

AD-A153 888

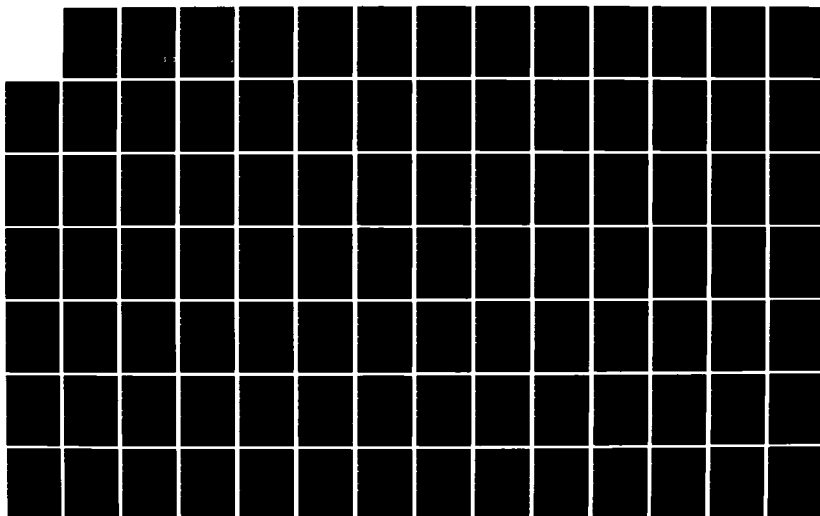
AN ANALYSIS OF THE EDUCATIONAL REQUIREMENTS OF AIR
FORCE COST ANALYSIS(U) AIR FORCE INST OF TECH
WRIGHT-PATTERSON AFB OH SCHOOL OF ENGINEERING P PERRY
DEC 84 AFIT/GSM/LSV/845-24

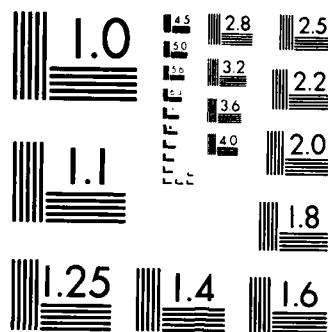
1/2

UNCLASSIFIED

F/G 5/9

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

AD-A153 800



AN ANALYSIS OF THE EDUCATIONAL
REQUIREMENTS OF AIR FORCE
COST ANALYSTS

THESIS

Phillip Perry
First Lieutenant, USAF
AFIT/GSM/LSY/84S-24

This document has been approved
for public release and sale; its
distribution is unlimited.

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

DTIC FILE COPY

DTIC
EL

MAY 16 1985

A

85

AFIT/GSM/LSY/84

(2)

AN ANALYSIS OF THE EDUCATIONAL
REQUIREMENTS OF AIR FORCE
COST ANALYSTS

THESIS

Phillip Perry
First Lieutenant, USAF
AFIT/GSM/LSY/84S-24

DTIC
ELECTE
MAY 16 1985
S A D

Approved for public release; distribution unlimited

The contents of the document are technically accurate, and no sensitive items, detrimental ideas, or deleterious information are contained therein. Furthermore, the views expressed in the document are those of the author(s) and do not necessarily reflect the views of the School of Systems and Logistics, the Air University, the United States Air Force, or the Department of Defense.



Availability Codes	
Avail and/or	Special
Post	
A1	

AFIT/GSM/LSY/84S-24

AN ANALYSIS OF THE EDUCATIONAL REQUIREMENTS OF AIR FORCE
COST ANALYSTS

THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Systems Management

Phillip Perry, B.S.
First Lieutenant, USAF

December 1984

Acknowledgements

I extend my gratitude to all who helped to make this research possible. There is no need to mention names. You all know who you are. You have helped me to take another step forward. Again, I thank you.

