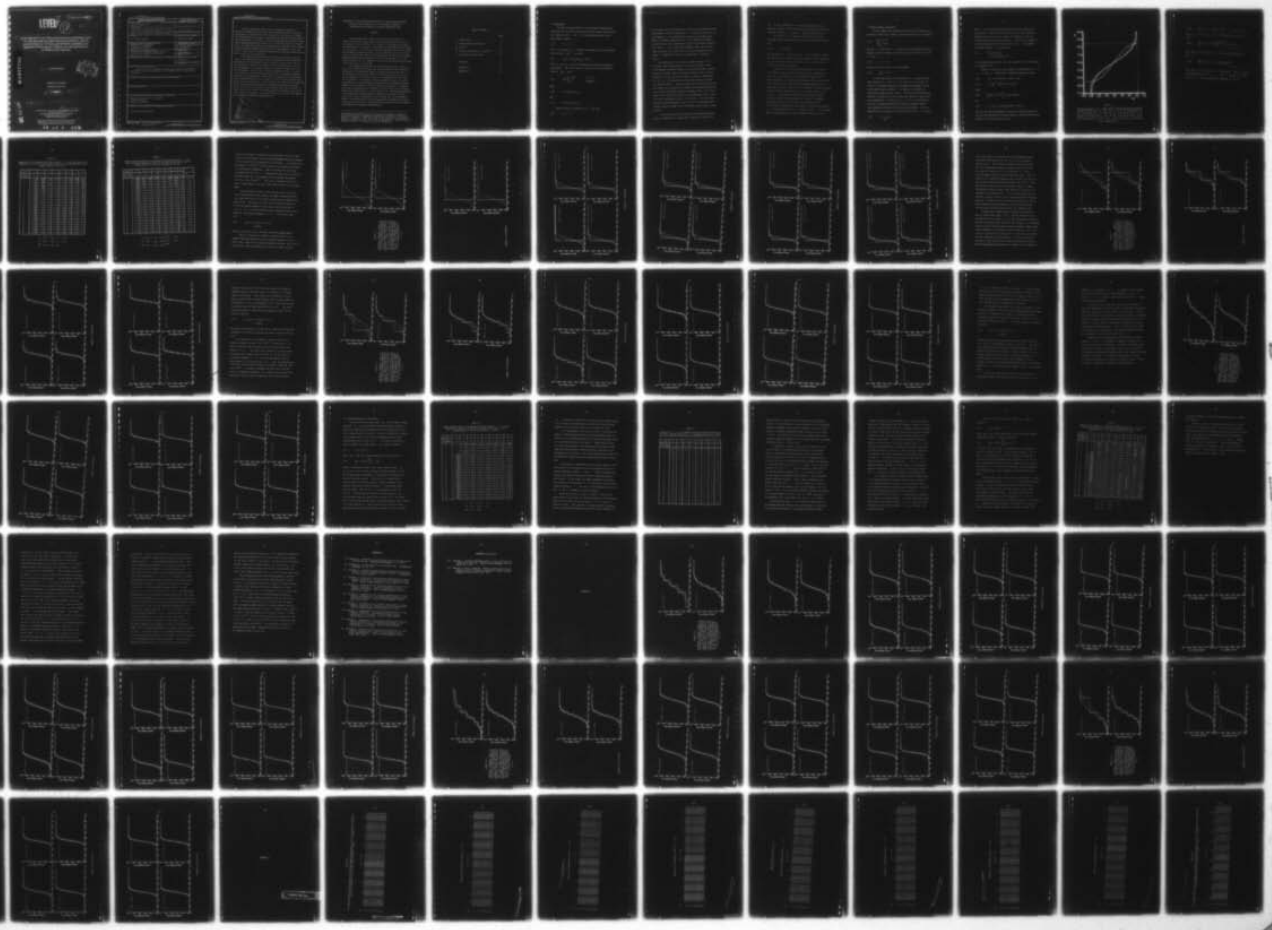
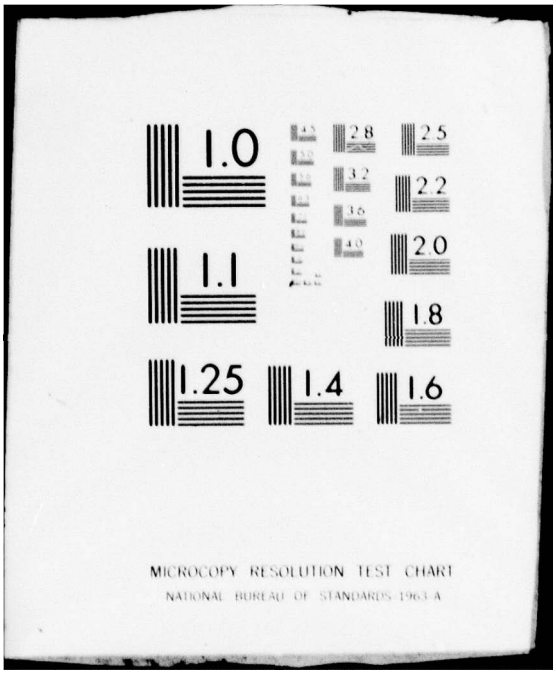
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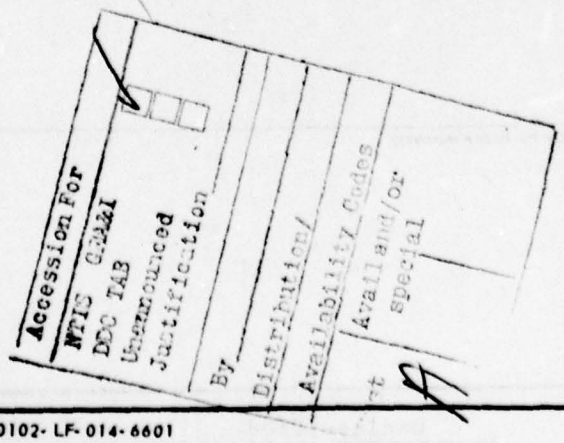
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The Constant Information Model can be used when we substitute a subset of equivalent, binary items, whose item characteristic functions are unknown, for the "Old Test," or a subset of test items whose operating characteristics are known, in estimating the operating characteristics of item response. In so doing, it has been suggested that we choose items whose common discrimination power is low, so that the interval of latent trait, for which their common item characteristic function in the Constant Information Model assumes positive values, is wide enough to cover the ability levels of all the examinees, on which the operating characteristics of new items are to be estimated.

This suggestion needs more investigation and precision, however, since it is expected from theory that the convergence of the conditional distribution of the maximum likelihood estimate, given latent trait, to the normality is slow for the values of latent trait which are close to the two endpoints of the above interval, in comparison with those close to the midpoint. In this paper, through a simulation study, the speed of convergence of the conditional distribution of the maximum likelihood estimate to the normality at various levels of latent trait is observed, using twenty hypothetical test sessions, in each of which ten equivalent, binary test items are given. As was expected, the conditional distribution of the maximum likelihood estimate is skewed for the values of latent trait close to the two endpoints of the interval, and the convergence is slower. From these results, the above suggestion is added by more precision, which is essential to the researchers who wish to apply this method in estimating the operating characteristics.



CONVERGENCE OF THE CONDITIONAL DISTRIBUTION OF THE MAXIMUM LIKELIHOOD ESTIMATE, GIVEN LATENT TRAIT, TO THE ASYMPTOTIC NORMALITY: OBSERVATIONS MADE THROUGH THE CONSTANT INFORMATION MODEL

ABSTRACT

Constant Information Model can be used when we substitute a subset of equivalent, binary items, whose item characteristic functions are unknown, for the "Old Test," or a subset of test items whose operating characteristics are known, in estimating the operating characteristics of item response. In so doing, it has been suggested that we choose items whose common discrimination power is low, so that the interval of latent trait, for which their common item characteristic function in the Constant Information Model assumes positive values, is wide enough to cover the ability levels of all the examinees, on which the operating characteristics of new items are to be estimated.

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The research was conducted at the principal investigator's laboratory, 409 Austin Peay Hall, Department of Psychology, University of Tennessee, Knoxville, Tennessee. Those who worked in the laboratory and helped the author in various ways for this research include Paul S. Changas, Robert L. Trestman, Philip S. Livingston, and Lin Wen Kuei-Chiu.

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I Introduction

Constant Information Model on the dichotomous response level (Samejima, 1972) of latent trait theory has been proposed and discussed (cf. Samejima, 1979). Let θ be a unidimensional latent trait, whose range is given by

$$(1.1) \qquad -\infty < \theta < \infty \quad ,$$

and g be a binary item. The model is defined by the item characteristic function, $P_g(\theta)$, such that

$$(1.2) \qquad P_g(\theta) = \sin^2[a_g(\theta - b_g) + (\pi/4)] \quad ,$$

where a_g and b_g are the discrimination and difficulty parameters, respectively. The model provides us with such an item information function, $I_g(\theta)$, that

$$(1.3) \qquad I_g(\theta) \begin{cases} = 4a_g^2 & \underline{\theta} < \theta < \bar{\theta} \\ = 0 & \text{otherwise} \quad , \end{cases}$$

where

$$(1.4) \qquad \underline{\theta} = [-\pi a_g^{-1}/4] + b_g$$

and

$$(1.5) \qquad \bar{\theta} = [\pi a_g^{-1}/4] + b_g \quad .$$

When we consider a subinterval of θ such that

$$(1.6) \qquad \underline{\theta} < \theta < \bar{\theta}$$

as its range, the item characteristic function of the Constant Information Model is strictly increasing in θ, with zero and unity as its two asymptotes --- the characteristics shared by the normal ogive model, the logistic model, and so on. For convenience, hereafter, we shall call the set of models which share this particular characteristic Type A. It has been shown (Samejima, 1979) that the area under the curve of the square root of the item information function equals π regardless of the model, provided that it belongs to Type A.

One usefulness of the Constant Information Model is that, by virtue of the transformation-free character (Samejima, 1969) of the maximum likelihood estimate, we can adopt this model whenever we locate a suitable subset of equivalent, binary items in a newly developed item pool, and use this subset of items as a substitute for the set of items whose operating characteristics are known (cf. Samejima, 1979). Thus we can make use of various combinations of a method and an approach for estimating the operating characteristics of the item response categories (Samejima, 1977a, 1977b, 1978a, 1978b, 1978c, 1978d, 1978e, 1978f) without depending upon the subset of a priori investigated items, or the Old Test. The only assumption used in this procedure is that the "true" item characteristic function, which is common to these equivalent, binary items, belongs to Type A.

In the actual process of estimating the operating characteristics, a combination of a method and an approach is selected for

use. In these combinations of a method and an approach, the asymptotic normality of the conditional distribution of the maximum likelihood estimate, $\hat{\theta}$, given θ, plays an important role.

For the test of n equivalent, binary items, Constant Information Model provides us with such a test information function that

$$I(\theta) = 4na_g^2 , \tag{1.7}$$

for the interval of θ given by (1.6). In the asymptotic normal distribution of the maximum likelihood estimate, the two parameters, i.e., the conditional mean and variance, are θ and the inverse of the test information function.

Estimation of the operating characteristics of the graded item response categories will be pursued further, by making more use of the characteristics of the polynomials obtained by the method of moments (cf. Samejima and Livingston, 1979), and so forth. In so doing, the role of the Constant Information Model will be important, as long as we wish to use the methods for a newly developed item pool, without depending upon a set of "known" items, or the Old Test. One problem we should seriously investigate before using the Constant Information Model for a subset of "unknown," equivalent items of the item pool concerns the differences in the speed of convergence to the normality caused by the positions of θ in the interval, $(\underline{\theta}, \bar{\theta})$ (cf. Samejima, 1979). In the present paper, we shall pursue this subject through a Monte Carlo study.

II Method and Data Calibration

For the common item characteristic function of the hypothetical equivalent, binary items, Constant Information Model with the parameters,

$$(2.1) \qquad \begin{cases} a_g = 0.25 \\ b_g = 0.00 \end{cases},$$

was used. The interval of θ for which the item information function assumes a positive constant is, therefore, given from (1.4), (1.5) and (1.6) by

$$(2.2) \qquad -\pi < \theta < \pi ,$$

and we have for the amount of item information

$$(2.3) \qquad I_g(\theta) = 0.25 .$$

As the fixed levels of the latent trait θ, eight positions were selected, i.e., -3.0, -2.2, -1.4, -0.6, 0.2, 1.0, 1.8 and 2.6. A group of one hundred hypothetical examinees were assigned to each of the eight levels of ability θ, to make the total number of hypothetical examinees eight hundred. There were twenty hypothetical sessions of testing, and in each session ten equivalent, binary items were administered. An item score u_g (= 0 or 1) was calibrated by the Monte Carlo method following the Constant Information Model, whose parameters were given in the preceding paragraph. After the completion of each session, the (cumulative) test score t such that

$$(2.4) \qquad t = \sum_{u_g \in V} u_g ,$$

where V is the response pattern obtained after the completion of each session, or the vector of item scores to the items, which were administered by the end of the session, was computed for each of the eight hundred hypothetical examinees. Thus after the completion of the k-th session the full test score is $10 \times k$. The maximum likelihood estimate $\hat{\theta}$ was obtained by

$$\hat{\theta} = P_g^{-1}[t/(10k)] = 4 \sin^{-1}\{[t/(10k)]^{1/2}\} - \pi \tag{2.5}$$

for each hypothetical subject, after the completion of the k-th session (cf. Samejima, 1979).

Figure 2-1 illustrates three different transformations of θ to τ_1, τ_2 and τ_3, respectively, through the formulae such that

$$\tau_1 = 5.00 \sin^2[0.25\theta + (\pi/4)] - 2.50 \quad , \tag{2.6}$$

$$\tau_2 = P_g^{**-1}[\sin^2\{0.25\theta + (\pi/4)\}] \quad , \tag{2.7}$$

where

$$P_g^{**}(\theta) \doteq (2\pi)^{-1/2} \int_{-\infty}^{s} \exp[-u^2/2]\, du \quad , \tag{2.8}$$

and

$$\tau_3 = (2/1.7) \log [\tan\{(0.25\theta) + (\pi/4)\}] \quad . \tag{2.9}$$

They are the three transformations, which are eventually required if the true item characteristic function common to these equivalent items follows: 1) the linear model such that

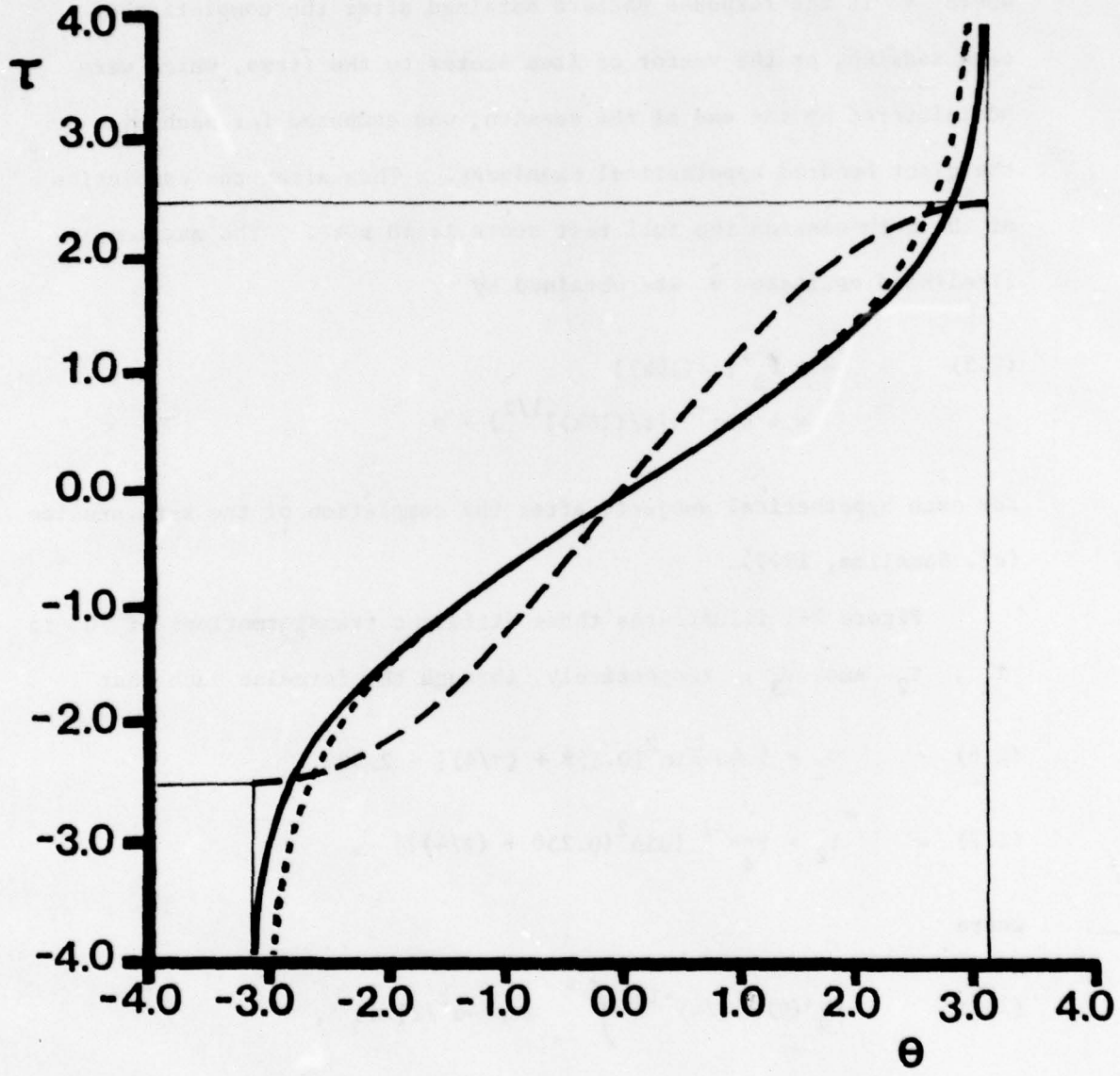


FIGURE 2-1

Transformations of θ to τ Which Result from Transforming the Constant Information Model with $a_g = 0.25$ and $b_g = 0.00$ As the Parameters, to the Linear Model with $\alpha_g = -2.50$ and $\beta_g = 2.50$ (Broken Curve), to the Normal Ogive Model with $a_g = 1.00$ and $b_g = 0.00$ (Solid Curve), and to the Logistic Model with $D = 1.70$, $a_g = 1.00$ and $b_g = 0.00$ (Dotted Curve), Respectively.

(2.10) $$P_g^*(\tau_1) = (\tau_1 - \alpha_g)(\beta_g - \alpha_g)^{-1} \quad \text{for} \quad \alpha_g < \tau_1 < \beta_g \ ,$$

with $\alpha_g = -2.50$ and $\beta_g = 2.50$, 2) the normal ogive model such that

(2.11) $$P_g^{**}(\tau_2) = (2\pi)^{-1/2} \int_{-\infty}^{a_g^*(\tau_2 - b_g^*)} \exp[-u^2/2]\, du \quad \text{for} \quad -\infty < \tau_2 < \infty \ ,$$

with $a_g^* = 1.00$ and $b_g^* = 0.00$, and 3) the logistic model such that

(2.12) $$P_g^{***}(\tau_3) = [1 + \exp\{-1.7a_g^{**}(\tau_3 - b_g^{**})\}]^{-1} \quad \text{for} \quad -\infty < \tau_3 < \infty \ ,$$

with $a_g^{**} = 1.00$ and $b_g^{**} = 0.00$, respectively. Table 2-1 presents the corresponding values of τ_1 , τ_2 and τ_3 to each of the eight levels of θ , at which hypothetical examinees are located.

TABLE 2-1

Values of τ_1, τ_2 and τ_3 Corresponding to the Eight Levels of θ, Which Result from the Transformations from the Constant Information Model with $a_g = 0.25$ and $b_g = 0.00$ As the Parameters, to the Linear Model with $\alpha_g = -2.50$ and $\beta_g = 2.50$, to the Normal Ogive Model with $a_g = 1.00$ and $b_g = 0.00$ and to the Logistic Model with $D = 1.70$, $a_g = 1.00$ and $b_g = 0.00$, Respectively.

Constant Information	Linear	Normal Ogive	Logistic
θ	τ_1	τ_2	τ_3
-3.0	-2.494	-3.023	-3.930
-2.2	-2.228	-1.604	-1.680
-1.4	-1.611	-0.923	-0.900
-0.6	-0.739	-0.379	-0.358
0.2	0.250	0.125	0.118
1.0	1.199	0.642	0.614
1.8	1.958	1.235	1.240
2.6	2.409	2.092	2.345

III Results

Table 3-1 presents the sample mean, $m_{\hat{\theta}}$, of the one hundred maximum likelihood estimates for each of the eight groups of examinees, which was obtained after the completion of each of the twenty sessions. It is observed that, as the number of items increases, $m_{\hat{\theta}}$ tends to approach the true ability θ on each ability level. And yet we find substantial differences in the speed of convergence across the different groups. In this table, all the entries whose absolute discrepancies from the true θ are greater than or equal to 0.15 are marked with ***, those the absolute discrepancies of which are greater than or equal to 0.10 and less than 0.15 are marked with **, and those whose absolute discrepancies are greater than or equal to 0.05 and less than 0.05 are marked with * .

We can see from Table 3-1 that, for Group 1, whose true ability level (= -3.0) is very close to the lower endpoint $\underline{\theta}$ (= $-\pi$), even after 200 items were administered, the discrepancy of $m_{\hat{\theta}}$ from θ is as large as 0.061 . In contrast to this, for Group 5, whose ability level is 0.2, i.e., closest of all the eight levels to the midpoint (= 0.0) of the interval, after the completion of the first session, or the administration of only ten items, the discrepancy of $m_{\hat{\theta}}$ from θ is as small as 0.020 . For the other six groups, with some fluctuations, there is a luminous tendency that, as the true ability level departs from the closer end point of the interval, $\underline{\theta}$ or $\bar{\theta}$ (=π), the convergence of $m_{\hat{\theta}}$ to θ becomes faster.

Table 3-2 provides us with the sample standard deviation, $s_{\hat{\theta}}$,

TABLE 3-1

Sample Mean of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees of Each of the Eight Ability Levels, after Completing Each of the Twenty Sessions of Testing.

Group	1	2	3	4	5	6	7	8
θ / Session	-3.0	-2.2	-1.4	-0.6	0.2	1.0	1.8	2.6
1	-3.142**	-2.587***	-1.453*	-0.677*	0.219	1.121**	2.068***	2.815***
2	-3.142**	-2.440***	-1.428	-0.637	0.214	1.082*	1.855*	2.816***
3	-3.142**	-2.342**	-1.451*	-0.625	0.195	1.045	1.811	2.759***
4	-3.142**	-2.302**	-1.445	-0.596	0.200	1.042	1.811	2.731**
5	-3.136**	-2.264*	-1.440	-0.566	0.203	1.046	1.810	2.732**
6	-3.116**	-2.264*	-1.414	-0.559	0.220	1.037	1.789	2.706**
7	-3.113**	-2.241	-1.412	-0.571	0.205	1.024	1.795	2.702**
8	-3.115**	-2.233	-1.416	-0.563	0.202	1.025	1.794	2.696*
9	-3.117**	-2.227	-1.416	-0.577	0.201	1.025	1.806	2.686*
10	-3.114**	-2.232	-1.415	-0.580	0.197	1.024	1.796	2.670*
11	-3.108**	-2.220	-1.411	-0.583	0.196	1.017	1.801	2.674*
12	-3.105**	-2.211	-1.419	-0.587	0.186	1.019	1.799	2.668*
13	-3.102**	-2.218	-1.419	-0.598	0.188	1.018	1.803	2.660*
14	-3.097*	-2.212	-1.422	-0.594	0.190	1.017	1.803	2.649
15	-3.088*	-2.209	-1.419	-0.596	0.196	1.015	1.801	2.635
16	-3.077*	-2.198	-1.414	-0.598	0.198	1.013	1.802	2.639
17	-3.075*	-2.197	-1.407	-0.599	0.199	1.016	1.801	2.629
18	-3.073*	-2.191	-1.404	-0.608	0.202	1.017	1.804	2.615
19	-3.068*	-2.192	-1.400	-0.612	0.206	1.020	1.804	2.613
20	-3.061*	-2.194	-1.401	-0.611	0.206	1.020	1.800	2.615

* $0.05 \leq |m_{\hat{\theta}} - \theta| < 0.10$

** $0.10 \leq |m_{\hat{\theta}} - \theta| < 0.15$

*** $0.15 \leq |m_{\hat{\theta}} - \theta|$

TABLE 3-2

Sample Standard Deviation of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees of Each of the Eight Ability Levels, after Completing Each of the Twenty Sessions of Testing.

Group	1	2	3	4	5	6	7	8	
θ / Session	-3.0	-2.2	-1.4	-0.6	0.2	1.0	1.8	2.6	$[I(\theta)]^{-1/2}$
1	0.000***	0.735**	0.810***	0.812***	0.686*	0.844***	0.908***	0.570*	0.632
2	0.000***	0.556**	0.490	0.464	0.460	0.517*	0.592**	0.461	0.447
3	0.000***	0.465**	0.415*	0.359	0.403	0.368	0.482**	0.410	0.365
4	0.000***	0.407*	0.330	0.319	0.328	0.297	0.383*	0.374*	0.316
5	0.057***	0.297	0.285	0.273	0.280	0.274	0.321	0.347*	0.283
6	0.113**	0.270	0.261	0.267	0.252	0.235	0.267	0.310*	0.258
7	0.114**	0.226	0.232	0.251	0.229	0.216	0.248	0.286	0.239
8	0.107**	0.212	0.225	0.235	0.219	0.211	0.222	0.276*	0.224
9	0.100**	0.214	0.222	0.217	0.203	0.197	0.216	0.262*	0.211
10	0.102*	0.214	0.216	0.205	0.198	0.196	0.203	0.239	0.200
11	0.109*	0.200	0.202	0.213	0.187	0.187	0.184	0.233	0.191
12	0.110*	0.186	0.191	0.198	0.174	0.178	0.175	0.223	0.183
13	0.115*	0.180	0.178	0.188	0.162	0.166	0.173	0.210	0.175
14	0.118*	0.171	0.167	0.173	0.163	0.162	0.169	0.208	0.169
15	0.124	0.165	0.166	0.172	0.154	0.157	0.170	0.189	0.163
16	0.130	0.163	0.163	0.164	0.146	0.157	0.163	0.187	0.158
17	0.131	0.159	0.160	0.157	0.140	0.150	0.158	0.169	0.153
18	0.132	0.152	0.157	0.153	0.137	0.146	0.154	0.143	0.149
19	0.135	0.149	0.157	0.153	0.135	0.142	0.156	0.138	0.145
20	0.135	0.141	0.153	0.155	0.130	0.137	0.150	0.121	0.141

$$* \quad 0.05 \leq \left| s_{\hat{\theta}} - \{I(\theta)\}^{-1/2} \right| < 0.10$$

$$** \quad 0.10 \leq \left| s_{\hat{\theta}} - \{I(\theta)\}^{-1/2} \right| < 0.15$$

$$*** \quad 0.15 \leq \left| s_{\hat{\theta}} - \{I(\theta)\}^{-1/2} \right|$$

which was calculated by using 10k as the denominator after the completion of the k-th session, of the one hundred maximum likelihood estimates for each group after the completion of each session. In the same table, the values of $[I(\theta)]^{-1/2}$ are also given in the rightest hand column, for the purpose of comparison. Some of the entries of this table are marked with ***, ** or * , following the same rule as we used for the sample mean $m_{\hat{\theta}}$, in accordance with the absolute discrepancy of the $s_{\hat{\theta}}$ from $[I(\theta)]^{-1/2}$. We observe a tendency in Table 3-2, which is very similar to the one we have found in Table 3-1, the sample means.

We notice that for Group 1, whose ability level is very close to the lower endpoint of the interval, the sample standard deviation $s_{\hat{\theta}}$ equals zero after 10, 20, 30 and 40 items have been administered, respectively. This owes to the fact that the response patterns of all the one hundred examinees of this group consist, uniformly, of $u_g = 0$, up to the fourth session, and the likelihood function has, therefore, the terminal maximum at $\theta = -\pi$. Since we have from (1.2)

$$(3.1) \qquad P_g(-3.0) = \sin^2[(-3.0 + \pi)/4] \doteq 0.00125 ,$$

which is very close to zero, the above results are understandable.

Figure 3-1 presents the cumulative frequency ratios of the maximum likelihood estimates of the one hundred examinees of Group 1 (solid line), along with the normal distribution function, $N(\theta, I(\theta)^{-1})$ (solid curve), after the completion of each of the twenty sessions.

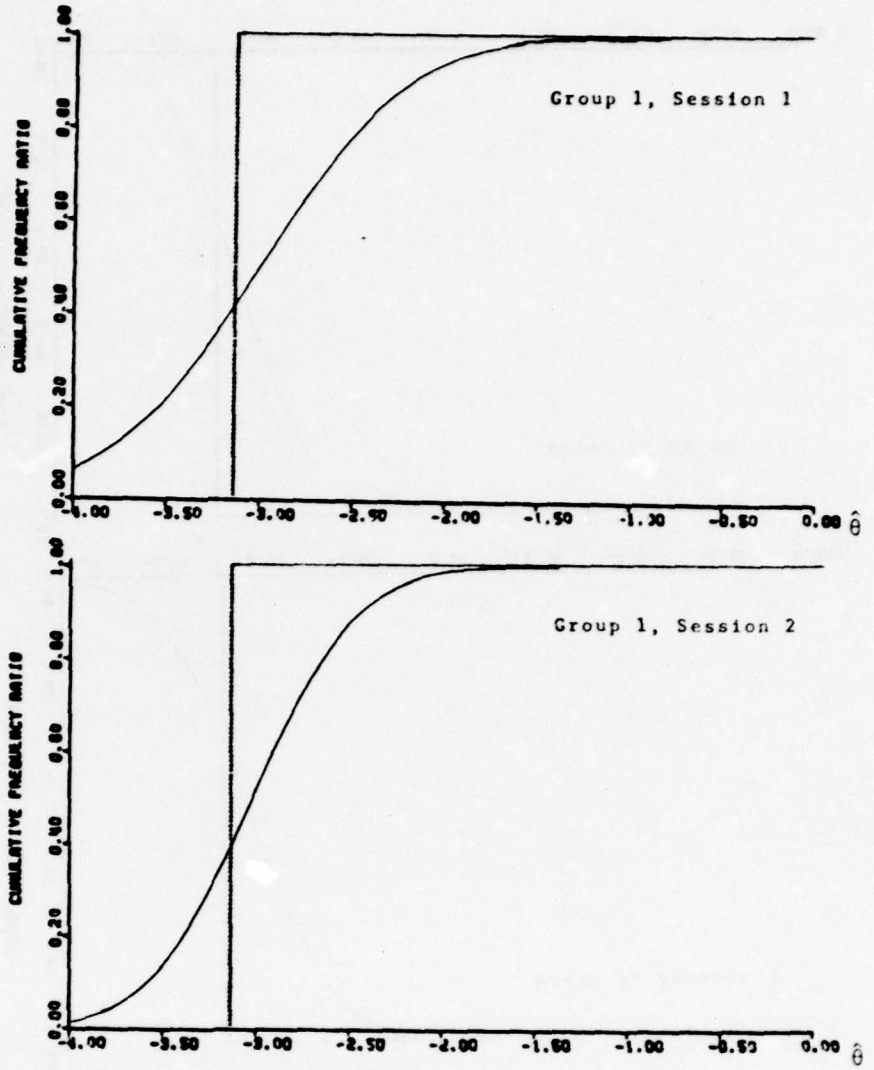


FIGURE 3-1

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = -3.0$

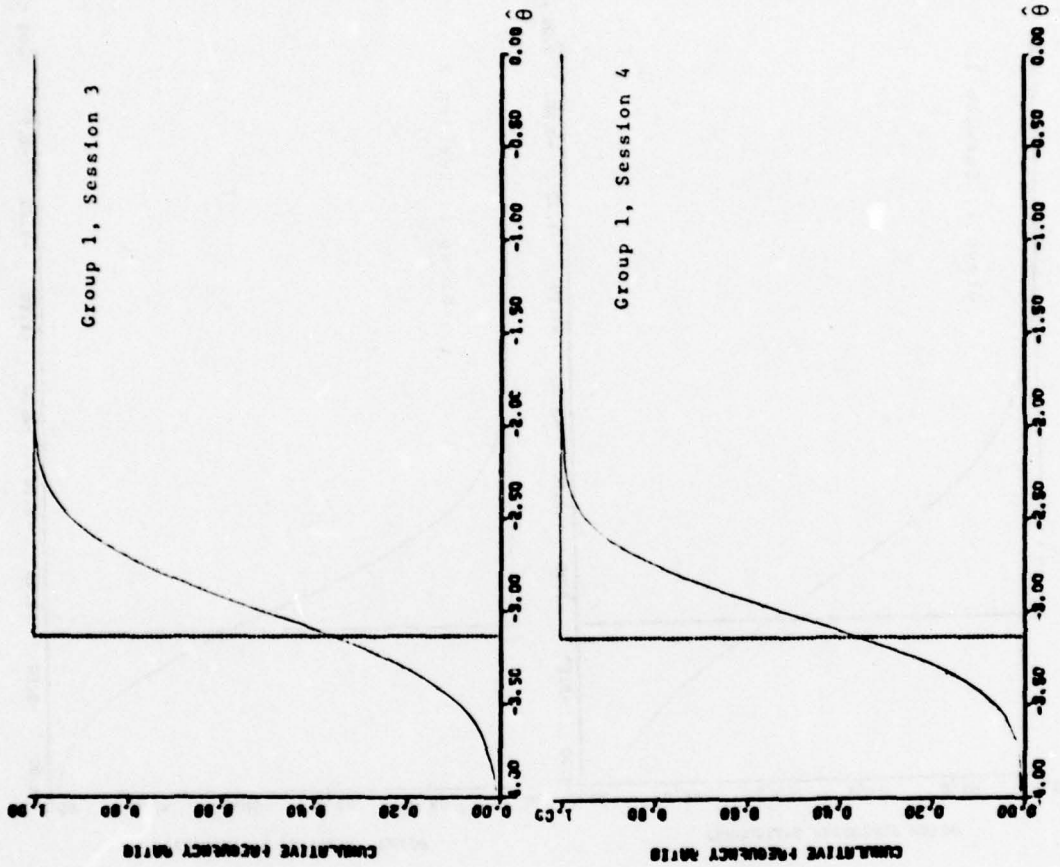


FIGURE 3-1 (Continued)

