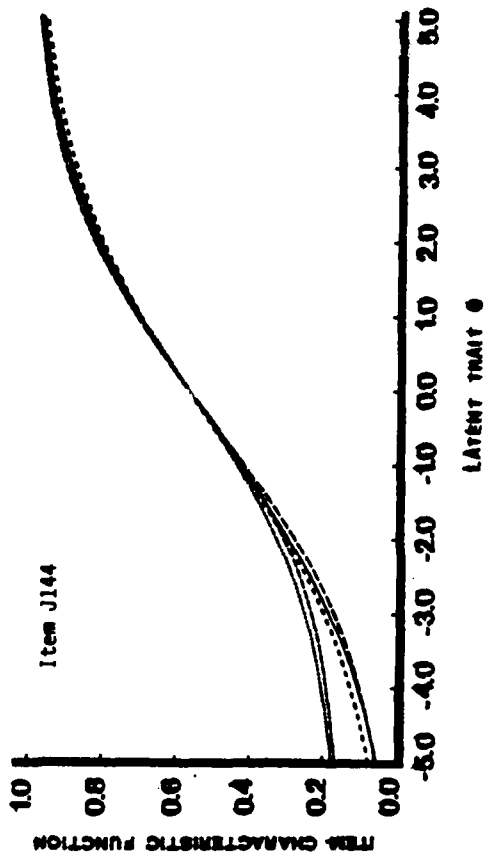
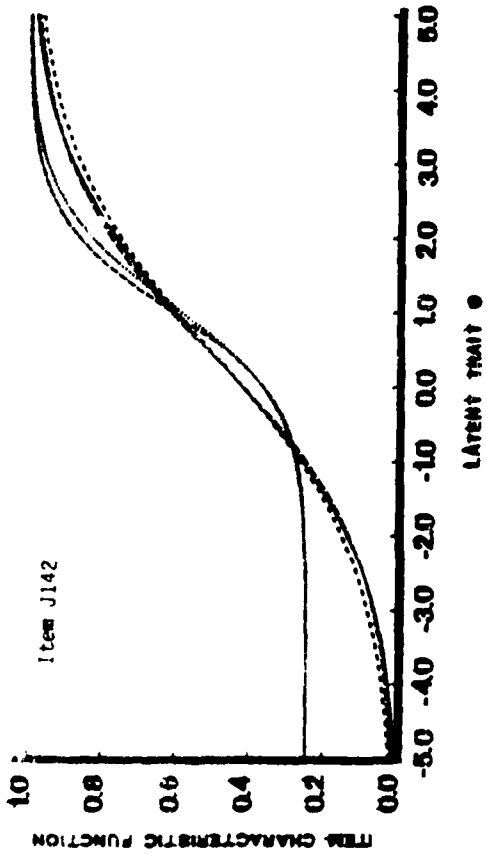
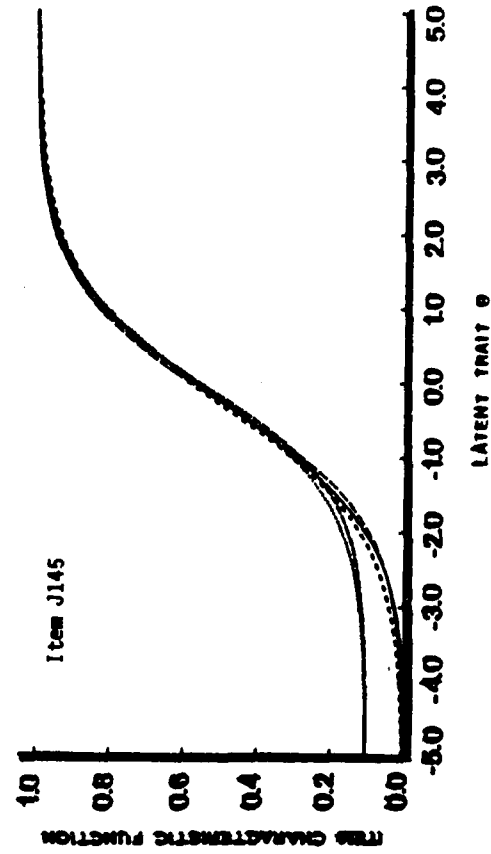
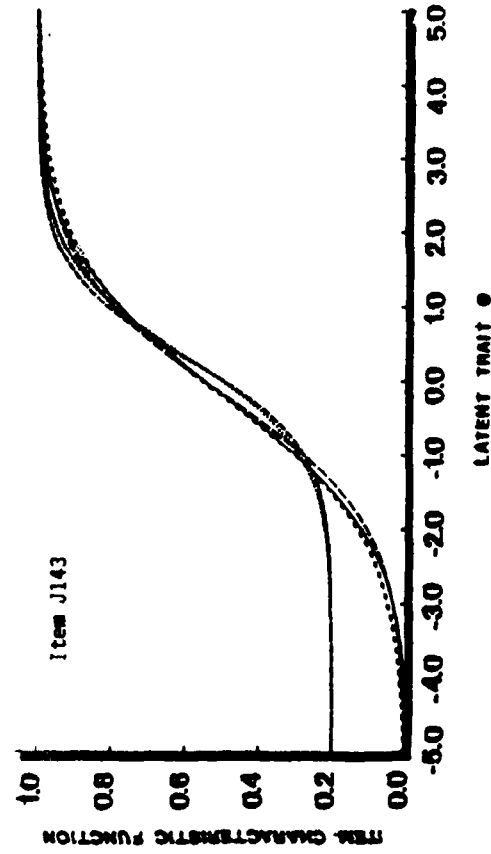


FIGURE 9-5 (Continued)

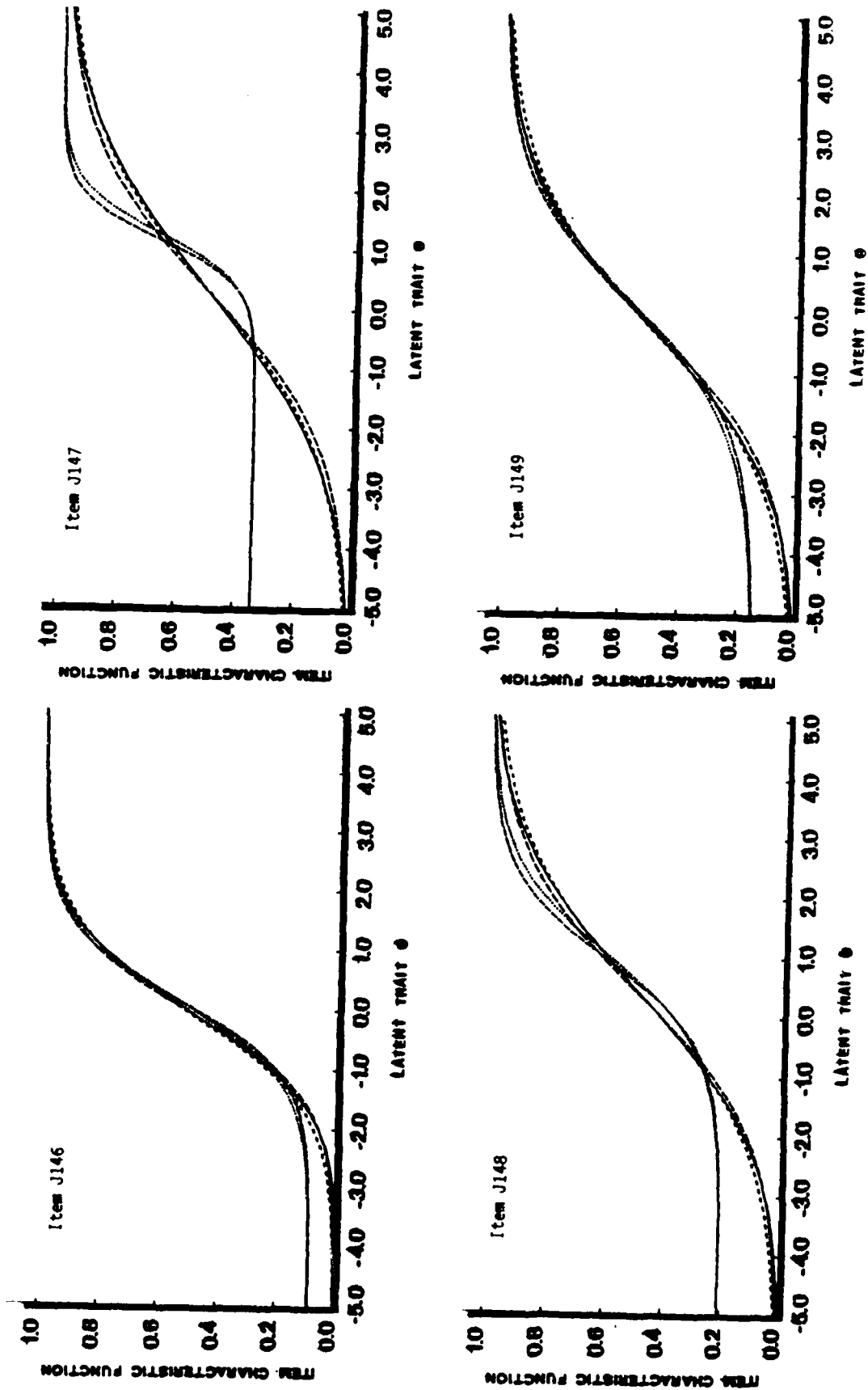


FIGURE 9-5 (Continued)

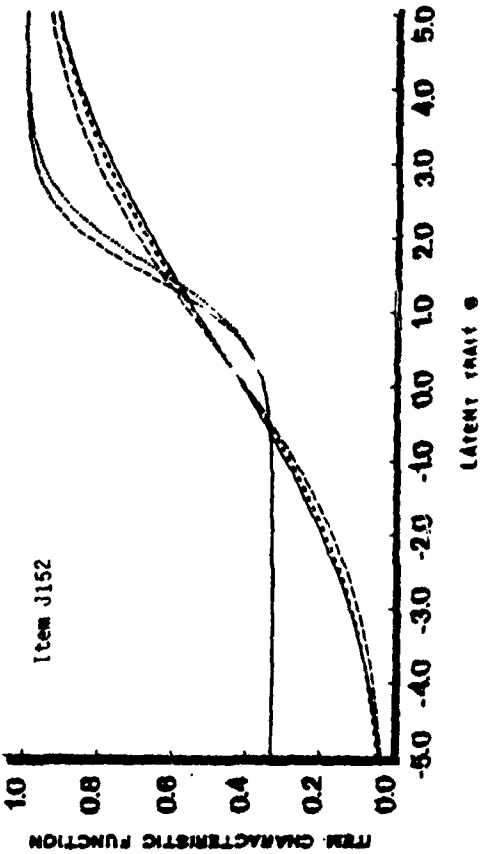
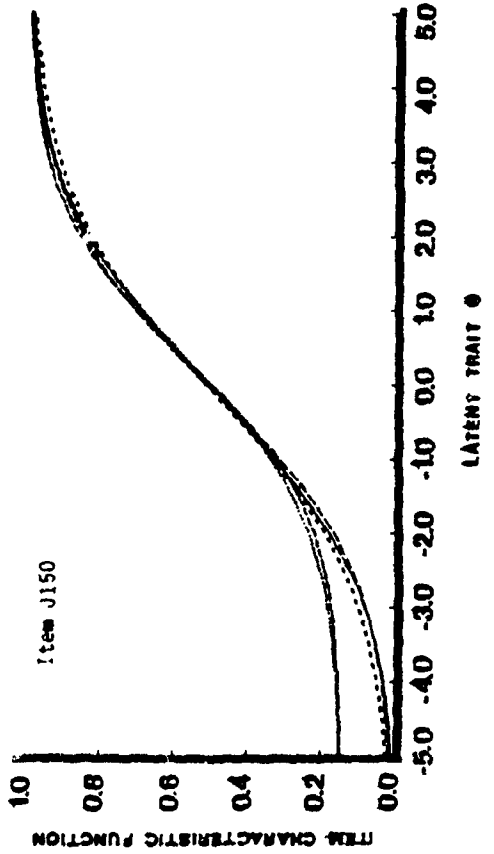
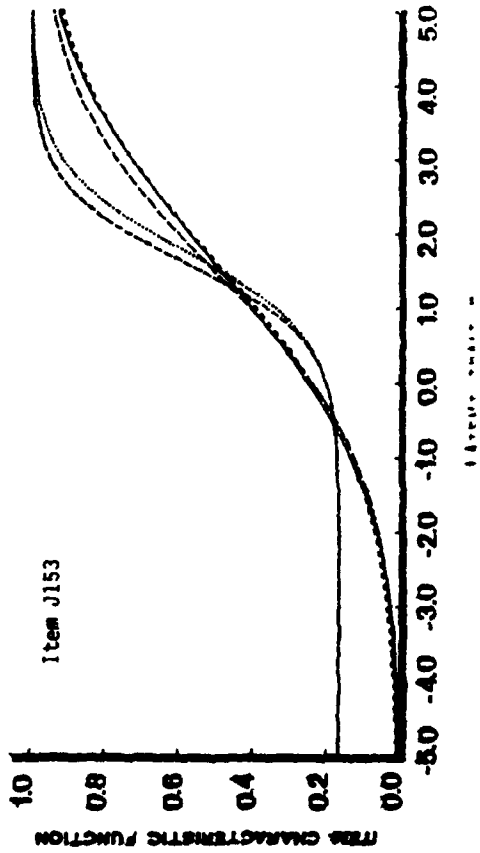
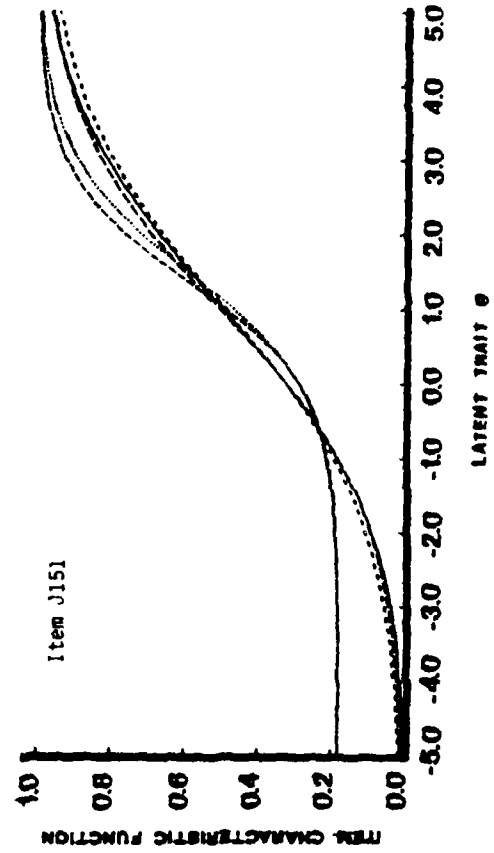