Phillip Perry

Table of Contents

	Page
Acknowledgements	ii
Abstract.	iv
I. Research Overview	1
General Issue	1
Specific Problem	2
Literature Review and Background	3
Research Objectives/Questions	10
II. Methodology	12
Introduction and Approach	12
Interview Results	15
Questionnaire Development and Format Description	16
Population Background	18
Analysis Description	18
III. Analysis Results.	27
Responses.	27
Subject by Subject Analysis Results.	27
Rating of AFIT PCE Courses	47
Written Comments	50
IV. Conclusions/Recommendations	54
Recommendations for Further Research	57
Appendix A: Interview Guide and Questionnaire.	58
Appendix B: Written Comments	71
Appendix C: Computer Cross-tabulations	86
Bibliography.	155
Vita.	157

Abstract

The United States Air Force has emphasized a need to improve the quality of its cost estimates. It seems that cost analysts who are adequately educated can provide the high quality estimates needed by the Air Force. This research effort developed an educational requirements list for Air Force cost analysts. This list is needed to evaluate the educational qualifications of not only potential cost analysts, but current analysts as well. The list is based on an evaluation of a number of cost analysis related subjects by experienced Air Force cost analysts via a mail survey. Experienced analysts rated thirty-five cost analysis subjects in terms of usefulness to job performance. Analysts were also asked to identify appropriate educational methods for acquiring knowledge in the subjects. The result of this effort is an Air Force cost analyst educational requirements list by educational method.

Analysis of the survey data was accomplished utilizing a computer crosstabulation procedure which compared responses to each subject. The analysis used decision rules which measured the central tendency of the responses. Based on the decision rules outlined in the methodology chapter subjects were recommended to be taught by various educational methods. Also, written comments are presented on how experienced cost analysts perceived the educational competence of all Air Force cost analysts can be improved.

AN ANALYSIS OF THE EDUCATIONAL REQUIREMENTS OF AIR FORCE COST ANALYSTS

I. Research Overview

General Issue

The present concern of many government officials over cost growth has increased the need for good cost estimating throughout the Department of Defense (Margolis, 1981:1,17). Most recently, the United States Air Force has emphasized the need to improve the quality of its cost estimates. However, improving the quality of these estimates involves three aspects. Two currently being pursued involve the development of techniques and the establishment of data bases used to generate cost estimates (Margolis, 1981:17). The other aspect consists of providing capable personnel to generate high quality estimates. Providing capable personnel means Air Force cost analysts must both be adequately educated and well trained. Training comes through experiences gained on the job. Education is acquired through formal course work taken as part of a college education or through professional continuing education (PCE). Although almost all cost analysts have a bachelor's degree, the courses taken may or may not have any relevance to cost analysis. Consequently, PCE courses may constitute all or a significant portion of an individual's cost analysis education. However, there is no list of standard Air Force cost analyst educational qualifications (Goetsch, 1980:10). This absence strongly implies that the continued education of an analyst is a task left mainly to the individual and his supervisor. This is particularly true for PCE courses. Some managers may take an active role in educating their analysts by requiring them to complete specified courses. However, this type of active participation may be neglected in the absence of a mandatory educational requirements plan.

Specific Problem

Educational competence is the body of knowledge that a cost analyst should possess to perform his job effectively. This body of knowledge contains both job specific knowledge which relates to the unique requirements of a given set of tasks, and general knowledge which all cost analysts should possess in order to be considered fully qualified analysts. This issue of educational competence can only be partially satisfied by an individual analyst. Certainly, the individual analyst and his supervisor should decide which job specific knowledge is required to perform various tasks. However, the decision concerning which general knowledge is required is too critical an issue to be left for each analyst to discern. The individual or his supervisor may have a short term perspective that is only job related and fail to acknowledge the importance of developing overall professional competence. Consequently, the educational plan developed by the individual or his supervisor may contain major deficiencies. The Air Force needs an established standard for measuring the adequacy of educational competence among its cost analysts which will induce a higher degree of quality in all Air Force cost estimating. This standard should identify just what subjects should be offered to provide the necessary general knowledge. The general knowledge should be distinguished from job specific knowledge so that individual analysts are not forced to acquire job specific knowledge not required to perform their current duties. To prevent this, job specific knowledge should only be offered in the form of elective courses which the individual may take based on his particular job requirements. However, general knowledge should be offered in the form of mandatory courses required of all cost analysts. Perhaps, by establishing a

comprehensive cost analysis educational program composed of mandatory and elective subjects, a standard can be developed which adequately satisfies the needs of the Air Force.