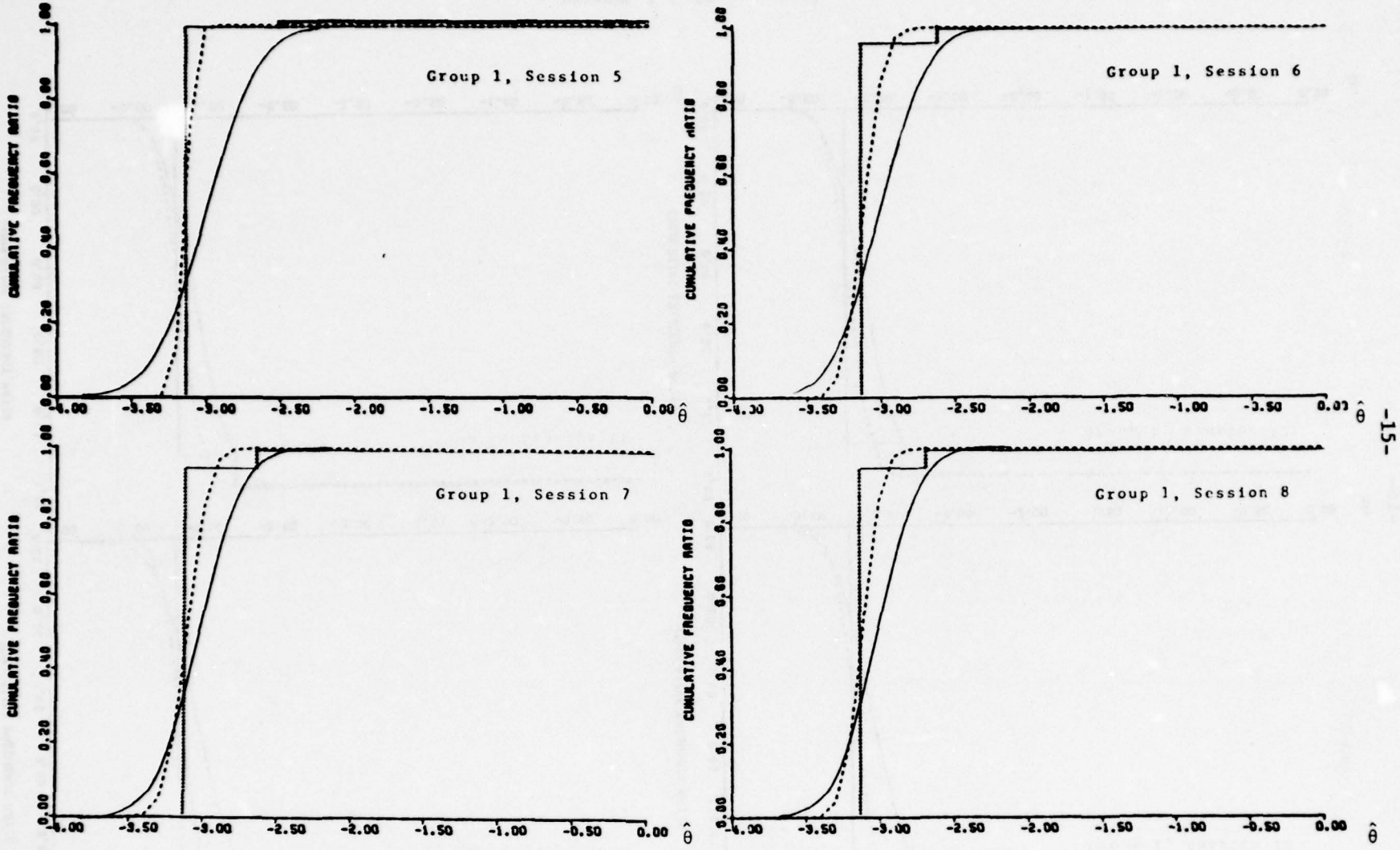


FIGURE 3-1 (Continued)

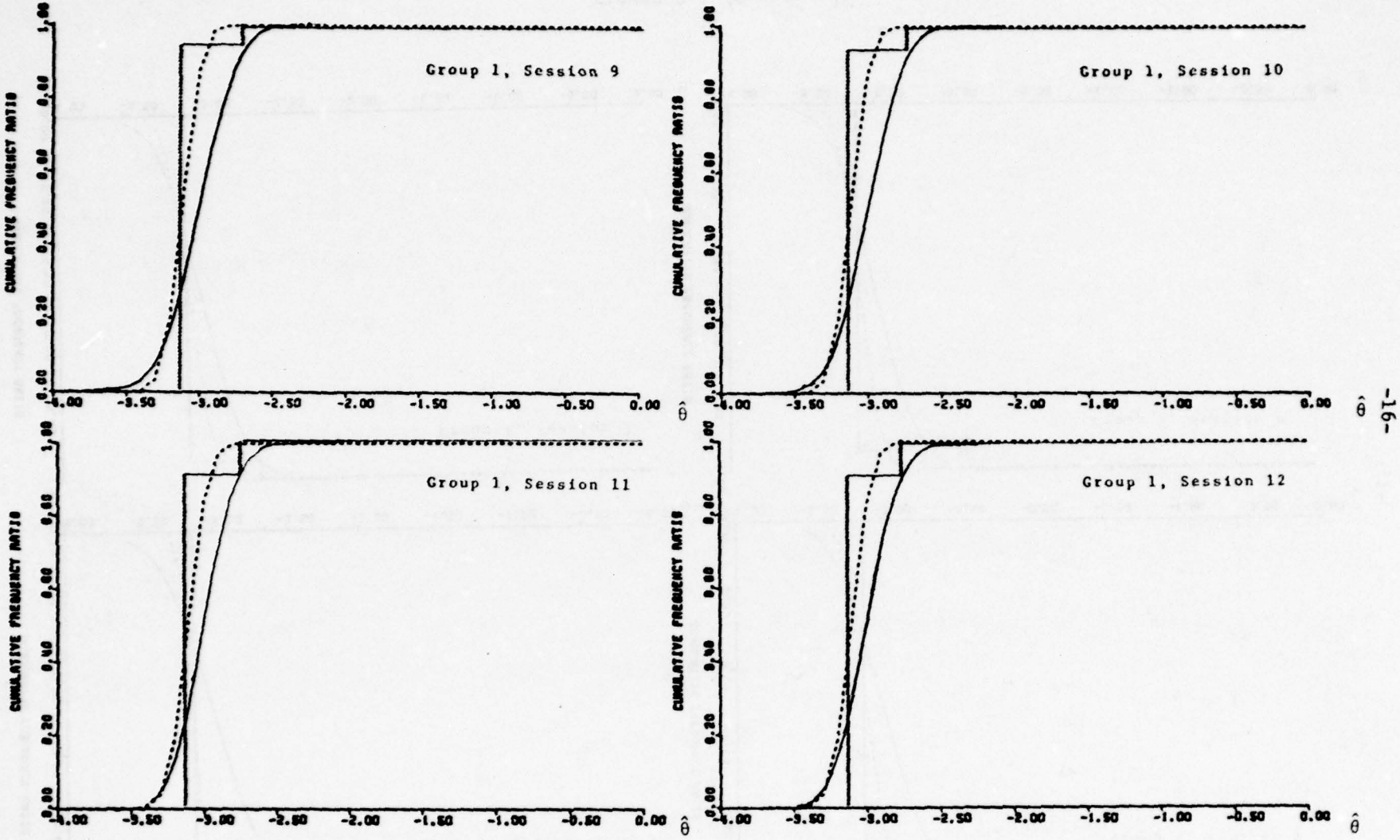


FIGURE 3-1 (Continued)

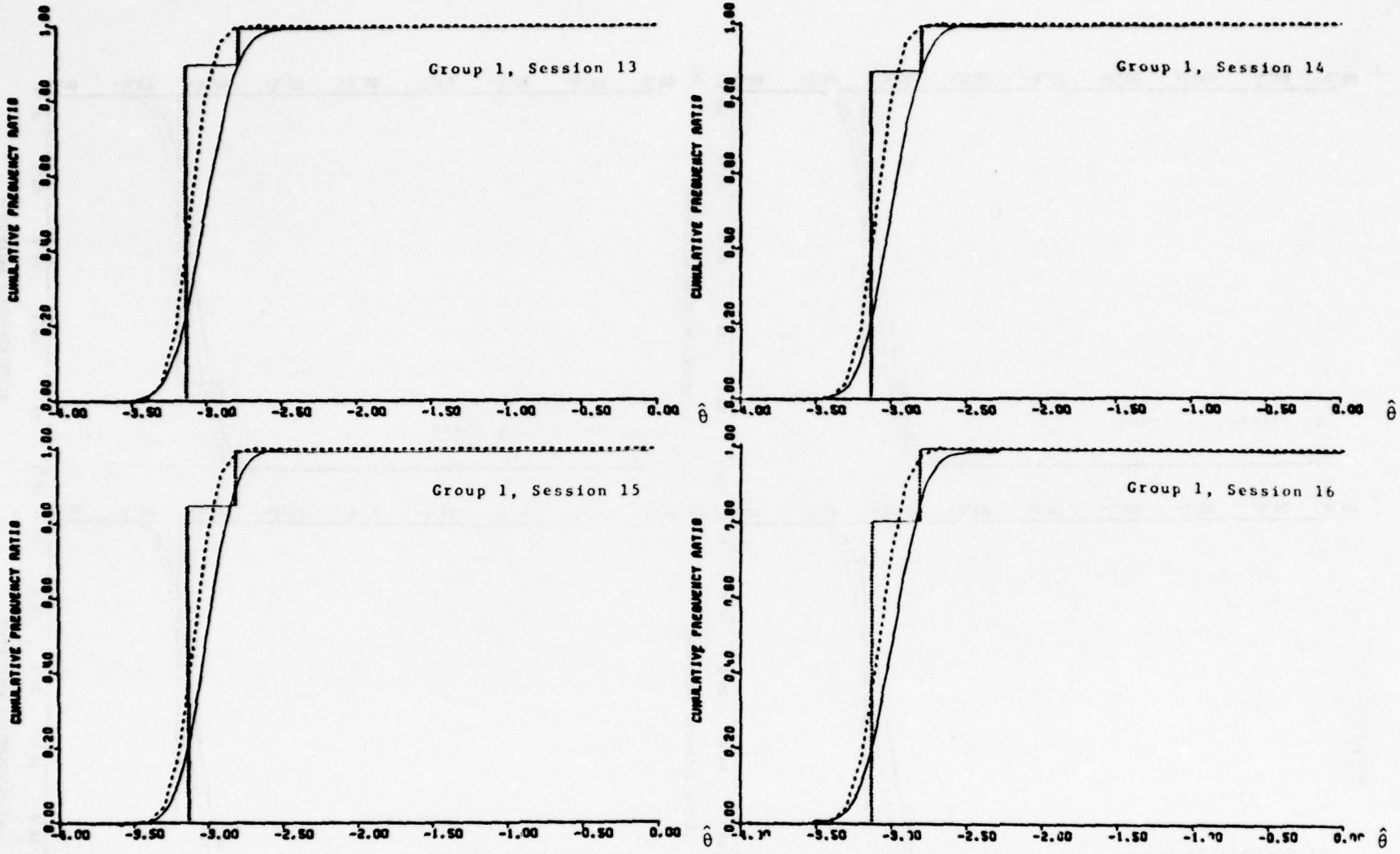


FIGURE 3-1 (Continued)

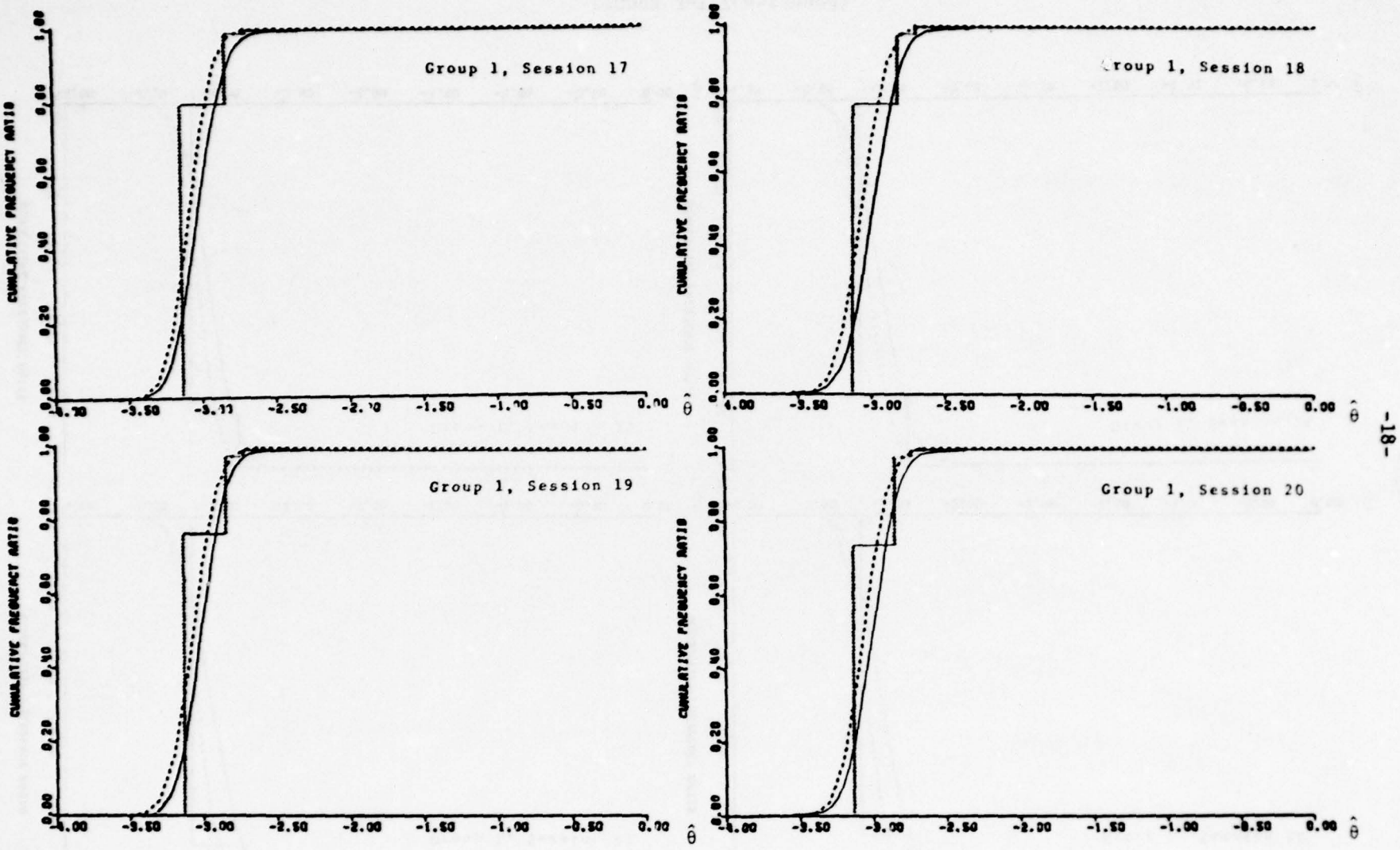


FIGURE 3-1 (Continued)

In the same figure, also presented are the corresponding normal distribution functions with $m_{\hat{\theta}}$ and $s^2_{\hat{\theta}}$ as the two parameters (dotted curves). These normal distribution functions coincide with the corresponding cumulative frequency ratios in the first four graphs of Figure 3-1, i.e., for sessions 1, 2, 3 and 4, since the sample variance is zero in these four cases. The discrepancy of the cumulative frequency ratio, and that of $N(m_{\hat{\theta}}, s^2_{\hat{\theta}})$, from the other normal distribution function, $N(\theta, I(\theta)^{-1})$, are substantially large even in the last graph of Figure 3-1, where the maximum likelihood estimates were obtained on the basis of the responses to two hundred items. It is also worth noting that the cumulative frequency ratio of each of the twenty graphs of Figure 3-1 indicates a J-shape curve for the frequency distribution of the one hundred maximum likelihood estimates, the result which confirms our theoretical anticipation made earlier (cf. Samejima, 1979).

A similar set of twenty graphs as Figure 3-1 was made for Group 8, whose ability level (= 2.6) is the next closest to one of the endpoints of the interval, $(-\pi, \pi)$, and is presented as Figure 3-2. We find in this figure that, unlike the case of Group 1, the cumulative frequency ratio of the one hundred maximum likelihood estimates shows a good convergence to the normal distribution function, $N(\theta, I(\theta)^{-1})$, in each of the last three or four graphs, or after 170 or more items have been administered to the examinees. For this ability level, although a J-shape curve for the frequency distribution of the one hundred maximum likelihood estimates is indicated by the cumulative

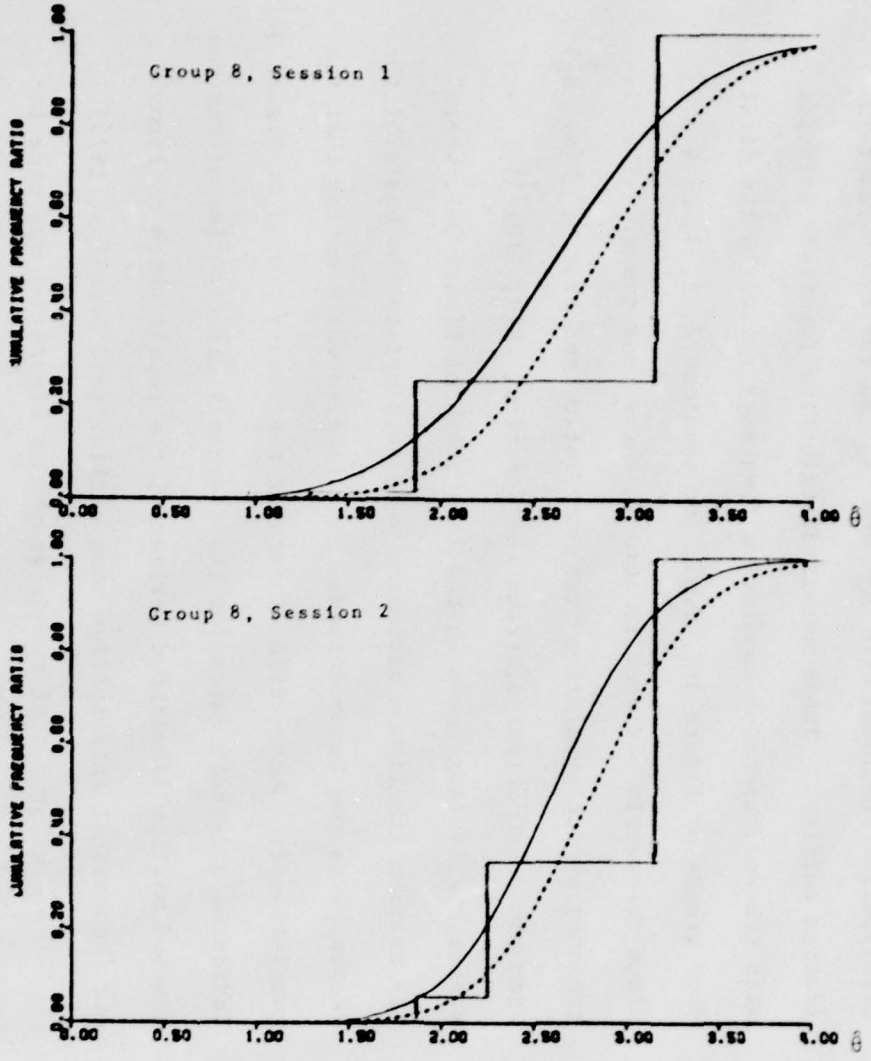


FIGURE 3-2

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = 2.6$

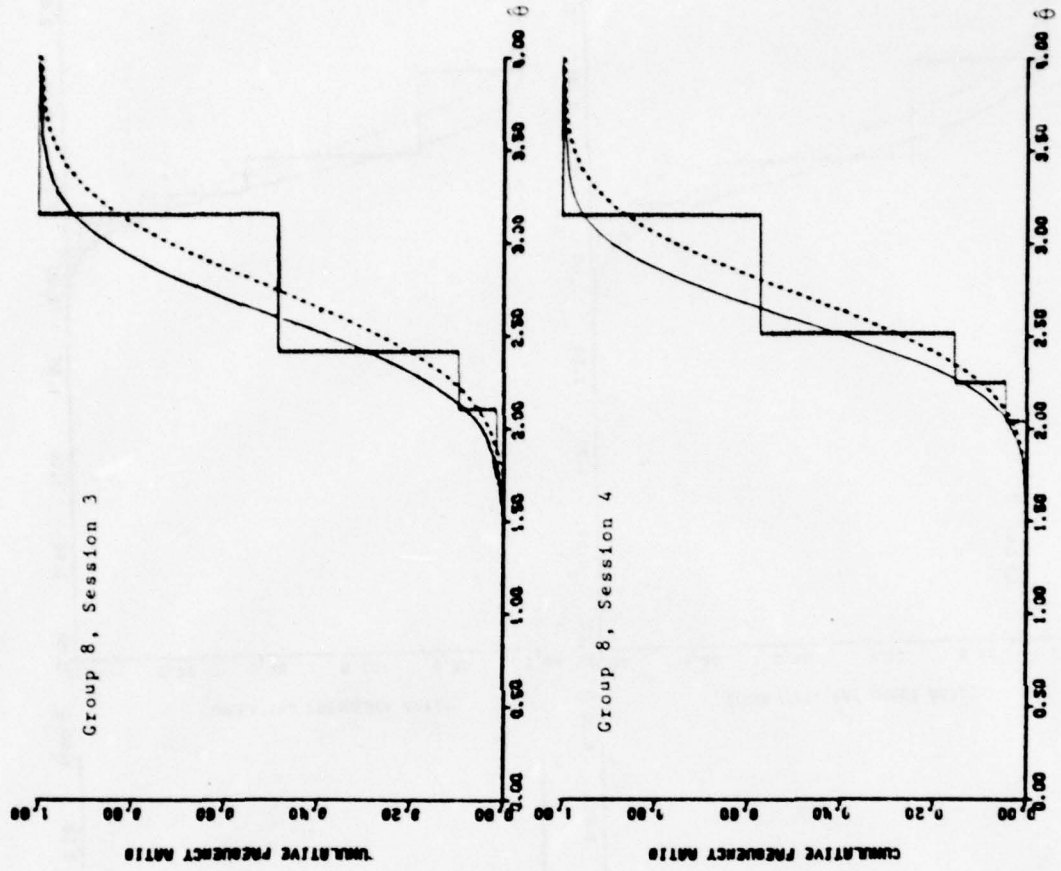


FIGURE 3-2 (Continued)

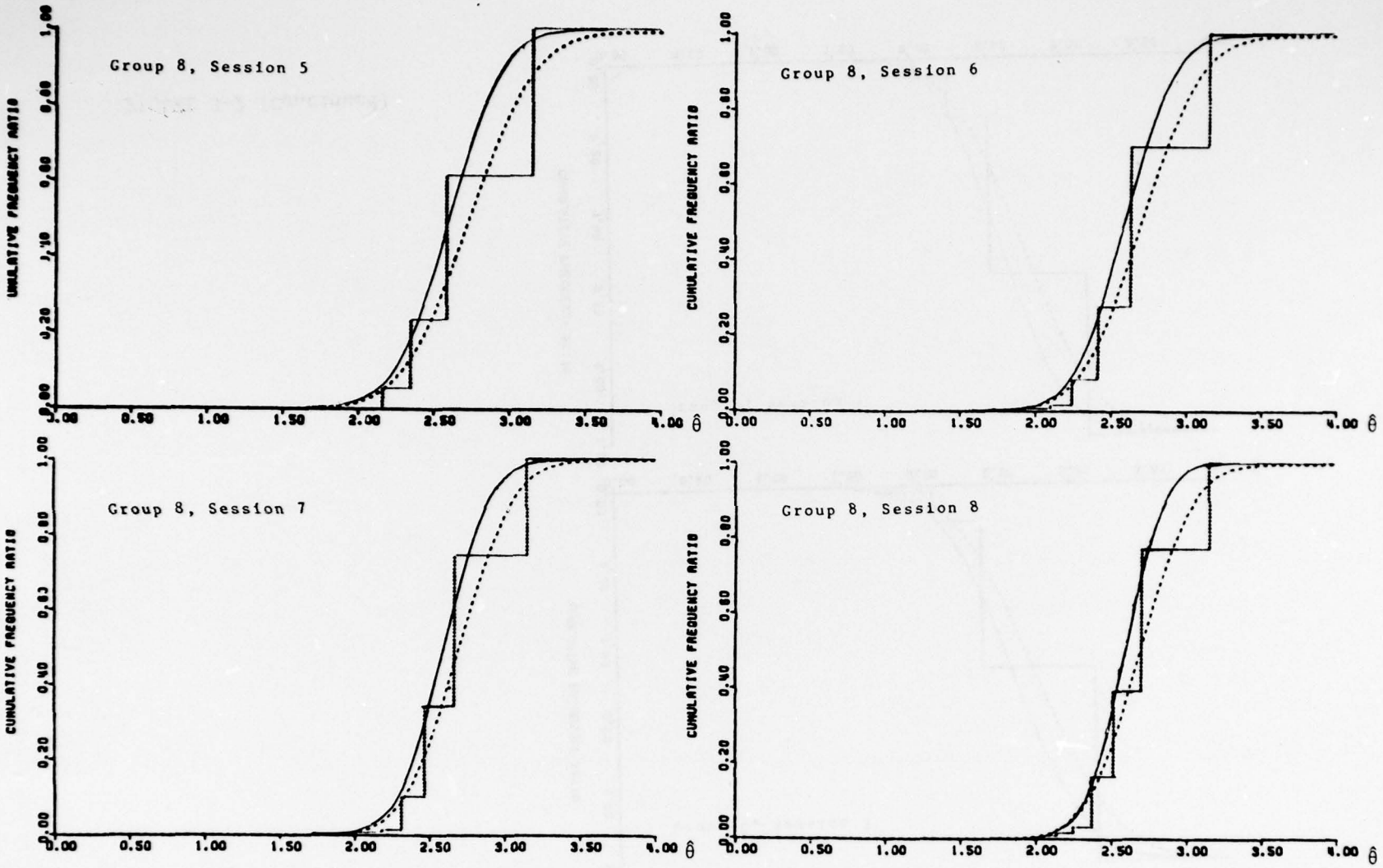


FIGURE 3-2 (Continued)

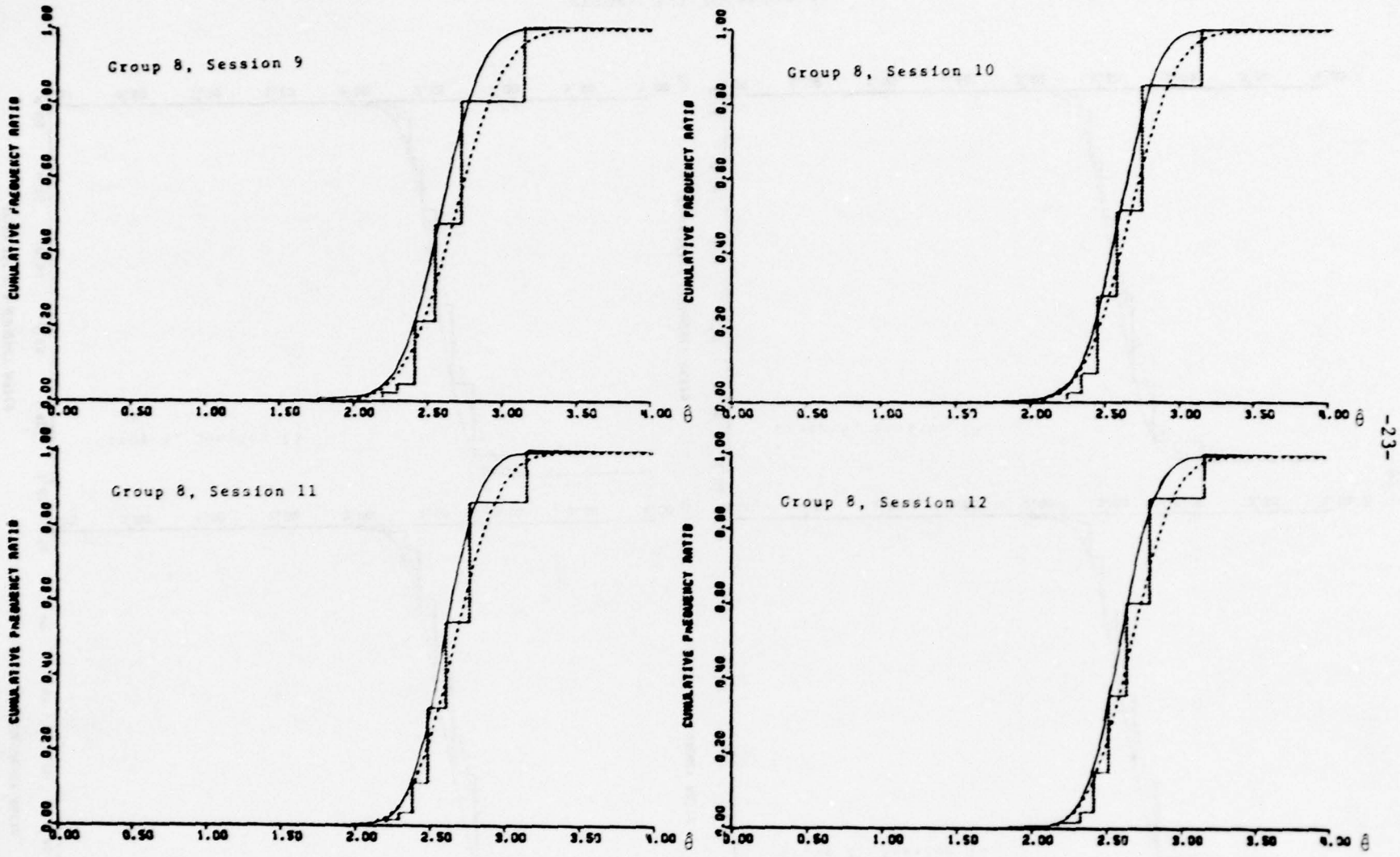


FIGURE 3-2 (Continued)

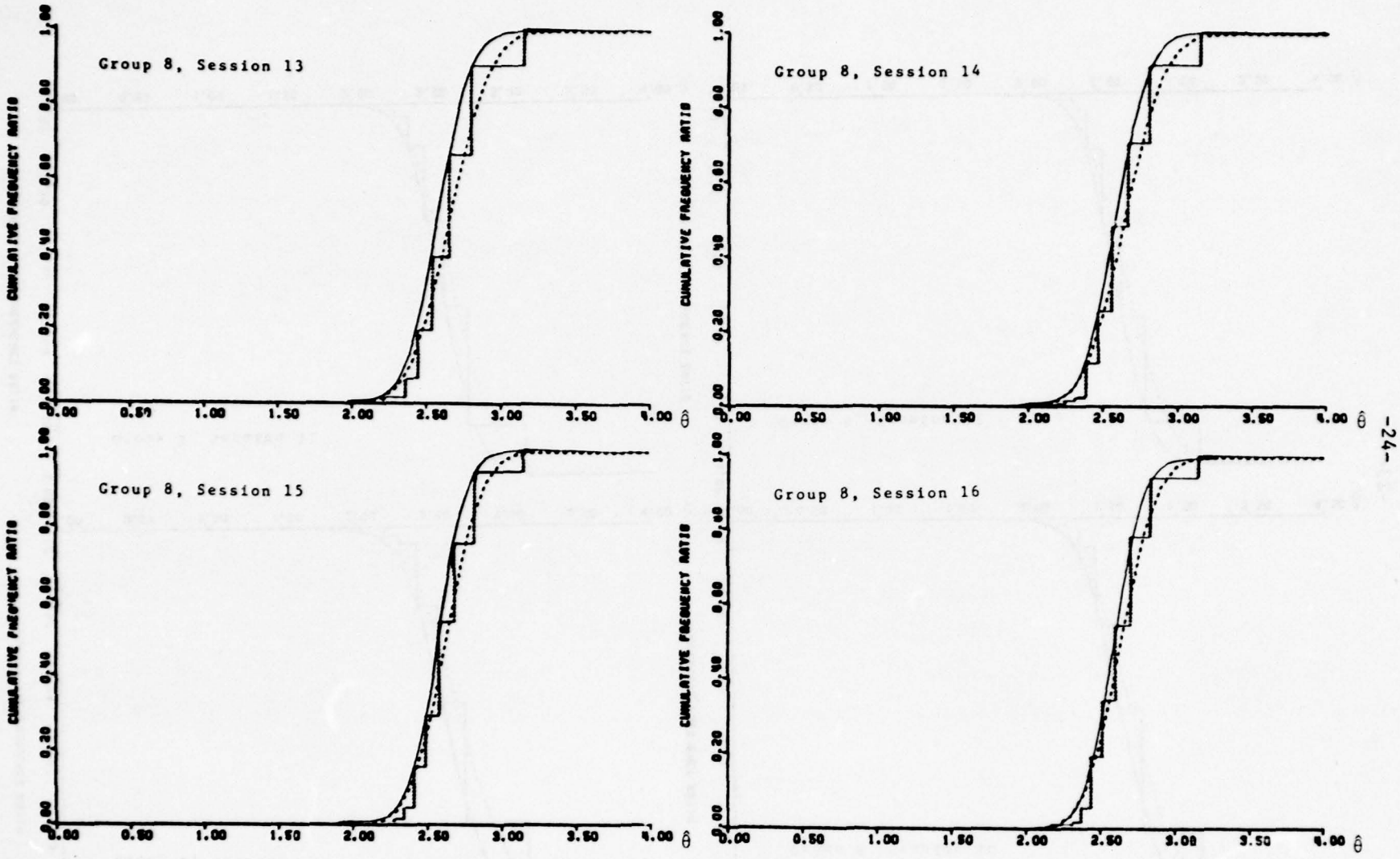


FIGURE 3-2 (Continued)

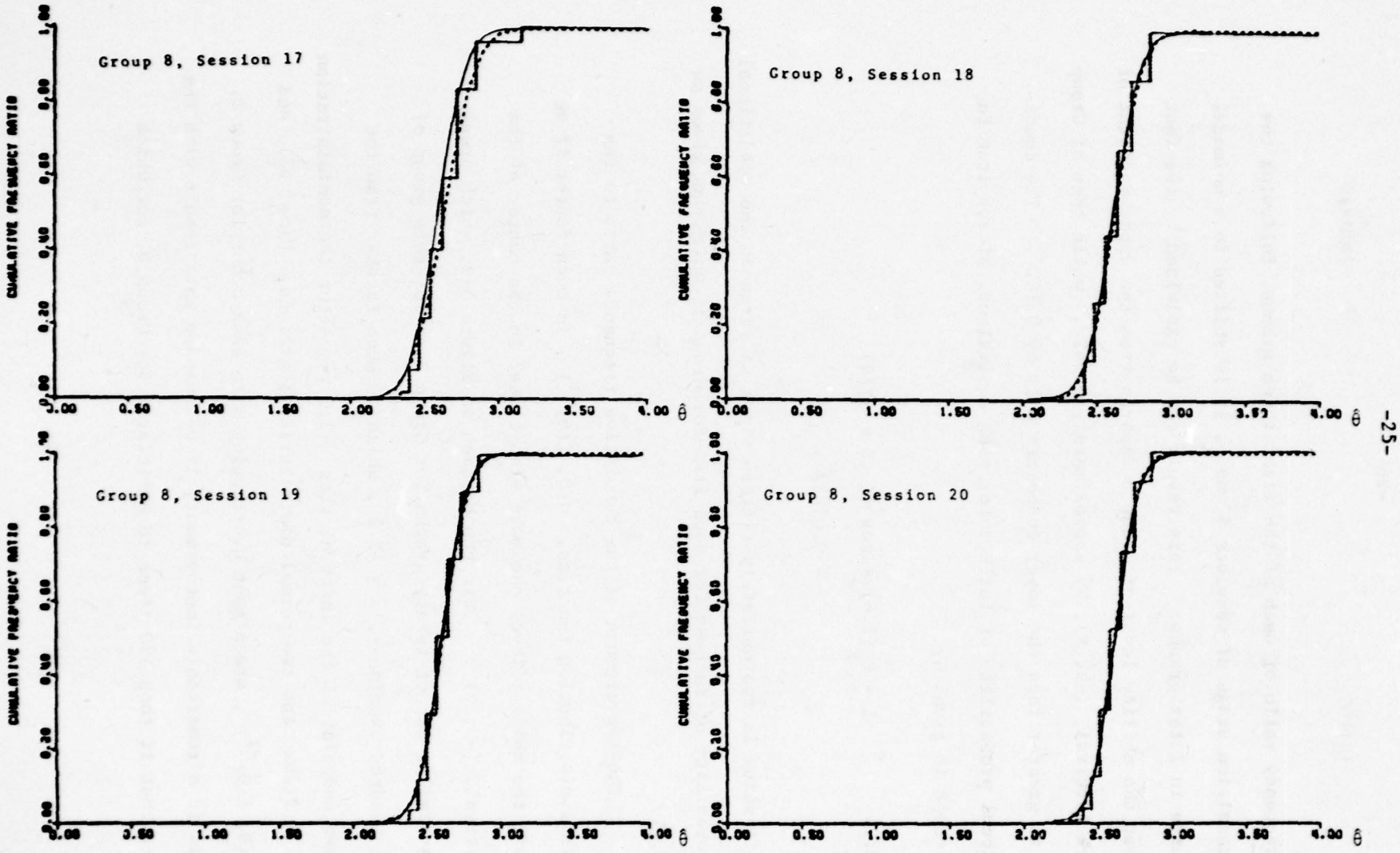


FIGURE 3-2 (Continued)

frequency ratio of each of the first three graphs, following the transition stage of sessions 4 and 5, it is shifted to a unimodal curve in later graphs. This result can be explained by the fact that the ability level of Group 8 departs from the upper endpoint of the interval, $(-\pi, \pi)$, by approximately 0.542 , while that of Group 1 is greater than the lower endpoints only by 0.142 . The conditional probability of failure for each equivalent, binary item for Group 8 is given by

$$(3.2) \qquad 1 - P_g(2.6) = \cos^2[(2.6 + \pi)/4] \doteq 0.01822 .$$

This value is approximately fifteen times as large as the conditional probability of success for each item for Group 1, which was given as (3.1).