FIGURE 9-5 (Continued)

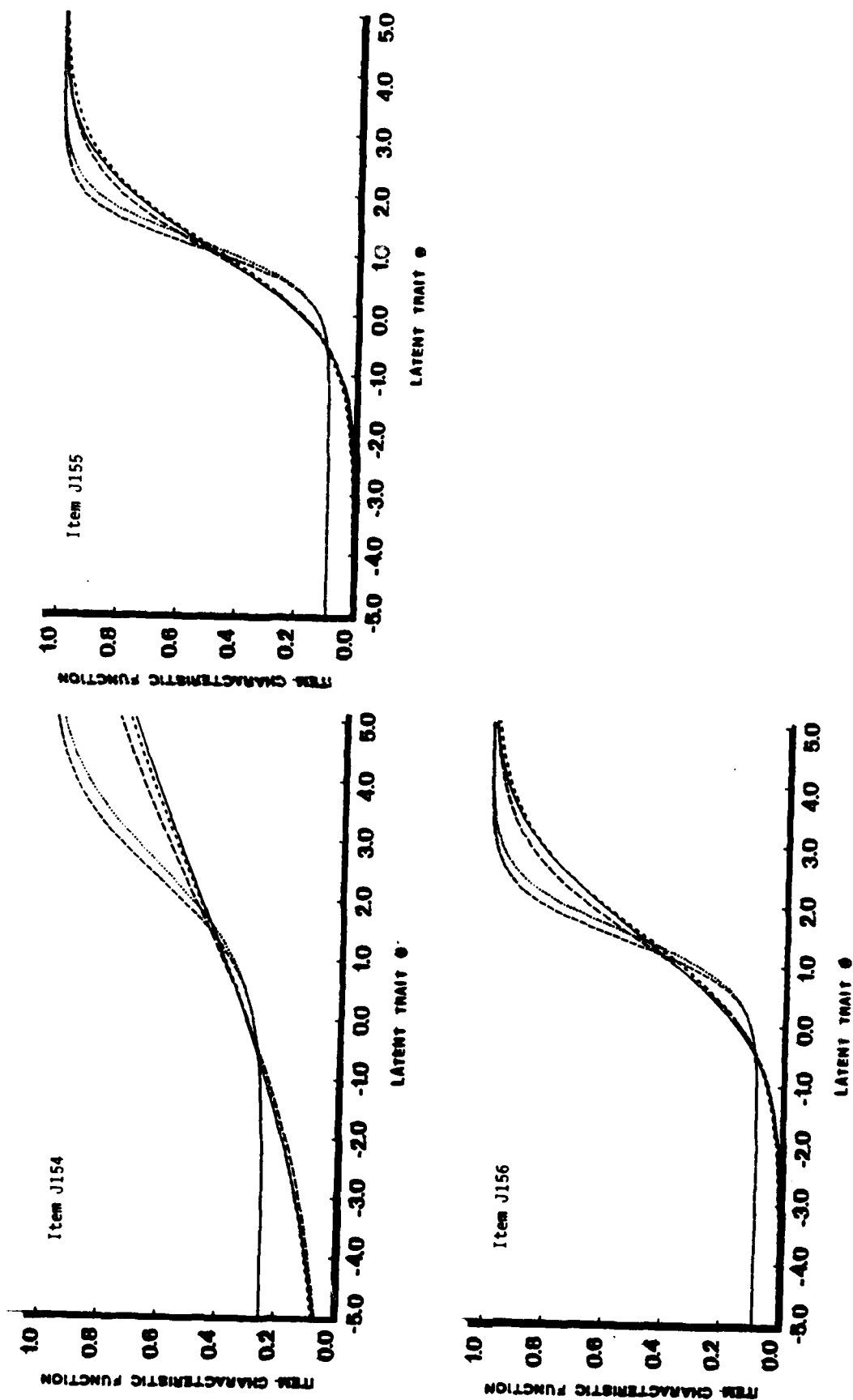


FIGURE 9-5 (Continued)

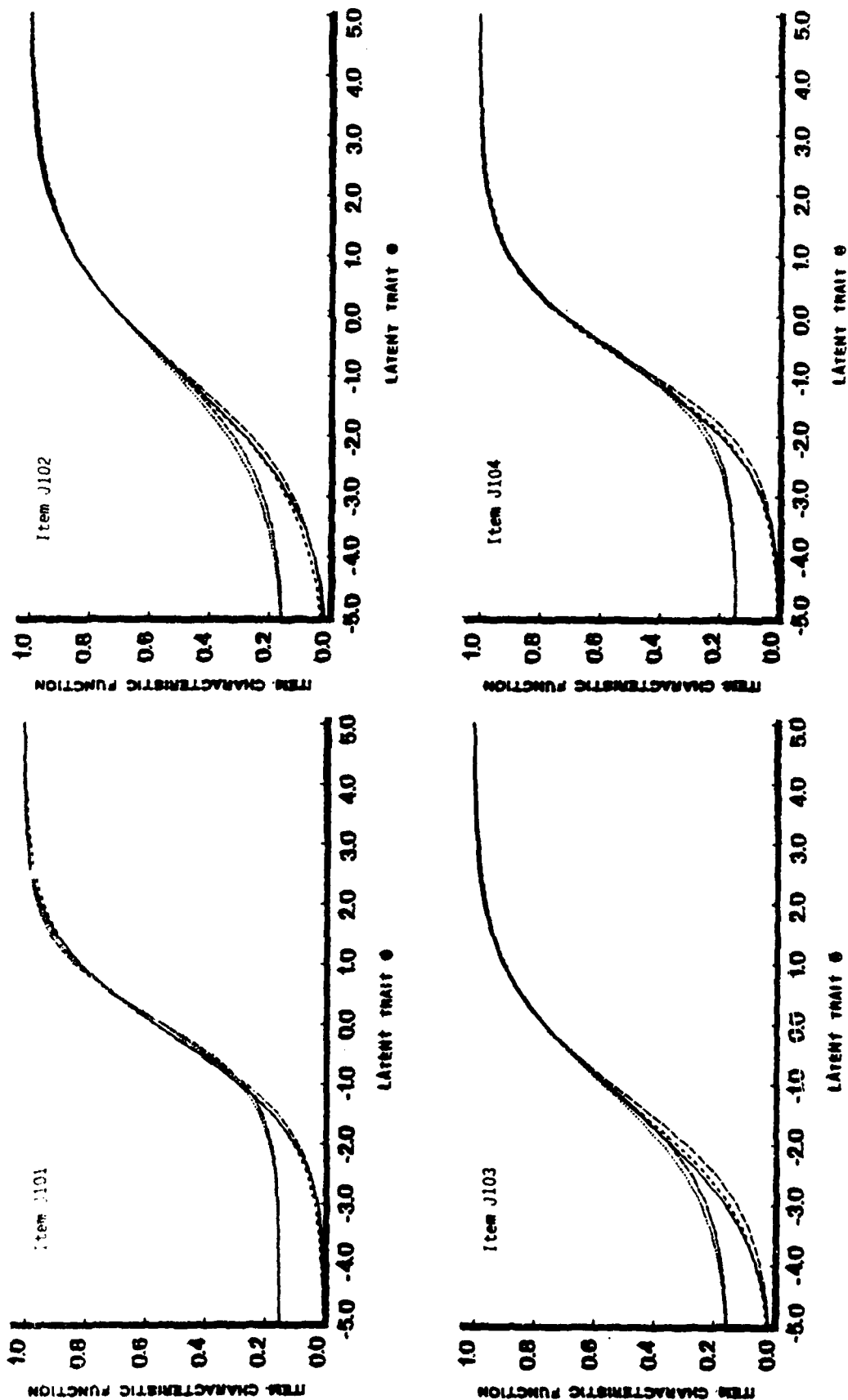


FIGURE 9-6

Estimated Item Characteristic Functions in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Two Estimated Item Characteristic Functions Following the Logistic Model¹ Obtained by Using LOGIST 5, Which Are Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), and Two Estimated Item Characteristic Functions Following the Three-Parameter Logistic Model Obtained by Using LOGIST 5, Which Are Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test J1. Results of the J1/2259 Case.

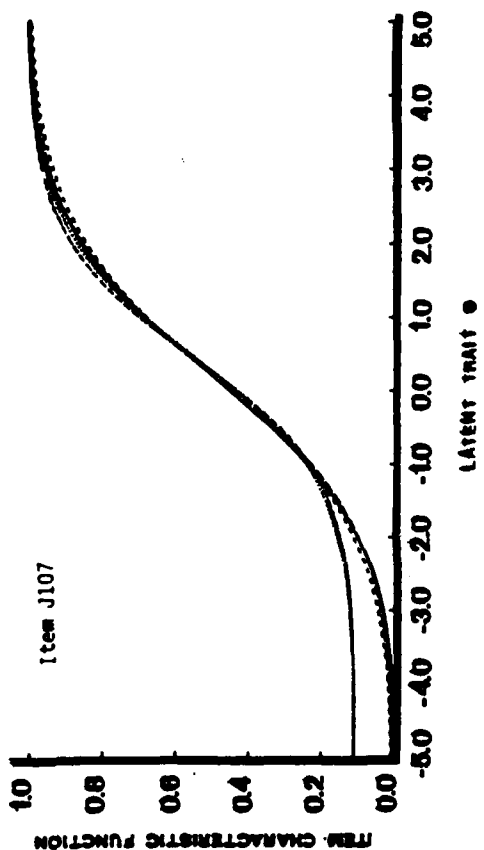
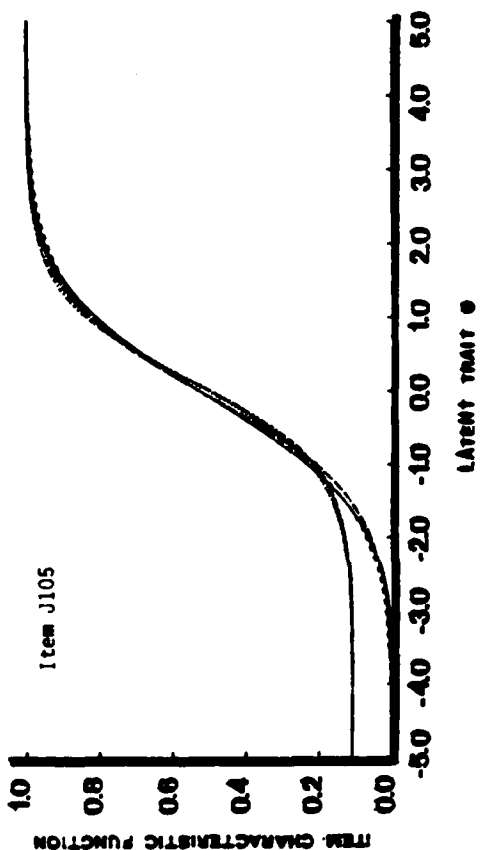
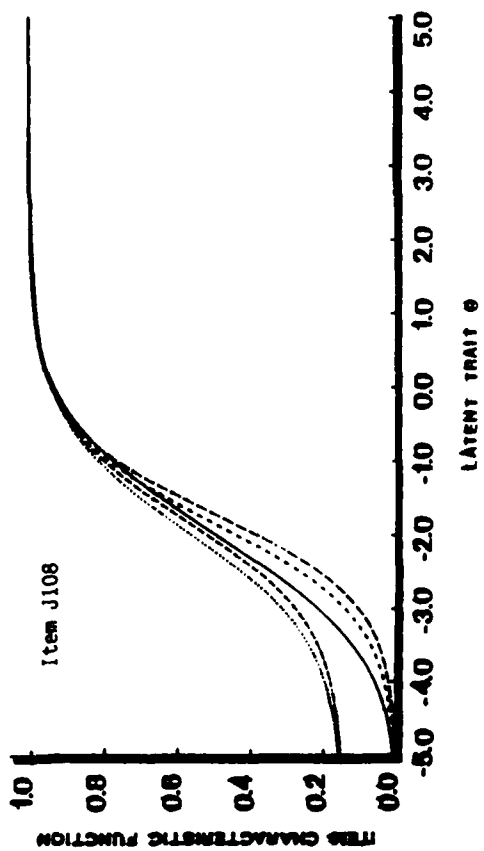
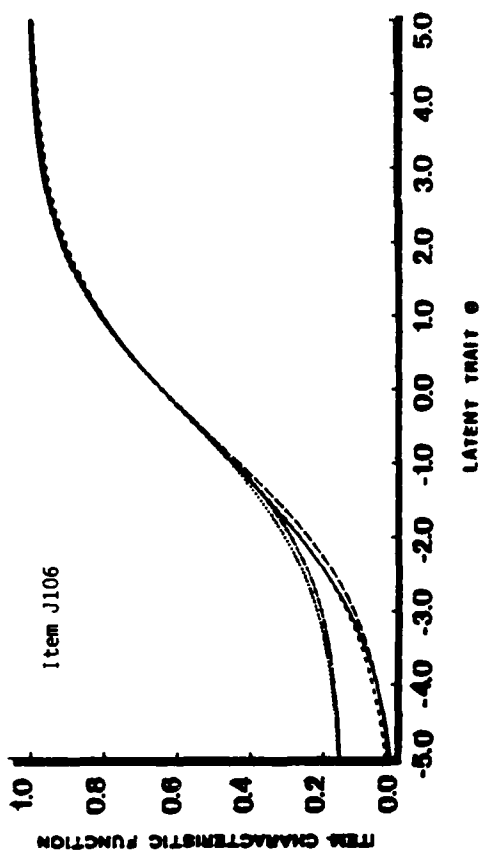