Literature Review and Background

Investigation of the problem involved examining the curriculum of the cost analysis master's degree program at the Air Force Institute of Technology (AFIT) as well as the curriculums of various undergraduate degree programs deemed appropriate for the cost analyst. Other considerations included an examination of the professional continuing education (PCE) program at AFIT as it applies to Air Force cost analysts. In addition, Air Force cost analysis on-the-job training (OJT) was also examined.

The nature of the information required to evaluate the problem identified by this research effort dictated a review of past efforts which examined similar problems. Determining the adequacy of curriculums is by no means a new issue to the Air Force academic community. In particular, previous AFIT theses provided a valuable source of reference material.

Allan C. Hart performed a study in 1965 evaluating the utilization of the logistics education offered at that time by AFIT. Data were provided via a questionnaire distributed to 1963 and 1964 AFIT graduates. Utilizing a hypothesis test approach, Hart concluded that in addition to meeting the institutional objectives, the curriculum of the School of Systems and Logistics provided the necessary tools for solving major logistics and weapon system problems (Hart, 1965:6,7,57).

In 1968 Robert Cook and John Greene conducted a study evaluating the relevancy of the then current School of Systems and Logistics curriculum to the then current operational requirements. The team used a question-

naire to gather the necessary data to perform their evaluation. A survey of graduates from 1965, 1966, and 1967 revealed that the AFIT curriculum was adequate to meet the needs of the operational environment at that time (Cook, 1968:4,95).

In 1971 a research effort conducted by James Cushman and James Townsend evaluated the adequacy of courses available to Air Force maintenance managers for providing the necessary management education for a chief of aircraft maintenance to perform his duties effectively. Through the use of a questionnaire and a guided interview the researchers concluded that the courses available to Air Force maintenance managers provided adequate management education in both production management and communicative skills. However, the courses available to the maintenance manager did not provide the necessary management base in the discipline of statistics. Only the three management disciplines of production management, communicative skills, and statistics were evaluated by the researchers (Cushman, 1971:12,68-69).

In 1972 James Ross and Earl Steiner recognized the continuing need to evaluate the AFIT logistics education program. Their research team sought to discover if the Air Force Logistics Command (AFLC) civilian employees viewed formal education as important. They also wanted to know what education would prepare AFLC civilian employees to be more effective managers. They concluded via a survey instrument that education was extremely important to civilian AFLC employees. They also noted that educational programs developed for logistical personnel should include management, communicative science, and personnel management as major disciplines in the curriculum (Ross, 1972:7-8,50-52).

In 1978 another study was conducted by William Crowder and James

Davidson to evaluate the "usefulness" of the graduate logistics program at AFIT. The objective of the research effort was to determine the extent to which logistics graduates were using their logistics education.

Questionnaires were distributed to graduates of the 1971A through 1975B classes and their supervisors to gather data. Analysis of the data revealed that both the graduates and their supervisors believed that the AFIT logistics program, was useful (Crowder, 1978:1,9,11,56).

Since the AFIT master's program in cost analysis has its foundation in the system management program a more recent study conducted by Ernest Speck is of particular importance to this research effort. In 1981 Speck was involved in an effort to determine the usefulness of the AFIT Graduate Systems Management program to Air Force Officers graduating in the classes of 1969 through 1978 (Speck, 1981:2). Utilizing a questionnaire to gather data on the issue, Speck concluded that the AFIT Graduate Systems Management program sufficiently supported the need of its graduates. However the graduates indicated a need for more emphasis on practical applications and less theoretical emphasis (Speck, 1981:58-60).