The convergence of the cumulative frequency ratio to the normal distribution function, $N(\theta, I(\theta)^{-1})$, is much faster if we shift the ability level one more step closer to the center of the interval, $(-\pi, \pi)$. This can be seen in Figure 3-3, which presents the similar set of twenty graphs for Group 2. For this group of one hundred examinees, $\theta = -2.2$, which is much farther from the lower endpoint of the interval than -3.0 . After the administration of 70 items, the two normal distribution functions, $N(m_{\hat{\theta}}, s^2_{\hat{\theta}})$ and $N(\theta, I(\theta)^{-1})$, are almost overlapping with each other for Group 2. This is a remarkable improvement, if we compare this result with the fact that it took 170 items to administer for Group 8, for which

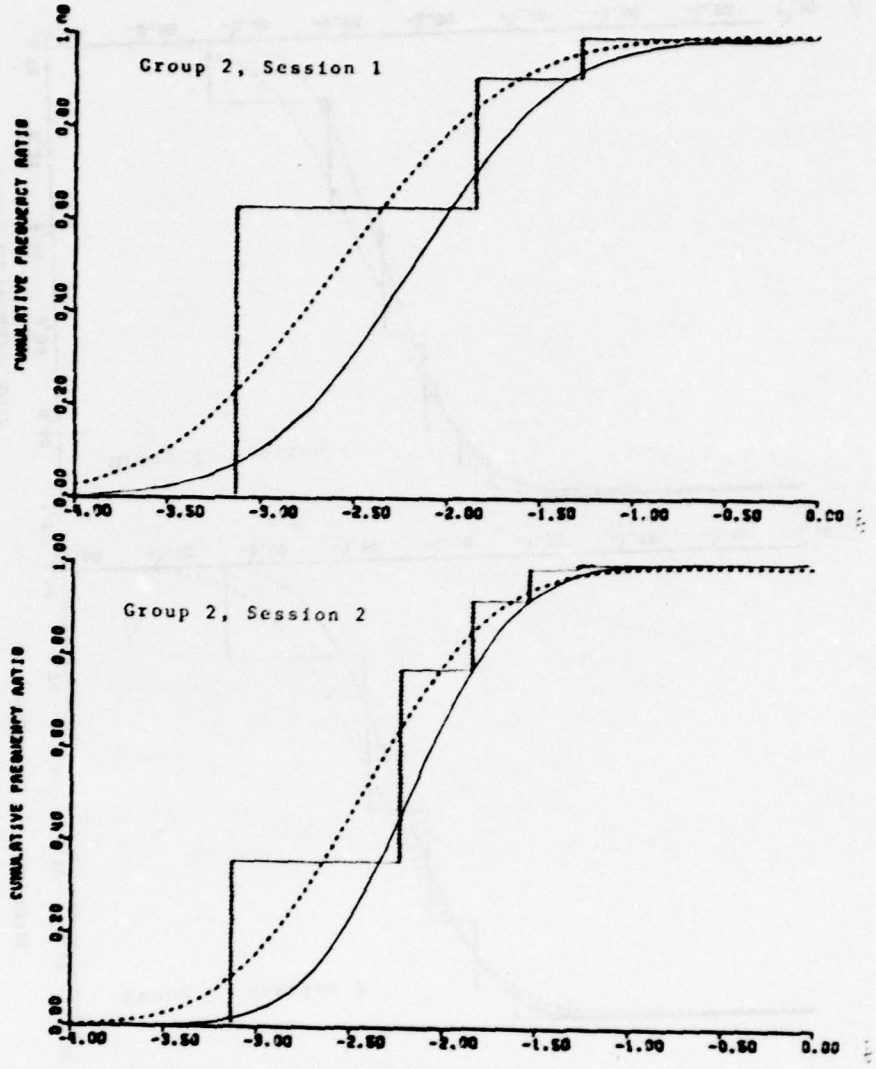


FIGURE 3-3

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = -2.2$

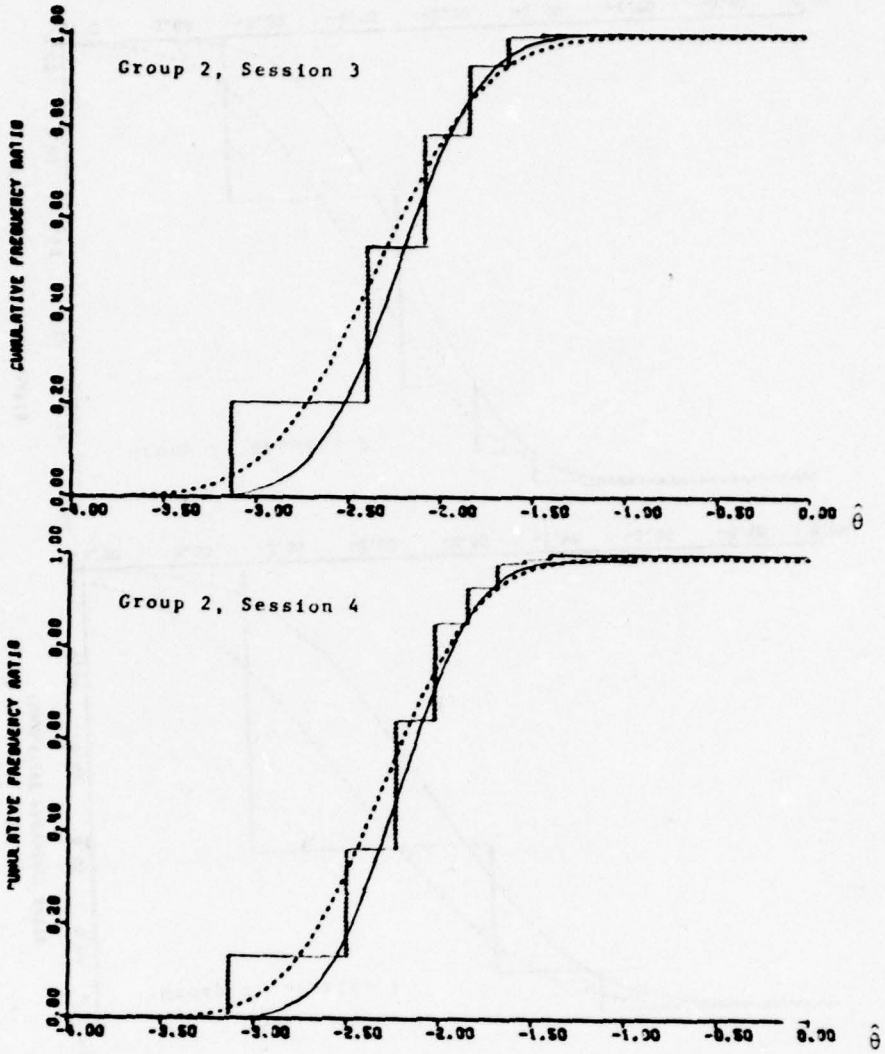


FIGURE 3-3 (Continued)

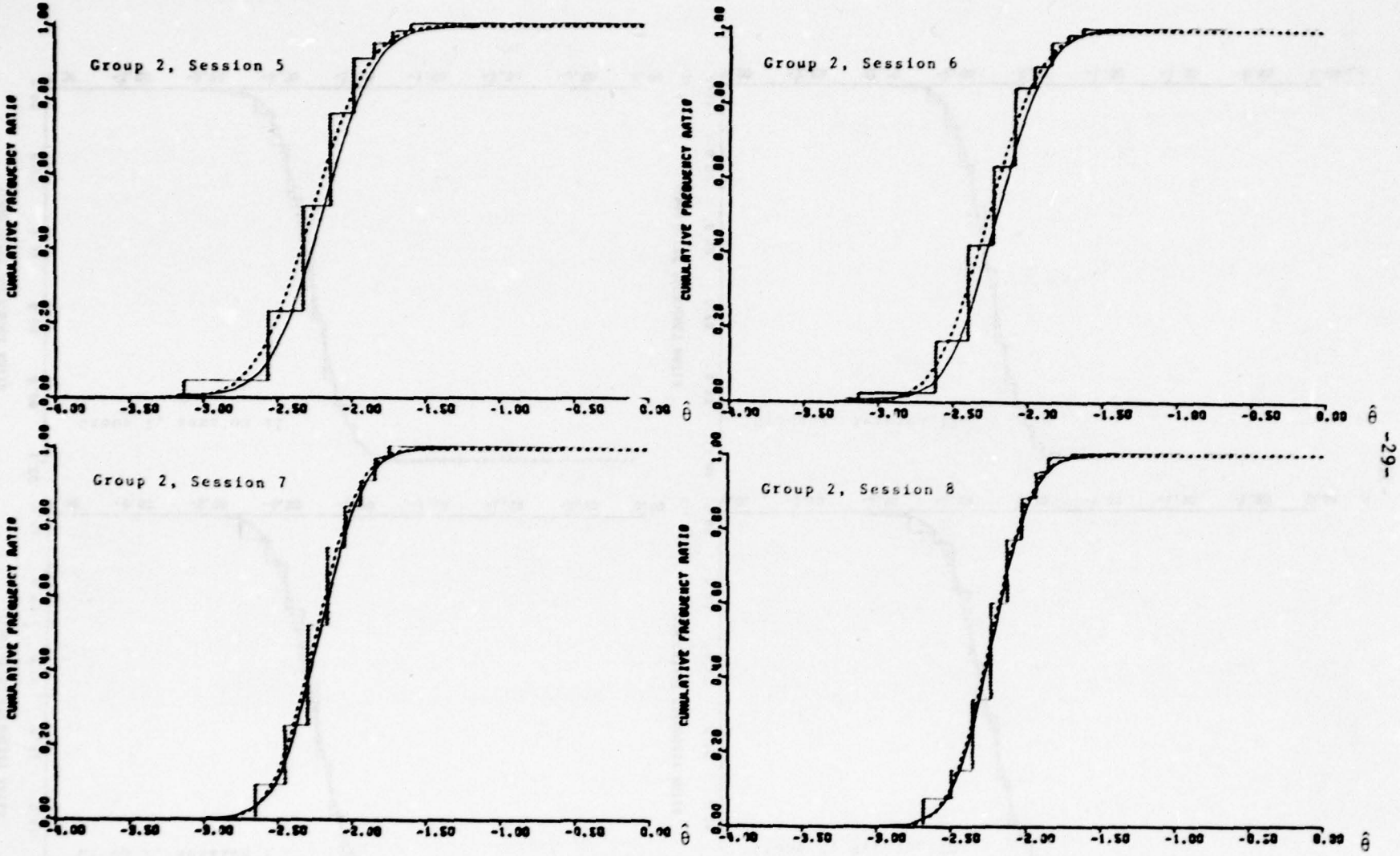


FIGURE 3-3 (Continued)

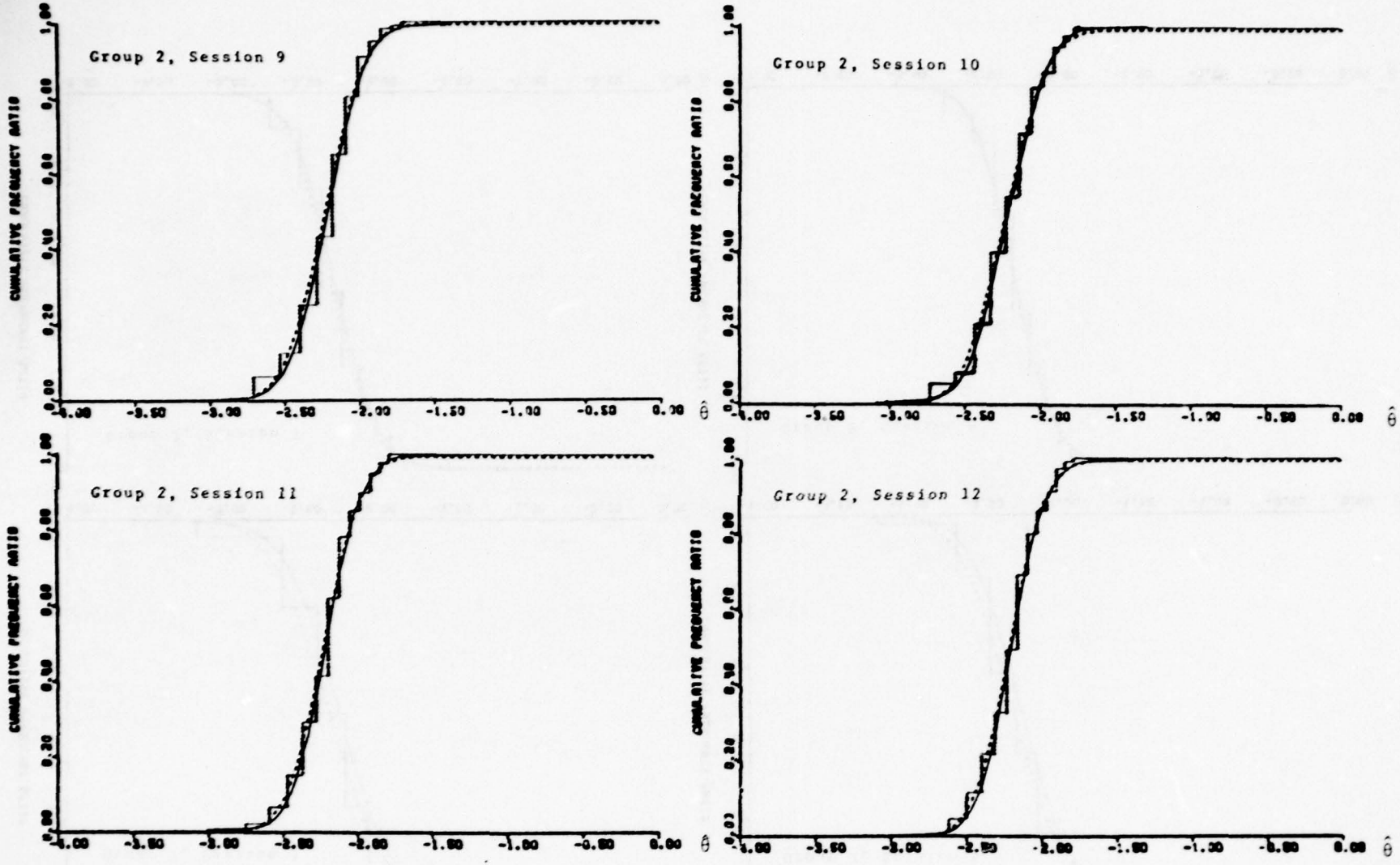


FIGURE 3-3 (Continued)

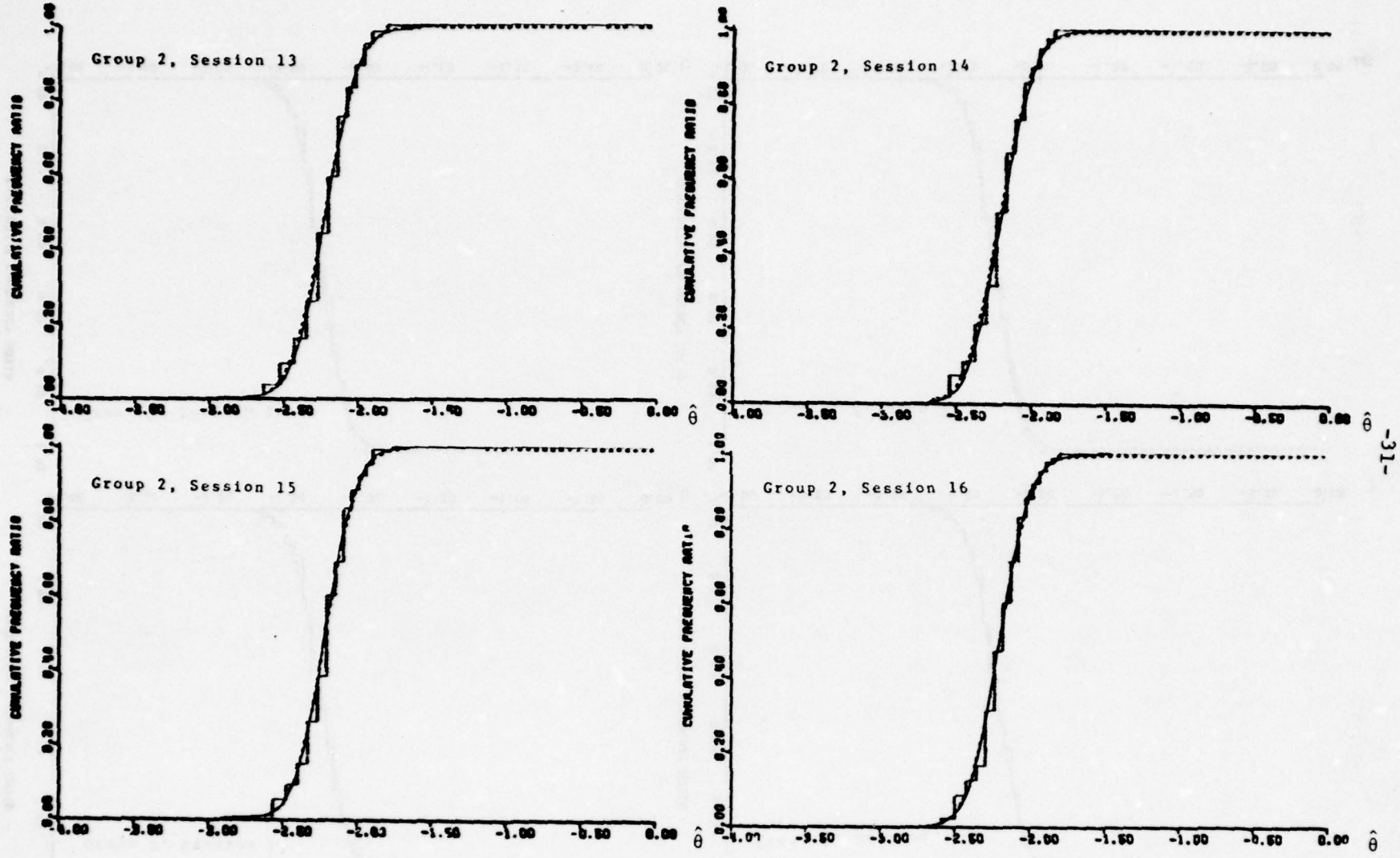


FIGURE 3-3 (Continued)

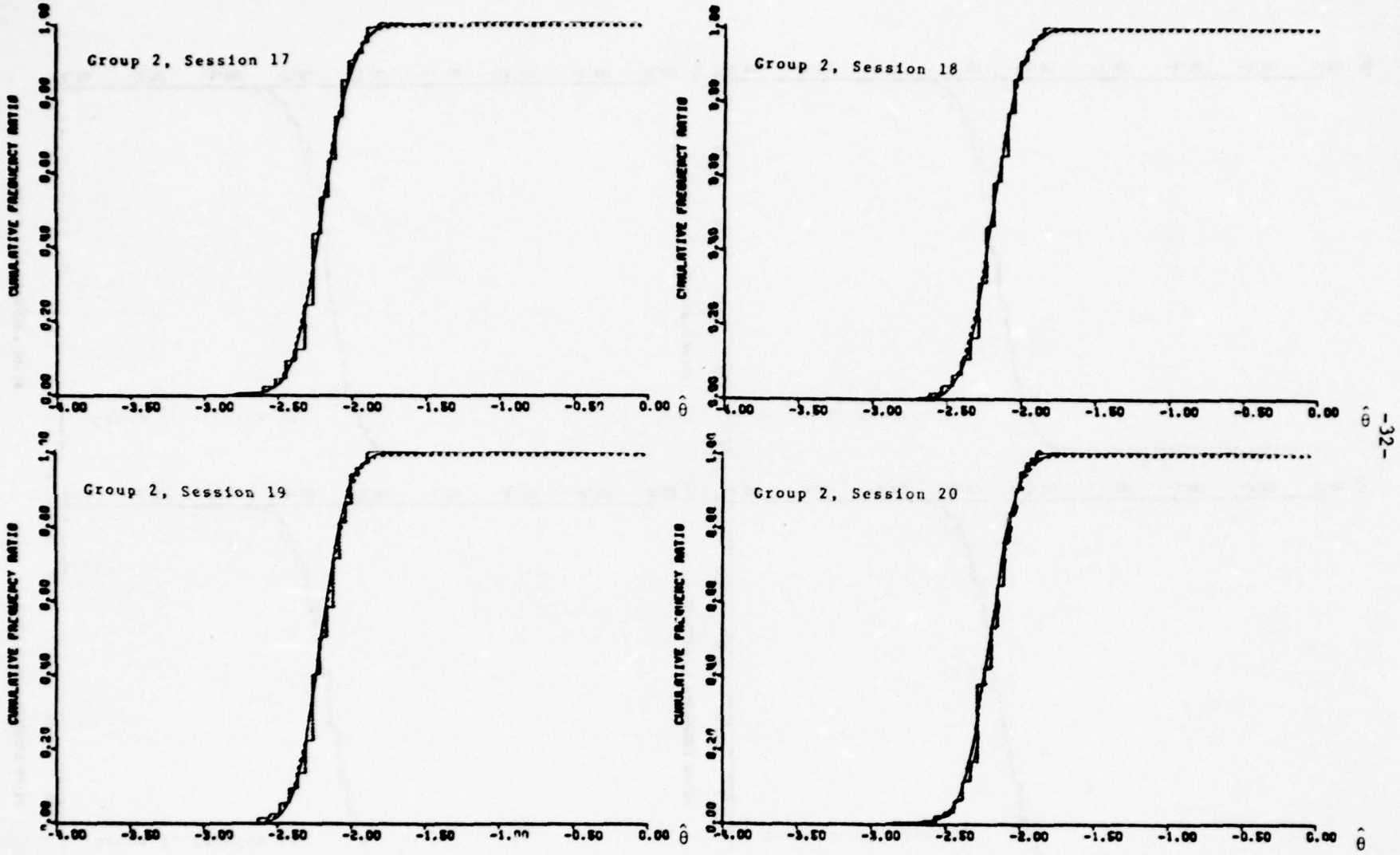


FIGURE 3-3 (Continued)

$\theta = 2.6$, to achieve this level of closeness. A J-shape frequency distribution of the maximum likelihood estimate is indicated by the cumulative frequency ratio only in the first graph of Figure 3-3, i.e., after ten items have been administered to the examinees, and, after that, unimodal frequency distributions are observed.

The remarkable improvement in the speed of convergence of the cumulative frequency ratio of one hundred maximum likelihood estimates for Group 2 in comparison with Group 8 can be explained from the difference between the conditional probability of success for Group 2 and that of failure for Group 8 . The former conditional probability is given by

$$(3.3) \qquad P_g(-2.2) = \sin^2[(-2.2 + \pi)/4] \doteq 0.05440 \ ,$$

whereas the latter conditional probability was already obtained in (3.2), which is approximately one-third of $P_g(-2.2)$. This difference between the two conditional probabilities indicates that the probability with which the examinee of Group 2 obtains the strictly decreasing likelihood function with the terminal maximum at $\theta = -\pi$ is much smaller than the one with which the examinee of Group 8 obtains the strictly increasing likelihood function with the terminal maximum at $\theta = \pi$, especially when the number of items is substantially large.

So far we have observed the results of the three groups of one hundred examinees whose ability levels are close to one of the

endpoints of the interval, $(-\pi, \pi)$. In contrast to those results, we shall observe a similar set of twenty graphs for Group 5, for which $\theta = 0.2$, i.e., closest to the center of the interval. Figure 3-4 presents these results.

We can see in this figure that, even in the first graph, or after the administration of only ten items, the two normal distribution functions, $N(m_{\hat{\theta}}, s^2_{\hat{\theta}})$ and $N(\theta, I(\theta)^{-1})$, are very close. We also notice that there are more varieties of different values of the maximum likelihood estimate, and thus the cumulative frequency ratio is much smoother, in earlier graphs, in comparison with those for the other three groups we observed earlier. There is no doubt that the speed of convergence of the distribution of the maximum likelihood estimate to the normality is much higher on this level of θ .

Similar sets of twenty graphs for the remaining four groups, Groups 3, 4, 6 and 7 , are presented in Appendix I as Figures A-1-1, A-1-2, A-1-3 and A-1-4, respectively. We can say from these results that, except for Group 7, whose ability level is 1.8 , the speed of convergence of the cumulative frequency ratio of the maximum likelihood estimate is quite high. The conditional probability of success in one binary item for each of these four groups of subjects is given in Table 4-4 which will be presented in the next section.

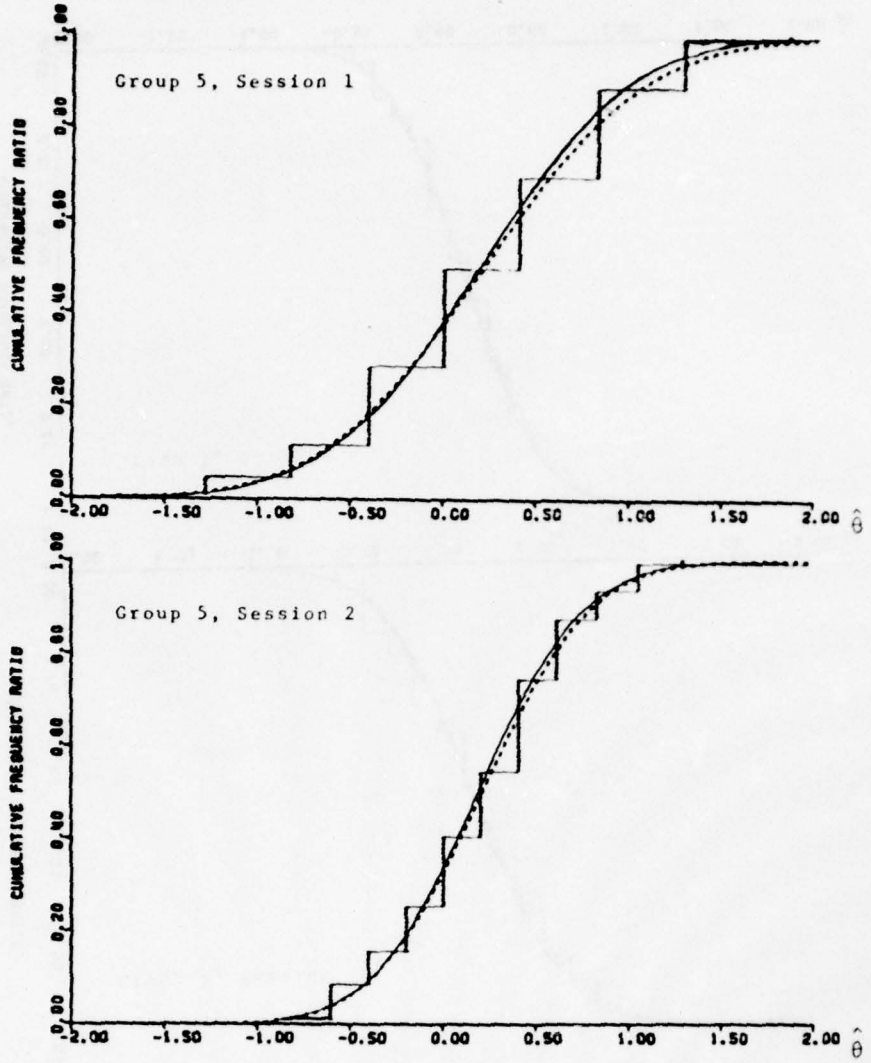


FIGURE 3-4

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = 0.2$

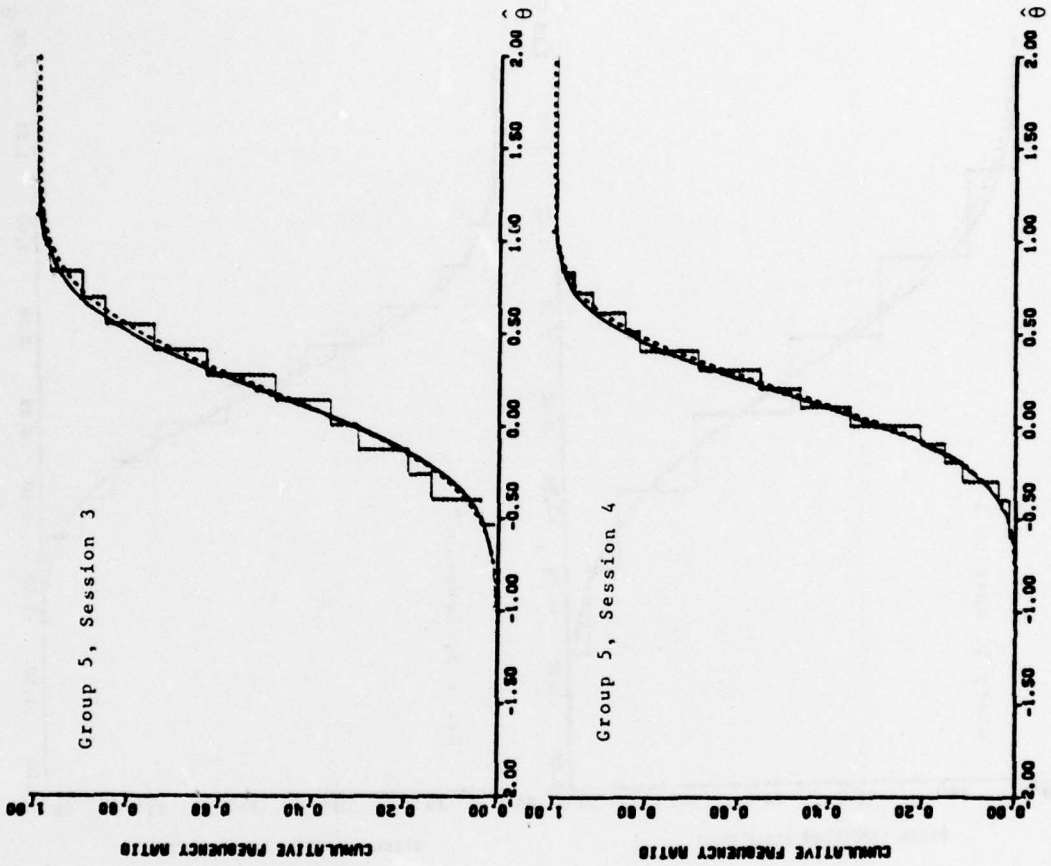


FIGURE 3-4 (Continued)

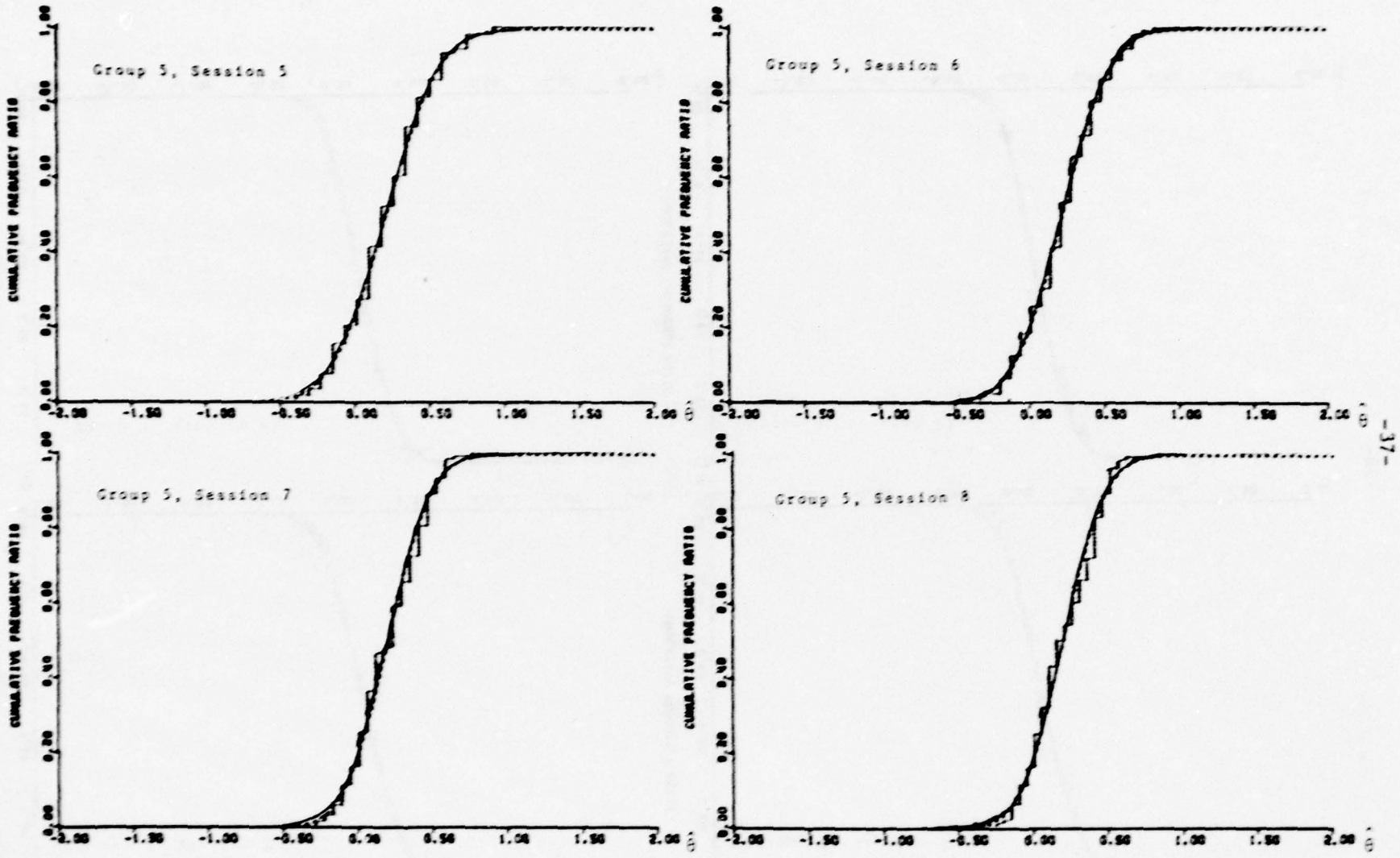


FIGURE 3-4 (Continued)