FIGURE 9-6 (Continued)

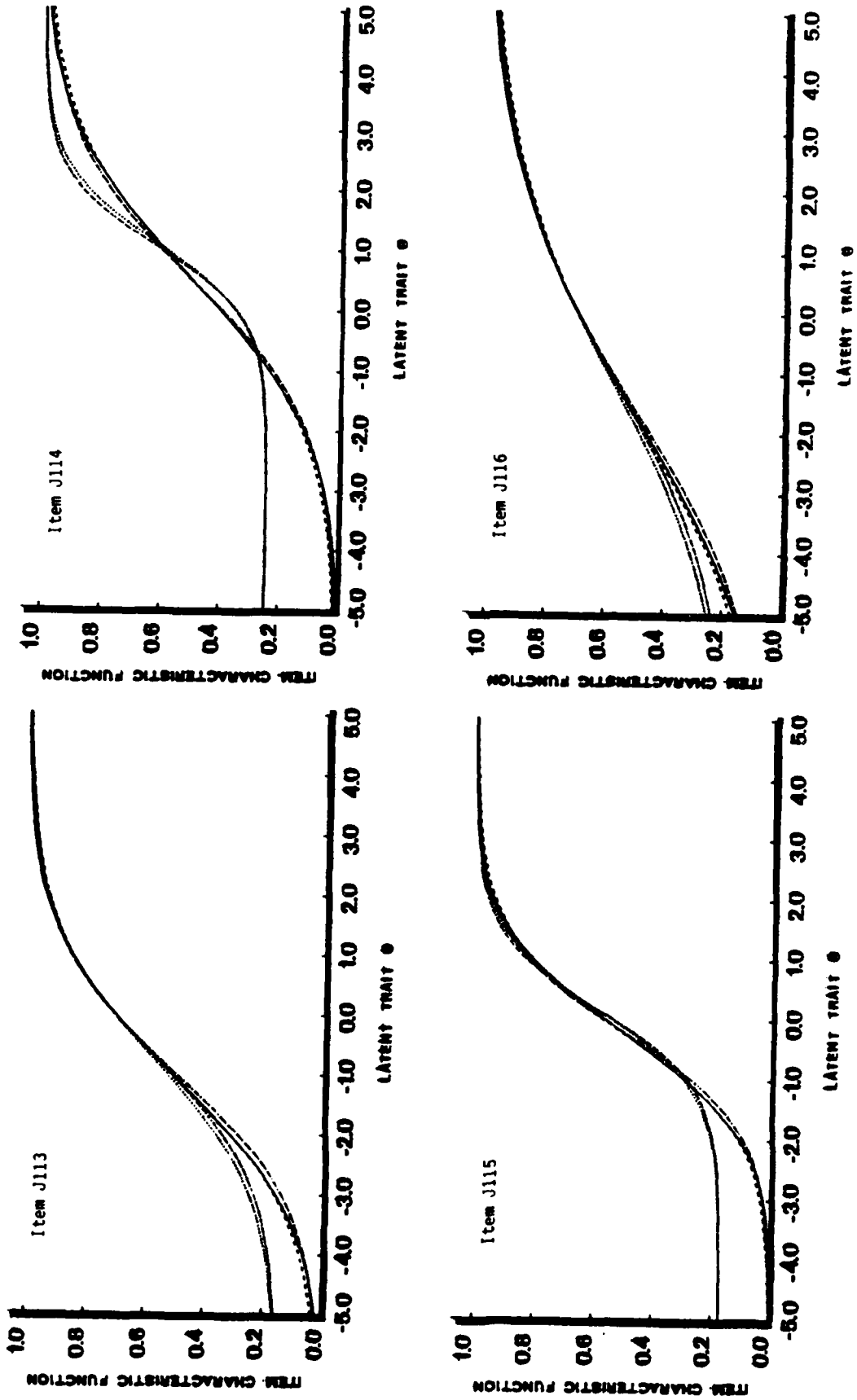


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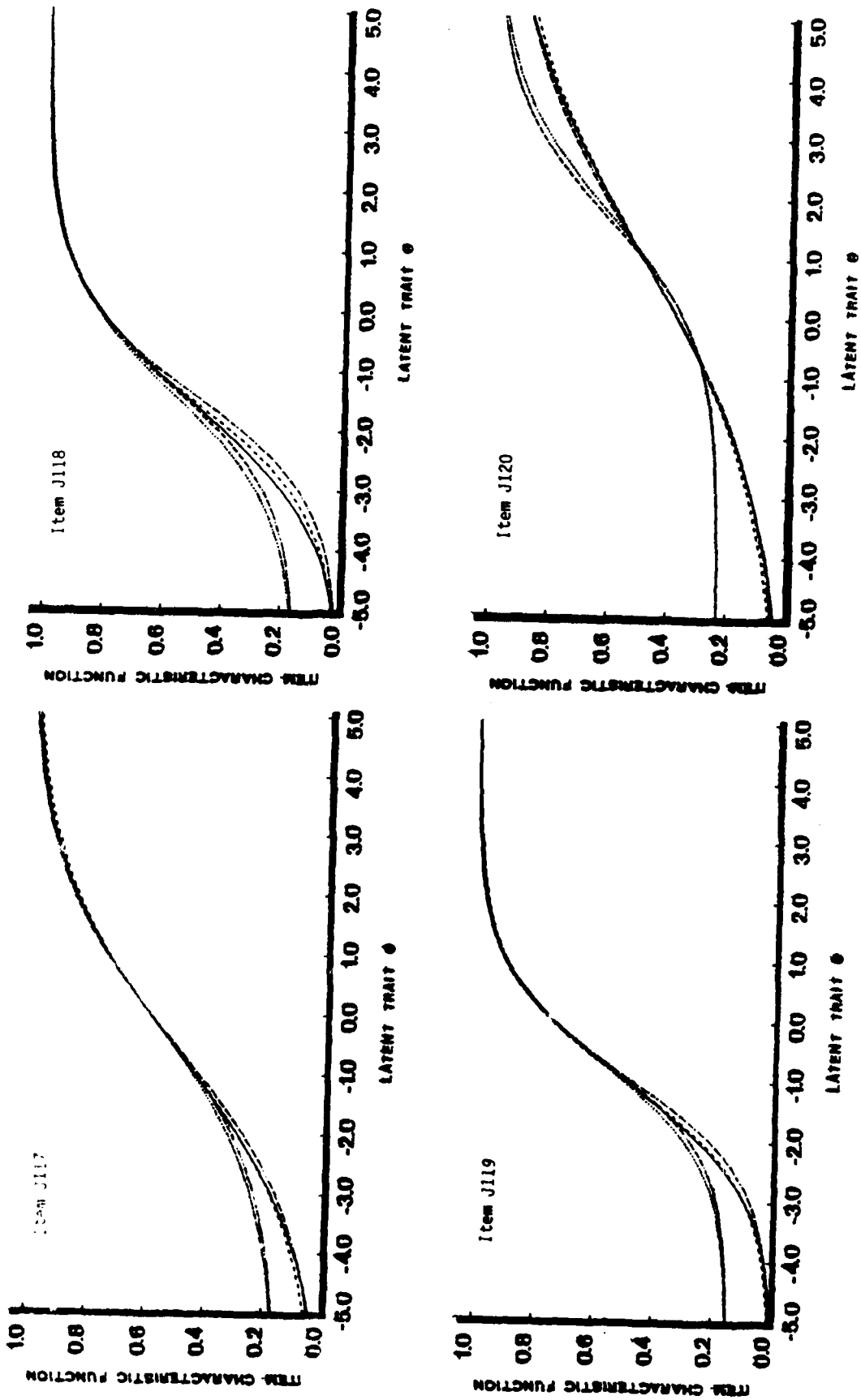


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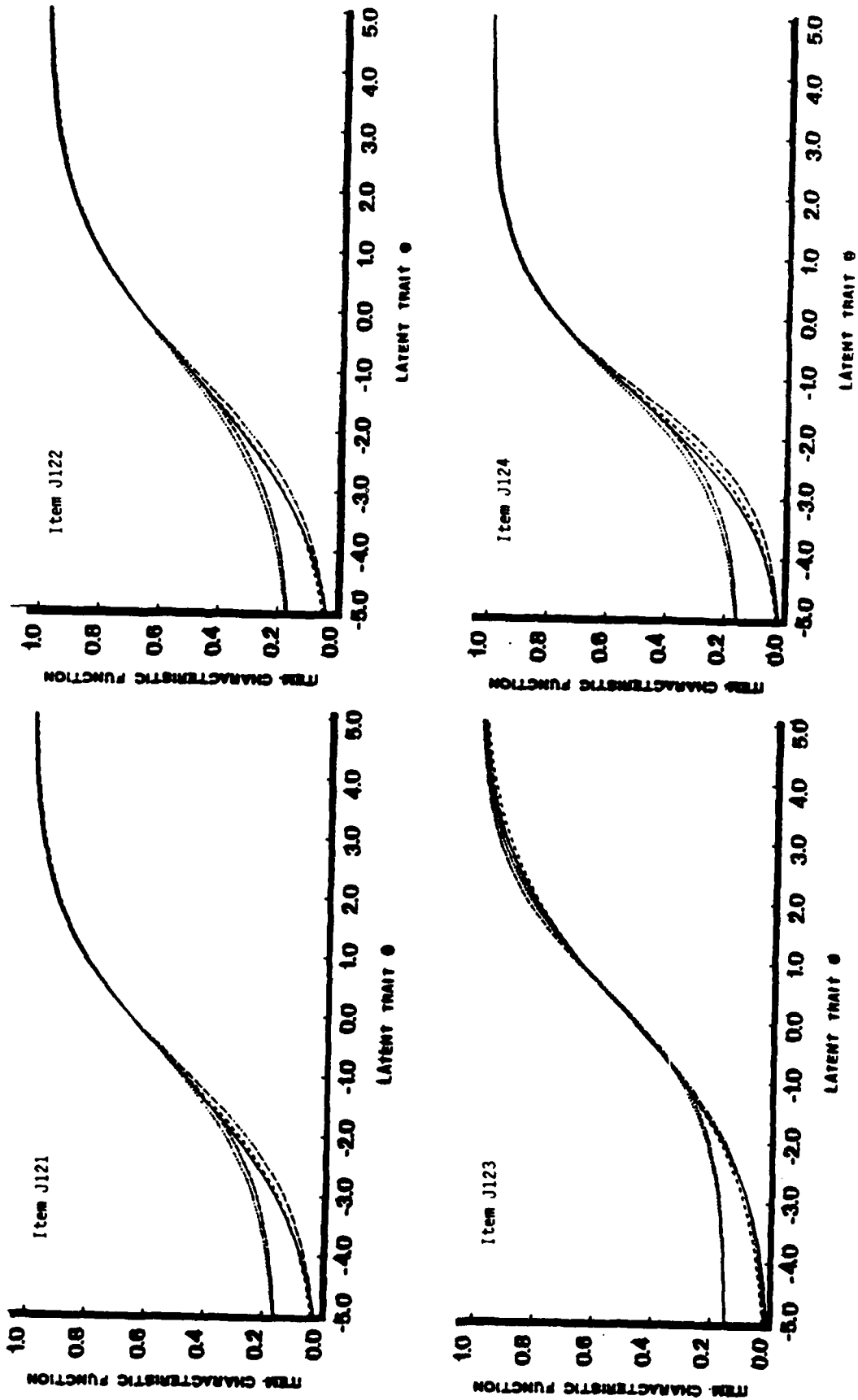