Another item of significant importance to this research effort is a collection of papers by Wayne M. Allen, the Director of Cost Analysis, Office of the Comptroller of the Army. In this collection of papers entitled "Towards a Cost Analysis Career (Job) Series," Allen builds a strong case towards establishing a unique defense job series for Army cost analysts. In the preface of the document Allen states:

This compendium of papers chronicles the movement within the Army to improve the cost estimating and analysis process through recognizing the "people element"--the need for improved mechanisms for identifying, selecting, training, transferring, evaluating, promoting, and retaining cost analysts. It is dedicated to all who have interests along these lines (Allen, 1980).

purposes. Also, those questionnaires in which the respondent did not identify at least four years experience in the cost analysis field were also omitted.

The data provided by the questionnaire falls in the categories of nominal and ordinal with the usefulness rating representing an ordinal scale of measurement and the educational methods representing a nominal measurement scale. Emory describes the various scales of measurement as follows:

<u>Type of Scale</u>	<u>Characteristics of Scale</u>
Nominal	No order, distance or origin.
Ordinal	Order, but no distance or unique origin.
Interval	Both order and distance but no unique origin.
Ratio	Order, distance, and unique origin (Emory, 1980:121).

Ordinal scales are used to establish rank order among alternatives with no particular meaning assigned to the differences among ranks. Ordinal scales only differentiate "better" from "worse". The appropriate measure of central tendency for ordinal data is the median. The median is the middle value of a rank-ordered data set. Half the values in the data set will lie below the median, and half the values will lie above the median. Nominal scales are used to identify the class or category to which an observation belongs. The appropriate measure of central tendency is the mode, which identifies the class or category containing the largest number of observations (Emory, 1980:122-124).

Contingency tables were used to compare the usefulness rating and educational methods identified by respondents. The tables provided frequency counts by rows, columns and total responses. The Crosstabs procedure available on the computer program, Statistical Package for the Social

The questionnaire was evaluated by several AFIT instructors for completeness and suitability. In addition, Captain Ben Dilla of the AFIT Organization Sciences Department provided some helpful suggestions on the format of the questionnaire. A short response time increased the likelihood that members of the population would return the questionnaire. Therefore, a goal was established that the questionnaire not take longer than twenty minutes to complete. In order to estimate the required response time, three AFIT faculty members were asked to complete the questionnaire. It was estimated that the questionnaire would take approximately ten minutes to complete, a time well within the established goal. A copy of the questionnaire can be found in Appendix A of this report.

Population Background

The questionnaire was distributed Air Force wide. The Air Force Military Personnel Center (AFPMC) and the Cost and Management Analysis Directorate at Headquarters United States Air Force provided a current list of cost analysts located in the continental United States (CONUS). A questionnaire was sent to each analyst in the population. Of course, there was no way of assuring the return of each questionnaire. However, an effort was made to encourage a response from each of analysts in the population. A letter from Colonel Pflumm, the Director of Cost and Management Analysis at Headquarters Air Force (AF/ACM), accompanied the questionnaire to express the concern for individual responses.

Analysis Description

Each returned questionnaire was screened to determine if it was complete and all responses were correctly recorded. Those questionnaires considered incomplete or improperly filled out were omitted for data

represented "extremely useful," "useful," and "of little use" respectively. A response of "critical" would imply that the respondent felt that this subject should be taught to every analyst. A response of "useless" would imply that a cost analyst has no need to know anything about this particular subject. A response of "useful" reflects the opinion that while this subject is of value, an analyst could probably perform adequately, but at a lower level of competence, without this knowledge. The responses "extremely useful" and "of little use" were used to allow the respondent some flexibility in rating the subjects.