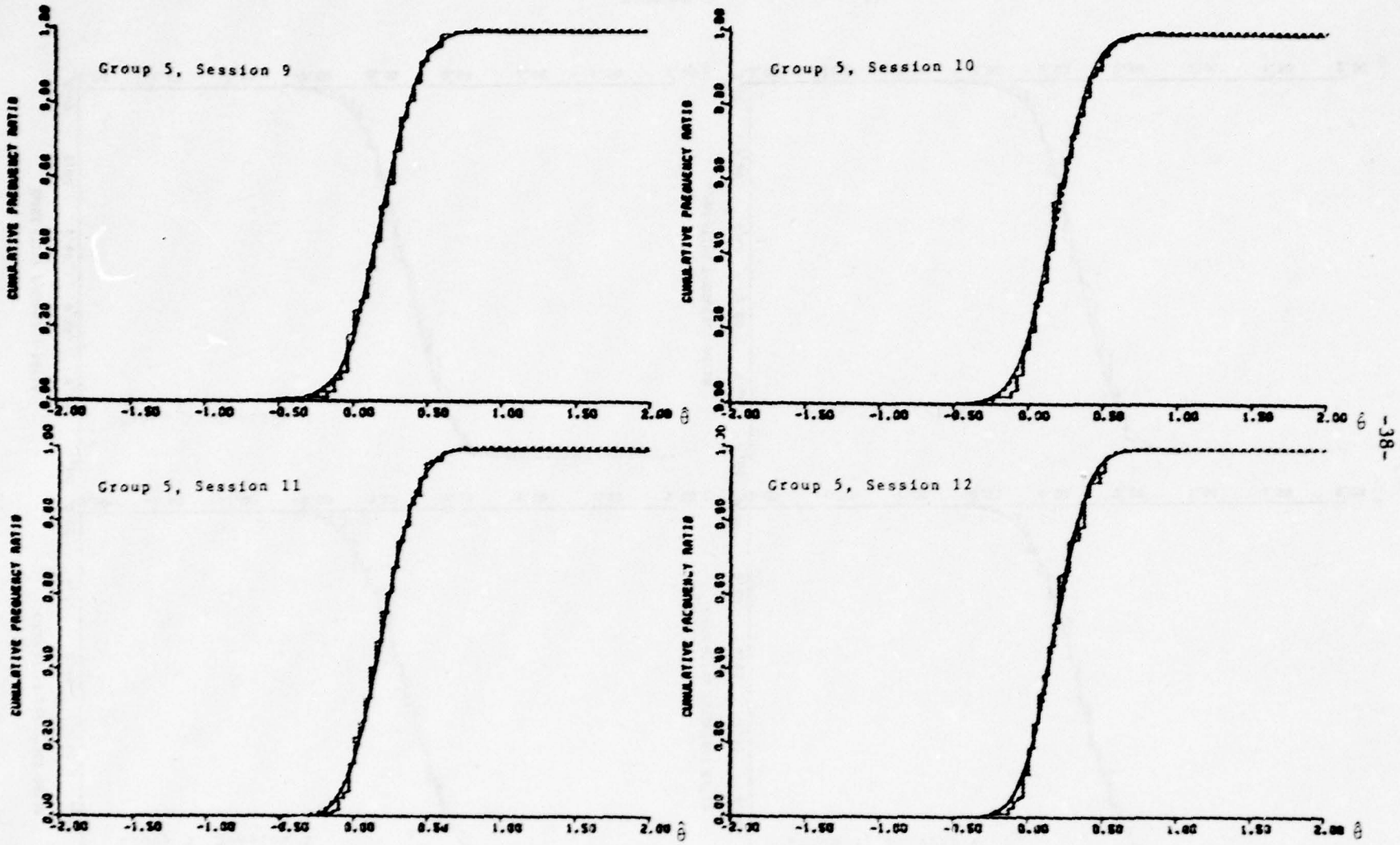


FIGURE 3-4 (Continued)

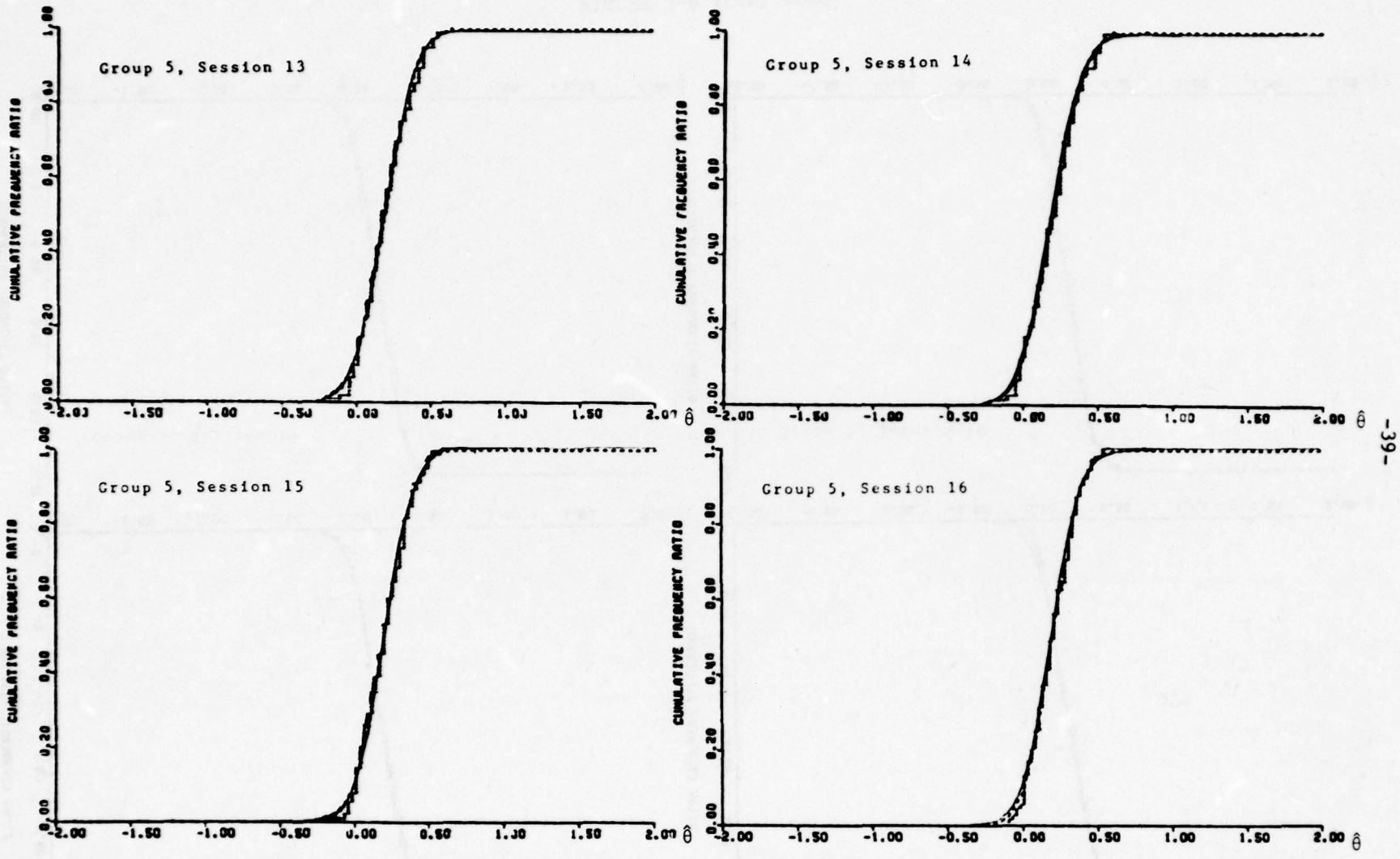


FIGURE 3-4 (Continued)

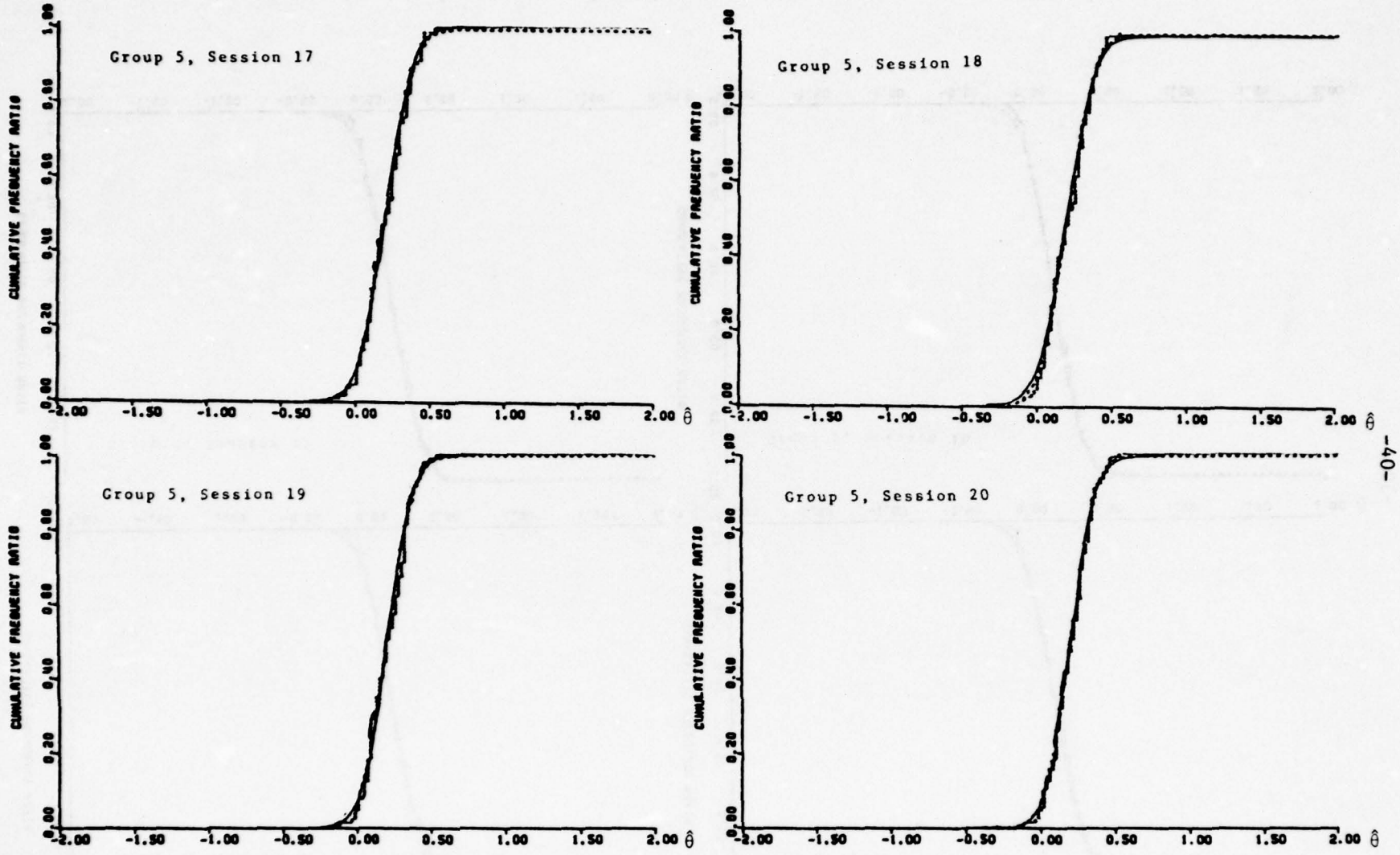


FIGURE 3-4 (Continued)

IV Further Observation of the Results

We have observed the sample mean, $m_{\hat{\theta}}$, and the sample standard deviation, $s_{\hat{\theta}}$, of the one hundred maximum likelihood estimates of each of the eight groups of examinees, after the completion of each of the twenty sessions of testing. We have also observed the cumulative frequency ratio in each case, in comparison with the normal distribution function, $N(\theta, I(\theta)^{-1})$. For further observation, here we consider the skewness index, $c_{1\hat{\theta}}$, which is defined by

$$c_{1\hat{\theta}} = m_{3\hat{\theta}} \, s_{\hat{\theta}}^{-3} \quad , \tag{4.1}$$

where $m_{3\hat{\theta}}$ is the third sample moment about the mean, given by

$$m_{3\hat{\theta}} = (1/100) \sum_{i=1}^{100} (\hat{\theta}_i - m_{\hat{\theta}})^3 \quad . \tag{4.2}$$

Table 4-1 presents the value of this sample skewness index, $c_{1\hat{\theta}}$, for the set of the one hundred maximum likelihood estimates of each of the eight groups of examinees, obtained after the completion of each of the twenty sessions. From (4.1), it is obvious that a positive value in the table indicates a positive skewness, and a negative value means a negative skewness. In this table, again the three marks, ***, ** and * , are assigned to some of the entries. The first mark is attached to all the values of $c_{1\hat{\theta}}$, whose absolute values are greater than or equal to 1.5 , the second one is for those the absolute values of which are greater than or equal to 1.0 and less than 1.5 , and the third one is assigned to those whose absolute values are greater than or equal to 0.5 and less than

TABLE 4-1

Sample Skewness Index of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees of Each of the Eight Ability Levels, after Completing Each of the Twenty Sessions of Testing.

Group	1	2	3	4	5	6	7	8
Session \ θ	-3.0	-2.2	-1.4	-0.6	0.2	1.0	1.8	2.6
1	---	0.770*	-0.782*	-0.622*	-0.120	0.668*	-0.071	-1.196**
2	---	-0.134	-0.272	-0.367	-0.052	0.599*	0.735*	-0.786*
3	---	-0.544*	-0.720*	0.071	0.071	0.058	0.829*	-0.267
4	---	-0.676*	-0.431	0.317	0.130	-0.111	0.771*	-0.033
5	9.849***	-0.626*	-0.545*	0.241	0.225	-0.105	0.762*	0.110
6	4.129***	-0.339	-0.526*	0.090	0.070	-0.007	-0.046	0.344
7	3.705***	0.050	-0.502*	0.078	0.074	-0.376	0.022	0.506*
8	3.705***	-0.245	-0.451	0.156	0.141	-0.275	0.026	0.497
9	3.705***	-0.371	-0.382	0.218	0.349	-0.328	0.064	0.609*
10	3.371***	-0.277	-0.345	0.140	0.597*	-0.311	-0.033	0.717*
11	2.865***	-0.237	-0.382	0.222	0.459	-0.132	-0.177	0.664*
12	2.667***	-0.167	-0.249	0.433	0.421	-0.022	0.022	0.709*
13	2.577***	-0.183	-0.367	0.246	0.389	-0.020	0.066	0.801*
14	2.271***	-0.214	-0.406	0.198	0.242	-0.029	0.182	0.851*
15	1.912***	-0.122	-0.355	0.252	0.212	-0.115	0.266	0.862*
16	1.545***	-0.157	-0.293	0.255	0.152	-0.064	0.308	0.899*
17	1.500***	-0.121	-0.407	0.015	0.068	-0.324	0.154	0.938*
18	1.448**	-0.183	-0.490	0.048	0.027	-0.232	0.228	0.587*
19	1.380**	-0.316	-0.445	0.193	0.055	-0.048	0.172	0.697*
20	1.189**	-0.271	-0.443	0.187	0.067	-0.032	0.200	0.287

* $0.5 \leq |c_{1\hat{\theta}}| < 1.0$

** $1.0 \leq |c_{1\hat{\theta}}| < 1.5$

*** $1.5 \leq |c_{1\hat{\theta}}|$

1.0 . We notice that the first four entries of the column of Group 1 in the table are indeterminate, since both the third and second moments about the mean are zero in each of these four cases.

It is interesting to note that, for Group 2, the sign of the index is reversed between the first and second sessions, and, for Group 8, it is reversed between the fourth and fifth sessions, while it is consistently positive for Group 1. Unlike Tables 3-1 and 3-2, which were presented in the preceding section and are for the sample mean and the sample standard deviation, respectively, the configuration of the values of the sample skewness index in Table 4-1 is somewhat more complicated and seemingly more difficult to interpret.

This problem of interpretation will be solved, however, if we pay attention to the frequencies of the two extreme values of the maximum likelihood estimate, $-\pi$ and π . Table 4-2 presents the frequency distribution of these two values for each group and for each session. In this table, the numbers appearing in the first four columns are the freqencies of $-\pi$, and those in the last three columns are those of π . For Group 5, the frequencies are zero for both $-\pi$ and π throughout the twenty sessions.

We can see in Table 4-2 that, for Group 1, even after the administration of 200 items, the terminal maximum for the likelihood function at the lower end of the interval $(-\pi, \pi)$ occurred 73 times out of 100 . This explains the J-shape cumulative frequency ratios of the maximum likelihood estimate for Group 1 throughout the

TABLE 4-2

Frequencies of $-\pi$ As the Maximum Likelihood Estimate Appearing in the First 4 Columns and Those of π Appearing in the Last 3 Columns. The Total Number of Maximum Likelihood Estimates in Each Cell is 100.

Group	1	2	3	4	5	6	7	8
Session \ θ	-3.0	-2.2	-1.4	-0.6	0.2	1.0	1.8	2.6
1	100	62	13	3	0	8	37	75
2	100	35	1	0	0	1	11	66
3	100	20	1	0	0	0	5	52
4	100	13	0	0	0	0	2	43
5	99	4	0	0	0	0	1	39
6	95	2	0	0	0	0	0	30
7	94	0	0	0	0	0	0	26
8	94	0	0	0	0	0	0	23
9	94	0	0	0	0	0	0	20
10	93	0	0	0	0	0	0	15
11	91	0	0	0	0	0	0	14
12	90	0	0	0	0	0	0	12
13	89	0	0	0	0	0	0	10
14	87	0	0	0	0	0	0	9
15	84	0	0	0	0	0	0	6
16	80	0	0	0	0	0	0	6
17	79	0	0	0	0	0	0	4
18	78	0	0	0	0	0	0	1
19	76	0	0	0	0	0	0	1
20	73	0	0	0	0	0	0	0

twenty sessions of testing, as we have observed in the preceding section. On the other hand, a close observation of the relationship between the skewness indices and the frequencies of the two extreme values of the maximum likelihood estimate reveals that, for Groups 8, 2 and 7 , the reversal of the sign of the skewness index occurs somewhere around the frequency 40 of the extreme values of the maximum likelihood estimate. Why is it so?

To answer this question, we must call our attention to the fact that there is a substantial gap between one of the extreme values of the maximum likelihood estimate and the adjacent one. To be more specific, for Session 1, or after the administration of 10 items, the value of the maximum likelihood estimate corresponding to the second best test score, 9 , is 1.8546 , which is obtained through (2.5) with $k = 1$. Thus the difference of this value of the maximum likelihood estimate from π is as large as 1.2870 . The same amount of discrepancy exists between $-\pi$ and the adjacent maximum likelihood estimate, -1.8546 , which corresponds to the second lowest test score, 1 . Even for Session 20, or after all the 200 items have been administered, this discrepancy is still as large as 0.2831 , since the maximum likelihood estimate corresponding to the second highest test score, 199 , is 2.8585 , and the one corresponding to the second lowest test score, 1 , is -2.8585 .

We notice that, when $-\pi$, one of the two extreme values of the maximum likelihood estimate, has a high frequency, it makes the total frequency distribution of the maximum likelihood estimate

J-shaped, causing a positive skewness to it. On the other hand, when such an extreme value has a low frequency, because of the long distance from the adjacent value of the maximum likelihood estimate, it creates a long tail on the left hand side of the total frequency distribution, and, therefore, causes a negative skewness to the frequency distribution. We can easily see that the same logic applies for the frequency of the other extreme value, π, of the maximum likelihood estimate, and negative and positive skewnesses. Considering these facts, we are in a good position to understand the meaning of the total configuration of the skewness indices in Table 4-1. It should also be pointed out that those which involve neither of the two extreme values, $-\pi$ and π, of the maximum likelihood estimate are small enough to be considered as sampling fluctuations. In fact, only a few of them are marked with *, and none of the others exceeds 0.5 in absolute value.

If we combine the result in Table 4-1 with the sample means of the maximum likelihood estimate, which are given in Table 3-1 in the preceding section, the effect of the two extreme values of the maximum likelihood estimate is more conspicuous. We notice that all the sample means, which involve one or more $-\pi$ or π, are shifted from the true values of θ to the directions indicated by the signs of the extreme values. It is also noted that all the sample means, which involve neither $-\pi$ nor π, have very small discrepancies from the true values of θ, i.e., less than 0.05 in absolute value.

Table 4-3 presents the kurtosis index, $c_{2\hat{\theta}}$, which is defined by

$$c_{2\hat{\theta}} = m_{4\hat{\theta}}\, s_{\hat{\theta}}^{-4} - 3 \quad , \tag{4.3}$$

where $m_{4\hat{\theta}}$ is the fourth sample moment of the one hundred maximum likelihood estimates, for which we can write

$$m_{4\hat{\theta}} = (1/100) \sum_{i=1}^{100} (\hat{\theta}_i - m_{\hat{\theta}})^4 \quad , \tag{4.4}$$

for each of the eight groups of examinees after the completion of each of the twenty sessions. The three types of marks, ***, ** and * , are assigned in this table by following the same rule as we have used for the skewness index in Table 4-1. As is well known, this kurtosis index is defined in comparison with the normal distribution, i.e., a positive value indicates a greater peakedness, and a negative value a lesser peakedness, than the normal distribution.

We notice that, again in these results, there exists a certain effect of the extreme values, $-\pi$ and π , of the maximum likelihood estimate. In fact, we observe two different transitions there, one of which is from positive to negative values, and the other from negative to positive values. The former transition stage corresponds, approximately, to the frequency 75 of $-\pi$ or π , and the latter transition stage corresponds, roughly, to the frequency 13 . Sampling fluctuations appear to be greater for the kurtosis index than for the skewness index, the fact which coincides with

TABLE 4-3

Sample Kurtosis Index of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees of Each of the Eight Ability Levels, after Completing Each of the Twenty Sessions of Testing.

Group	1	2	3	4	5	6	7	8
θ / Session	-3.0	-2.2	-1.4	-0.6	0.2	1.0	1.8	2.6
1	---	-0.866*	0.027	0.980*	-0.499	0.567*	-1.141**	-0.472
2	---	-1.278**	0.720*	0.270	-0.525*	1.576***	0.080	-1.184**
3	---	-0.617*	1.429**	-0.179	-0.699*	0.267	0.888*	-1.608***
4	---	0.124	0.940*	0.136	-0.296	0.084	1.291**	-1.505***
5	95.010***	1.299**	0.458	0.291	-0.308	-0.108	2.071***	-1.520***
6	15.053***	0.930*	0.310	-0.574*	-0.484	-0.326	-0.421	-1.142**
7	11.730***	-0.423	0.622*	-0.465	-0.817*	-0.236	0.087	-0.973*
8	11.730***	-0.010	0.087	-0.303	-0.703*	-0.394	0.225	-0.758*
9	11.730***	0.114	-0.477	-0.228	-0.192	-0.343	0.752*	-0.552*
10	9.361***	0.003	-0.317	-0.279	0.423	0.170	1.404**	-0.152
11	6.210***	0.021	-0.402	0.115	-0.212	0.414	0.608*	-0.085
12	5.111***	-0.307	-0.505*	0.242	-0.501*	0.349	0.298	0.183
13	4.893***	-0.117	-0.319	-0.052	-0.510*	0.517*	0.305	0.472
14	3.358***	-0.164	-0.119	0.030	-0.622*	1.405**	0.121	0.492
15	1.804***	0.034	-0.194	0.184	-0.767*	1.264**	-0.077	0.867*
16	0.499	-0.080	-0.303	0.293	-0.696*	0.659*	0.014	0.895*
17	0.424	0.027	-0.085	0.358	-0.746*	0.699*	0.170	1.278**
18	0.301	0.027	0.167	0.535*	-0.650*	0.375	-0.015	0.451
19	0.284	0.069	-0.042	0.306	-0.695*	-0.031	-0.007	0.858*
20	-0.236	-0.117	-0.307	0.793*	-0.483	0.276	0.092	-0.628*

* $0.5 \leq |c_{2\hat{\theta}}| < 1.0$

** $1.0 \leq |c_{2\hat{\theta}}| < 1.5$

*** $1.5 \leq |c_{2\hat{\theta}}|$

our general knowledge of greater sampling fluctuations for higher order moments.

Table 4-4 presents the conditional probability of success, $P_g(\theta)$, for a single item, which is given by (1.2), for each of the eight ability levels, together with the item information function $I_g(\theta)$, and three other item information functions obtainable after the transformation of θ to τ_1, τ_2 and τ_3 through (2.6), (2.7) and (2.9), respectively. These item information functions are obtained by multiplying $I_g(\theta)$ with the square of the derivative of θ with respect to the corresponding transformed variables, respectively (cf. Samejima, 1979).

TABLE 4-4

Conditional Probability of Success, $P_g(\theta)$, in a Single Equivalent Item g, Item Information Function, $I_g(\theta)$, and Three Other Item Information Functions, $I_g^*(\tau_1)$, $I_g^{**}(\tau_2)$ and $I_g^{***}(\tau_3)$, Obtained After Transforming Ability θ to τ_1, τ_2 and τ_3, Respectively.

θ	$P_g(\theta)$	$I_g(\theta)$	$I_g^*(\tau_1)$	$I_g^{**}(\tau_2)$	$I_g^{***}(\tau_3)$
-3.0	0.001253	0.25	31.9762	0.0137	0.0036
-2.2	0.054396	0.25	0.7776	0.2364	0.1487
-1.4	0.177891	0.25	0.2735	0.4639	0.4227
-0.6	0.352240	0.25	0.1753	0.6041	0.6594
0.2	0.549917	0.25	0.1616	0.6330	0.7153
1.0	0.739713	0.25	0.2078	0.5471	0.5564
1.8	0.891663	0.25	0.4141	0.3581	0.2792
2.6	0.981779	0.25	2.2360	0.1118	0.0517

V Discussion and Conclusions

We have found out that the convergence of the cumulative frequency distribution of the maximum likelihood estimate to the normal distribution function, $N(\theta, I(\theta)^{-1})$, is substantially slower for the levels of ability close to one of the two endpoints of the interval, $(-\pi, \pi)$, in comparison with the levels of ability close to the center of the interval. It has become obvious that the frequency of one of the two extreme values, $-\pi$ and π, of the maximum likelihood estimate is a good indicator of the degree of convergence, since it affects, strongly, the moments of the frequency distribution. One important implication of this finding is that we should avoid using the normal distribution, $N(\theta, I(\theta)^{-1})$, as the approximation to the conditional distribution of the maximum likelihood estimate, unless there are a large enough number of items so that the conditional probability of the "all success" response pattern, and that of the "all failure" response pattern, are neglibly small.

To pursue this further, the conditional probability of the "all success" response pattern, and that of the "all failure" response pattern, were calculated from $P_g(\theta)$, which is presented for each of the eight different levels of ability in Table 4-4 of the preceding section. Since all the items are equivalent, these conditional probabilities are $P_g(\theta)^n$ and $[1 - P_g(\theta)]^n$, respectively. For $\theta = -3.0$, or the ability level of Group 1, when we increase the number of items to 256, 512, 1,024, 2,048 and 4,096, the conditional

probability of the "all failure" response pattern becomes 0.725, 0.526, 0.277, 0.077 and 0.006, respectively. This means that, even if more than 1,000 items are administered, we must expect approximately 28 examinees out of 100 will obtain the "all failure" response pattern, and we need more than 4,000 items to reduce it to 0.6 person out of 100 examinees. These outcomes are exactly the same for $\theta = 3.0$, when we consider the conditional probability of the "all success" response pattern. We may conclude, therefore, that for the values of θ 3.0 or greater in absolute value we should give up, totally, the idea of using the normal approximation to the conditional distribution of the maximum likelihood estimate. For $\theta = 2.6$, if we increase the number of items from 32 to 64, 128, 256 and 512, the conditional probabilities of the "all success" response pattern are 0.555, 0.308, 0.095, 0.009 and 0.00008, respectively. Thus we can say that, for this level of ability, if we use approximately 300 items, chances are slim for one person out of 100 examinees to obtain π as the maximum likelihood estimate. This number, 300, is still too large for practical purposes, however, and we must say that in the vicinity of $\theta = 2.6$, and also that of $\theta = -2.6$, the idea of using the normal approximation to the conditional distribution of the maximum likelihood estimate is unrealistic. The situation is much more ameliorated, however, if we switch to the ability level, $\theta = -2.2$. On this level of ability, for 8, 16, 32, 64 and 128 items, the conditional probabilities of the "all failure" response pattern are 0.639, 0.409, 0.167, 0.028 and 0.0008,

respectively. Thus we can conclude that, as long as we have 100 items, it is unlikely to happen that one person out of one hundred examinees obtains $-\pi$ as his maximum likelihood estimate. This is well exemplified and supported by the result of our Monte Carlo study, which is given in Table 4-2 of the preceding section. In other words, we can be assured that 100 items are enough as far as we use the subinterval of θ, $(-2.2, 2.2)$, for which the normal approximation to the conditional distribution of the maximum likelihood estimate is adopted. This number of items will be reduced to half, i.e., 50, if we switch the subinterval of θ from $(-2.2, 2.2)$ to $(-1.8, 1.8)$, since for $\theta = 1.8$ the conditional probabilities of the "all success" response pattern are 0.632, 0.400, 0.160, 0.025 and 0.0006, for 4, 8, 16, 32 and 64 items, respectively. If we need to use, say, only 35 items, we must narrow down the interval further to $(-1.4, 1.4)$, for the conditional probabilities of the "all failure" response pattern at $\theta = -1.4$, or those of the "all success" response pattern at $\theta = 1.4$, are 0.676, 0.457, 0.209, 0.044 and 0.002 for 2, 4, 8, 16 and 32 items, respectively. We notice that the gain in the reduction of the number of items is decreasing compared with the amount of sacrifice in the interval length, and it is probably meaningless to consider further reductions of items. If we wish to use a set of "unknown" equivalent items as a substitute for the Old Test, it is advisable to aim at including 35 to 50 equivalent items in the new item pool. This can be done through the content analysis of the items, and their proportions

correct in the preliminary study, etc. As an additional information, the conditional probabilities of the "all success" response pattern for the ability levels 1.0, 0.6 and 0.2 , or those of the "all failure" response pattern for the ability levels -1.0, -0.6 and -0.2 , are: 0.547, 0.299, 0.090 and 0.008; 0.420, 0.176, 0.031 and 0.001; and 0.302, 0.091, 0.008 and 0.00007; for 2, 4, 8 and 16 items, respectively.

The conclusion made in the preceding paragraph is supported by the result of our Monte Carlo study, which was made in earlier sections. In the graph of Session 10 in Figure 3-3, that of Session 5 in Figure A-1-4, and that of Session 4 in Figure A-1-1, which involve 100 items for $\theta = -2.2$, 50 items for $\theta = 1.8$ and 40 items for $\theta = -1.4$, respectively, the normal distribution function, $N(\theta, I(\theta)^{-1})$ and the cumulative frequency ratio are sufficiently close. We find in Tables 3-1, 3-2, 4-1 and 4-3 that the sample mean, the sample standard deviation, the sample skewness index and the sample kurtosis index are: -2.232 [$\theta = -2.200$], 0.214 [$I(\theta)^{-1/2} = 0.200$], -0.277 and 0.003 in the first case, 1.810 [$\theta = 1.800$], 0.321 [$I(\theta)^{-1/2} = 0.283$], 0.762 and 2.071 in the second case, and -1.445 [$\theta = -1.400$], 0.330 [$I(\theta)^{-1/2} = 0.316$], -0.431 and 0.940 in the third case, respectively. We can say that, at least, the sample mean and the sample standard deviation are very close to the asymptotic values in each case.