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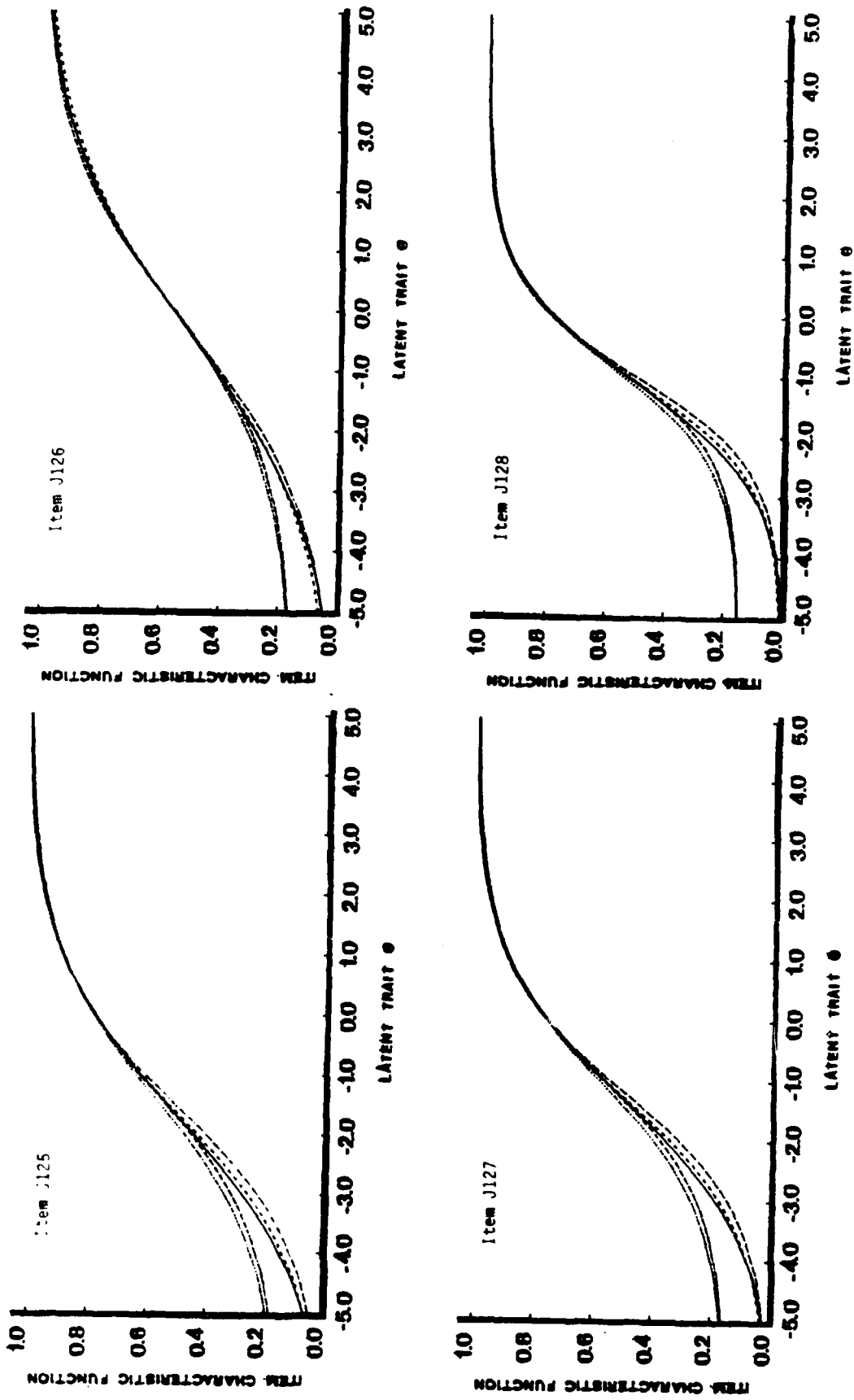


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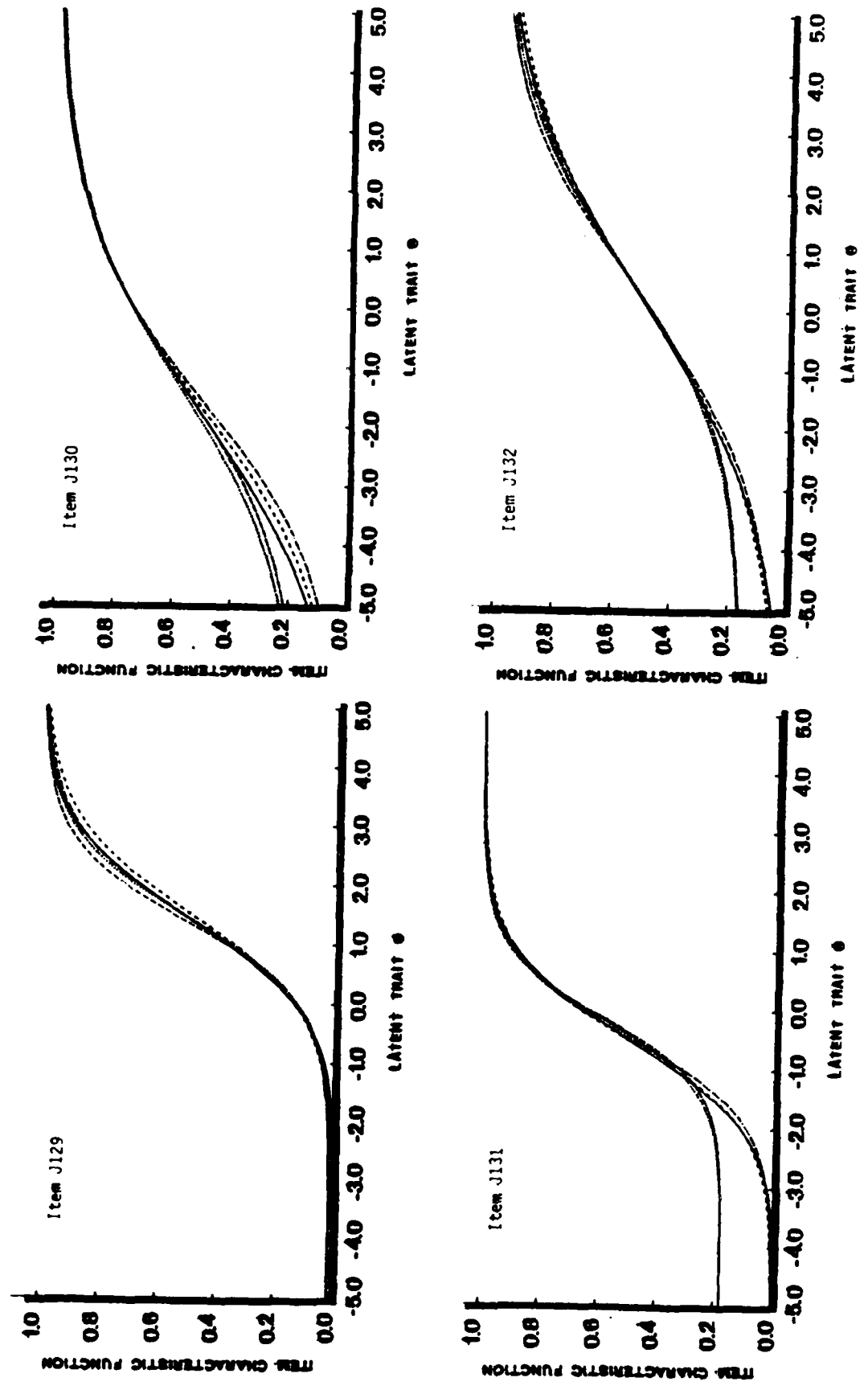


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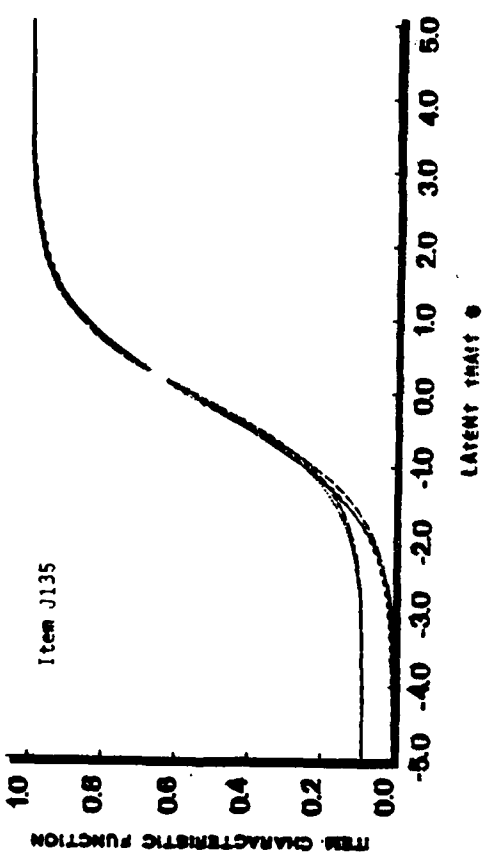
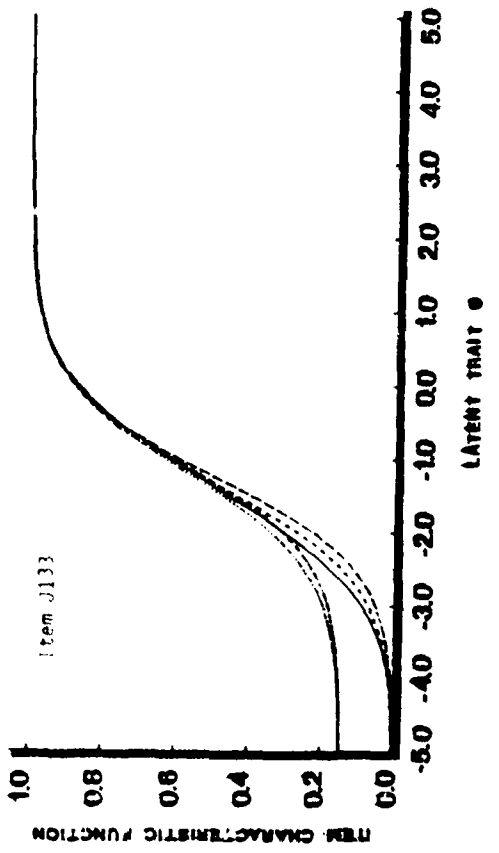
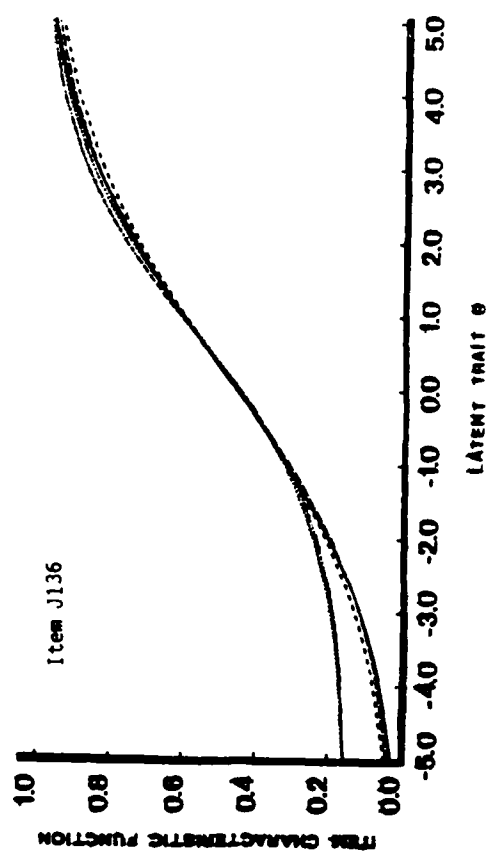
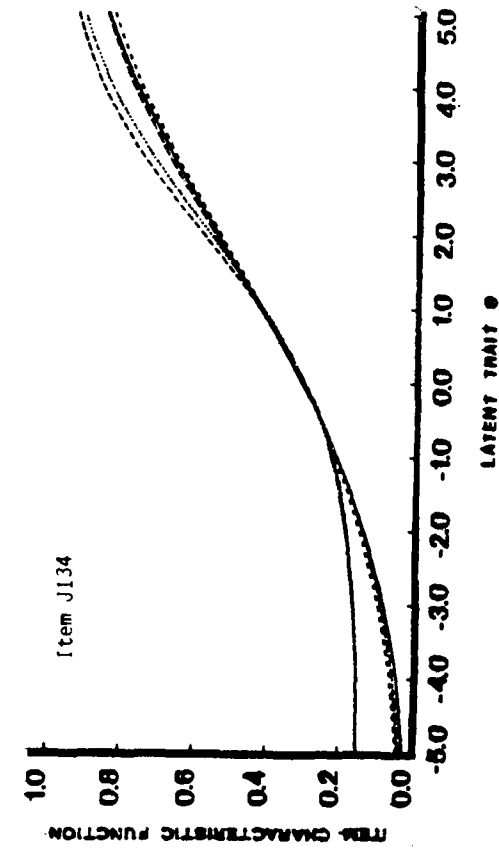


FIGURE 9-6 (Continued)