Analysts were also asked to identify which of four educational methods were deemed appropriate for acquiring the knowledge in the subjects they rated. The four educational methods were:

1. On-the-job training (OJT)
2. Professional continuing education (PCE)
3. Undergraduate education (UG)
4. Graduate education (GRAD)

Respondents were allowed to choose multiple combinations. They could select one of the four methods, any one of six possible combinations of two methods, any one of four possible combinations of three methods, or even all four methods. This allowed for fifteen possible responses.

In addition, analysts were asked to rate several PCE courses offered by AFIT using the same five-point scale. The courses evaluated were:

1. QMT 170 Principles of Contract Pricing
2. QMT 180 Learning Curve Analysis
3. QMT 345 Introductory Quantitative Analysis
4. QMT 353 Introduction to Life Cycle Cost Management
5. QMT 540 Advanced Pricing Methods
6. QMT 550 Advanced Quantitative Methods
7. QMT 551 Advanced Cost and Economic Analysis
8. SYS 362 Cost Schedule Control System Criteria

As a final task each analyst was asked to briefly describe how the educational competence could be improved for all Air Force cost analysts.

analysis. Also along those lines, ideas concerning undergraduate degree preferences varied across the spectrum. Degree preferences varied from English to chemical engineering. There also seemed to be a general consensus among several who were interviewed to place personality and attitude above education in predicting successful job performance. Moreover, all tended to agree that at least four years experience in the cost analysis field was necessary to gain a general working knowledge for effective job performance.

Questionnaire Development and Format Description

After the interviews were completed, a comparison was made between the headings contained in the interview guide and the subjects identified during the interviews. A review of AFIT, Wright State, Ohio State, and University of Dayton catalogs revealed a number of other cost analysis related subjects. This analysis resulted in the identification of twenty-seven subjects which were potential candidates for a cost analysis educational program. These subjects are listed below:

- | | |
|---------------------------------------|---------------------------------|
| 1. Basic Programming | 15. Managerial Statistics |
| 2. Calculus | 16. Matrices and Linear Algebra |
| 3. Cobol Programming | 17. Microeconomics |
| 4. Defense Production Management | 18. Production Management |
| 5. Federal Financial Management | 19. Quantitative Analysis |
| 6. Financial and Cost Accounting | 20. Quantitative Decisionmaking |
| 7. Fortran Programming | 21. Regression I |
| 8. Introductory Statistics | 22. Regression II |
| 9. Linear Mathematical Models | 23. R & D Management |
| 10. Macroeconomics | 24. Research Methods |
| 11. Mgt and Behavior in Organizations | 25. Seminar in Cost Analysis |
| 12. Management Information Systems | 26. Technical Communications |
| 13. Managerial Accounting | 27. Technological Forecasting |
| 14. Managerial Finance | |

Experienced Air Force cost analysts were asked to rate the twenty-seven subjects on a scale from one to five with one being "critical" to the job and five being "useless." The numbers two, three, and four

Interview Results

The interviews began during the latter weeks of February 1984 and were completed during the first week of March 1984. The nine interviews conducted ranged from thirty minutes to one hour in length. All of the individuals identified seemed interested in the research and were more than willing to participate. Each analyst interviewed was asked to identify educational requirements, based upon the general headings contained in the interview guide, that he felt were essential to the effective performance of an Air Force cost analyst. A number of subjects were discussed under each of the general headings, and the identification of these subjects was quite helpful in developing the questionnaire that followed. There were several subjects that were identified under the "OTHER TOPICS" area which were considered quite important and may have been otherwise overlooked.