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APPENDIX I

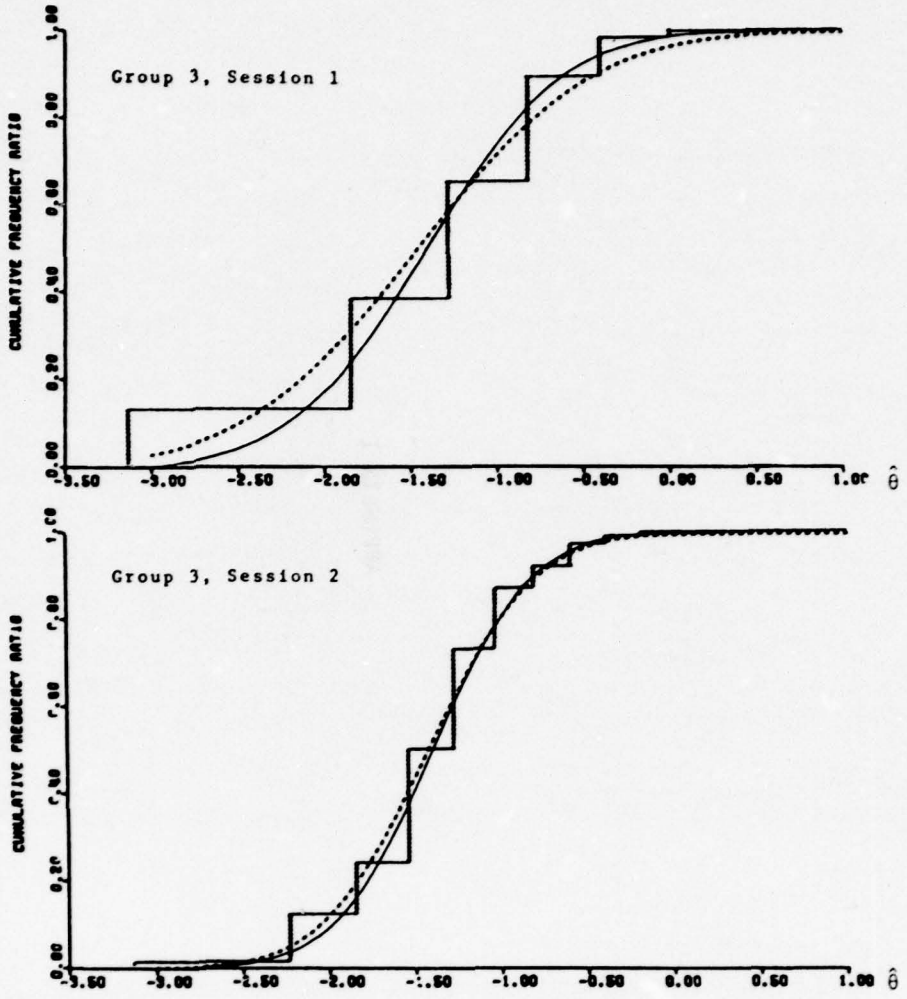


FIGURE A-1-1

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = -1.4$

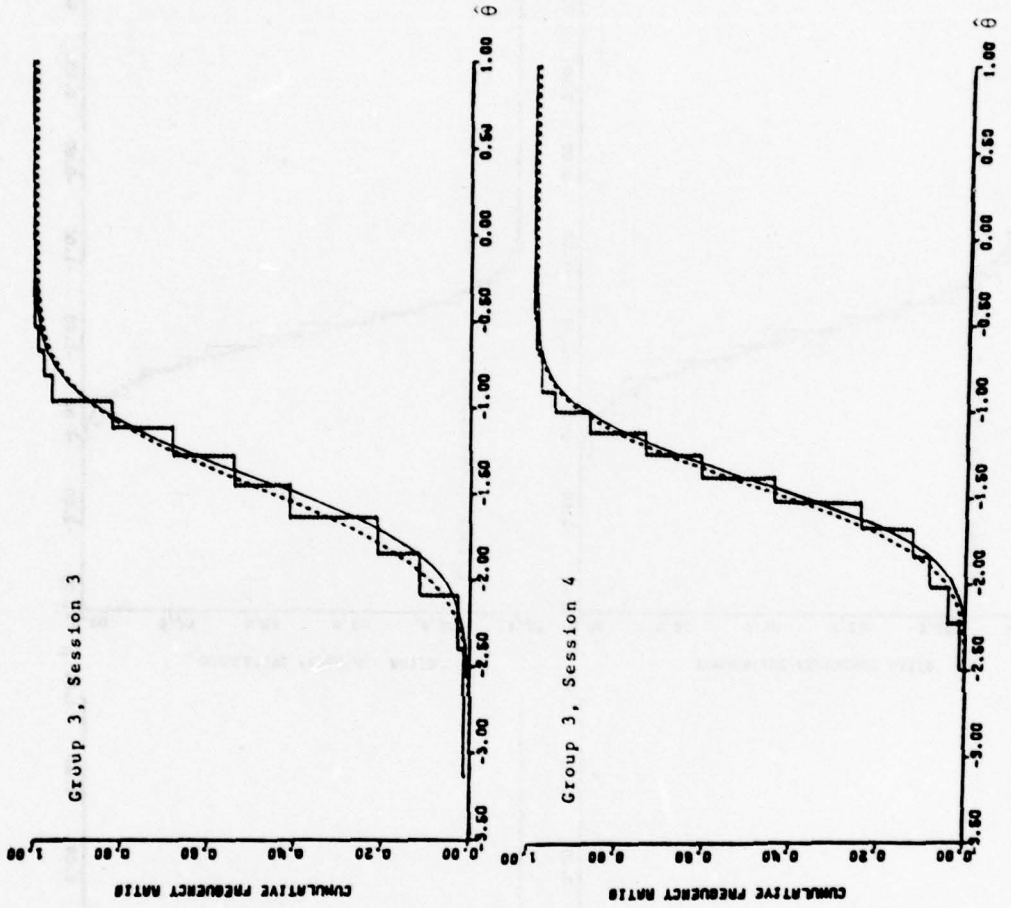


FIGURE A-1-1 (Continued)

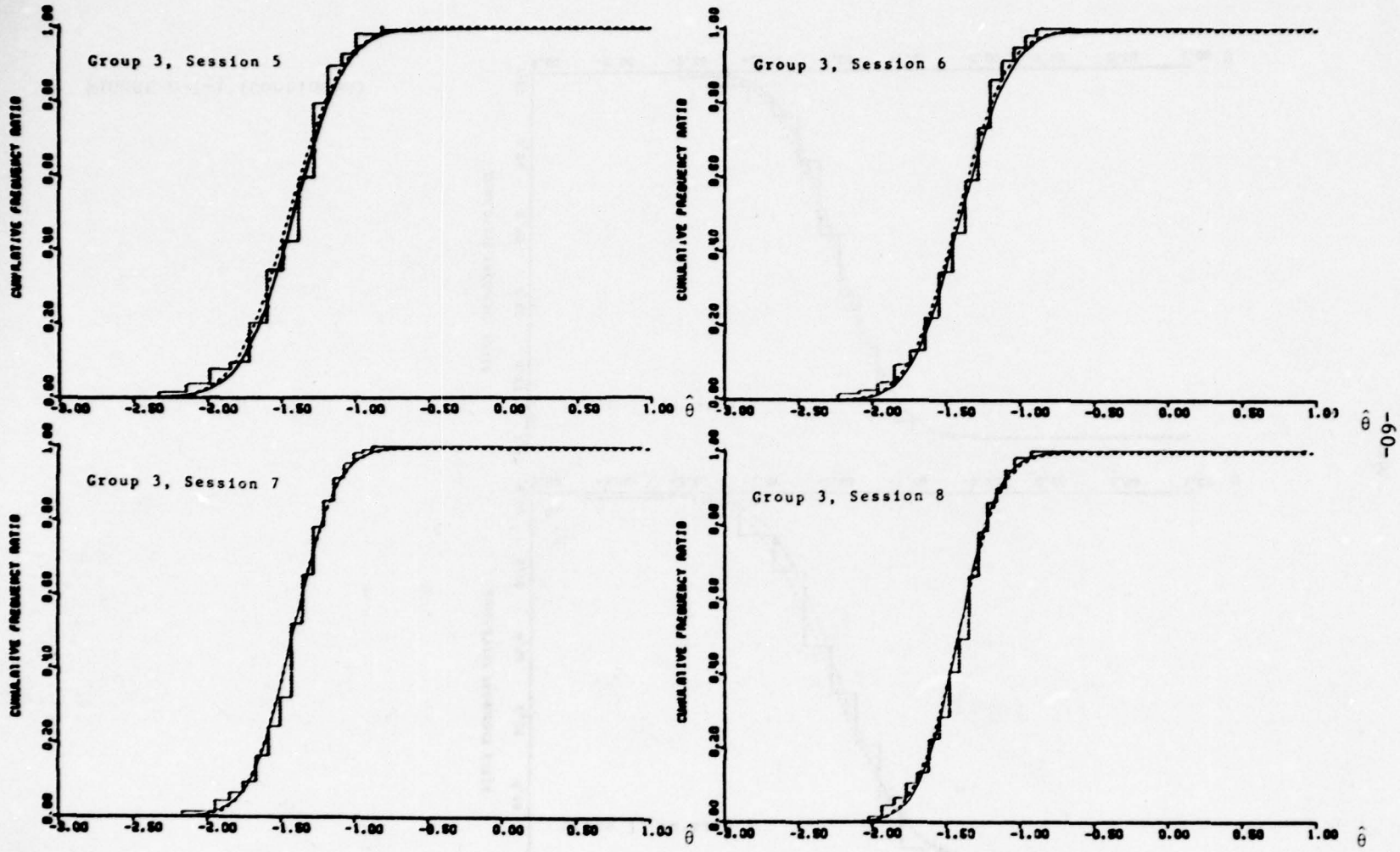


FIGURE A-1-1 (Continued)

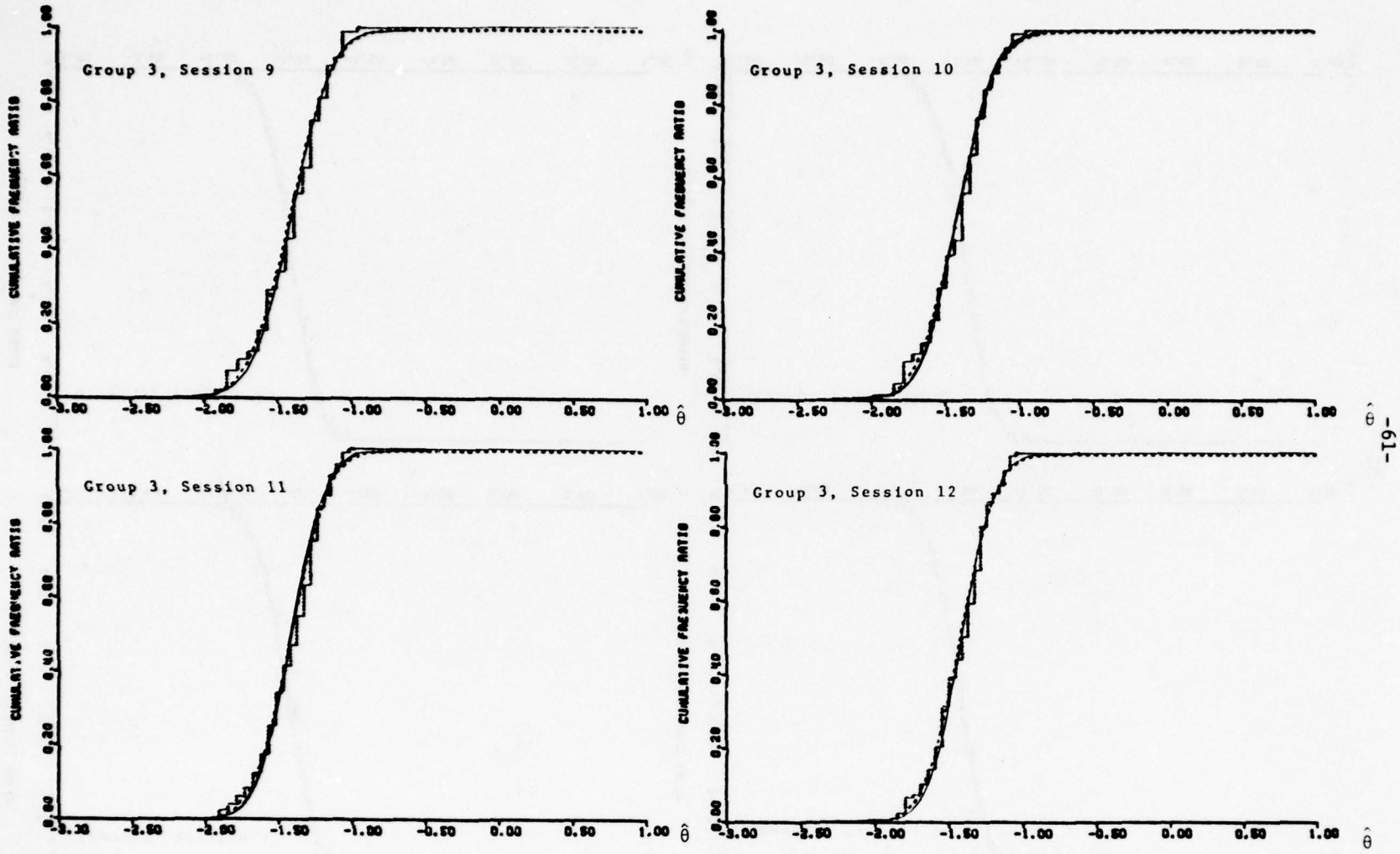


FIGURE A-1-1 (Continued)

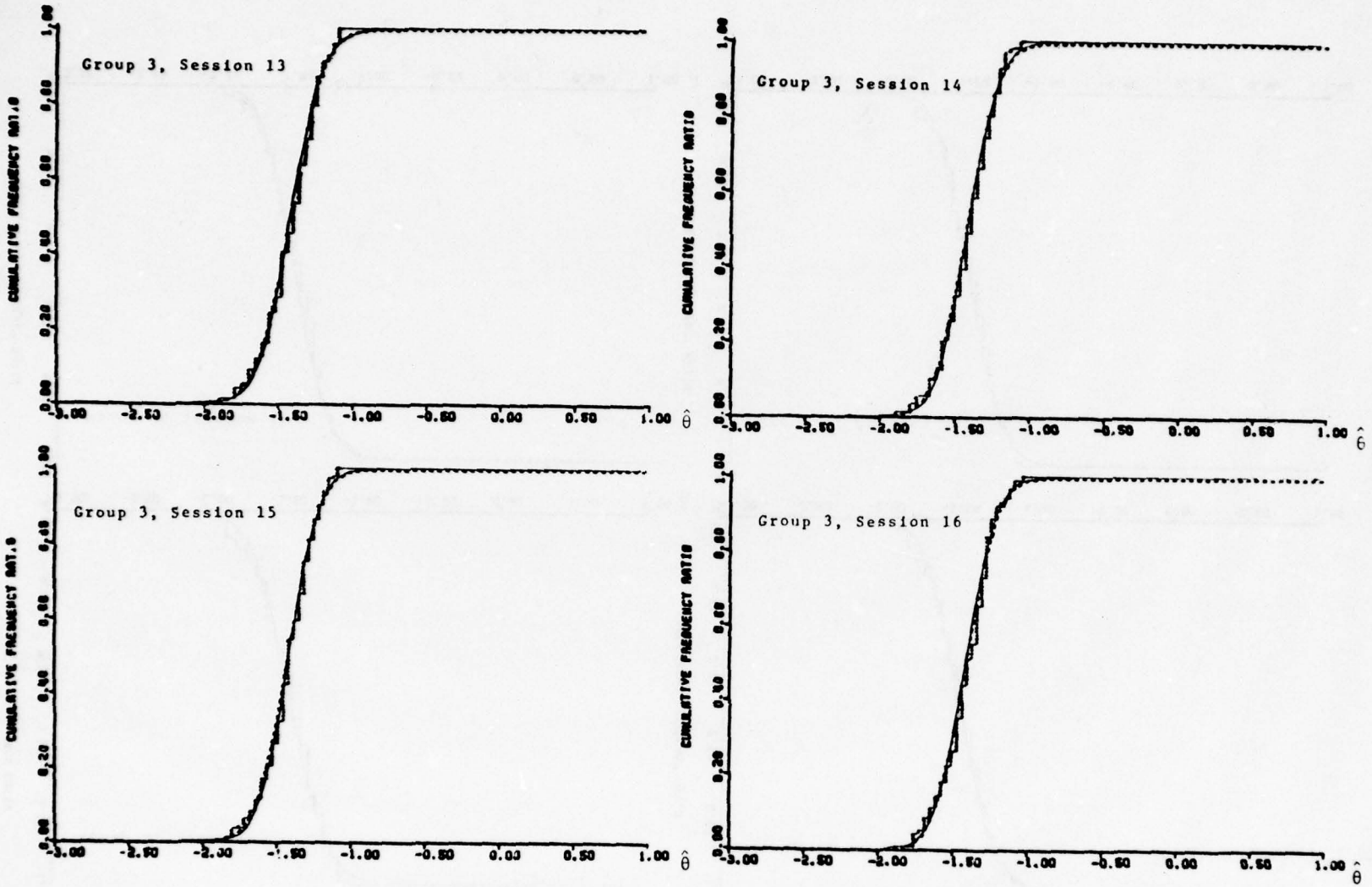


FIGURE A-1-1 (Continued)

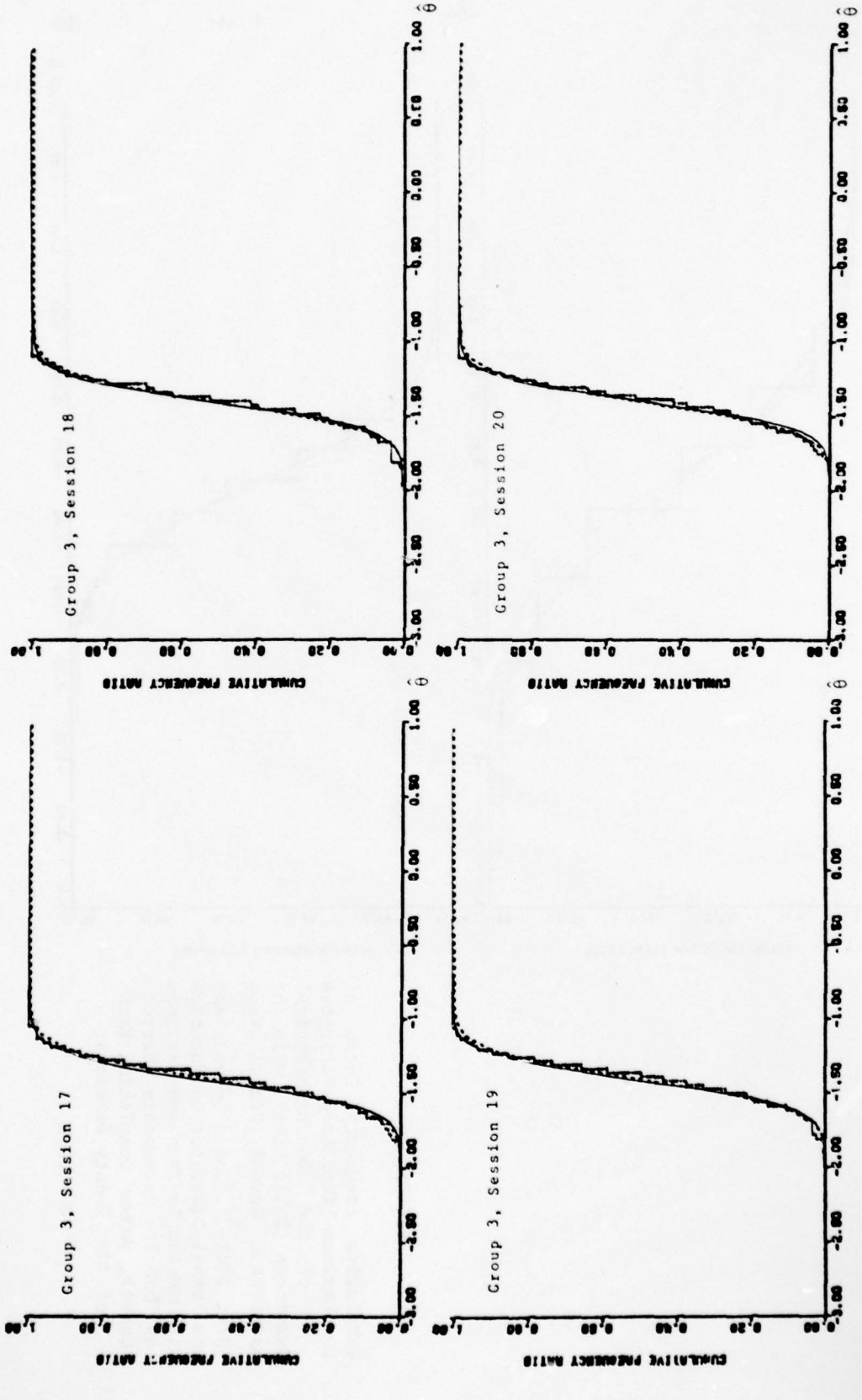


FIGURE A-1-1 (Continued)

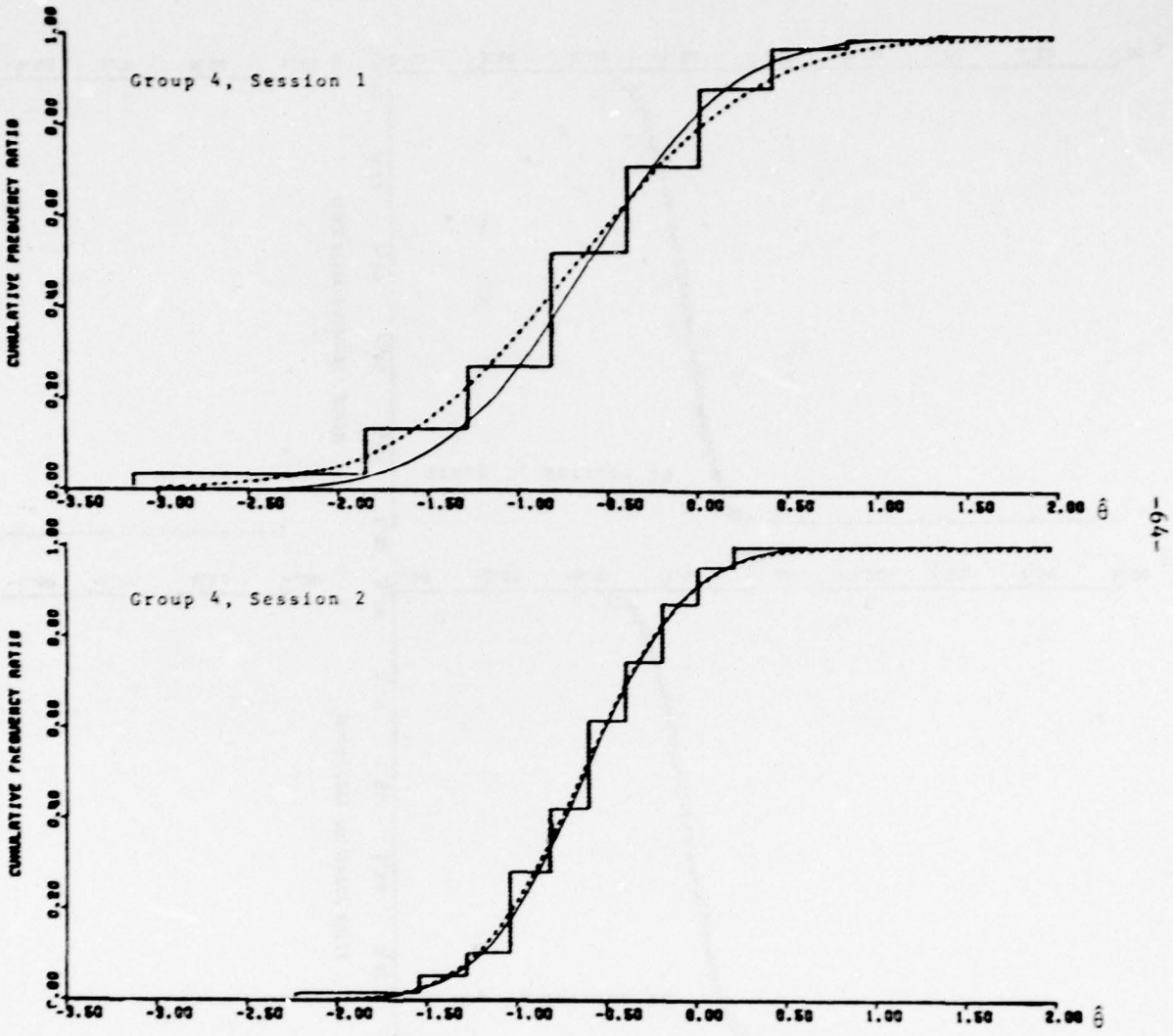


FIGURE A-1-2

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = -0.6$

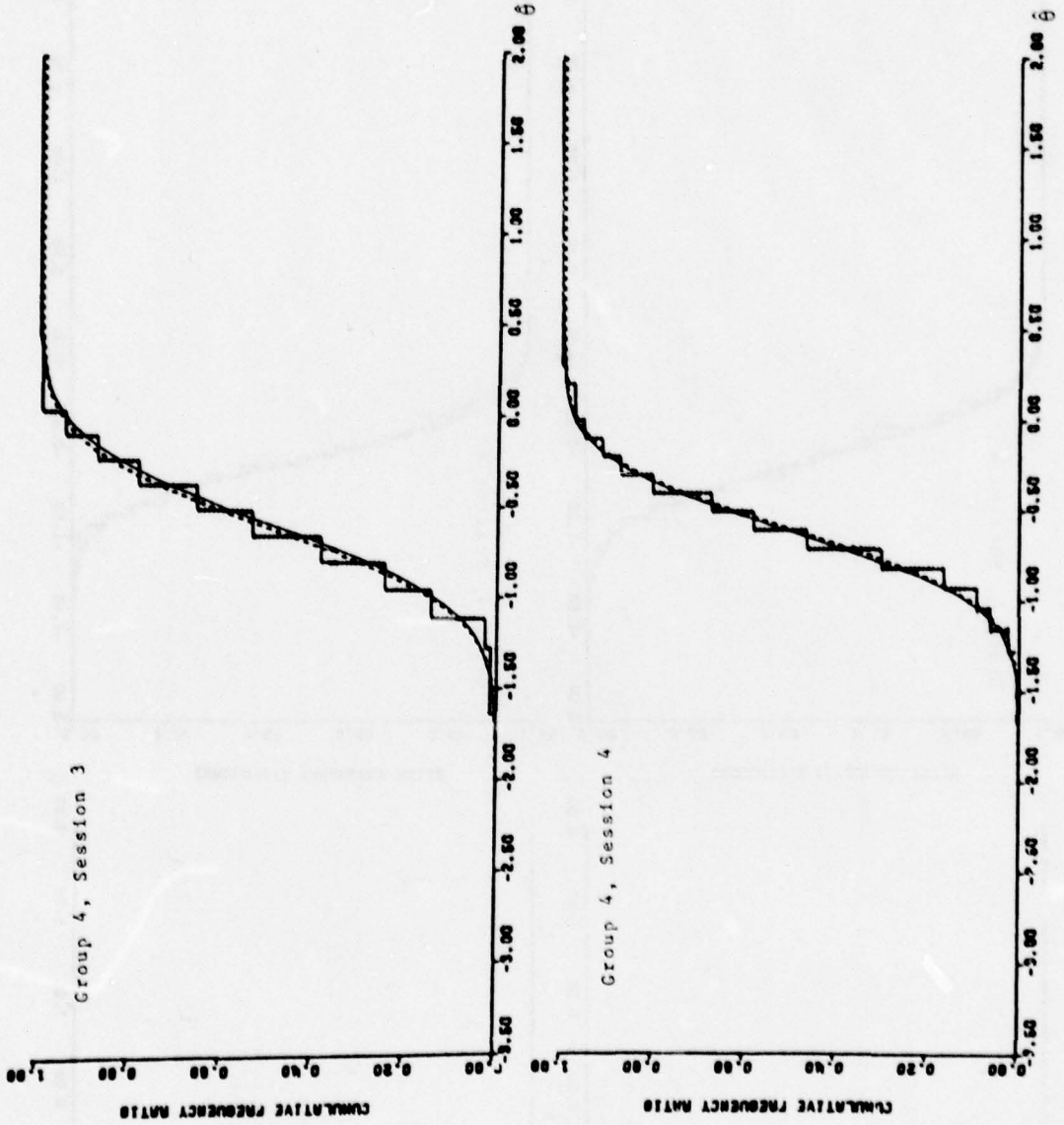


FIGURE A-1-2 (Continued)

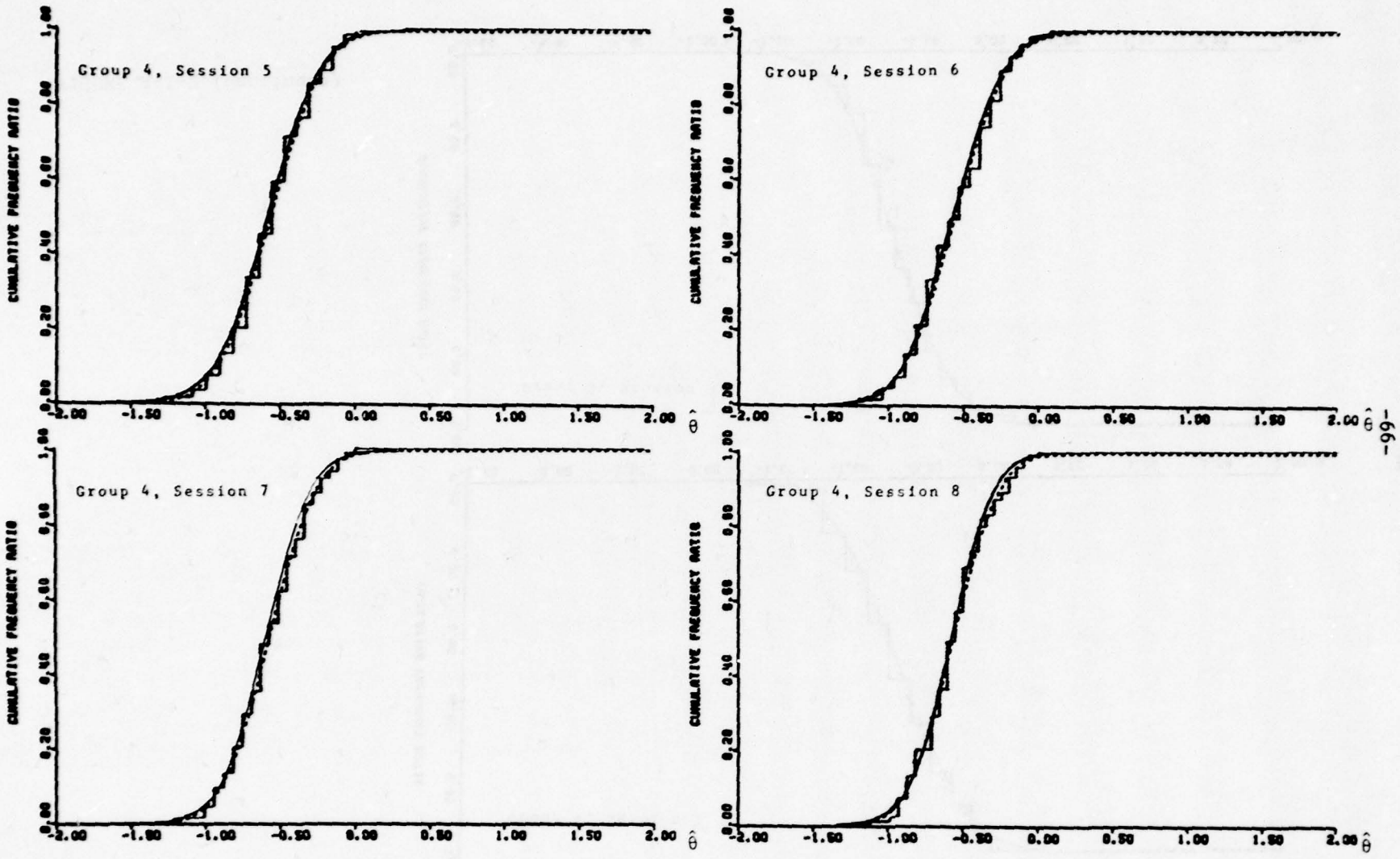


FIGURE A-1-2 (Continued)

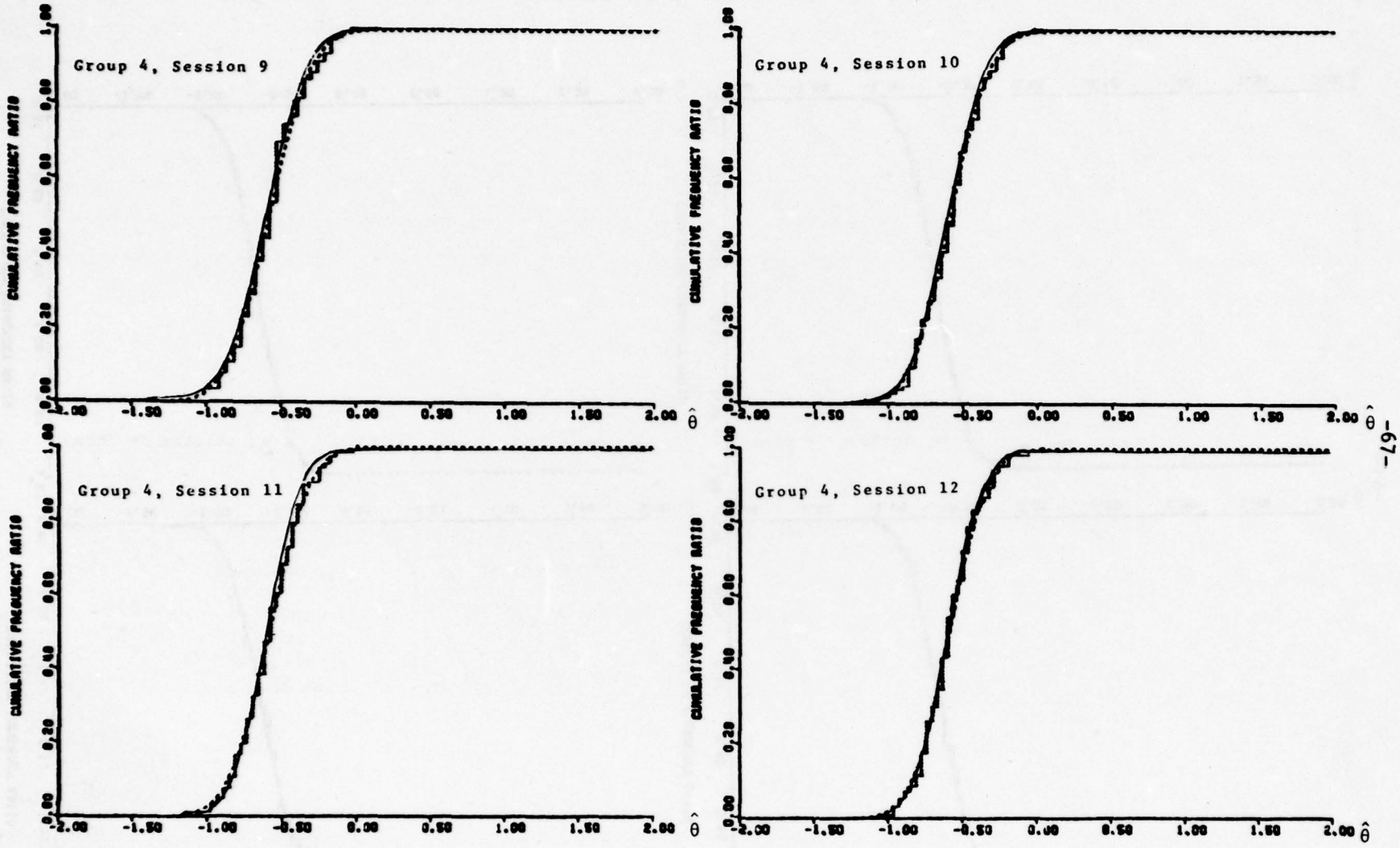


FIGURE A-1-2 (Continued)

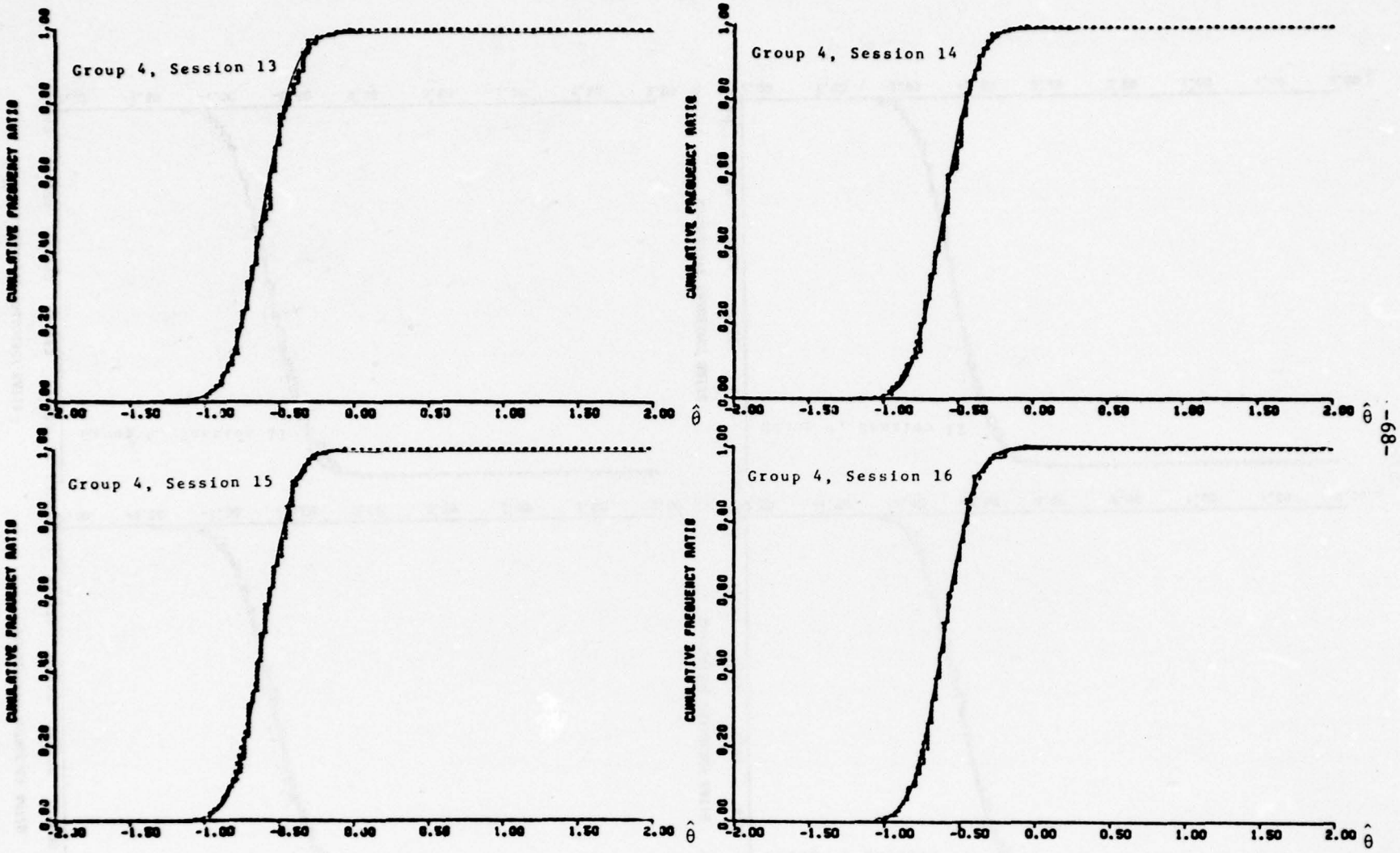


FIGURE A-1-2 (Continued)