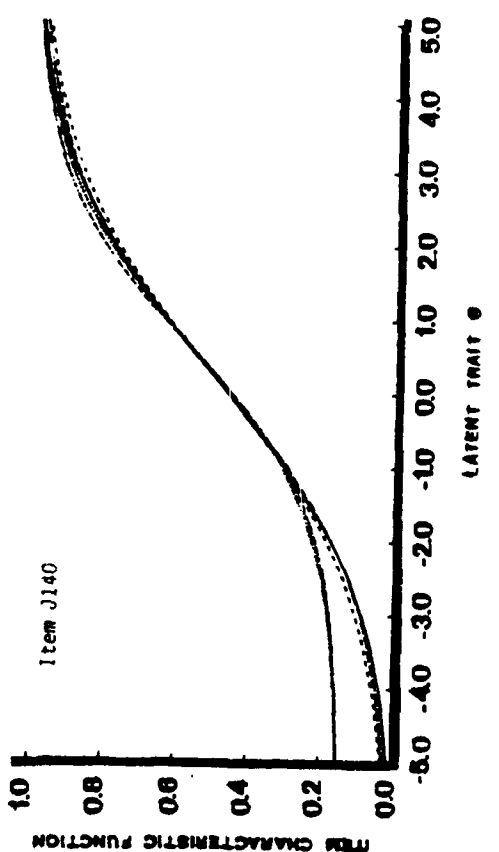
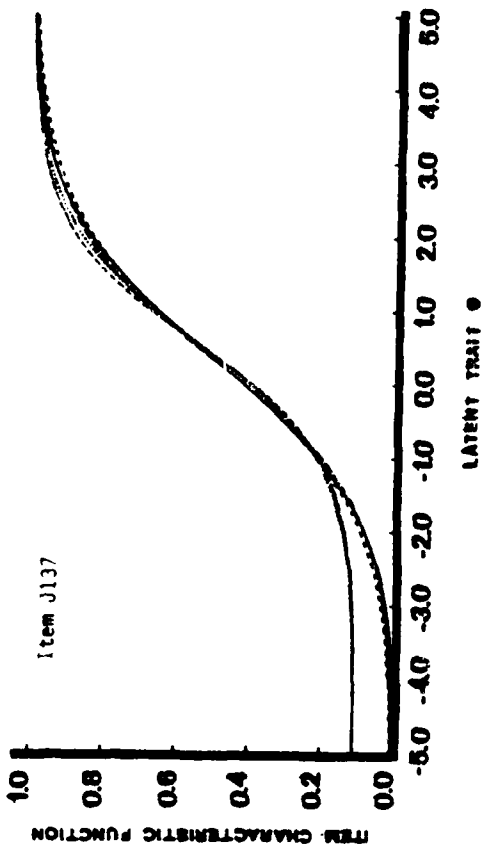
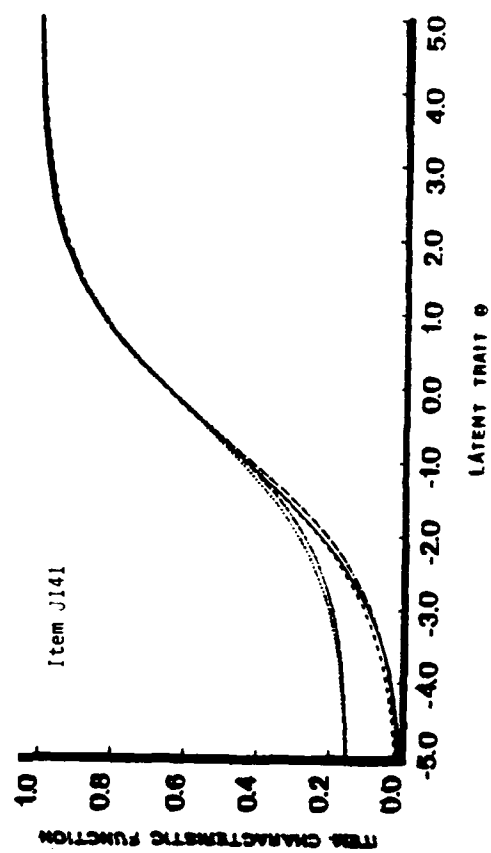
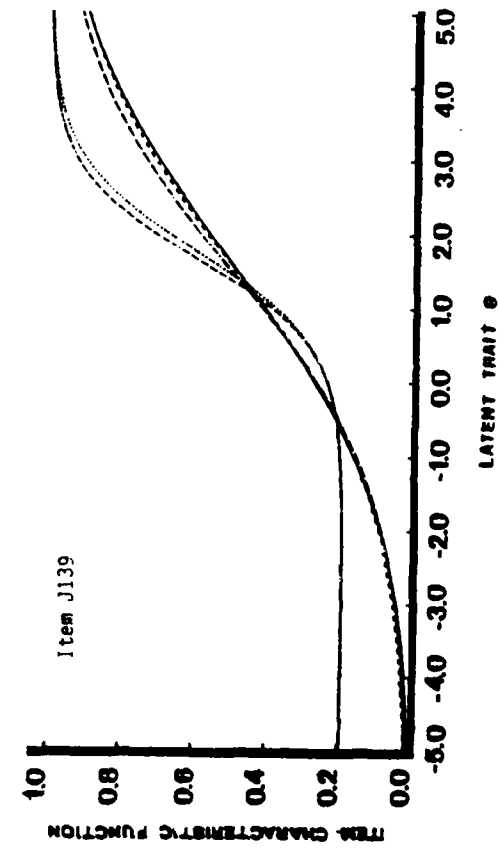
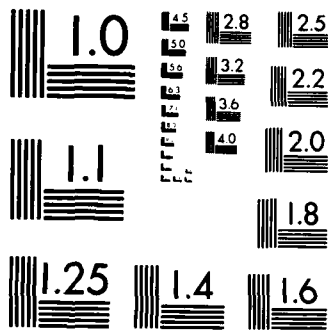


FIGURE 9-6 (Continued)



MICROCOPY RESOLUTION TEST CHART
NBS-1963-A

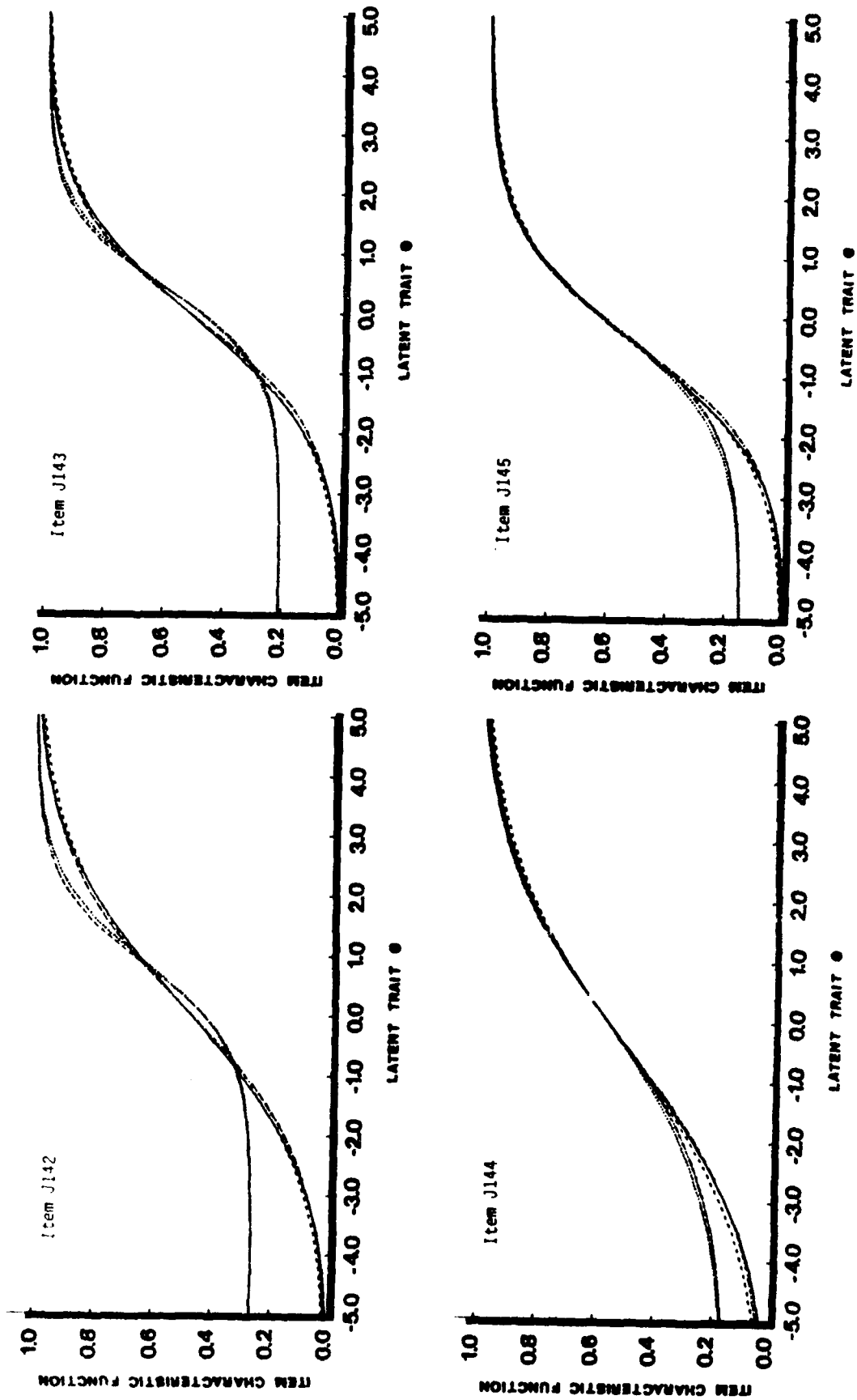


FIGURE 9-6 (Continued)

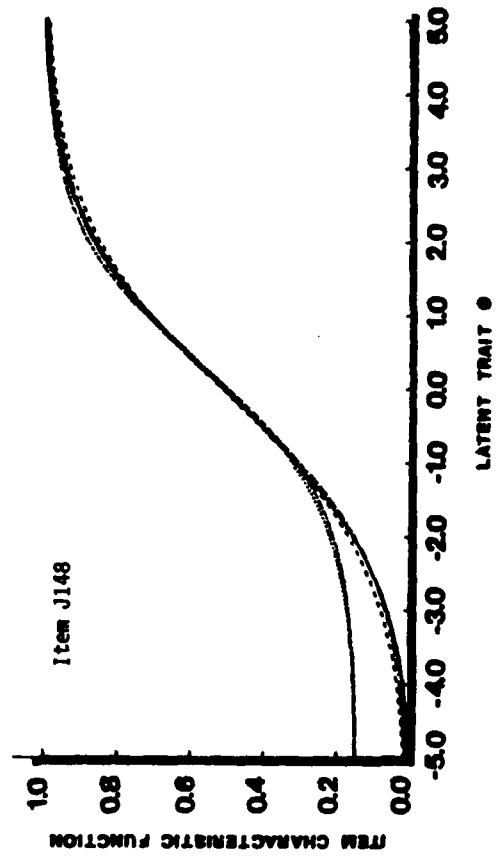
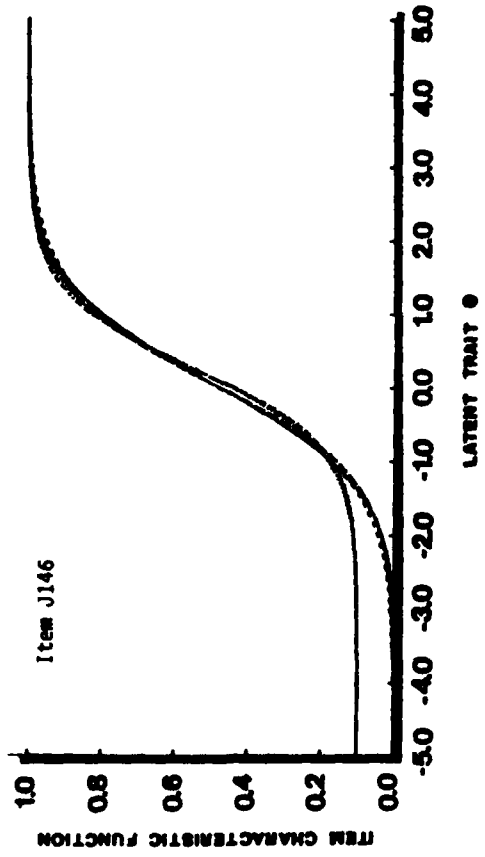
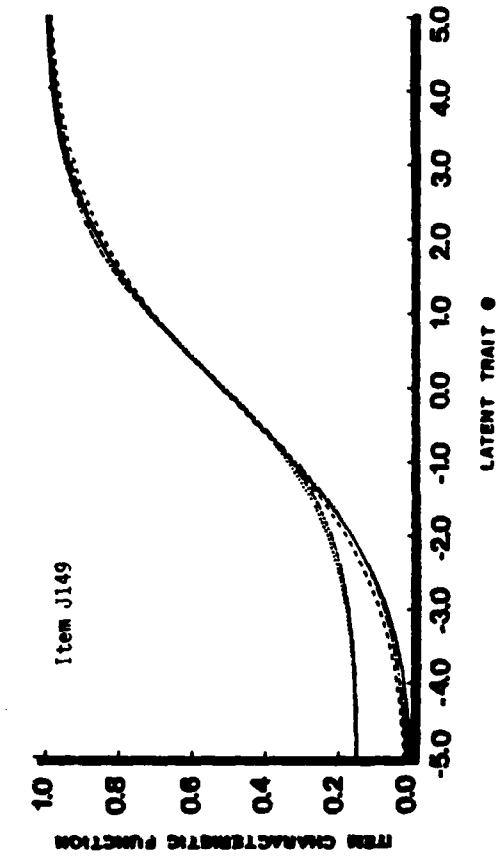
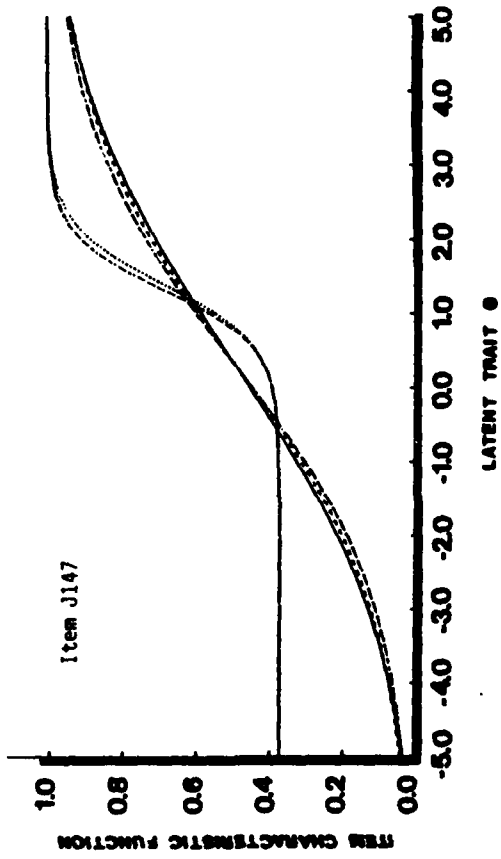


FIGURE 9-6 (Continued)

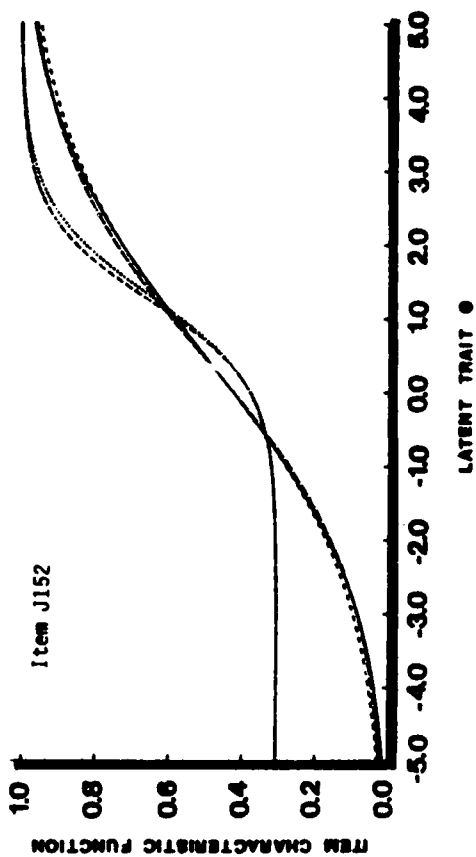
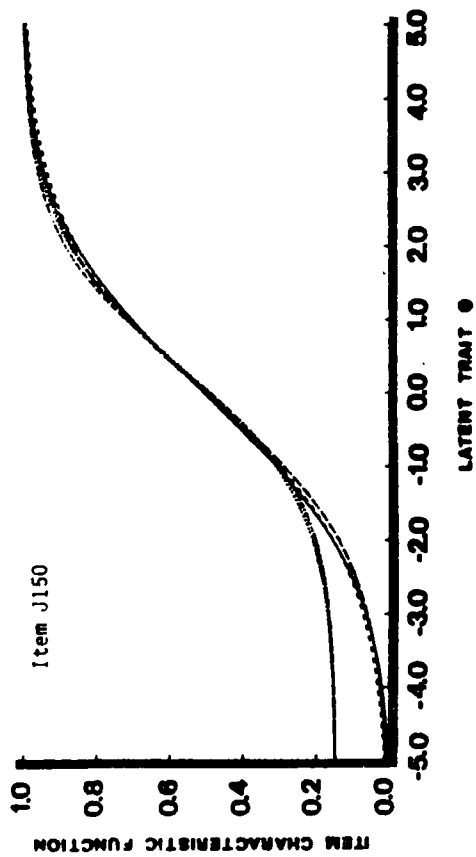
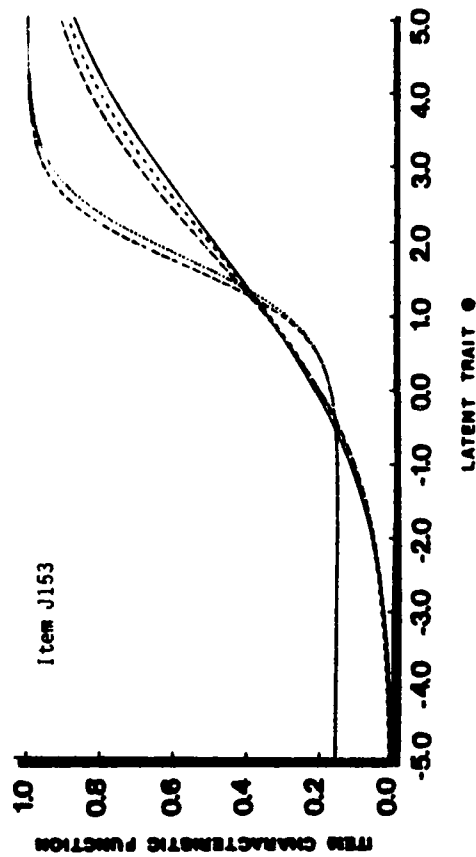
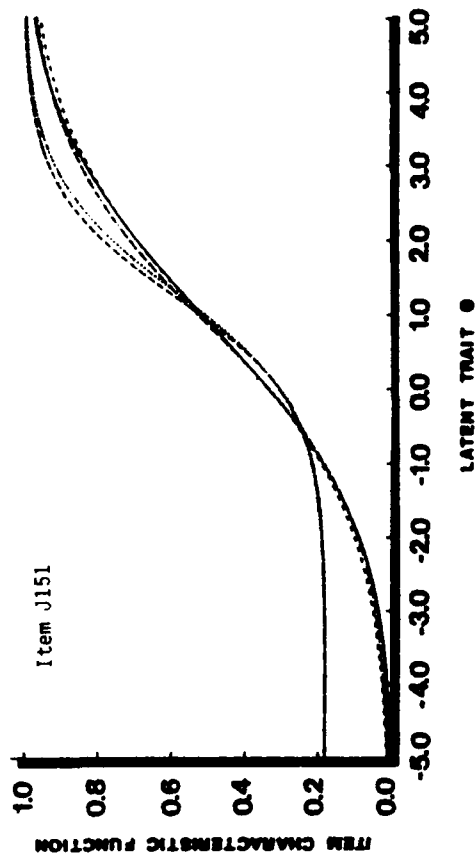


FIGURE 9-6 (Continued)

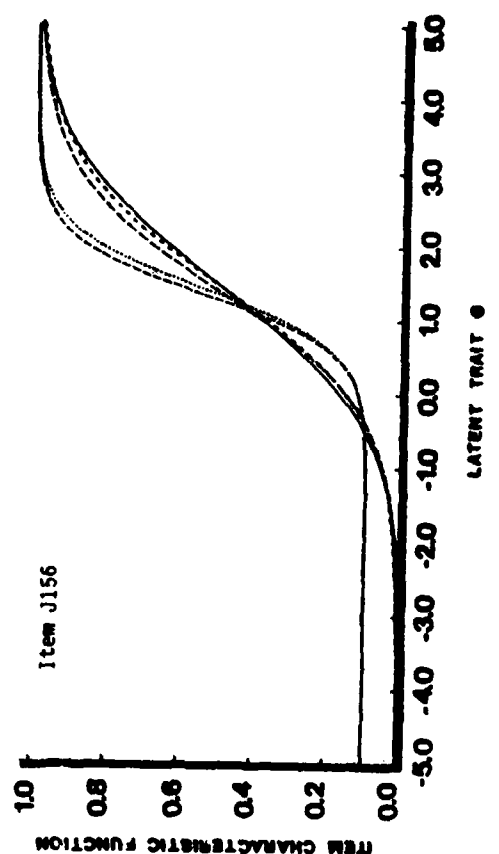
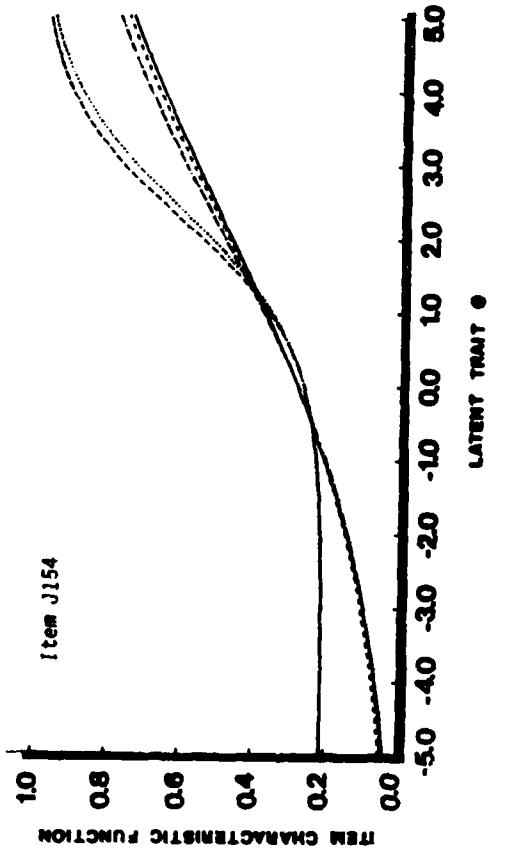
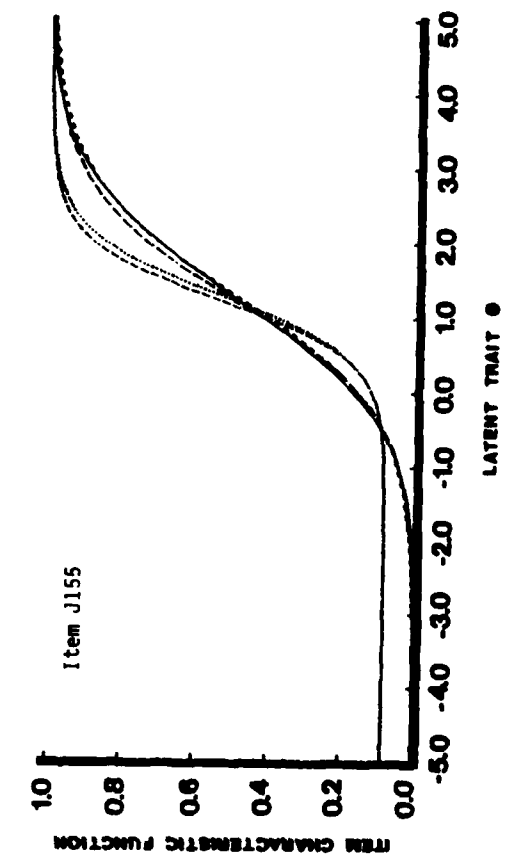


FIGURE 9-6 (Continued)

close to the normal ogive curve, which is drawn by a solid line.

- (4) For certain items, the three-parameter logistic curves are drastically different from the other three curves, whereas for many other items they are close to the other three for the range of θ , $(-1.0, \infty)$.

X. Discussion and Conclusions

Data based upon Shiba's Word/Phrase Comprehension Tests A5, A6, J1 and J2 were analyzed, and the item discrimination and the item difficulty parameters of each item of these tests were estimated by two methods, i.e., Tetrachoric Method and Logist 5. Scale adjustment, or equating, was made in the effort of putting all the estimated item characteristic functions on a single scale of θ . In this process, it was found out that the mean and the standard deviation of the distribution of the maximum likelihood estimate $\hat{\theta}$ seem to be somewhat different from those of the distribution of θ , and a certain systematic tendency has been observed. Further investigation of this tendency will be done in separate paper.

It has been observed by using simulated data (Samejima, ONR/RR-84-3) that the estimated item characteristic functions obtained by Logist 5 by assuming three-parameter logistic model can be drastically different from the true item characteristic function, when the latter follows normal ogive model. This is caused from the fact that in Logist 5 the maximum likelihood estimate $\hat{\theta}$ is treated as if it were θ itself in estimating the item parameters, and especially

on the lower side of θ the maximum likelihood estimate contains a substantial amount of error (Samejima, 1973; Lord, 1980). More detailed observation and discussion of this problem will be made, again, in a separate paper.

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APPENDIX

TABLE A-1

Intermediate Results for Obtaining the Best Fitted Linear Relationships between the Two Sets of Estimated Item Discrimination Parameters for the Mapping Test Items and between Those of Estimated Difficulty Parameters, Which Were Obtained by the Method, for 14 Overlapping Items of Tests A5 and A6, A5/0599 and A6/0412 Cases.

TITLE: SHIBA'S DATA
A5-0599 VS A6-0412 (TEST 1)

ITEM DISCRIMINATION PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	0.95380000D 01	0.68128571D 00	0.71331080D 01	0.50950771D 00	0.45357490D-01	0.21297298D 00
2	0.80030000D 01	0.57164286D 00	0.49577170D 01	0.35412264D 00	0.27347087D-01	0.16536955D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.100000000000D 01	0.8409230123745D 00
2	0.8409230123745D 00	0.100000000000D 01

COVARIANCE MATRIX

1	0.4535748979592D-01	0.2961667346939D-01
2	0.2961667346939D-01	0.2734708673469D-01

CROSS PRODUCT MATRIX

1	0.5095077142857D 00	0.41906687857143D 00
2	0.41906687857143D 00	0.3541226428571D 00

C *****

NOTE : THE FOLLOWING 2 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 2 14

THUS THE RESULTING NUMBER OF ITEMS IS 14

C *****

TABLE A-1 (Continued): A5/0599 And A6/0412 Cases.

ITERATION 0

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 1.199495253067

WEIGHTED CROSS-PRODUCT MATRIX

1	0.5095077142857D 00	0.5026710191729D 00
2	0.5026710191729D 00	0.5095077143710D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.6836695155515D-02	0.0000000000000D 00	-0.7071067812165D 00	0.0000000000000D 00
2	0.1012178733501D 01	0.0000000000000D 00	0.7071067812165D 00	0.0000000000000D 00

IMSL SUBROUTINE IEGF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 1.019015428657

SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX = 1.019015428657

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.10000000000085D 01

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 = 0.8336839996056D 00

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = 0.3665857982987D-02

TABLE A-1 (Continued): A5/0599 And A6/0412 Cases.

ITERATION	WEIGHT	S. D. RATIO (SLOPE)	INTERCEPT
1	1.000000000000	0.831646872746	0.005053723411
2	1.202433427902	0.833711740337	0.003646956619
3	1.199455341237	0.833683622317	0.003666115025
4	1.199495795805	0.833684004736	0.003665854488
5	1.199495245584	0.833683999535	0.003665858031
6	1.199495253067	0.833683999606	0.003665857983

TABLE A-1 (Continued): A5/0599 And A6/0412 Cases.