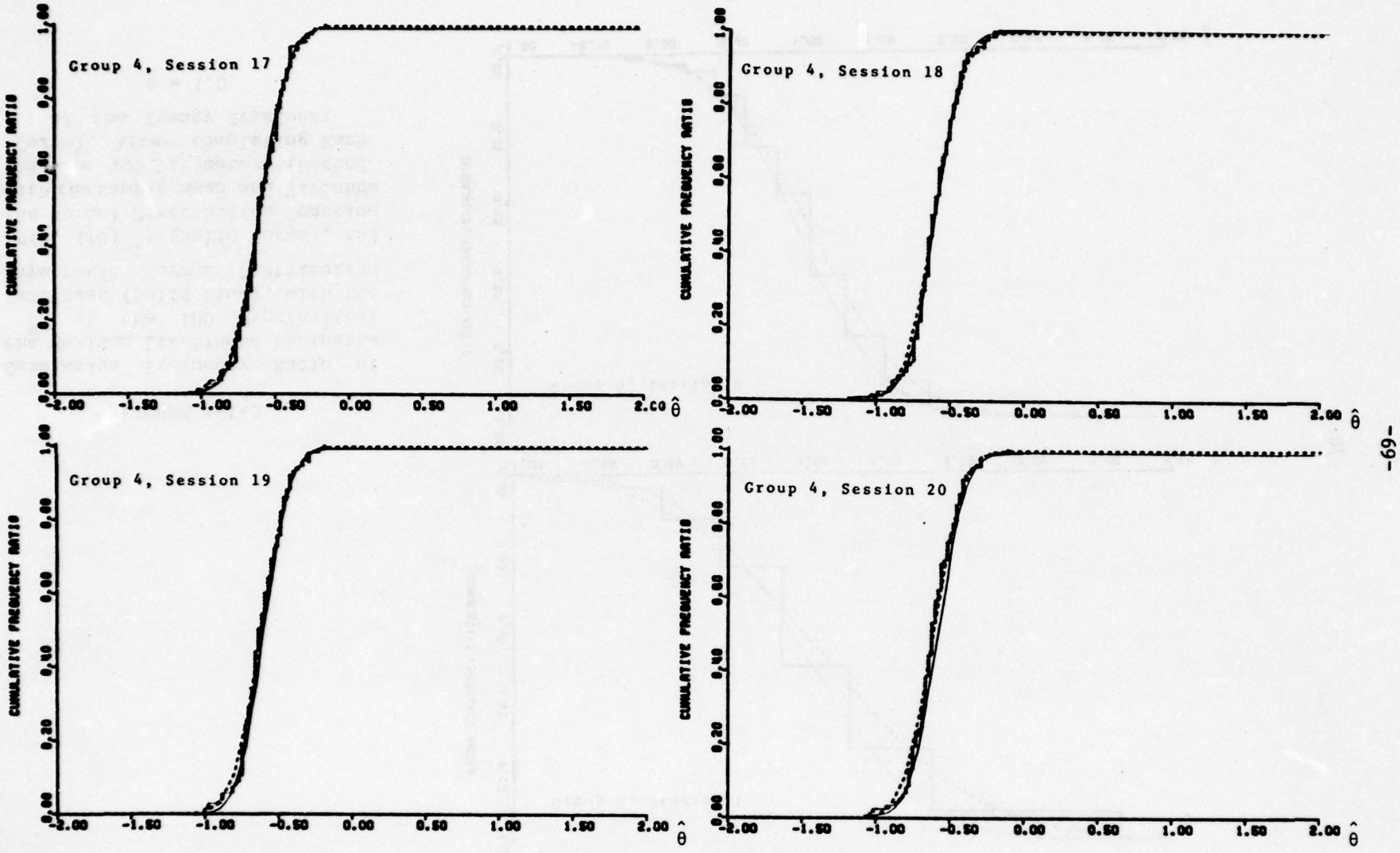
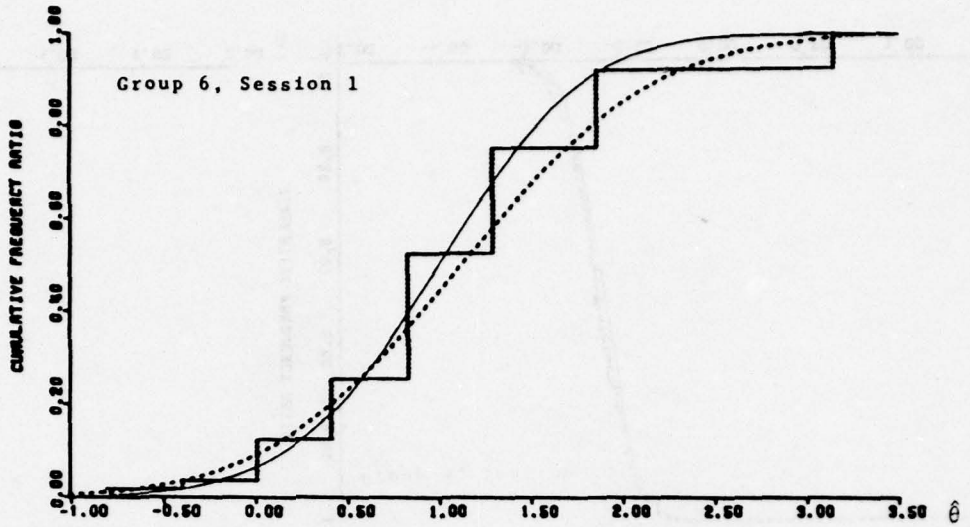


FIGURE A-1-2 (Continued)



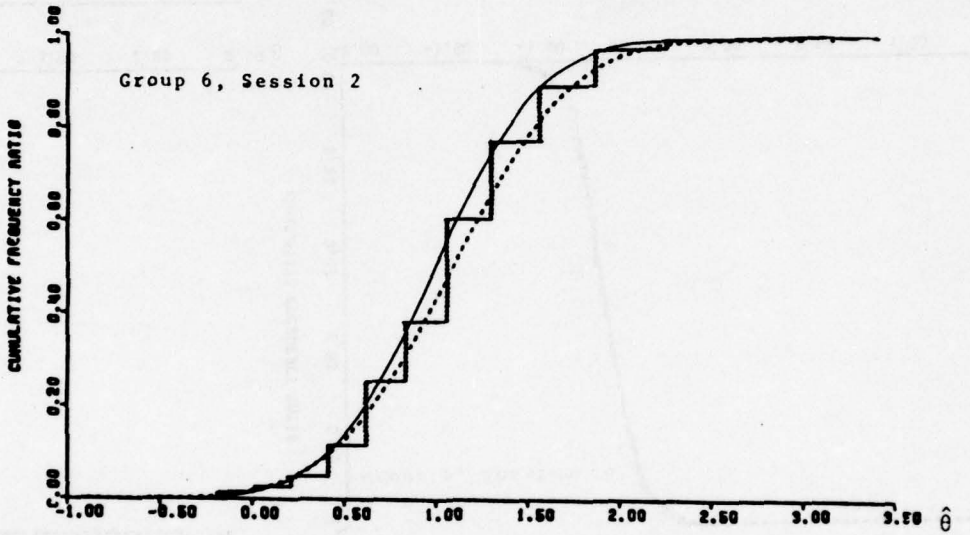


FIGURE A-1-3

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = 1.0$

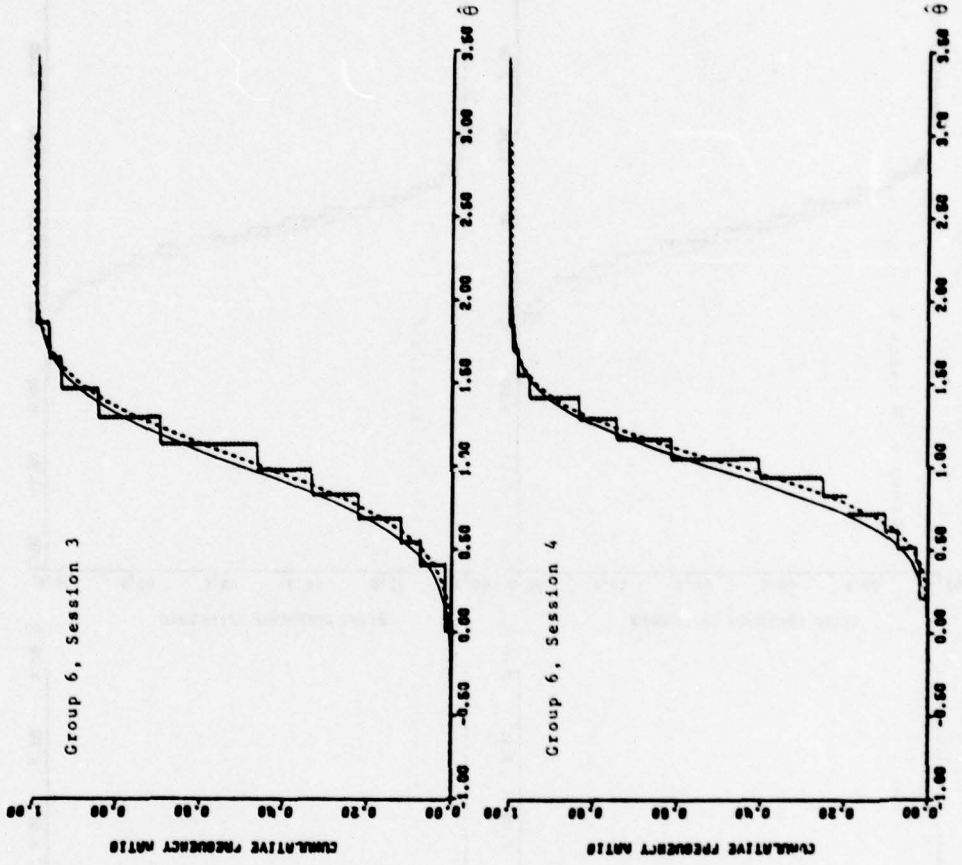


FIGURE A-1-3 (Continued)

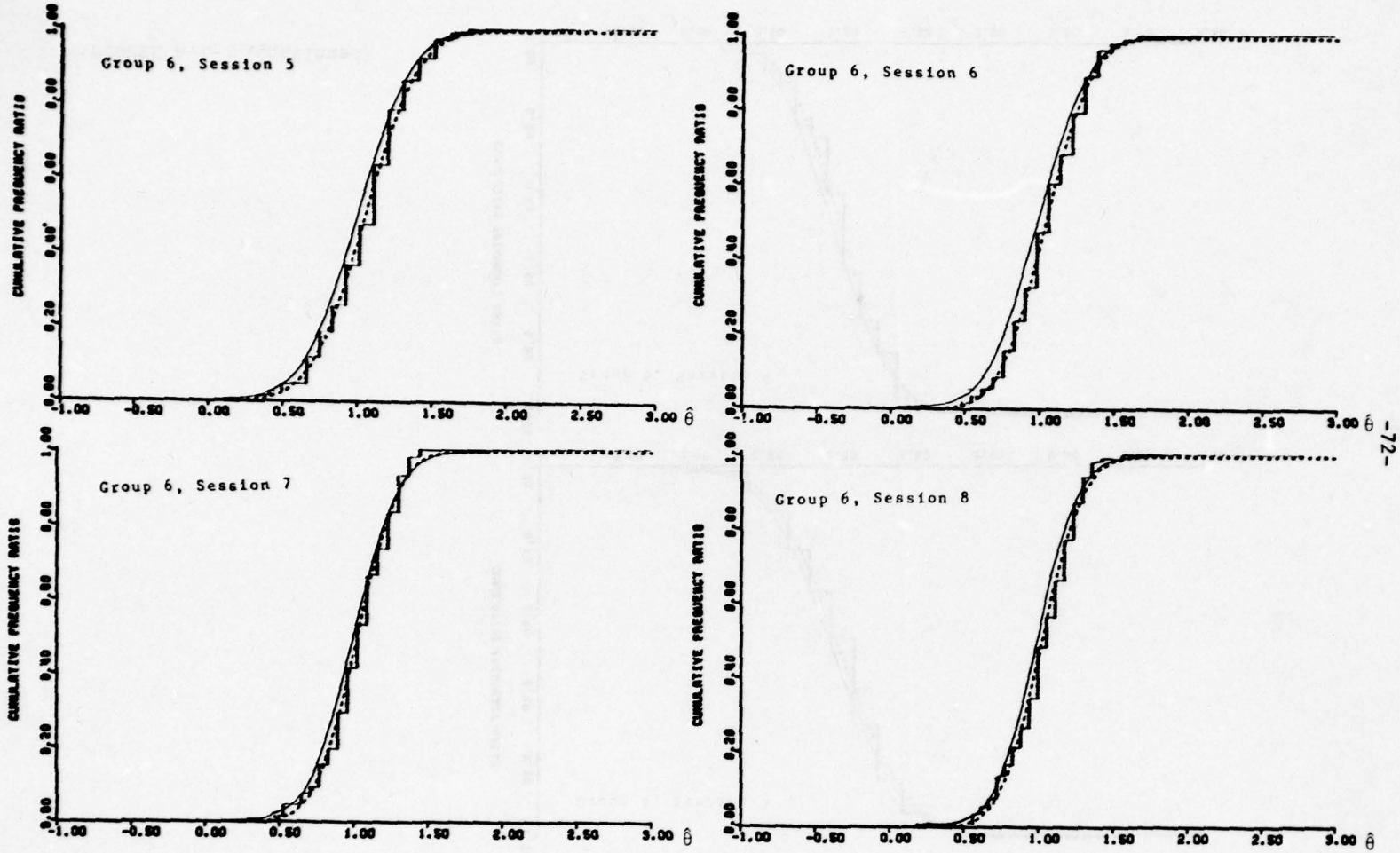


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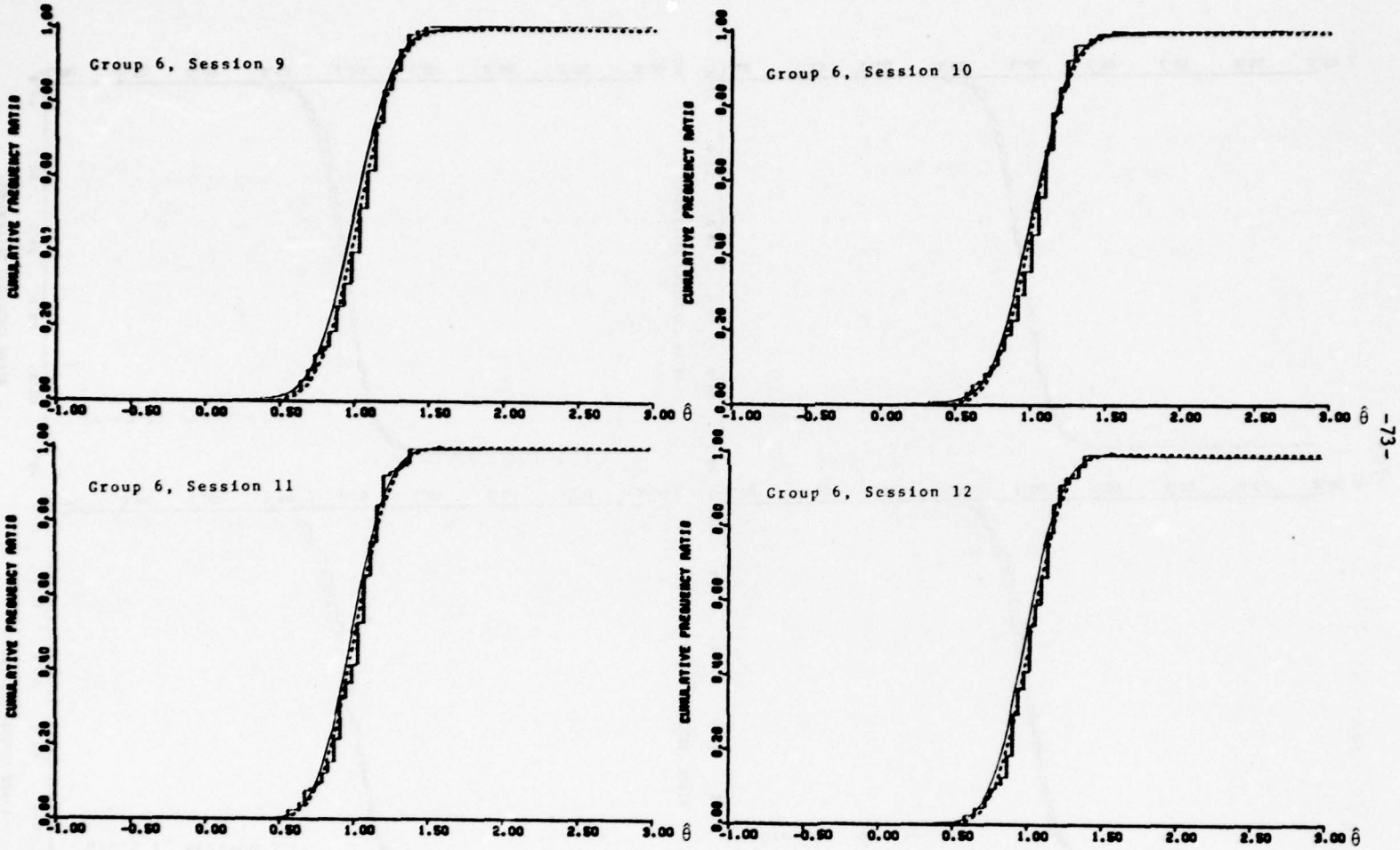


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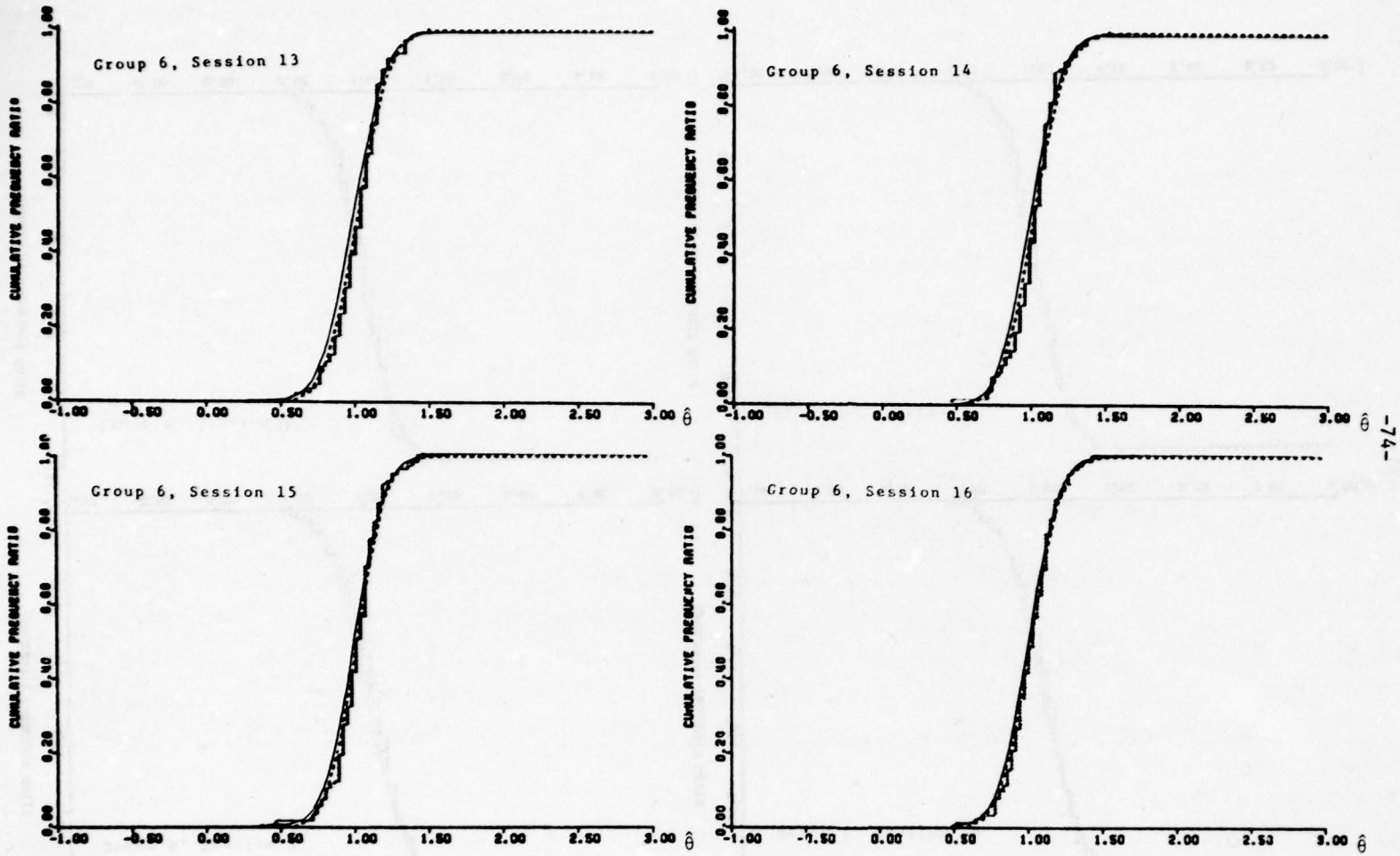


FIGURE A-1-3 (Continued)

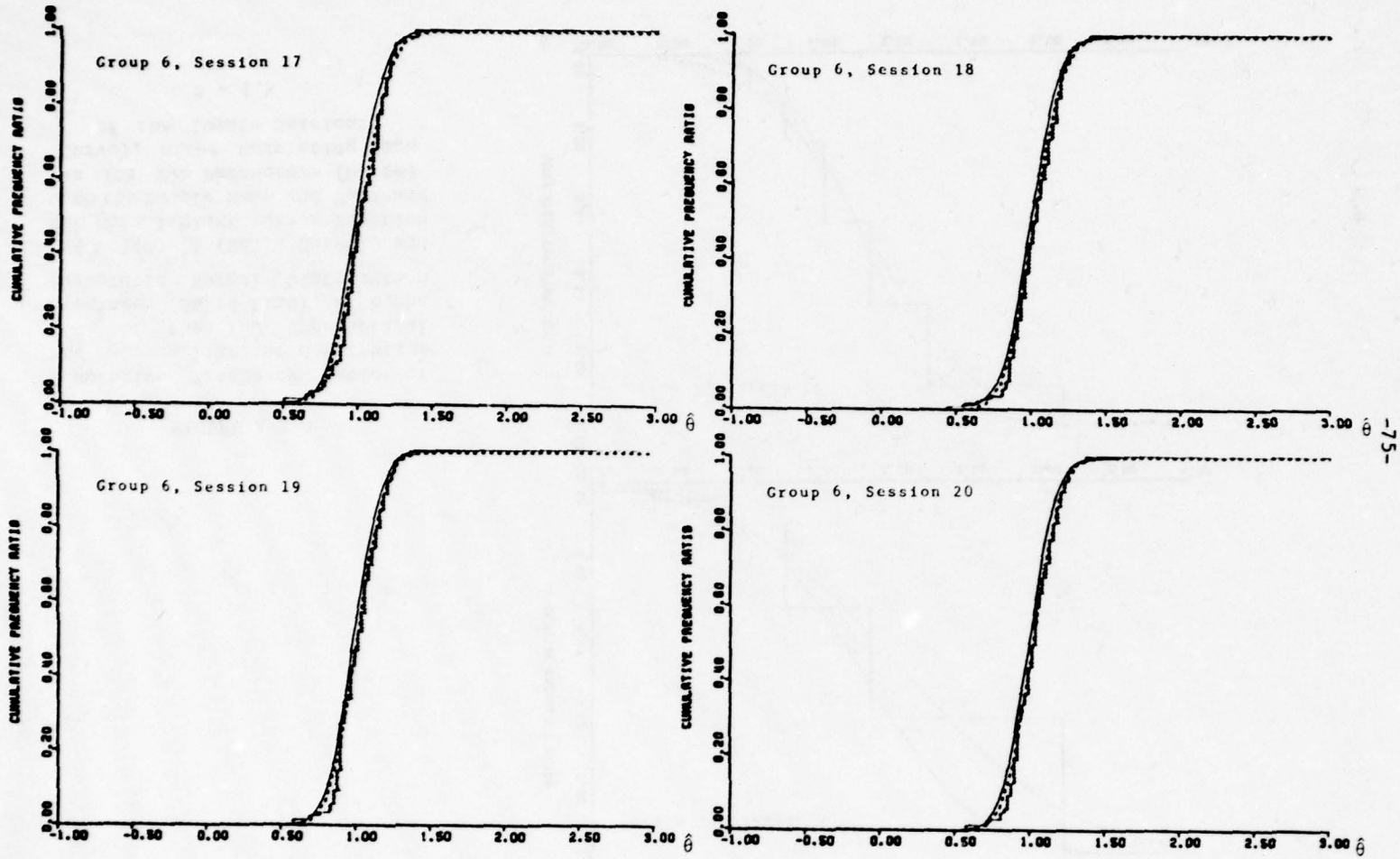


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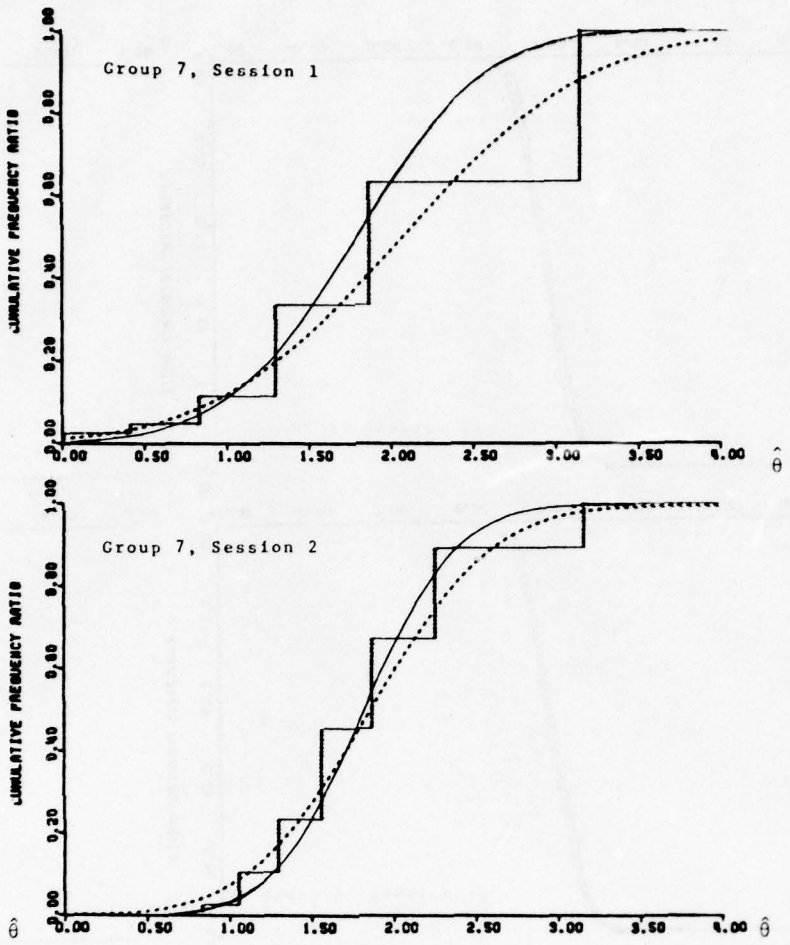


FIGURE A-1-4

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = 1.8$

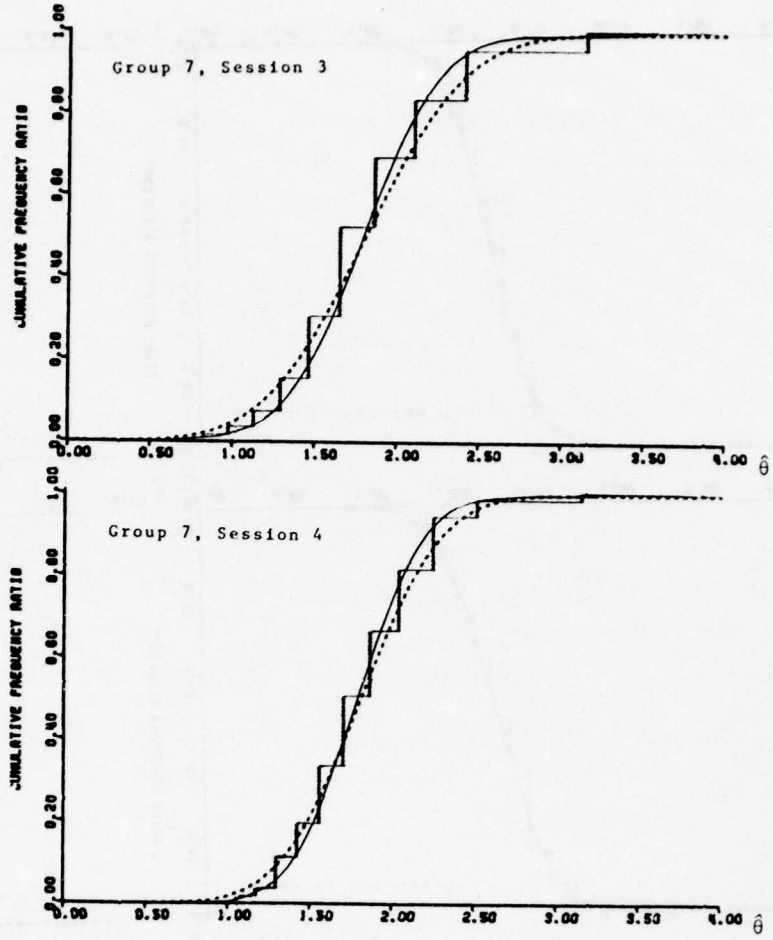


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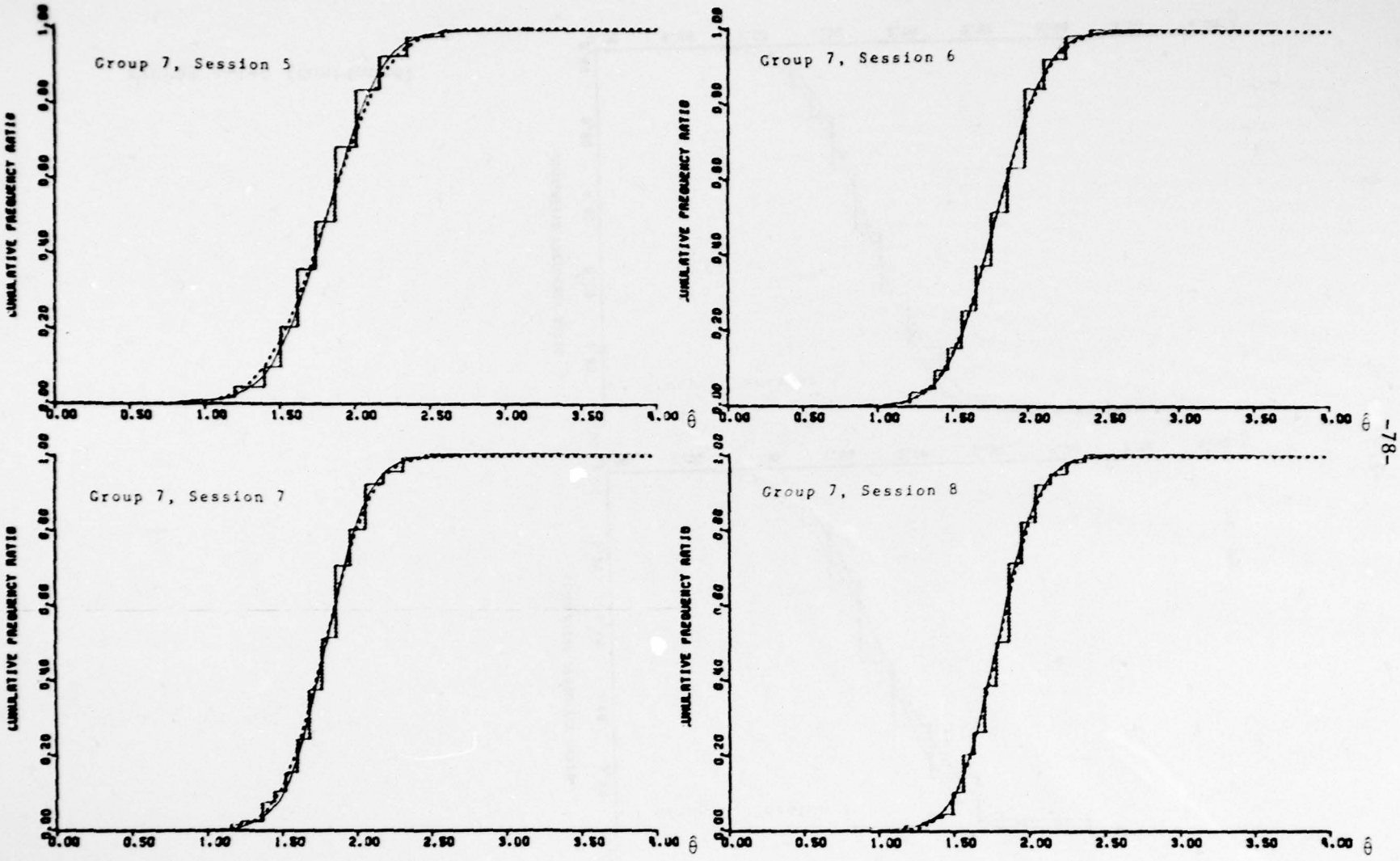


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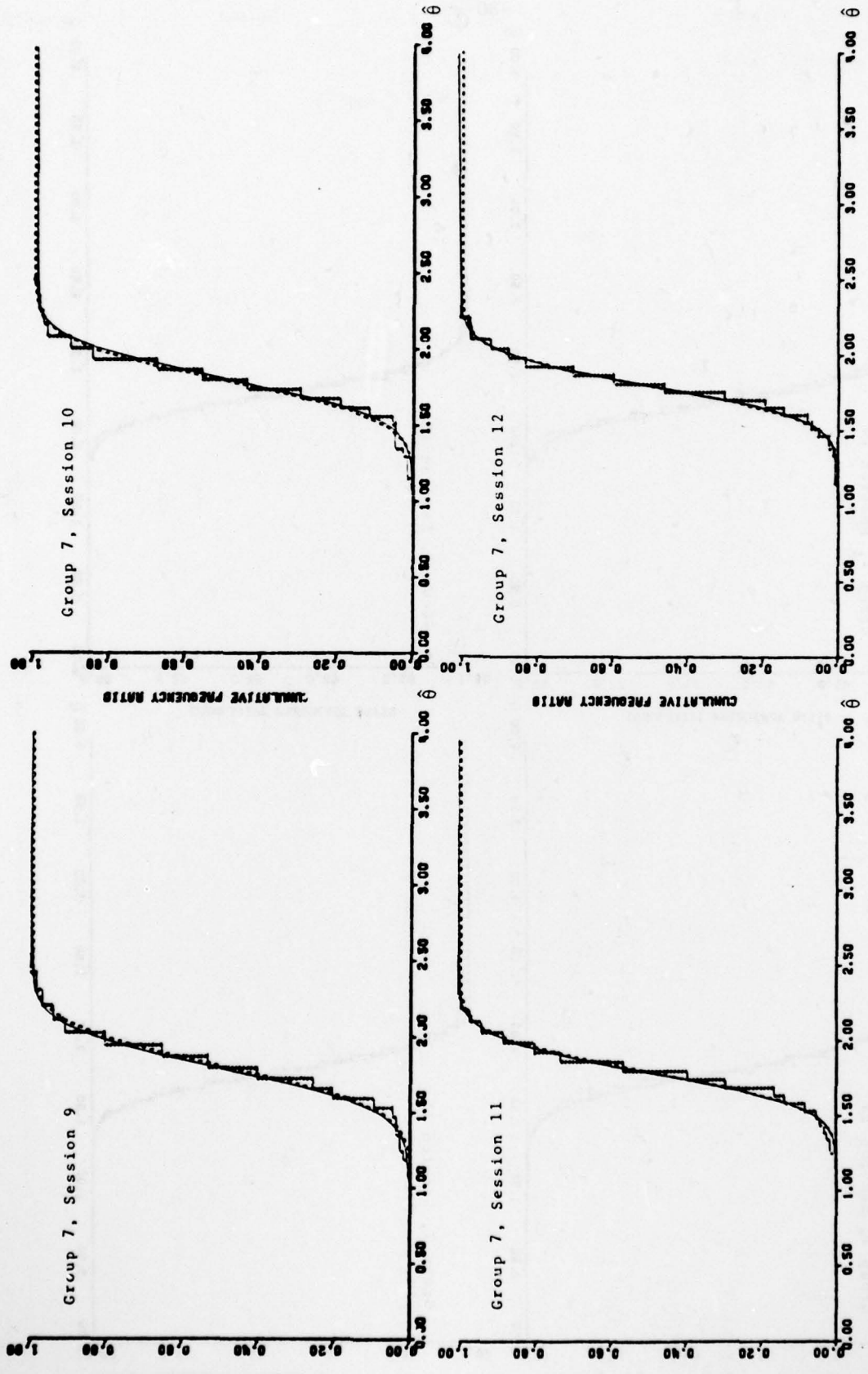