ITEM DIFFICULTY PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	-0.65950000D 01	-0.61392857D 00	0.93064810D 01	0.66474864D 00	0.28784035D 00	0.53650755D 00
2	-0.10240000D 01	-0.73142857D-01	0.49998740D 01	0.35713386D 00	0.35178398D 00	0.59311380D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.100000000000D 01	0.7401978051847D 00
2	0.7401978051847D 00	0.100000000000D 01

COVARIANCE MATRIX

1	0.287840352040D 00	0.2355383673469D 00
2	0.2355383673469D 00	0.3517839795918D 00

CROSS PRODUCT MATRIX

1	0.6647486428571D 00	0.2804428571429D 00
2	0.2804428571429D 00	0.3571338571429D 00

C *****

NOTE : THE FOLLOWING 2 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 2 14

THUS THE RESULTING NUMBER OF ITEMS IS 14

C *****

TABLE A-1 (Continued): A5/0599 And A6/0412 Cases.

ITERATION 22

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 0.904560896885

WEIGHTED COVARIANCE MATRIX

1	0.2878403520408D 00	0.2130587968182D 00
2	0.2130587968182D 00	0.2878403520246D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

EIGENVALUE		EIGENVECTOR	
(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.5008991488509D 00	0.0000000000000D 00	0.7071067812000D 00
2	0.7147815521452D-01	0.0000000000000D 00	0.7071067811731D 00

IMSL SUBROUTINE IGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.575680704065

SUM OF DIAGONALS OF COVARIANCE MATRIX = 0.575680704065

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.9999999999619D 00

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 = 0.1105508764977D 01

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = 0.6055605596413D 00

ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2 USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT = -0.5477664029682D 00

TABLE A-1 (Continued):

For 14 Overlapping Items of Tests A6 and J1, A6/0412 And J1/0614 Cases.

TITLE: SHIBA'S DATA
A6-0412 VS. J1-0614 (TEST 1)

ITEM DISCRIMINATION PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	0.86120000D 01	0.61514286D 00	0.55404400D 01	0.39574571D 00	0.17344980D-01	0.13170034D 00
2	0.85160000D 01	0.60828571D 00	0.56974460D 01	0.40696043D 00	0.36948918D-01	0.19222101D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.100000000000D 01	0.5235044981970D 00
2	0.5235044981970D 00	0.100000000000D 01

COVARIANCE MATRIX

1	0.1734497959184D-01	0.1325281632653D-01
2	0.1325281632653D-01	0.3694891836735D-01

CROSS PRODUCT MATRIX

1	0.3957457142857D 00	0.3874354285714D 00
2	0.3874354285714D 00	0.4069604285714D 00

C *****

NOTE : THE FOLLOWING 2 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 14

THUS THE RESULTING NUMBER OF ITEMS IS 14

C *****

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

ITERATION 7

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 0.986125113863

WEIGHTED CROSS-PRODUCT MATRIX

1 0.3957457142857D 00 0.3820598061144D 00
 2 0.3820598061144D 00 0.3957457143091D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

EIGENVALUE		EIGENVECTOR	
(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.1368590818301D-01	0.0000000000000D 00	-0.7071067811974D 00 0.7071067811757D 00
2	0.7778055204118D 00	0.0000000000000D 00	-0.7071067811757D 00 -0.7071067811974D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.751491428595

SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX = 0.791491428595

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.00000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.100000000000031D 01

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 = 0.1014070107305D 01

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.1551226886493D-01

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT
1	1.000000000000	1.014577739339	-0.015824535085
2	0.985631717735	1.014051927940	-0.015501085958
3	0.986142792541	1.014070758520	-0.015512669455
4	0.986124480564	1.014070083976	-0.015512254515
5	0.986125136518	1.014070108139	-0.015512269378
6	0.986125113021	1.014070107274	-0.015512268846
7	0.986125113863	1.014070107305	-0.015512268865

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

ITEM DIFFICULTY PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	-0.94800000 01	-0.67714286 00	0.88560460 01	0.63257471 00	0.17405227 00	0.41719572 00
2	-0.37210000 01	-0.26578571 00	0.47963270 01	0.34259479 00	0.27195274 00	0.52149088 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.100000000000 01	0.846745342959 5D
2	0.846745342959 5D	0.100000000000 01

COVARIANCE MATRIX

1	0.174052265306 1D	0.184221102040 8D
2	0.184221102040 8D	0.271952739795 9D

CROSS PRODUCT MATRIX

1	0.632574714285 7L	0.364196000000 0D
2	0.364196000000 0D	0.342594785714 3D

C *****

NOTE : THE FOLLOWING 2 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 14

THUS THE RESULTING NUMBER OF ITEMS IS 14

C *****

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

ITERATION 14

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 0.800005772627

WEIGHTED COVARIANCE MATRIX

1	0.1740522653061D 00	0.1473779450723D 00
2	0.1473779450723D 00	0.1740522652891D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.3214302103699D 00	0.0000000000000D 00	0.7071067812069D 00	0.0000000000000D 00
2	0.2667432022530D-01	0.0000000000000D 00	0.7071067811662D 00	0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.348104530595

SUM OF DIAGONALS OF COVARIANCE MATRIX = 0.348104530595

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.0000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.9999999999423D 00

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 = 0.1249990980264D 01

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = 0.5806367494928D 00

ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2 USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT = -0.4645127514203D 00

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

ITERATION	WEIGHT	S. D. RATIO (SLOPE)	INTERCEPT	MEAN DISTANCE
1	1.000000000000	1.300414682155	0.614780799059	-0.472757503814
2	0.768985473420	1.241081834236	0.574603984897	-0.462986379339
3	0.805748639948	1.251610256184	0.581733230616	-0.464787842495
4	0.798970761912	1.249698127475	0.580438446319	-0.464462923932
5	0.800193245084	1.250043991803	0.580672645878	-0.464521768582
6	0.79971846237	1.249981385820	0.580630252684	-0.46451119342
7	0.800011913253	1.249992716808	0.580637925381	-0.464513046815
8	0.80004661270	1.249990665975	0.580636536675	-0.464512697958
9	0.80005973820	1.249991037161	0.580636788020	-0.464512761099
10	0.80005736258	1.249990969979	0.580636742528	-0.464512749671
11	0.80005779255	1.249990982138	0.580636750762	-0.464512751739
12	0.80005771473	1.249990979937	0.580636749272	-0.464512751365
13	0.80005772882	1.249990980336	0.580636749542	-0.464512751433
14	0.80005772627	1.249990980264	0.580636749493	-0.464512751420

WHEN SCATTER DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

MEAN OF POP. 1 = 0.	S. D. OF POP. 1 = 1.
MEAN OF POP. 2 = -0.4645127514203D 00	S. D. OF POP. 2 = 0.8000057726729D 00
SLOPE = 0.1249990980264D 01	INTERCEPT = 0.5806367494928D 00

WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S. D. RATIO

MEAN OF POP. 1 = 0.	S. D. OF POP. 1 = 1.
MEAN OF POP. 2 = -0.4377494503856D 00	S. D. OF POP. 2 = 0.9007008047842D 00
SLOPE = 0.110246593195D 01	INTERCEPT = 0.4860098359637D 00

TABLE A-1 (Continued):

For 16 Overlapping Items of Tests J2 and J1, J2/0758 And J1/0614 Cases.

TITLE: SHIBA'S DATA
J2-0758 VS. J1-0614 (TEST 1)

ITEM DISCRIMINATION PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	0.8092000D 01	0.50575000D 00	0.44159780D 01	0.27599862D 00	0.20215563D-01	0.14218144D 00
2	0.11114000D 02	0.69462500D 00	0.83597860D 01	0.52248662D 00	0.39982734D-01	0.19995683D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.100000000000D 01	0.3997593573121D 00
2	0.3997593573121D 00	0.100000000000D 01

COVARIANCE MATRIX

1	0.2021556250000D-01	0.1136521875000D-01
2	0.1136521875000D-01	0.3998273437500D-01

CROSS PRODUCT MATRIX

1	0.2759986250000D 00	0.3626718125000D 00
2	0.3626718125000D 00	0.5224866250000D 00

C *****

NOTE : THE FOLLOWING 3 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 4 7 17

THUS THE RESULTING NUMBER OF ITEMS IS 16

C *****

TABLE A-1 (Continued): J2/0758 And J1/0614 Cases.

ITERATION 9

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 0.726801592904

WEIGHTED CROSS-PRODUCT MATRIX

1	0.2759986250000D 00	0.2635904510264D 00
2	0.2635904510264D 00	0.2759986250041D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.1240817397564D-01	0.0000000000000D 00	-0.7071067811838D 00	0.0000000000000D 00
2	0.5395890760285D 00	0.0000000000000D 00	-0.7071067811838D 00	0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.5513972500004

SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX = 0.5519972500004

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.0000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.10000000000008D 01

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 = 0.1375891315830D 01

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.1232032980777D-02

TABLE A-1 (Continued): J2/0758 And J1/0614 Cases.

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT
1	1.000000000000	1.395984896675	-0.011394361494
2	0.716340128308	1.378952668070	-0.000757311876
3	0.727297763205	1.375935517220	-0.001254387834
4	0.726778244682	1.375889235142	-0.001230980673
5	0.726802692004	1.375891413775	-0.001232082517
6	0.726801541160	1.375891311218	-0.001232030649
7	0.726801595334	1.375891316046	-0.001232033090
8	0.726801592784	1.375891315819	-0.001232032975
9	0.726801592904	1.375891315830	-0.001232032981

TABLE A-1 (Continued): J2/0758 And J1/0614 Cases.

ITEM DIFFICULTY PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	0.86380000D 01	0.53987500D 00	0.12376770D 02	0.77354812D 00	0.48208311D 00	0.69432205D 00
2	-0.11854000D 02	-0.74087500D 00	0.14688514D 02	0.91803212D 00	0.36913636D 00	0.60756593D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.100000000000D 01	0.8162276245961D 00
2	0.8162276245961D 00	0.100000000000D 01

COVARIANCE MATRIX

1	0.48208310937 1D 00	0.3443227031250D 00
2	0.344322703125 0 00	0.3691363593750D 00

CROSS PRODUCT MATRIX

1	0.7735481250000D 00	-0.5565718750000D-01
2	-0.5565718750000D-01	0.9180321250000D 00

C *****

NOTE : THE FOLLOWING 3 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 4 7 17

THUS THE RESULTING NUMBER OF ITEMS IS 16

C *****

TABLE A-1 (Continued): J2/0758 And J1/0614 Cases.

ITERATION 16

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 1.142792931346

WEIGHTED COVARIANCE MATRIX

1	0.48208310937500 00	0.39348955123320 00
2	0.39348955123320 00	0.48208310939970 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.88593558154200-01	0.00000000000000 00	-0.70710678119760 00	0.00000000000000 00
			0.70710678117540 00	0.00000000000000 00
2	0.87557266062050 00	0.00000000000000 00	-0.70710678117540 00	0.00000000000000 00
			-0.70710678119760 00	0.00000000000000 00

IMSL SUBROUTINE IGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.964166218775

SUM OF DIAGONALS OF COVARIANCE MATRIX = 0.964166218775

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.10000000000031D 01

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 = 0.8750491647281D 00

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.1213292167808D 01

ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2 USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT = 0.1386541712984D 01

TABLE A-1 (Continued): JZ/0758 And JI/0614 Cases.

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT	MEAN DISTANCE
1	1.000000000000	0.849347935243	-1.199416716539	1.412161808807
2	1.177373792890	0.880939805924	-1.21642377723	1.380880248052
3	1.135151338690	0.873728365042	-1.21579101077	1.387821604051
4	1.144520471133	0.875346815669	-1.213452862109	1.386253814361
5	1.142404333600	0.874982163041	-1.213255995272	1.386606546418
6	1.142880440584	0.875064250755	-1.213300312376	1.386527116529
7	1.142773229666	0.875045768162	-1.213290334087	1.386544999394
8	1.142797367159	0.875049929455	-1.213292580665	1.386540973062
9	1.142791932596	0.875048992545	-1.213292074850	1.386541879583
10	1.142793156177	0.875049203489	-1.213292188733	1.386541675481
11	1.142792880690	0.875049155995	-1.213292163093	1.386541721434
12	1.142792942715	0.875049166688	-1.213292168866	1.386541711088
13	1.142792928750	0.875049164281	-1.213292167566	1.386541713417
14	1.142792931894	0.875049164823	-1.213292167859	1.386541712893
15	1.142792931186	0.875049164701	-1.213292167793	1.386541713011
16	1.142792931346	0.875049164728	-1.213292167808	1.386541712984

WHEN SCATTER DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

MEAN OF POP. 1 = 0.	S.D. OF POP. 1 = 1.
MEAN OF POP. 2 = 0.1386541712984D 01	S.D. OF POP. 2 = 0.1142792931310D 01
SLOPE = 0.8750491647281D 00	INTERCEPT = -0.1213292167808D 01

WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

MEAN OF POP. 1 = 0.	S.D. OF POP. 1 = 1.
MEAN OF POP. 2 = 0.1468885831893D 01	S.D. OF POP. 2 = 0.1253937346912D 01
SLOPE = 0.974880104358D 00	INTERCEPT = -0.1171418839634D 01

TABLE A-1 (Continued):

For 51 Overlapping Items of Test J1, J1/1075 And J1/0614 Cases.