FIGURE A-1-4 (Continued)

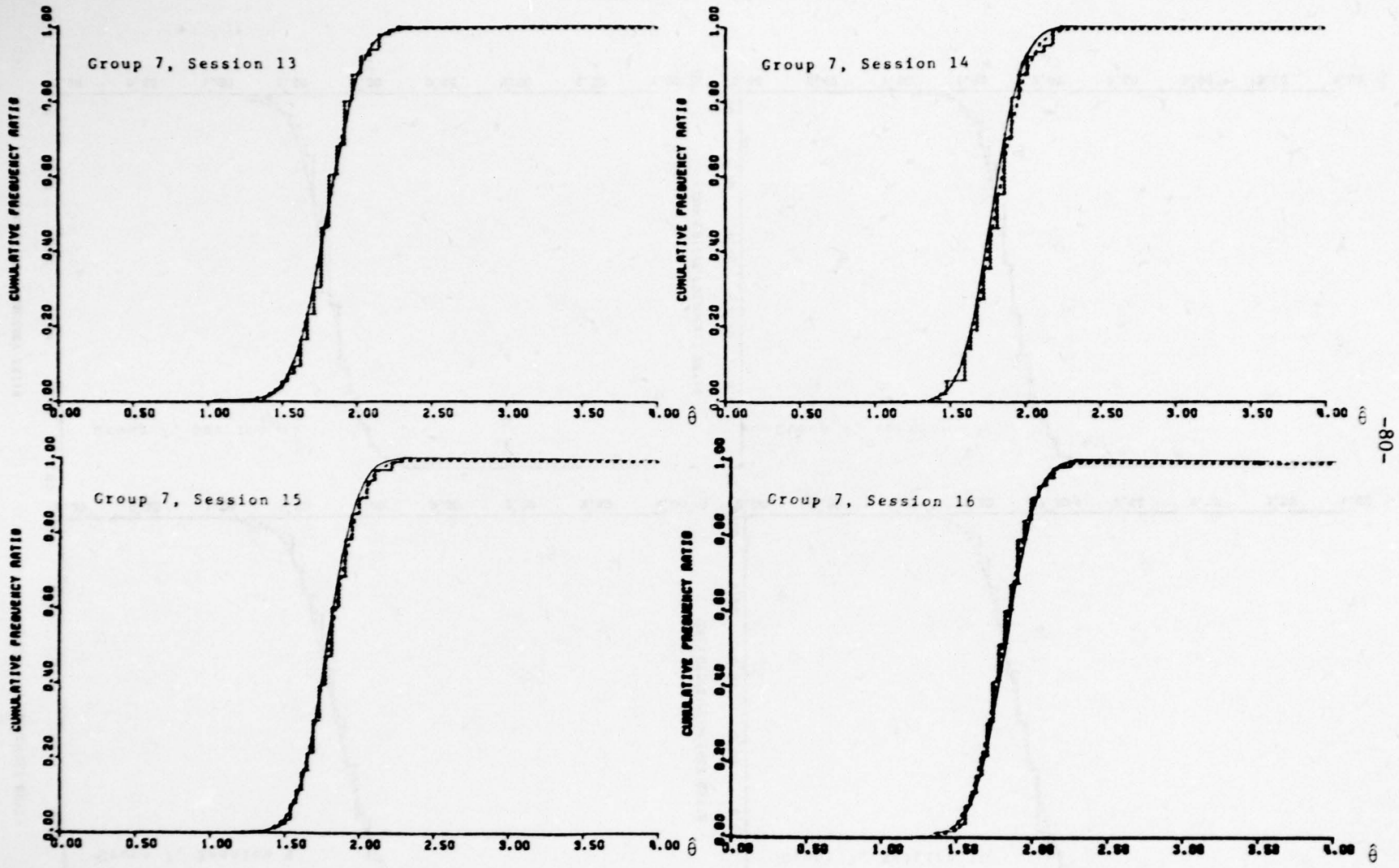


FIGURE A-1-4 (Continued)

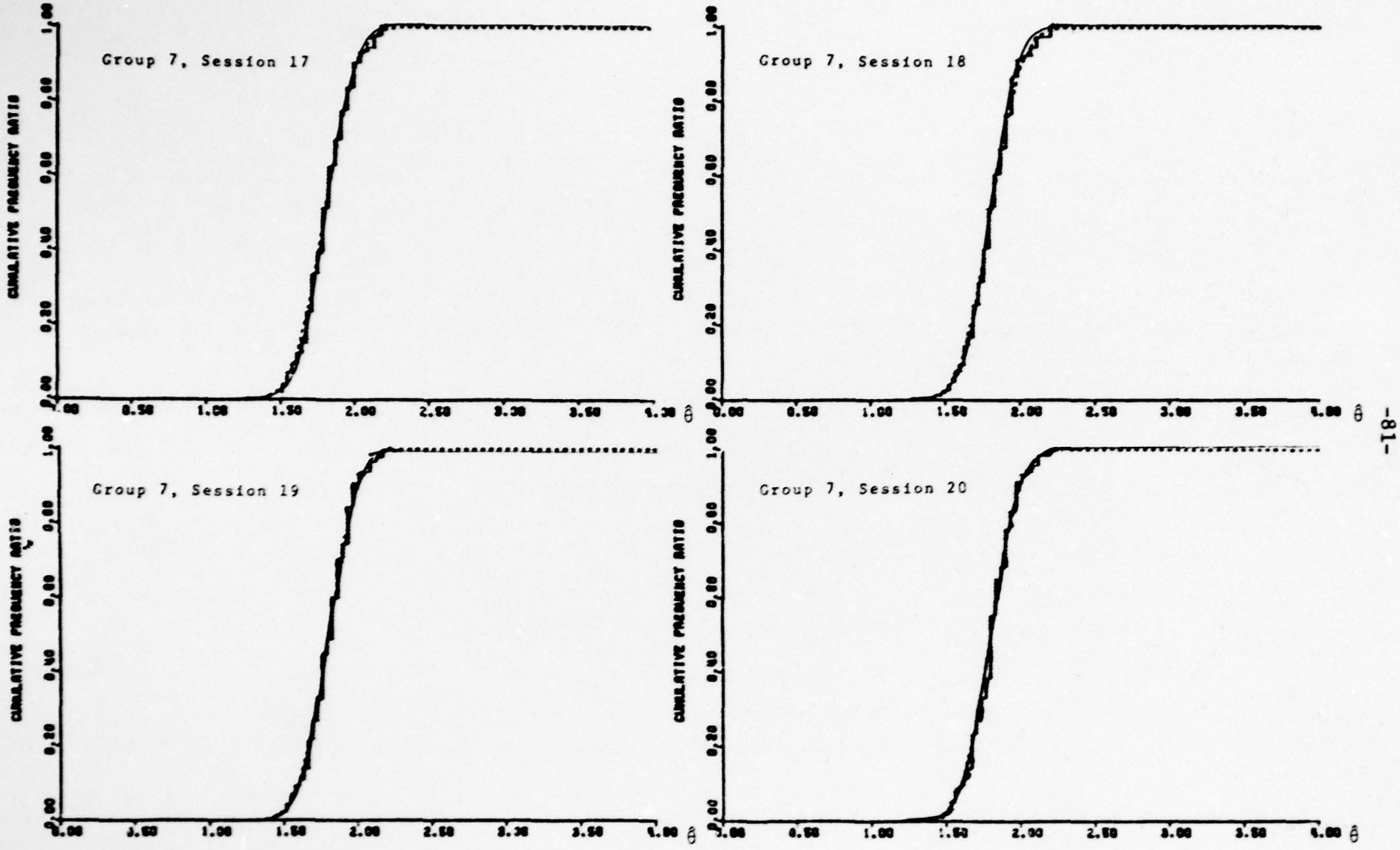


FIGURE A-1-4 (Continued)

APPENDIX II

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TABLE A-2-1

Ten Sample Moments about the Origin of the Maximum Likelihood Estimates of the 100 Hypothetical Examinees after the Completion of Each of the Twenty Sessions. Group 1, $\theta = -3.0$.

Session	Moments about Origin									
	1	2	3	4	5	6	7	8	9	10
1	-0.31420030 01	0.98721640 01	-0.31018340 02	0.97459620 02	-0.30621810 03	illegible	illegible	0.94986780 04	-0.29043900 05	0.93769540 05
2	-0.31420030 01	0.98721640 01	-0.31018340 02	0.97459620 02	-0.30621810 03	illegible	illegible	0.94986780 04	-0.29043900 05	0.93769540 05
3	-0.31420030 01	0.98721640 01	-0.31018340 02	0.97459620 02	-0.30621810 03	illegible	illegible	0.94986780 04	-0.29043900 05	0.93769540 05
4	-0.31420030 01	0.98721640 01	-0.31018340 02	0.97459620 02	-0.30621810 03	illegible	illegible	0.94986780 04	-0.29043900 05	0.93769540 05
5	-0.31363200 01	0.98396970 01	-0.30878700 02	0.96924000 02	-0.30428590 03	illegible	illegible	0.94922660 04	-0.29059300 05	0.92955520 05
6	-0.31161000 01	0.97228250 01	-0.30370780 02	0.94957060 02	-0.29712720 03	illegible	illegible	0.91358370 04	-0.28646990 05	0.89054030 05
7	-0.31132000 01	0.97056090 01	-0.30289050 02	0.94624940 02	-0.29586540 03	illegible	illegible	0.90797670 04	-0.28496010 05	0.88215460 05
8	-0.31156000 01	0.97149690 01	-0.30329060 02	0.94767750 02	-0.29634340 03	illegible	illegible	0.90544900 04	-0.28500240 05	0.88347060 05
9	-0.31166200 01	0.97234120 01	-0.30363330 02	0.94891400 02	-0.29676160 03	illegible	illegible	0.91077110 04	-0.28540610 05	0.88944840 05
10	-0.31139300 01	0.97070200 01	-0.30288590 02	0.94588700 02	-0.29561320 03	illegible	illegible	0.90565250 04	-0.28500170 05	0.88881350 05
11	-0.31076200 01	0.96692530 01	-0.30118900 02	0.93910760 02	-0.29307260 03	illegible	illegible	0.89465750 04	-0.27954370 05	0.87638600 05
12	-0.31054000 01	0.96555650 01	-0.30055740 02	0.93652170 02	-0.29208160 03	illegible	illegible	0.89016000 04	-0.27838500 05	0.87110250 05
13	-0.31018200 01	0.96345430 01	-0.29962920 02	0.93286990 02	-0.29073150 03	illegible	illegible	0.88445810 04	-0.27684550 05	0.86479720 05
14	-0.30955200 01	0.96024620 01	-0.29817310 02	0.92699550 02	-0.28850980 03	illegible	illegible	0.87460670 04	-0.27313030 05	0.85350610 05
15	-0.30883200 01	0.95530220 01	-0.29593680 02	0.91800180 02	-0.28511770 03	illegible	illegible	0.85966210 04	-0.26804060 05	0.83643630 05
16	-0.30772800 01	0.94865720 01	-0.29293570 02	0.90594820 02	-0.28057670 03	illegible	illegible	0.83970950 04	-0.26215260 05	0.81367140 05
17	-0.30749700 01	0.94726390 01	-0.29230470 02	0.90340480 02	-0.27961470 03	illegible	illegible	0.83542130 04	-0.26097450 05	0.80877650 05
18	-0.30725000 01	0.94577800 01	-0.29163350 02	0.90070730 02	-0.27859730 03	illegible	illegible	0.83092550 04	-0.25827310 05	0.80357020 05
19	-0.30676100 01	0.94284150 01	-0.29030880 02	0.89538720 02	-0.27659150 03	illegible	illegible	0.82205630 04	-0.25526040 05	0.79338560 05
20	-0.30611400 01	0.93888980 01	-0.28849940 02	0.88802570 02	-0.27378440 03	illegible	illegible	0.80931950 04	-0.25066110 05	0.77856270 05

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Table A-2-1 (Continued): Group 2, $\theta = -2.2$

Session	Moments about Origin									
	1	2	3	4	5	6	7	8	9	10
1	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 03	0.6083425D 03	-0.1895971D 04	0.5928928D 04	-0.1857691D 05	0.5827332D 05
2	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 03	0.3969359D 03	-0.1169616D 04	0.3614097D 04	-0.1108443D 05	0.3423323D 05
3	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 03	0.2863572D 03	-0.8199965D 03	0.2396965D 04	-0.7123672D 04	0.2144953D 05
4	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 03	0.2368665D 03	-0.6534148D 03	0.1846187D 04	-0.5325160D 04	0.1562882D 05
5	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1668082D 03	-0.4120416D 03	0.1034036D 04	-0.2637703D 04	0.6842305D 04
6	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1462645D 03	-0.3463558D 03	0.8266727D 03	-0.1987968D 04	0.4814916D 04
7	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1416159D 03	-0.3333883D 03	0.7915519D 03	-0.1895075D 04	0.4574065D 04
8	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1400178D 03	-0.3296536D 03	0.7833424D 03	-0.1878481D 04	0.4545074D 04
9	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1418173D 03	-0.3342734D 03	0.7949323D 03	-0.1907061D 04	0.4614679D 04
10	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1344917D 03	-0.3144394D 03	0.7382295D 03	-0.1746771D 04	0.4165166D 04
11	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1296548D 03	-0.2980533D 03	0.6925942D 03	-0.1616162D 04	0.3794660D 04
12	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1312074D 03	-0.3024945D 03	0.7017601D 03	-0.1638070D 04	0.3846817D 04
13	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1279766D 03	-0.2932600D 03	0.6760284D 03	-0.1567189D 04	0.3653638D 04
14	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1263672D 03	-0.2885268D 03	0.6622874D 03	-0.1528228D 04	0.3564700D 04
15	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1223407D 03	-0.2777705D 03	0.6339499D 03	-0.1454636D 04	0.3354680D 04
16	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1213979D 03	-0.2749866D 03	0.6260123D 03	-0.1432225D 04	0.3292922D 04
17	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1188783D 03	-0.2680551D 03	0.6073109D 03	-0.1382478D 04	0.3161980D 04
18	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1188033D 03	-0.2677784D 03	0.6064480D 03	-0.1380038D 04	0.3155546D 04
19	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02	0.1185840D 03	-0.2667139D 03	0.6024000D 03	-0.1366290D 04	0.3111827D 04
20	-0.[illegible] 01	0.[illegible] 01	-0.[illegible] 02	0.[illegible] 02	-0.[illegible] 02					

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Table A-2-1 (Continued): Group 3, $\theta = -1.4$

Session	Moments about Origin									
	1	2	3	4	5	6	7	8	9	10
1	-0.14534930 01	0.2766C330 01	-0.63434080 01	0.16483150 02	-0.46344390 02	0.13656550 03	-0.41559080 03	0.12716220 04	-0.39473850 04	0.12314950 05
2	-0.14279300 01	0.22795330 01	-0.39741130 01	0.74990800 01	-0.15246530 02	0.35473620 02	-0.77592760 02	0.19218250 03	-0.50178110 03	0.13694730 04
3	-0.14508700 01	0.22772830 01	-0.38553420 01	0.70367870 01	-0.13868910 02	0.29569790 02	-0.68152080 02	0.16884980 03	-0.44564110 03	0.12363600 04
4	-0.14447500 01	0.21960960 01	-0.35026360 01	0.58553650 01	-0.10249990 02	0.18079280 02	-0.35603820 02	0.71001880 02	-0.19567840 03	0.53079600 03
5	-0.14398400 01	0.21545270 01	-0.33492060 01	0.54060970 01	-0.90540840 01	0.15715750 02	-0.28020950 02	0.52263170 02	-0.13664870 03	0.37499570 03
6	-0.14142400 01	0.20682250 01	-0.31270900 01	0.48864670 01	-0.78867920 01	0.13133920 02	-0.22649300 02	0.39026210 02	-0.97229510 02	0.17493260 03
7	-0.14124300 01	0.20489320 01	-0.30524200 01	0.46707450 01	-0.73418840 01	0.12052170 02	-0.20799360 02	0.33486530 02	-0.84607220 02	0.15432970 03
8	-0.14155300 01	0.20564240 01	-0.30555860 01	0.46590740 01	-0.72760910 01	0.11851130 02	-0.20411080 02	0.33172540 02	-0.84017260 02	0.15439780 03
9	-0.14158800 01	0.20539540 01	-0.30517600 01	0.46409160 01	-0.72161260 01	0.11457400 02	-0.19746010 02	0.30565640 02	-0.77011660 02	0.14359620 03
10	-0.14152400 01	0.20493550 01	-0.30352610 01	0.45951810 01	-0.71052410 01	0.11260380 02	-0.19382850 02	0.29985840 02	-0.75904210 02	0.14198970 03
11	-0.14105500 01	0.20302730 01	-0.29815250 01	0.44655770 01	-0.68173140 01	0.10690020 02	-0.18773850 02	0.28971750 02	-0.73644080 02	0.13890610 03
12	-0.14186800 01	0.20489670 01	-0.30115880 01	0.45023670 01	-0.68920460 01	0.10560820 02	-0.18594780 02	0.28271550 02	-0.71922490 02	0.13588210 03
13	-0.14187600 01	0.20446040 01	-0.29928930 01	0.44492820 01	-0.67156500 01	0.10267710 02	-0.18081770 02	0.25168820 02	-0.63804360 02	0.11945220 03
14	-0.14218800 01	0.20496460 01	-0.29955950 01	0.44389360 01	-0.66686290 01	0.10155260 02	-0.17876810 02	0.24505920 02	-0.62050130 02	0.11645050 03
15	-0.14194800 01	0.20424200 01	-0.29788540 01	0.44036500 01	-0.65974190 01	0.10014710 02	-0.17633480 02	0.23973240 02	-0.60773530 02	0.11422660 03
16	-0.14135000 01	0.20244890 01	-0.29378160 01	0.43187400 01	-0.64300180 01	0.96926010 01	-0.17077730 02	0.22621860 02	-0.57475330 02	0.10821360 03
17	-0.14073400 01	0.20060830 01	-0.28966030 01	0.42367570 01	-0.62771890 01	0.94178420 01	-0.16615100 02	0.22016260 02	-0.56026070 02	0.10543460 03
18	-0.14040600 01	0.19955820 01	-0.28734410 01	0.41898360 01	-0.61886390 01	0.92603350 01	-0.16357000 02	0.21656600 02	-0.55064160 02	0.10373610 03
19	-0.14001800 01	0.19850890 01	-0.28500430 01	0.41441650 01	-0.61030340 01	0.91063550 01	-0.16096090 02	0.21016140 02	-0.53523740 02	0.10071670 03
20	-0.14012900 01	0.19870880 01	-0.28516700 01	0.41427650 01	-0.60909020 01	0.90863590 01	-0.16041730 02	0.20766010 02	-0.51966740 02	0.09771660 02

Table A-2-1 (Continued): Group 4, $\theta = -0.6$

Session	Moments about Origin									
	1	2	3	4	5	6	7	8	9	10
1	-0.67666000 00	0.11176760 01	-0.19807440 01	0.46506420 01	-0.11929910 02	0.30705270 02	-0.79053530 02	0.20615750 03	-0.54262360 03	0.14052290 04
2	-0.63657000 00	0.62014270 00	-0.70492170 00	0.93079940 00	-0.13961690 01	0.23591010 01	-0.42739960 01	0.88474550 01	-0.17058770 02	0.35955900 02
3	-0.62515000 00	0.51938550 00	-0.48215620 00	0.49262740 00	-0.54027290 00	0.63334810 00	-0.78001060 00	0.10382930 01	-0.14362490 01	0.20720760 01
4	-0.59573000 00	0.45660880 00	-0.38291390 00	0.35046410 00	-0.34126210 00	0.34995570 00	-0.37430350 00	0.41327150 00	-0.46670790 00	0.54291860 00
5	-0.56618000 00	0.39512700 00	-0.30324190 00	0.25335940 00	-0.22556760 00	0.18290360 00	-0.14100410 00	0.21674340 00	-0.13241870 00	0.23616400 00
6	-0.55942000 00	0.38437500 00	-0.29322650 00	0.24059610 00	-0.20839520 00	0.16889900 00	-0.13770440 00	0.17168470 00	-0.17149760 00	0.17527300 00
7	-0.57095000 00	0.38890380 00	-0.29266690 00	0.23656660 00	-0.20224490 00	0.16112030 00	-0.13060120 00	0.16298240 00	-0.16226340 00	0.16642550 00
8	-0.56255000 00	0.37165630 00	-0.28921480 00	0.22869440 00	-0.17089460 00	0.14650380 00	-0.13060770 00	0.12060670 00	-0.11478790 00	0.11224350 00
9	-0.57704000 00	0.37998370 00	-0.27129580 00	0.20579520 00	-0.16402040 00	0.13626830 00	-0.11722670 00	0.10405230 00	-0.94736300 01	0.88108020 01
10	-0.57993000 00	0.37835600 00	-0.26697470 00	0.19995570 00	-0.15714820 00	0.12899220 00	-0.10884550 00	0.95151210 01	-0.85383490 01	0.76503430 01
11	-0.58333000 00	0.38553290 00	-0.27555970 00	0.20958780 00	-0.16801440 00	0.14103220 00	-0.12335230 00	0.11196530 00	-0.10503170 00	0.10163780 00
12	-0.58671000 00	0.38353950 00	-0.26778350 00	0.19678410 00	-0.15074710 00	0.12655440 00	-0.10730610-01	0.81726960-01	-0.69665070-01	0.60795370-01
13	-0.59812000 00	0.39303940 00	-0.27567100 00	0.20350560 00	-0.15658170 00	0.13246010 00	-0.11212400 00	0.85715500-01	-0.73453270-01	0.64062940-01
14	-0.59408000 00	0.38298450 00	-0.26215770 00	0.18848040 00	-0.14107890 00	0.11952940 00	-0.10117470-01	0.77062340-01	-0.65136520-01	0.56119050-01
15	-0.59590000 00	0.38462120 00	-0.26316330 00	0.18872300 00	-0.14090840 00	0.11866990 00	-0.10077630-01	0.76675070-01	-0.64259570-01	0.55527060-01
16	-0.59774000 00	0.38427140 00	-0.26076980 00	0.18510870 00	-0.13661270 00	0.11493170 00	-0.09770900-01	0.74320400-01	-0.62481330-01	0.54012360-01
17	-0.59896000 00	0.38337870 00	-0.25912890 00	0.18370970 00	-0.13603830 00	0.11488360 00	-0.09741500-01	0.74119600-01	-0.62378060-01	0.53911920-01
18	-0.60791000 00	0.39285520 00	-0.26705310 00	0.18983700 00	-0.14071260 00	0.11885410 00	-0.10054110 00	0.76414960-01	-0.64259860-01	0.55119260-01
19	-0.61208000 00	0.39805490 00	-0.27161210 00	0.19310680 00	-0.14246120 00	0.12075690 00	-0.10231990-01	0.77731990-01	-0.65416960-01	0.56169650-01
20	-0.61146000 00	0.39795350 00	-0.27214360 00	0.19437180 00	-0.14459300 00	0.12284870 00	-0.10454390-01	0.79420950-01	-0.67240460-01	0.57240240-01

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Table A-2-1 (Continued): Group 5, $\theta = 0.2$

Session	Moments about Origin									
	1	2	3	4	5	6	7	8	9	10
1	0.21447000 00	0.31538430 00	0.26190960 00	0.65078100 00	0.51243870 00	0.11714690 01	0.11953420 01	0.25860380 01	0.52956420 01	0.67316120 01
2	0.21377000 00	0.45737240 00	0.14043400 00	0.16666650 00	0.13039820 00	0.15760760 00	0.15011370 00	0.16061820 00	0.19697020 00	0.23106490 00
3	0.19505000 00	0.40019420 00	0.10686610 00	0.10252610 00	0.82814010-01	0.80197830-01	0.76052590-01	0.77497480-01	0.79396990-01	0.83753610-01
4	0.20317000 00	0.41472350 00	0.77491640-01	0.62703710-01	0.43281410-01	0.33864210-01	0.33833170-01	0.31037290-01	0.28465400-01	0.27167110-01
5	0.20338000 00	0.42005080 00	0.61373260-01	0.41926960-01	0.29051360-01	0.22161590-01	0.21744690-01	0.14284830-01	0.11944400-01	0.10194910-01
6	0.20160000 00	0.41197000 00	0.55736080-01	0.31929990-01	0.19499990-01	0.12834740-01	0.86099700-02	0.69852880-02	0.49570820-02	0.32018650-02
7	0.20482000 00	0.42724750-01	0.41657400-01	0.21660810-01	0.11641490-01	0.67011680-02	0.48103770-02	0.29144740-02	0.16289110-02	0.10864170-02
8	0.20161000 00	0.40844010-01	0.38566100-01	0.19755390-01	0.10846090-01	0.65555280-02	0.46007690-02	0.27960880-02	0.21865630-02	0.19669710-02
9	0.20015000 00	0.40197630-01	0.36127820-01	0.18903020-01	0.10928250-01	0.69043460-02	0.49339610-02	0.33113600-02	0.44937750-02	0.16548030-02
10	0.19747000 00	0.39038070-01	0.35436830-01	0.19135420-01	0.12047460-01	0.81693650-02	0.61934740-02	0.45406190-02	0.35964220-02	0.29230870-02
11	0.19593000 00	0.38527880-01	0.31022680-01	0.16231600-01	0.82553170-02	0.54962060-02	0.39507840-02	0.18952150-02	0.12363270-02	0.85314960-03
12	0.18653000 00	0.36534030-01	0.29635710-01	0.11471060-01	0.54962060-02	0.44037020-02	0.14009550-02	0.79260600-03	0.44175740-03	0.45156830-03
13	0.18771000 00	0.36133030-01	0.25935780-01	0.96853660-02	0.44037020-02	0.42063590-02	0.10601710-02	0.55625520-03	0.30083600-03	0.16035470-03
14	0.19016000 00	0.36870060-01	0.23045450-01	0.79259260-02	0.37101040-02	0.19249010-02	0.59912520-03	0.40379660-03	0.23579690-03	0.11961790-03
15	0.19564000 00	0.38203420-01	0.22193810-01	0.67792920-02	0.32370350-02	0.16488490-02	0.76178000-03	0.36293270-03	0.17765800-03	0.86360460-04
16	0.19802000 00	0.38819360-01	0.20865630-01	0.79503260-02	0.26226800-02	0.13866860-02	0.51773360-03	0.26388910-03	0.13375030-03	0.64264340-04
17	0.19944000 00	0.39356210-01	0.19654760-01	0.72780610-02	0.27408740-02	0.11446040-02	0.39460610-03	0.20740650-03	0.91944840-04	0.47617850-04
18	0.20140000 00	0.39494220-01	0.19629270-01	0.71249860-02	0.27408740-02	0.11094960-02	0.38662070-03	0.19522050-03	0.92767190-04	0.49311360-04
19	0.20560000 00	0.40375240-01	0.23175640-01	0.73474340-02	0.28391490-02	0.11541200-02	0.39511850-03	0.21470220-03	0.97154090-04	0.45366610-04
20	0.20615000 00	0.39311940-01	0.19330140-01	0.69242060-02	0.26552250-02	0.10721360-02	0.37218030-03	0.19703170-03	0.88349150-04	0.49320250-04

Table A-2-1 (Continued): Group 6, $\theta = 1.0$

Session	Moments about Origin									
	1	2	3	4	5	6	7	8	9	10
1	0.11210300 01	0.13697200 01	0.42090310 01	0.16573110 02	0.29142860 02	0.63030320 02	0.15019330 03	0.78549470 03	0.24339900 04	0.75004350 04
2	0.10623500 01	0.14963240 01	0.22169980 01	0.34913700 01	0.79629100 01	0.16100090 02	0.43862400 02	0.12452280 03	0.35567770 03	0.10520320 04
3	0.10430500 01	0.14272900 01	0.15678290 01	0.21494120 01	0.31372490 01	0.48396380 01	0.78424420 01	0.13259730 02	0.23239270 02	0.41561080 02
4	0.10427630 01	0.11749110 01	0.14054650 01	0.17674170 01	0.23212770 01	0.31695510 01	0.44853720 01	0.65480030 01	0.98464760 01	0.15212550 02
5	0.10459590 01	0.11692430 01	0.13761470 01	0.16972440 01	0.21732460 01	0.28706350 01	0.39208490 01	0.55867850 01	0.79604880 01	0.11466180 02
6	0.10373400 01	0.11532280 01	0.13660100 01	0.16822500 01	0.21554940 01	0.28336150 01	0.38743950 01	0.55257070 01	0.78924220 01	0.11373420 02
7	0.10429300 01	0.11731290 01	0.12134930 01	0.13697110 01	0.16170160 01	0.19279410 01	0.23435060 01	0.28939400 01	0.36149400 01	0.44957600 01
8	0.10451300 01	0.11722980 01	0.12115930 01	0.13759740 01	0.16103950 01	0.19212500 01	0.23373420 01	0.28947930 01	0.36149400 01	0.44957600 01
9	0.10294800 01	0.10952600 01	0.11946360 01	0.13483420 01	0.15949510 01	0.18103370 01	0.21268210 01	0.26140660 01	0.32102300 01	0.39931900 01
10	0.10234900 01	0.10871390 01	0.11869390 01	0.13372910 01	0.15838360 01	0.18114900 01	0.21270350 01	0.26081320 01	0.32092910 01	0.39931900 01
11	0.10169400 01	0.10777300 01	0.11572620 01	0.12866310 01	0.14667650 01	0.17129490 01	0.20484900 01	0.25068130 01	0.31393700 01	0.40207930 01
12	0.10191000 01	0.10873270 01	0.11552290 01	0.12790660 01	0.14508150 01	0.16842060 01	0.19990070 01	0.24668670 01	0.30800390 01	0.38083300 01
13	0.10163400 01	0.10804300 01	0.11394180 01	0.12463060 01	0.13978250 01	0.15986970 01	0.18863040 01	0.22226510 01	0.26982220 01	0.33361550 01
14	0.10170200 01	0.10835600 01	0.11321450 01	0.12357920 01	0.13791520 01	0.15737400 01	0.18504040 01	0.21913360 01	0.26732300 01	0.33318110 01
15	0.10154400 01	0.10556920 01	0.11214560 01	0.12160150 01	0.13451490 01	0.15175170 01	0.17494270 01	0.20460660 01	0.24453020 01	0.29699520 01
16	0.10127200 01	0.10594000 01	0.11137570 01	0.12057350 01	0.13315460 01	0.14984460 01	0.17168080 01	0.20064610 01	0.23843110 01	0.28749930 01
17	0.10160200 01	0.10734000 01	0.11165810 01	0.12029910 01	0.13174750 01	0.14653410 01	0.16857140 01	0.19625060 01	0.23195990 01	0.28746020 01
18	0.10106100 01	0.10596130 01	0.11149700 01	0.11969280 01	0.13099670 01	0.14528490 01	0.16649340 01	0.19621730 01	0.23195990 01	0.28075550 01
19	0.10198400 01	0.10744900 01	0.11227590 01	0.12091550 01	0.13232430 01	0.14790430 01	0.16902440 01	0.19905980 01	0.23544520 01	0.28364520 01
20	0.10201300 01	0.10574400 01	0.11190130 01	0.12010620 01	0.13091130 01	0.14476090 01	0.16628750 01	0.19654000 01	0.23233900 01	0.27719760 01

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Table A-2-1 (Continued): Group 7, $\theta = 1.8$

Session	Moments about Origin									
	1	2	3	4	5	6	7	8	9	10
1	0.2067e50D 01	0.5103071D 01	0.1390103D 02	0.4024d48D 02	0.1206935D 03	0.3[illegible]D 03	0.1142[illegible]D 04	0.3558131D 04	0.1112241D 05	0.3[illegible]D 05
2	0.1e53e70D 01	0.3792e57D 01	0.8[illegible]D 01	0.2059[illegible]D 02	0.5346489D 02	0.1[illegible]D 03	0.4170[illegible]D 03	0.1223578D 04	0.3665216D 04	0.1113994D 05
3	0.1d11[illegible]D 01	0.5135[illegible]D 01	0.7[illegible]D 01	0.1[illegible]D 02	0.3844256D 02	0.9[illegible]D 02	0.[illegible]D 03	0.7019636D 03	0.1996[illegible]D 04	0.5[illegible]D 04
4	0.1d11270D 01	0.3[illegible]D 01	0.6[illegible]D 01	0.1[illegible]D 02	0.3055370D 02	0.8[illegible]D 02	0.1[illegible]D 03	0.4187121D 03	0.1[illegible]D 04	0.2[illegible]D 04
5	0.1e[illegible]D 01	0.5[illegible]D 01	0.6512[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.5[illegible]D 02	0.1[illegible]D 03	0.3[illegible]D 03	0.[illegible]D 04	0.[illegible]D 04
6	0.1[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 04
7	0.1[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03
8	0.1[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03
9	0.1[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03
10	0.1795[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03
11	0.1800[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03
12	0.1[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03
13	0.1803[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03
14	0.1803[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03
15	0.1801[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03
16	0.1802[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03
17	0.1800[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03
18	0.1e03[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03
19	0.1803[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03
20	0.1799[illegible]D 01	0.5[illegible]D 01	0.[illegible]D 01	0.1[illegible]D 02	0.2[illegible]D 02	0.[illegible]D 02	0.[illegible]D 02	0.[illegible]D 03	0.[illegible]D 03	0.[illegible]D 03

Table A-2-1 (Continued): Group 8, $\theta = 2.6$

Session	Moments about Origin									
	1	2	3	4	5	6	7	8	9	10
1	0.2681[illegible]D 01	[illegible]	0.24817040 02	0.[illegible]	0.2347[illegible] 03	0.73142700 03	0.22854740 04	0.71575070 04	0.22445440 05	0.70443070 05
2	0.2681[illegible] 01	0.[illegible] 01	0.24050690 02	0.7[illegible] 02	0.21955670 03	0.67368200 03	0.20810430 04	0.64597550 04	0.20121730 05	0.62834330 05
3	0.2758[illegible] 01	0.7777[illegible] 01	0.22[illegible] 02	0.654[illegible] 02	0.19420680 03	0.58336550 03	0.17695560 04	0.5509886[illegible] 04	0.16661830 05	0.51942340 05
4	0.27[illegible] 01	0.7[illegible] 01	0.21[illegible] 02	0.6[illegible] 02	0.18[illegible] 03	0.53445510 03	0.15974390 04	0.48187300 04	0.14[illegible] 05	0.44821360 05
5	0.2731[illegible] 01	0.7[illegible] 01	0.21[illegible] 02	0.611[illegible] 02	0.17[illegible] 03	0.51196710 03	0.15424710 04	0.46159120 04	0.13[illegible] 05	0.42399020 05
6	0.[illegible] 01	0.[illegible] 01	0.20[illegible] 02	0.[illegible] 02	0.16[illegible] 03	0.47564650 03	0.13857510 04	0.40781440 04	0.12111640 05	0.36266570 05
7	0.2[illegible] 01	0.7[illegible] 01	0.20[illegible] 02	0.[illegible] 02	0.[illegible] 03	0.46056860 03	0.13300860 04	0.38794100 04	0.11419510 05	0.33899270 05
8	0.2[illegible] 0[illegible]	0.7[illegible] 01	0.19[illegible] 02	0.[illegible] 02	0.[illegible] 03	0.44923960 03	0.12893670 04	0.37364230 04	0.10926360 05	0.32226130 05
9	0.2[illegible] 01	0.7[illegible] 01	0.19[illegible] 02	0.[illegible] 02	0.[illegible] 03	0.43425180 03	0.12370320 04	0.35575460 04	0.10324640 05	0.30222960 05
10	0.2[illegible] 01	0.7[illegible] 01	0.19[illegible] 02	0.[illegible] 02	0.[illegible] 03	0.41091730 03	0.11551900 04	0.32764660 04	0.9374415[illegible] 04	0.27049600 05
11	0.2[illegible] 01	0.7[illegible] 01	0.19[illegible] 02	0.[illegible] 02	0.[illegible] 03	0.40182550 03	0.11212960 04	0.31540990 04	0.8946339[illegible] 04	0.25559940 05
12	0.2[illegible] 01	0.7[illegible] 01	0.19[illegible] 02	0.[illegible] 02	0.[illegible] 03	0.39113270 03	0.10840670 04	0.30272960 04	0.8518349[illegible] 04	0.24152580 05
13	0.2[illegible] 01	0.7[illegible] 01	0.18[illegible] 02	0.[illegible] 02	0.[illegible] 03	0.38090720 03	0.10510940 04	0.29225000 04	0.81884420 04	0.23120480 05
14	0.2[illegible] 01	0.7[illegible] 01	0.18[illegible] 02	0.[illegible] 02	0.[illegible] 03	0.36327030 03	0.99057250 03	0.27191610 04	0.75146660 04	0.23910310 05
15	0.2[illegible] 01	0.7[illegible] 01	0.18[illegible] 02	0.[illegible] 02	0.[illegible] 03	0.35276940 03	0.99801380 03	0.27409580 04	0.75775290 04	0.21990160 05
16	0.2[illegible] 01	0.6[illegible] 01	0.17[illegible] 02	0.[illegible] 02	0.[illegible] 03	0.33448450 03	0.95360510 03	0.25917080 04	0.73833460 04	0.19472240 05
17	0.2[illegible] 01	0.6[illegible] 01	0.17[illegible] 02	0.[illegible] 02	0.[illegible] 03	0.33213640 03	0.88343430 03	0.23575780 04	0.63933450 04	0.17215160 05
18	0.2[illegible] 01	0.6[illegible] 01	0.17[illegible] 02	0.[illegible] 02	0.[illegible] 03	0.33036320 03	0.87524620 03	0.23238870 04	0.61836190 04	0.16489550 05

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TABLE A-2-2

Ten Sample Moments about the Mean of the Maximum Likelihood Estimates of the 100 Hypothetical Examinees after the Completion of Each of the Twenty Sessions. Group 1, $\theta = -3.0$.

Session	Moments about Mean									
	1	2	3	4	5	6	7	8	9	10
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	-0.16830980-14	0.31935780-02	0.17778960-02	0.99984940-03	0.56223470-03	0.31615960-03	0.17778070-03	0.99969670-04	0.56214940-04	0.31610790-04
6	-0.26978420-14	0.12745390-01	0.59419010-02	0.29325590-02	0.14428910-02	0.71001240-03	0.3494[illegible]0-03	0.1719479[illegible]-03	0.8461357[illegible]-04	0.41639[illegible]-04
7	-0.23803180-14	0.12994560-01	0.54889020-02	0.24873710-02	0.11219910-02	0.5[illegible]025140-03	0.2284204[illegible]-03	0.1030633[illegible]-03	0.4650217[illegible]-04	0.2095[illegible]770-04
8	-0.19584330-14	0.11370300-01	0.44926320-02	0.19044120-02	0.80355390-03	0.3[illegible]915[illegible]70-03	0.1451[illegible]520-03	0.6[illegible]415000-04	0.2[illegible]78[illegible]760-04	0.1076[illegible]010-04
9	-0.12878570-14	0.10091600-01	0.37564980-02	0.15001580-02	0.59632790-03	0.23711610-03	0.9[illegible]28[illegible]000-04	0.37[illegible]8641[illegible]-04	0.1[illegible]9[illegible]8[illegible]-04	0.5[illegible]2[illegible]9[illegible]-05
10	-0.20361490-14	0.10468150-01	0.36100450-02	0.13945420-02	0.50491780-03	0.18830550-03	0.70[illegible]2490-04	0.2[illegible]8[illegible]860-04	0.9[illegible]8[illegible]120-05	0.3642[illegible]30-05
11	-0.16209260-14	0.11951180-01	0.37435860-02	0.13154720-02	0.45679860-03	0.1[illegible]860[illegible]0-03	0.[illegible]52[illegible]4620-04	0.1[illegible]9[illegible]250-04	0.[illegible]6709[illegible]0-05	0.[illegible]3[illegible]6943[illegible]-05
12	-0.55067060-14	0.12056040-01	0.35300090-02	0.11789350-02	0.38775000-03	0.12774650-03	0.4207[illegible]60-04	0.1[illegible]860820-04	0.[illegible]5657520-05	0.1503[illegible]40-05
13	-0.49804600-14	0.13256010-01	0.39337340-02	0.13870380-02	0.49583020-03	0.18400740-03	0.7[illegible]19[illegible]40-04	0.2[illegible]37[illegible]60-04	0.11[illegible]2[illegible]20-04	0.4914[illegible]10-05
14	-0.13011810-14	0.14026090-01	0.37731140-02	0.12509070-02	0.41616840-03	0.1440[illegible]190-03	0.5[illegible]7[illegible]700-04	0.1931[illegible]280-04	0.7[illegible]8[illegible]220-05	0.2966[illegible]70-05
15	-0.12878590-14	0.15301500-01	0.36185020-02	0.11247800-02	0.34332020-03	0.1[illegible]958490-03	0.[illegible]8[illegible]500-04	0.1255122[illegible]-04	0.4502[illegible]40-05	0.1[illegible]6[illegible]530-05
16	-0.27844390-14	0.16920240-01	0.34013160-02	0.10017390-02	0.27705420-03	0.[illegible]124[illegible]650-04	0.[illegible]247[illegible]470-04	0.7873[illegible]620-05	0.[illegible]6[illegible]8[illegible]-05	0.[illegible]03[illegible]6[illegible]0-06
17	-0.43742790-14	0.17196790-01	0.33841300-02	0.10126810-02	0.28505120-03	0.[illegible]6[illegible]3[illegible]0-04	0.[illegible]2[illegible]7[illegible]-04	0.[illegible]8[illegible]121[illegible]-05	0.[illegible]4[illegible]2[illegible]-05	0.[illegible]03[illegible]9[illegible]-05
18	-0.67901240-14	0.17523810-01	0.33600630-02	0.10137550-02	0.28530530-03	0.[illegible]8[illegible]6[illegible]20-04	0.[illegible]2[illegible]9[illegible]-04	0.[illegible]87[illegible]0[illegible]-05	0.[illegible]92[illegible]5[illegible]-05	0.[illegible]9[illegible]1[illegible]-06
19	-0.19717560-14	0.18184180-01	0.33839590-02	0.10860570-02	0.33247420-03	0.1143[illegible]40-03	0.4[illegible]97[illegible]-04	0.1555[illegible]750-04	0.[illegible]8[illegible]0[illegible]-05	0.2[illegible]74[illegible]-05
20	-0.41699980-14	0.18319680-01	0.29475460-02	0.92772280-03	0.26320590-03	0.8640721[illegible]-04	0.[illegible]004[illegible]0-04	0.11041350-04	0.4[illegible]82[illegible]-05	0.1633570[illegible]-05

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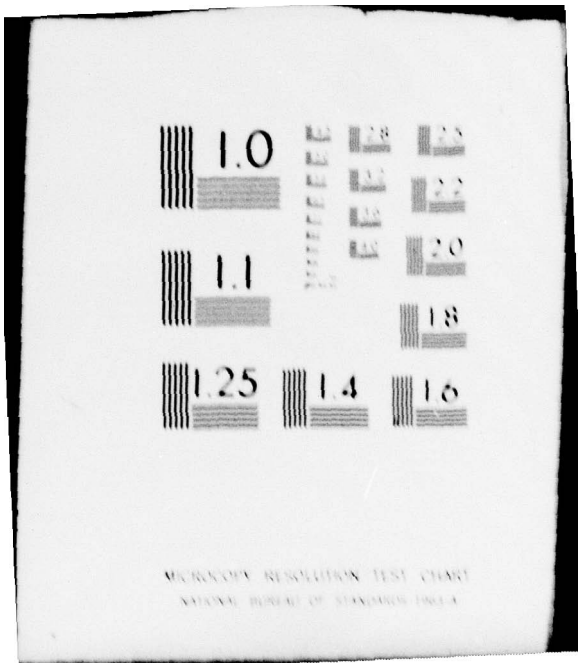

1.0
1.1
1.25
1.4
1.6
2.0
1.8
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Table A-2-2 (Continued): Group 2, $\theta = -2.2$

Session	Moments about Mean									
	1	2	3	4	5	6	7	8	9	10
1	-0.1[illegible]D-14	0.[illegible]D 00	0.38022150 00	0.6641[illegible]D 00	0.65815050 00	0.15823660 01	0.29596420 01	0.59462380 01	0.12289330 02	0.25981960 02
2	-0.7704948D-15	0.5342[illegible]D 00	-0.2300586D-01	0.1640[illegible]D 00	0.1014484D-01	0.1059884D 00	0.3206696D-01	0.8129372D-01	0.4714312D-01	0.7407298D-01
3	-0.1139086D-14	0.2102[illegible]D 00	-0.5474545D-01	0.1114611D 00	-0.4023772D-01	0.6613614D-01	-0.3218684D-01	0.4111895D-01	-0.2117462D-01	0.2614124D-01
4	-0.6[illegible]D-14	0.1[illegible]D 00	-0.4550[illegible]D-01	0.[illegible]D-01	-0.4091636D-01	0.5563850D-01	-0.3103796D-01	0.3820506D-01	-0.2243039D-01	0.2676738D-01
5	-0.2[illegible]D-14	0.[illegible]D-01	-0.[illegible]D 01	0.[illegible]D-01	-0.1695176D-01	0.2102637D-01	-0.1458184D-01	0.1834287D-01	-0.1179977D-01	0.1122316D-01
6	-0.[illegible]D-14	0.[illegible]D-01	-0.6703[illegible]D-02	0.[illegible]D-01	-0.7894182D-02	0.1128228D-01	-0.7129490D-02	0.7672008D-02	-0.5869151D-02	0.5638984D-02
7	-0.[illegible]D-14	0.[illegible]D-01	0.5760172D-03	0.[illegible]D-02	0.1467965D-03	0.1124286D-02	0.4503451D-04	0.2057757D-03	0.1408523D-04	0.3950548D-04
8	-0.[illegible]D-14	0.4477011D-01	-0.[illegible]D-02	0.[illegible]D-02	-0.[illegible]D-03	0.1105712D-02	-0.1275131D-03	0.2328174D-03	-0.2078762D-04	0.5255658D-04
9	-0.[illegible]D-14	0.[illegible]D-01	-0.3632667D-02	0.6513[illegible]D-02	-0.1361717D-02	0.1298159D-02	-0.2727141D-03	0.2909890D-03	-0.6754671D-04	0.6841100D-04
10	-0.1976197D-14	0.[illegible]D-01	-0.2703[illegible]D-02	0.[illegible]D-02	-0.1092502D-02	0.1236301D-02	-0.3399392D-03	0.2791853D-03	-0.9664214D-04	0.6703231D-04
11	-0.1649[illegible]D-14	0.[illegible]D-01	-0.1911478D-02	0.[illegible]D-02	-0.7121742D-03	0.8876381D-03	-0.2335007D-03	0.1998901D-03	-0.7229198D-04	0.5062430D-04
12	-0.[illegible]D-14	0.[illegible]D-01	-0.1066449D-02	0.[illegible]D-02	-0.2339768D-03	0.3951173D-03	-0.4649706D-04	0.5595901D-04	-0.8687504D-05	0.8549864D-05
13	-0.1227907D-14	0.[illegible]D-01	-0.1078449D-02	0.[illegible]D-02	-0.2241522D-03	0.3949845D-03	-0.4135621D-04	0.5985446D-04	-0.7560859D-05	0.9793461D-05
14	-0.1593721D-14	0.[illegible]D-01	-0.1073472D-02	0.[illegible]D-02	-0.2396875D-03	0.2787821D-03	-0.4605401D-04	0.3778748D-04	-0.8730763D-05	0.5771331D-05
15	-0.1749830D-14	0.[illegible]D-01	-0.5534C80D-03	0.[illegible]D-02	-0.6233736D-04	0.2632585D-03	-0.1341669D-05	0.3576509D-04	0.1521752D-05	0.5367772D-05
16	-0.[illegible]D-14	0.[illegible]D-01	-0.6605412D-03	0.[illegible]D-02	-0.1233460D-03	0.2185847D-03	-0.1892805D-04	0.2641631D-04	-0.2866046D-05	0.3458301D-05
17	-0.1207[illegible]D-14	0.2515[illegible]D-01	-0.4846577D-03	0.1516[illegible]D-02	-0.1401249D-03	0.2146686D-03	-0.2850436D-04	0.2847863D-04	-0.5295739D-05	0.4148867D-05
18	-0.1851[illegible]D-14	0.[illegible]D-01	-0.6462335D-03	0.1624[illegible]D-02	-0.1633613D-03	0.1749637D-03	-0.3176287D-04	0.2321028D-04	-0.5893380D-05	0.3480674D-05
19	-0.1203482D-14	0.2411[illegible]D-01	-0.1039661D-02	0.1501[illegible]D-02	-0.2286781D-03	0.1664897D-03	-0.4333586D-04	0.2396806D-04	-0.8166046D-05	0.5993452D-05
20	-0.1694200D-14	0.1943[illegible]D-01	-0.7606120D-03	0.1142480D-02	-0.1427195D-03	0.1046513D-03	-0.2221573D-04	0.1194437D-04	-0.3296489D-05	0.1520210D-05

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Table A-2-2 (Continued): Group 3, $\theta = -1.4$

Session	Moments about Mean									
	1	2	3	4	5	6	7	8	9	10
1	-0.14521720-14	0.65535980 00	-0.41486540 00	0.13002090 01	-0.15186580 01	0.[illegible]	[illegible]	0.41276270 01	-0.1[illegible]	0.2[illegible]
2	-0.43520[illegible]	0.2[illegible]	-0.3[illegible]	0.21523710 00	-0.11437900 00	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
3	-0.16565920-14	0.17225890 00	-0.51499920-01	0.1[illegible]	-0.1[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
4	-0.14722950-14	0.10879320 00	-0.15966720-01	0.46632930-01	-0.14911340-01	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
5	-0.18704450-14	0.[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
6	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
7	-0.17399970-14	0.53832710-01	-0.6[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
8	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
9	-0.14223340-14	0.[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
10	-0.16256440-14	0.46451120-01	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
11	-0.14986010-14	0.[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
12	-0.12767[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
13	-0.14255260-14	0.[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
14	-0.18851990-14	0.[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
15	-0.18141040-14	0.[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
16	-0.16830980-14	0.[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
17	-0.18385240-14	0.[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
18	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
19	-0.14810380-14	0.[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
20	-0.15[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]	[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]

Table A-2-2 (Continued): Group 4, $\theta = -0.6$

Session	Moments about Mean									
	1	2	3	4	5	6	7	8	9	10
1	-0.44630970-15	0.65926740 00	-0.33274490 00	0.17293950 01	-0.23710930 01	0.79703870 01	-0.15293660 02	0.44209230 02	-0.96075010 02	0.25921170 03
2	-0.89595000-15	0.21492140 00	-0.36532470-01	0.15102880 00	-0.10850840 00	0.22136350 00	-0.27856730 00	0.47254460 00	-0.70806820 00	0.11496660 01
3	-0.11368680-14	0.12857300 00	0.32926250-02	0.46638440-01	0.22468410-02	0.30206970-01	0.14650310-02	0.26570820-01	0.11695270-02	0.26289570-01
4	-0.11766980-14	0.10171460 00	0.10295590-01	0.32448240-01	0.89475520-02	0.15892100-01	0.71673950-02	0.54359860-02	0.55799490-02	0.62035160-02
5	-0.11672610-14	0.74567190-01	0.49275610-02	0.18295570-01	0.40110290-02	0.81686390-02	0.34574600-02	0.50016160-02	0.29145490-02	0.35961090-02
6	-0.12095680-14	0.71424220-01	0.17142830-02	0.12377020-01	0.69588330-03	0.32138810-02	0.21066600-03	0.10262490-02	0.99402180-04	0.36460150-03
7	-0.84039010-15	0.66919670-01	0.12259110-02	0.10035610-01	0.18709120-03	0.23188620-02	-0.65676760-04	0.66030710-03	-0.73945860-04	0.21447500-03
8	-0.11023130-14	0.55233850-01	0.20265380-02	0.82293600-02	0.50835110-03	0.17203990-02	0.76156690-04	0.43993180-03	-0.25368720-05	0.12751580-03
9	-0.96728180-15	0.47006540-01	0.22176380-02	0.61253030-02	0.56815180-03	0.10872980-02	0.13750730-03	0.22412820-03	0.34954800-04	0.50378670-04
10	-0.90816240-15	0.42037250-01	0.12026120-02	0.48075440-02	0.33346990-03	0.82686770-03	0.83674050-04	0.17797690-03	0.22446470-04	0.43171190-04
11	-0.12961850-14	0.45255000-01	0.21350640-02	0.63805620-02	0.70751240-03	0.14127400-02	0.21194920-03	0.38449760-03	0.64349690-04	0.11514540-03
12	-0.11882190-14	0.33316850-01	0.33710560-02	0.50106240-02	0.12919780-02	0.10815550-02	0.44946010-03	0.31126880-03	0.16194450-03	0.10338440-03
13	-0.86403110-15	0.35291830-01	0.16311980-02	0.36715550-02	0.62824610-03	0.65569900-03	0.21061750-03	0.15713600-03	0.67821930-04	0.43390890-04
14	-0.10309810-14	0.30053450-01	0.10546670-02	0.27365780-02	0.41192620-03	0.43341830-03	0.13072750-03	0.92990620-04	0.38607040-04	0.23246220-04
15	-0.10629000-14	0.29524370-01	0.12795580-02	0.27751610-02	0.43002600-03	0.45212430-03	0.13544610-03	0.99363640-04	0.40951560-04	0.25437120-04
16	-0.12732870-14	0.26516490-01	0.11269430-02	0.23859070-02	0.33388540-03	0.34249550-03	0.84955700-04	0.62057820-04	0.2072630-04	0.12745630-04
17	-0.12043140-14	0.24597450-01	0.59211560-04	0.20483090-02	-0.13565200-04	0.26320680-03	-0.38990110-05	0.49045640-04	-0.8069232D-06	0.65893640-05
18	-0.10075270-14	0.23346660-01	0.16988740-03	0.19256520-02	-0.28537750-04	0.24380580-03	-0.13160130-04	0.35025480-04	-0.35694100-05	0.54962810-05
19	-0.13367090-14	0.23412930-01	0.69054530-03	0.18121650-02	0.95502800-04	0.21514540-03	0.14735990-04	0.29862240-04	0.25026800-05	0.44552140-05
20	-0.99864560-15	0.24110130-01	0.69824360-03	0.22045910-02	0.13098060-03	0.33839840-03	0.33364880-04	0.63429090-04	0.93557150-05	0.13001460-04

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Table A-2-2 (Continued): Group 5, $\theta = 0.2$

Section	Moments about Mean									
	1	2	3	4	5	6	7	8	9	10
1	0.11124430-14	0.47088660 00	-0.38726990-01	0.55455040 00	-0.12779610 00	0.[illegible] 00	-0.[illegible] 00	0.18634690 01	-0.[illegible] 00	0.[illegible] 01
2	0.11366880-14	0.21167d30 00	-0.50861690-02	0.11088820 00	-0.12251520-02	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
3	0.23453460-15	0.16210970 00	0.46190710-02	0.60470590-01	0.91384040-02	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
4	0.22426510-15	0.10769530 00	0.45955450-02	0.31479800-01	0.34890970-02	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
5	0.19678700-15	0.78667380-01	0.49626540-02	0.16657050-01	0.30941820-02	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
6	0.28282930-15	0.63506170-01	0.11230740-02	0.10147470-01	0.48715320-03	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
7	0.26742590-15	0.52458160-01	0.88812710-03	0.60085190-02	0.2693667J-03	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
8	0.27172710-15	0.47779660-01	0.14728310-02	0.52483840-02	0.71366160-03	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
9	0.25965340-15	0.41399270-01	0.29383460-02	0.48101720-02	0.11752270-02	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
10	0.24605320-15	0.39044670-01	0.46081530-02	0.52179240-02	0.17716280-02	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
11	0.23351010-15	0.34859070-01	0.29956760-02	0.33951990-02	0.86783970-03	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
12	0.21566080-15	0.30303740-01	0.22231010-02	0.22950390-02	0.40362160-03	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
13	0.21593840-15	0.26095490-01	0.16496980-02	0.16994220-02	0.27930110-03	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
14	0.21219140-15	0.26509230-01	0.10461190-02	0.16709200-02	0.16784340-03	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
15	0.32612830-15	0.23680950-01	0.77416210-03	0.12524110-02	0.12004810-03	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
16	0.38344330-15	0.21247660-01	0.47145850-03	0.10403490-02	0.67855060-04	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
17	0.27686190-15	0.19600350-01	0.18557790-03	0.86611120-03	0.12920270-04	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
18	0.40328850-15	0.18791660-01	0.7453712J-04	0.82983990-03	0.30183550-05	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
19	0.33181790-15	0.18290270-01	0.13585890-03	0.77131550-03	0.14542540-04	0.[illegible]	0.[illegible]	0.[illegible]	-0.[illegible]	0.[illegible]
20	0.29601320-15	0.16801750-01	0.14683840-03	0.71051590-03	0.13109770-04	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]

Table A-2-2 (Continued): Group 6, $\theta = 1.0$

Session	Moments about Mean									
	1	2	3	4	5	6	7	8	9	10
1	0.2[illegible]-14	0.[illegible] 00	0.4022811D 00	0.1013991D 01	0.2106407D 01	0.6446262D 01	0.9390755D 01	0.2513229D 02	0.3589072D 02	0.1032822D 03
2	0.2[illegible]-14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	0.2[illegible]-14	0.1391255D 00	0.2861285D-02	0.3965693D-01	0.5547193D-02	0.4222579D-01	0.5338758D-02	0.3734438D-01	0.4515726D-02	0.3674632D-01
4	0.1521306D-14	0.[illegible]D-01	-0.2403868D-02	0.2[illegible]	-0.1677446D-02	0.1029642D-01	-0.9787409D-03	0.5626728D-02	-0.6727391D-03	0.3461033D-02
5	0.1787495D-14	0.[illegible]D-01	-0.2163932D-02	0.1638222D-01	-0.1655810D-02	0.5275559D-02	-0.7233554D-03	0.2057295D-02	-0.3998583D-03	0.1864474D-03
6	0.1626[illegible]D-14	0.[illegible]D-01	-0.8477336D-04	0.8152[illegible]	0.3483176D-04	0.1795247D-02	0.6514495D-04	0.4842722D-03	0.4133370D-04	0.1453666D-03
7	0.1[illegible]-14	[illegible]	-0.3799135D-02	0.8036[illegible]	-0.1361462D-02	0.1157661D-02	-0.4051794D-03	0.2703965D-03	-0.1165135D-03	0.[illegible]
8	0.1[illegible]-14	0.[illegible]D-01	-0.2[illegible]D-02	0.3161[illegible]	-0.5150422D-03	0.8546772D-03	-0.7968256D-04	0.1696646D-03	-0.[illegible]	0.3723515D-04
9	0.1[illegible]-14	[illegible]	-0.2491784D-02	0.3[illegible]	-0.[illegible]	0.5603663D-03	-0.1079435D-03	0.9278770D-04	-0.[illegible]	0.1695493D-04
10	0.1[illegible]-14	[illegible]	-0.2360946D-02	0.[illegible]	-0.[illegible]	0.8465720D-03	-0.6718590D-04	0.1772862D-03	-0.[illegible]	0.[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.7627537D-03	0.6333010D-04	0.1713858D-03	0.3097876D-04	0.[illegible]
12	0.1[illegible]	[illegible]	-0.1235813D-03	0.[illegible]	0.[illegible]	0.5610901D-03	0.5123832D-04	0.1150917D-03	0.2024120D-04	0.2659896D-04
13	0.1[illegible]	[illegible]	-0.9[illegible]	[illegible]	[illegible]	0.3938426D-03	-0.1246877D-05	0.6825572D-04	-0.[illegible]	0.1286396D-04
14	[illegible]	[illegible]	-0.1238870D-03	0.[illegible]	-0.[illegible]	0.5947266D-03	-0.6879810D-04	0.1454306D-03	-0.2903126D-04	0.[illegible]
15	0.1[illegible]	0.[illegible]	-0.4418531D-03	0.[illegible]	-0.[illegible]	0.4850235D-03	-0.1235810D-03	0.1190987D-03	-0.[illegible]	0.[illegible]
16	[illegible]	[illegible]	-0.[illegible]	0.[illegible]	-0.[illegible]	0.3453674D-03	-0.5945[illegible]	0.6703225D-04	-0.[illegible]	0.[illegible]
17	0.1[illegible]	[illegible]	-0.[illegible]	[illegible]	-0.[illegible]	0.3013457D-03	-0.9805904D-04	0.6363331D-04	-0.[illegible]	0.[illegible]
18	0.1[illegible]	0.[illegible]	-0.[illegible]	[illegible]	-0.[illegible]	0.2081141D-03	-0.5825489D-04	0.3690914D-04	-0.[illegible]	0.[illegible]
19	0.1[illegible]	[illegible]	-0.1363[illegible]	[illegible]	-0.[illegible]	0.1354999D-03	-0.2870976D-04	0.2036990D-04	-0.[illegible]	0.[illegible]
20	0.1[illegible]	0.[illegible]	-0.[illegible]	[illegible]	-0.[illegible]	0.1365059D-03	-0.3057387D-04	0.2193712D-04	-0.[illegible]	0.[illegible]

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Table A-2-2 (Continued): Group 7, $\theta = 1.8$

Session	Moments about Mean									
	1	2	3	4	5	6	7	8	9	10
1	0.28244970-14	0.82406650 00	-0.53244400-01	0.12624000 01	-0.75515100 00	[illegible]	[illegible]	0.69504580 01	-0.15611200 02	0.32264040 02
2	0.30753180-14	0.35061230 00	0.15257630 00	0.37865420 00	0.33053520 00	0.55102000 00	0.59714200 00	0.64846760 00	0.10644700 01	0.14060400 01
3	0.25446310-14	0.23222260 00	0.92826360-01	0.20967450 00	0.18982940 00	0.30537900 00	0.45533710 00	0.50561850 00	0.83980440 00	0.84367000 00
4	0.19761970-14	0.14672030 00	0.43316370-01	0.92374180-01	0.62912180-01	0.12160000 00	0.14779420 00	0.20127500 00	0.46175180 00	0.35004320 00
5	0.23359010-14	0.10273500 00	0.25106340-01	0.53517690-01	0.43912740-01	0.64220100-01	0.75671130-01	0.10516120 00	0.15206130 00	0.17742060 00
6	0.16031620-14	0.71179600-01	-0.88122390-03	0.19066620-01	-0.11780430-03	0.34045270-02	[illegible]	0.10264020-02	0.32321990-04	0.39192730-03
7	0.22404300-14	0.61586990-01	0.33557950-03	0.11708940-01	0.26396720-03	0.32686920-02	0.13173930-03	0.11067630-02	0.01677220-04	0.41066760-03
8	0.18518520-14	0.49276150-01	0.27895160-03	0.78309060-02	0.71368120-04	0.19483740-02	[illegible]	[illegible]	-0.24230000-04	0.17231190-03
9	0.21960210-14	0.46652450-01	0.64552330-03	0.81666990-02	0.16254720-03	0.42264660-04	[illegible]	0.77254460-03	-0.64370300-05	0.27119600-04
10	0.22515320-14	0.41224060-01	-0.27692310-03	0.74649430-02	-0.93309930-04	0.24974330-02	[illegible]	0.81982410-03	-0.11382610-04	0.22825960-03
11	0.18096640-14	0.33767130-01	-0.10963880-02	0.41137490-02	-0.46346500-03	0.77661160-03	[illegible]	0.16019010-03	-0.00247000-04	0.46331660-04
12	0.18962610-14	0.30574770-01	0.11623980-03	0.30627920-02	-0.23445780-04	0.49952760-03	[illegible]	0.77120630-04	-0.31640060-05	0.14300470-04
13	0.14277470-14	0.29961890-01	0.34132800-03	0.29670760-02	0.39739020-04	[illegible]	0.29044950-05	0.77880650-04	-0.21720000-06	0.15190000-04
14	0.15765170-14	0.28587430-01	0.87796030-03	0.25509510-02	0.19198010-03	0.52177120-03	[illegible]	0.40008440-04	0.00588600-05	0.70026010-05
15	0.16675550-14	0.28731090-01	0.12961660-02	0.24126290-02	0.33050940-03	0.31099470-03	0.42385080-04	0.44850880-04	0.15511040-04	0.45868040-05
16	0.13700150-14	0.26604660-01	0.13367030-02	0.21335640-02	0.26898910-03	0.26217120-03	0.35178680-04	0.33795480-04	0.10001760-04	0.66896510-05
17	0.14677150-14	0.25038370-01	0.66819660-03	0.17742710-02	0.88042120-04	0.17994220-03	0.20528010-04	0.20228010-04	0.10754080-05	0.45202660-05
18	0.17763570-14	0.23855840-01	0.83952020-03	0.16983090-02	0.17916840-03	0.17576960-03	[illegible]	0.21337020-04	0.48720000-05	0.28111680-05
19	0.19939510-14	0.24326170-01	0.65226110-03	0.17713990-02	0.15165040-03	0.13662750-03	0.27616440-04	0.23084640-04	0.96742000-05	0.21974080-05
20	0.19295680-14	0.22392010-01	0.67079930-03	0.15501800-02	0.15324140-03	[illegible]	[illegible]	0.19666560-04	0.44664200-05	0.44691110-05

Table A-2-2 (Continued): Group 8, $\theta = 2.6$

Session	Moments about Mean									
	1	2	3	4	5	6	7	8	9	10
1	0.d99b0e3u-14	0.xxxfxxxx 00	-0.xxxlxxxx 00	0.xxxxxxxx 00	-0.x7560xx 00	0.31534110 00	-0.37357220 00	0.46910240 00	-0.61841500 00	0.8037xx30 00
2	0.177a5f0-14	0.x1c333x0 00	-0.7697330-01	0.920+237u-01	-0.5x9x69x0-01	0.5079x190-01	-0.4371x170-01	0.3999x030-01	-0.3x9748?u-01	0.347x3140-01
3	0.x2x0+1x5-14	0.xx7xxxx0 00	-0.1x33190u-01	0.39x10770-01	-0.1x007x4u-01	0.1456x260-01	-0.9011x840-02	0.7735052u-02	-0.5917x34u-02	0.x977702u-02
4	0.x15xxxxu-14	0.xxxxxxxx 00	-0.1721x93u-02	0.29x30xxu-01	-0.x0513030-02	0.83420100-02	-0.31937300-02	0.3010?x70-02	-0.1x397150-02	0.1266977?-02
5	0.x3211x0-14	0.xxxxxxxx 00	0.x2x8x2xu-02	0.2113x20u-01	-0.50xx4?xu-03	0.44546630-02	-0.4071x330-03	0.1058x640-02	-0.2x282x60-03	0.28362753-03
6	0.x01xxxxu-14	0.xx5x0xxx-01	0.1x2x055u-01	0.170x405u-01	0.1xxxx46u-02	0.3423x690-02	0.2127x840-03	0.7487x80-03	-0.2972x59u-04	0.17x5367u-03
7	0.11x7x?0-14	0.91xx05xu-01	0.11xx7x0-01	0.1x07x25u-01	0.2x0x2x00-02	0.2686x340-02	0.5?285?40-03	0.4?987570-03	0.1x8x30-0-03	0.x941x633-04
8	0.x1?xxxxu-14	0.?xx101xu-01	0.10x3x94u-01	0.16x6x7xu-01	0.2x2x05xu-02	0.2513x240-02	0.4871x630-03	0.5235847u-03	0.801x9x00-04	0.1151x?80-03
9	0.1x0?x8?u-14	0.xxx1x2xu-01	0.1x921170-01	0.11x7x0xu-01	0.2xx0x41u-02	0.2258x310-02	0.6251220u-03	0.4665x22u-03	0.1291?510-03	0.9x47x65u-04
10	0.1bxx2x?-14	0.x71x1?0-01	0.x7x1x940-02	0.x2051130-02	0.2x75x01u-02	0.1876556D-02	0.6590513u-03	0.4902832u-03	0.1x03x12u-03	0.873?x310-04
11	0.1x5x1x3u-14	xx.xx7xxx1u-01	0.8x4x659u-02	0.xxx6x1xu-02	0.2x45031u-02	0.17214410-02	0.5801x480-03	0.3627x360-03	0.1309?180-03	0.7x0x65x0-04
12	0.1x5x1x4u-14	0.xx7x.6xxu-01	0.7xxx6x1u-02	0.7xx7x2u-02	0.22x4x62u-02	0.16205540-02	0.5x16x70-03	0.3572x050-03	0.1232?510-03	0.80x2086?-04
13	0.1?03x52u-14	0.xxx7xxxu-01	0.?xx6x2u-02	0.x7133x1u-02	0.2x1x9x1u-02	0.13986440-02	0.5432?660-03	0.3128121?-03	0.1294?x60-03	0.713??x9u-04
14	0.1x7x2x0u-14	0.xx.1xxxxu-01	0.7x3x2.0-02	0.6x0x2x7u-02	0.23227205-02	0.13985510-02	0.6036681D-03	0.3268?250-03	0.1505x440-03	0.7817x025-04
15	0.21x0x5x-14	0.xx7x?xxu-01	0.5x3x7?3u-02	0.x933x41u-02	0.1x33x45u-02	0.10881580-02	0.4997x57D-03	0.2583144D-03	0.1311x500-03	0.6x0873?0-04
16	0.19xx55x-14	0.xx?1x3?1u-01	0.5x3164x-02	0.x71x36x-02	0.17?73?x0-02	0.1024617D-02	0.4776x640-03	0.2499x17D-03	0.1227?950-03	0.626x9x03-04
17	0.x87xx?C-14	0.x.x9x2xxu-01	0.44?xx?x0-02	0.2x6x5xxu-02	0.13x177?-02	0.76202990-03	0.3685x490-03	0.1931?510-03	0.9766x480-04	0.503?327?-04
18	0.1?x?x?0-14	0.xx6x4x30-01	0.1713x46u-02	0.1x37x1?u-04	0.x33x??2-03	0.24629930-03	0.1152x560-03	0.6149937?-04	0.3170?x?0-04	0.1676x343-04
19	0.x455x13u-14	0.1xx7x?xu-01	0.1x1?2x6?-04	0.1xx?x6?5u-04	0.xx7?xx?7u-03	0.2x88?x80-03	0.1165?700-03	0.6312?880-04	0.32?31?70-04	0.173?7933-04
20	0.21x?376u-14	0.1x6?xx4u-01	0.5109217D-03	0.5110x4xu-03	0.417?x260-04	0.2405292D-04	0.2894227D-05	0.1285619D-05	0.1885167D-06	0.7214x16D-07

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