TITLE: SHIBA'S DATA
J1-1074 VS. J1-0614(TEST 1)

ITEM DISCRIMINATION PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	0.28444000D 02	0.55772549D 00	0.16950276D 02	0.33235835D 00	0.21300631D-01	0.14594736D 00
2	0.29880403D 02	0.58589026D 00	0.18849666D 02	0.36960130D 00	0.26333899D-01	0.16227723D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.100000000000D 01	0.8918349193782D 00
2	0.8918349193782D 00	0.100000000000D 01

COVARIANCE MATRIX

1	0.2130063052672D-01	0.2112215775133D-01
2	0.2112215775133D-01	0.2633389857026D-01

CROSS PRODUCT MATRIX

1	0.3323583529412D 00	0.3478880912473D 00
2	0.3478880912473D 00	0.3696012975106D 00

C *****

NOTE : THE FOLLOWING 4 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 20 34 53

THUS THE RESULTING NUMBER OF ITEMS IS 51

C *****

TABLE A-1 (Continued): J1/1075 And J1/0614 Cases.

ITERATION 6

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 0.948279922320

WEIGHTED CROSS-PRODUCT MATRIX

1	0.3323583529412D 00	0.3298952921442D 00
2	0.3298952921442D 00	0.3323583529404D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.6622536450850D 00	0.0000000000000D 00	0.7071067811870D 00	0.0000000000000D 00
2	0.2463060796568D-02	0.0000000000000D 00	-0.7071067811861D 00	0.0000000000000D 00

IMSL SUBROUTINE IECRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.664716705882

SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX = 0.664716705882

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.99999999999988D 00

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 = 0.1054540939296D 01

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.2254100442144D-02

TABLE A-1 (Continued): J1/1075 And J1/0614 Cases.

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT
1	1.000000000000	1.054958746346	-0.002487122084
2	0.947904364473	1.054537820491	-0.002252361006
3	0.948282726867	1.054540962581	-0.002254113429
4	0.948279901382	1.054540939122	-0.002254100345
5	0.948279922478	1.054540939297	-0.002254100443
6	0.948279922320	1.054540939296	-0.002254100442

TABLE A-1 (Continued): J1/1075 And J1/0614 Cases.

ITEM DIFFICULTY PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	-0.15737000D 02	-0.30856863D 00	0.45800121D 02	0.89804159D 00	0.80282699D 00	0.89600613D 00
2	-0.27864246D 02	-0.54635777D 00	0.47578883D 02	0.93291928D 00	0.63441247D 00	0.79650014D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.100000000000D 01	0.9762090248589D 00
2	0.9762090248589D 00	0.100000000000D 01

COVARIANCE MATRIX

1	0.8028269903883D 00	0.6966901266655D 00
2	0.6966901266655D 00	0.6344124693203D 00

CROSS PRODUCT MATRIX

1	0.8980415882353D 00	0.8652789933303D 00
2	0.8652789933303D 00	0.9329192803139D 00

C *****

NOTE : THE FOLLOWING 4 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 20 34 53

THUS THE RESULTING NUMBER OF ITEMS IS 51

C *****

TABLE A-1 (Continued): J1/1075 And J1/0614 Cases.

ITERATION 7

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 1.124929037174

WEIGHTED COVARIANCE MATRIX

1 0.8028269903883D 00 0.7837269533981D 00
 2 0.7837269533981D 00 0.8028269903489D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.158653943767D 01	0.00000000000000D 00	0.7071067811954D 00	0.00000000000000D 00
2	0.1910003697046D-01	0.00000000000000D 00	0.7071067811777D 00	0.00000000000000D 00

IMSL SUBROUTINE IGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 1.605653980737

SUM OF DIAGONALS OF COVARIANCE MATRIX = 1.605653980737

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.9999999999749D 00

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 = 0.8889449617972D 00

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.2720572415696D 00

ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2 USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT = 0.3060450908227D 00

TABLE A-1 (Continued)

for 50 Overlapping Items of Test J1, J1/2259 And J1/6614 Cases

FILE SHIPPA'S DATA
J1-2259 VS. J1-0614 (TEST 1)

ITEM DISCRIMINATION PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	0.28065000D 02	0.56130000D 00	0.16806635D 02	0.33613270D 00	0.21075010D-01	0.14517235D 00
2	0.27877960D 02	0.55755919D 00	0.16818299D 02	0.33636598D 00	0.25493724D-01	0.15966754D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.10000000000000D 01
2	0.8766880632215D 00
	0.10000000000000D 01

COVARIANCE MATRIX

1	0.21075010000000D-01
2	0.2032102568093D-01
	0.2549372362347D-01

CROSS PRODUCT MATRIX

1	0.3361327000000D 00
2	0.3332790007617D 00
	0.3363659774213D 00

C. *****

NOTE : THE FOLLOWING 5 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 20 30 34 53

THUS THE RESULTING NUMBER OF ITEMS IS 50

C. *****

TABLE A-1 (Continued): JI/2259 And JI/0614 Cases.

ITERATION 5

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 0.999653178539

WEIGHTED CROSS-PRODUCT MATRIX

1	0.336132700000D 00	0.3331634124516D 00
2	0.3331634124516D 00	0.3361327000015D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.29692875491340-02	0.0000000000000D 00	-0.7071067811873D 00	0.0000000000000D 00
2	0.6692961124523D 00	0.0000000000000D 00	-0.7071067811873D 00	0.0000000000000D 00

IMSL SUBROUTINE IGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.672265400001

SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX = 0.672265400001

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.1000000000000D 01

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 = 0.1000346941790D 01

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.3935545338146D-02

TABLE A-1 (Continued): J1/2259 And J1/0514 Cases.

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT
1	1.000000000000	1.000350034417	-0.003937281230
2	0.999650088064	1.000346914228	-0.003935529867
3	0.999653206080	1.000346942036	-0.003935545476
4	0.999653178291	1.000346941788	-0.003935545337
5	0.999653178539	1.000346941790	-0.003935545338

TABLE A-1 (Continued): JI/2259 And JI/0614 Cases.

ITEM DIFFICULTY PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	-0.13932000 02	-0.27864000 00	0.42542096D 02	0.85084192D 00	0.77320167D 00	0.87931887D 00
2	-0.28417353D 02	-0.56834706D 00	0.53543449D 02	0.10708690D 01	0.74785060D 00	0.86478356D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.1000000000000 01	0.9522353454024D 00
2	0.9522353454024D 00	0.1000000000000 01

COVARIANCE MATRIX

1	0.7732016704000D 00	0.7240992757067D 00
2	0.7240992757067D 00	0.7478506011339D 00

CROSS PRODUCT MATRIX

1	0.8508419200000D 00	0.8824635000518D 00
2	0.8824635000518D 00	0.1070868979895D 01

C *****

NOTE : THE FOLLOWING 5 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 20 30 34 53

THUS THE RESULTING NUMBER OF ITEMS IS 50

C *****

TABLE A-1 (Continued): J1/2259 And J1/0614 Cases.

ITERATION 8

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 1.016808032255

WEIGHTED COVARIANCE MATRIX

1	0.7732016704000D 00	0.7362699596889D 00
2	0.7362699596889D 00	0.7732016704206D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.3693171072144D-01	0.0000000000000D 00	-0.7071067811915D 00	0.0000000000000D 00
2	0.1509471630099D 01	0.0000000000000D 00	0.7071067811816D 00	0.0000000000000D 00

I4SL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 1.546403340821

SUM OF DIAGONALS OF COVARIANCE MATRIX = 1.546403340821

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.00000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.10000000000014D 01

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 = 0.9834698077630D 00

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.2943130311382D 00

ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2 USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT = 0.2992598540545D 00

TABLE A-1 (Continued): J1/2259 And J1/0614 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

ITERATION	WEIGHT	S. D. RATIO (SLOPE)	INTERCEPT	MEAN DISTANCE
1	1.000000000000	0.982647950869	-0.294542030557	0.299743186050
2	1.01765849233	0.983511050148	-0.294301539360	0.299235620500
3	1.016765393506	0.983467739067	-0.294313607560	0.299261069650
4	1.016810171068	0.983469911529	-0.294313002225	0.299259793080
5	1.016807924957	0.983469802557	-0.294313032589	0.299259857113
6	1.016808037623	0.983469808023	-0.294313031066	0.299259853902
7	1.016808031972	0.983469807749	-0.294313031142	0.299259854063
8	1.016808032255	0.983469807763	-0.294313031138	0.299259854055

WHEN SCATTER DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

MEAN OF POP. 1 = 0.	S. D. OF POP. 1 = 1.
MEAN OF POP. 2 = 0.2992598540545D 00	S. D. OF POP. 2 = 0.1016808032241D 01
SLOPE = 0.9834698077630D 00	INTERCEPT = -0.2943130311382D 00

WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

MEAN OF POP. 1 = 0.	S. D. OF POP. 1 = 1.
MEAN OF POP. 2 = 0.2945629608377D 00	S. D. OF POP. 2 = 0.1008543903576D 01
SLOPE = 0.9915284763056D 00	INTERCEPT = -0.2920675637355D 00

TABLE A-1 (Continued):

For 52 Overlapping Items of Test J1, J1/2259 And J1/1075 Cases.

TITLE: SHIBA'S DATA
J1-2259 VS. J1-1074(TEST 1)

ITEM DISCRIMINATION PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	0.301372320 02	0.57956215D 00	0.18911201D 02	0.36367695D 00	0.27784660D-01	0.16668731D 00
2	0.28477185D 02	0.54763817D 00	0.16997876D 02	0.32688223D 00	0.26974657D-01	0.16423963D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.10000000000000 01
2	0.9452827655565D 00
	0.10000000000000 01

COVARIANCE MATRIX

1	0.2778466027838D-01
2	0.2587868798142D-01
	0.2697465742219D-01

CROSS PRODUCT MATRIX

1	0.3636769492423D 00
2	0.3432690474184D 00
	0.3268822277158D 00

C *****

NOTE : THE FOLLOWING 3 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER
FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 30 53

THUS THE RESULTING NUMBER OF ITEMS IS 52

C *****

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

ITERATION 5

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 1.054780842012

WEIGHTED CROSS-PRODUCT MATRIX

1	0.3636769492423D 00	0.3620736148727D 00
2	0.3620736148727D 00	0.3636769492274D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.7257505641075D 00	0.0000000000000D 00	0.7071067811938D 00	0.0000000000000D 00
2	0.1603334362159D-02	0.0000000000000D 00	-0.7071067811793D 00	0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.727353898470

SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX = 0.727353898470

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.9999999999794D 00

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 = 0.9480642424941D 00

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.1823976764064D-02

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

ITERATION	WEIGHT	S. D. RATIO (SLOPE)	INTERCEPT
1	1.000000000000	0.947840578724	-0.001694351708
2	1.055029740704	0.948065233039	-0.001824552847
3	1.054779739991	0.948064238108	-0.001823976222
4	1.054780846914	0.948064242514	-0.001823978775
5	1.054780842012	0.948064242494	-0.001823978764

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

ITEM DIFFICULTY PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	-0.23045380D 02	-0.44318039D 00	0.48007492D 02	0.92322101D 00	0.72681215D 00	0.85253279D 00
2	-0.26333962D 02	-0.50642234D 00	0.55876272D 02	0.10745437D 01	0.61808010D 00	0.90447761D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.10000000000000D 01	0.9655502480105D 00
2	0.9655502480105D 00	0.10000000000000D 01

COVARIANCE MATRIX

1	0.7268121517680D 00	0.7445328837562D 00
2	0.7445328837562D 00	0.8180801004390D 00

CROSS PRODUCT MATRIX

1	0.9232210079976D 00	0.9689693328117D 00
2	0.9689693328117D 00	0.1074543686815D 01

C *****

NOTE : THE FOLLOWING 3 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 30 53

THUS THE RESULTING NUMBER OF ITEMS IS 52

C *****

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

ITERATION 8

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 0.942569050615

WEIGHTED COVARIANCE MATRIX

1	0.72681215176800 00	0.70177365339360 00
2	0.70177365339360 00	0.72681215176170 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.1428585805158D 01	0.0000000000000D 00	0.7071067811881D 00	0.0000000000000D 00
2	0.2503849837122D-01	0.0000000000000D 00	-0.7071067811850D 00	0.0000000000000D 00
			0.7071067811881D 00	0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 1.453624303530

SUM OF DIAGONALS OF COVARIANCE MATRIX = 1.453624303530

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.00000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.99999999999955D 00

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 = 0.1060930230356D 01

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.3623886888928D-01

ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2 USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT = 0.3415763624448D-01

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT	MEAN DISTANCE
1	1.000000000000	1.063168686223	-0.035246829150	0.033152621598
2	0.940584512089	1.060850452017	-0.036274225085	0.034193331137
3	0.942639933931	1.060933076869	-0.036237607371	0.034156355533
4	0.942566521680	1.060930128796	-0.036238913899	0.034157681939
5	0.942569140849	1.060930233980	-0.036238867283	0.034157634614
6	0.942569047400	1.060930230227	-0.036238868947	0.034157636303
7	0.942569050734	1.060930230361	-0.036238868887	0.034157636242
8	0.942569050615	1.060930230356	-0.036238868889	0.034157636244

WHEN SCATTER DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

MEAN OF POP. 1 = 0.	S.D. OF POP. 1 = 1.
MEAN OF POP. 2 = 0.3415763624448D-01	S.D. OF POP. 2 = 0.9425690506191D 00
SLOPE = 0.1060930230356D 01	INTERCEPT = -0.3623886888928D-01

WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

MEAN OF POP. 1 = 0.	S.D. OF POP. 1 = 1.
MEAN OF POP. 2 = 0.3554705806374D-01	S.D. OF POP. 2 = 0.9453126535562D 00
SLOPE = 0.1057851067832D 01	INTERCEPT = -0.3760349333103D-01

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