Those subjects were:

- Logistics Management
- R & D/Systems Management
- Contract Administration/Acquisition Management
- Production Management
- Defense Contractor and Air Force Relations

Before mailing the respondents final questionnaire packages, a comparison was made between the questionnaire and the interview results. Engineering was a general area which was also identified as important, but none of those interviewed would identify any specific type of engineering as being more important than other types. An engineering background of a "general nature" was all that they would identify, insisting that such a background would be extremely helpful in communicating with engineers when making inquiries. Several individuals pointed out that it was good to have a cost analysis team with varied backgrounds to achieve a comprehensive

at Wright-Patterson Air Force Base. Five of the interviews were with individuals from Air Force Systems Command (AFSC), Aeronautical System Division's Cost Analysis Directorate (ASD/ACC). The other four were with individuals from Air Force Logistics Command (AFLC) Headquarter's Cost and Management Analysis Directorate (AFLC/ACM). These individuals were chosen for three reasons. First, both commands were represented by a significant number of highly experienced analysts, with experience levels ranging from four to twenty years. Second, the analysts possessed varied backgrounds with their formal education including everything from anthropology to physics. Also the extensive experiences of the those interviewed aided in establishing the comprehensiveness of the questionnaire. Third, the analysts from the two commands represented a contrast in viewpoints which was extremely useful in comparing opinions. Since many of the cost analysts in AFSC and AFLC are located at Wright-Patterson, the convenience in accessing the analysts was also a prime consideration.

It was decided that an interview guide would be useful in establishing the content of the questionnaire by helping to guide the discussion and act as a prompt to stimulate ideas during the interview. The interview guide consisted of a list of topic questions or areas identified through the literature review as being applicable to the cost analysis field. The expectation was that this guide would lead the analysts to identify omitted topics or areas of concern. This step was taken to insure that the questionnaire, which was the primary survey instrument, was adequately evaluated. In addition, the interview guide helped to minimize the potential influence that the researcher's attitudes, opinions and biases may have had on the analysts. Furthermore, the analysts were guaranteed anonymity to induce candid responses during the interviews. The full text of the interview guide is listed in Appendix A.

research questions identified in chapter one required solicitation of opinions from a population of nearly four hundred geographically dispersed cost analysts. Therefore, the questionnaire was the only practical means of acquiring the needed information. In order to develop and validate the content of the questionnaire, however, it was necessary to rely on the expert opinions of experienced cost analysts. Soliciting these opinions required a method of exchange which allowed free expression and crossflow of information between the researcher and the analyst. This could best be accomplished by means of a personal interview. Thus, it was necessary to explore the strengths and weaknesses of both the interview and the questionnaire process.

The primary strength of the questionnaire, as previously mentioned, is its versatility in gathering needed data. Questioning is the only way of getting information on private behavior, attitudes, or opinions. The questionnaire provides a fast, inexpensive, and convenient means for gathering information of interest to a researcher. The major criticism of the questionnaire is that it depends too heavily on written communication. The respondent has no means of getting feedback whenever he perceives a question as being either unclear or ambiguous.

Personal interviews lend themselves to original thought more readily than the structured format of the questionnaire. Furthermore, feedback is an integral part of the interview process. One major criticism of the personal interview is that it is very time consuming and therefore can only be used to reach a limited population. Another criticism is that it is too easy for the interviewer to inject his own beliefs, attitudes or biases into the interview process.

A series of nine interviews were conducted with selected cost analysts

II. Methodology

Introduction and Approach

The information requested by the research questions at the end of chapter one lends itself most appropriately to the interrogation process, or more commonly, the survey instrument. A survey is one of the most popular means of gathering data. Its popularity is directly attributable to its versatility, which is the greatest strength of a survey instrument. However, one of the major criticisms of the survey is that the respondent can intentionally give false or misleading answers. Another key criticism is the belief by most people that designing an interview or questionnaire is a simple task. This is hardly the case and is most likely the reason for much of the heavy criticism of survey results. (Emory, 1980:213-214).

Emory identifies two different modes for soliciting information. He identifies the personal mode as a "relationship between interviewer and interviewee," and the impersonal mode as "two-way communication" via a printed instrument (i.e., questionnaire). He also describes a combination of the two communication modes as a "mixed mode" (Emory, 1980:214-215).

Determining the appropriate communication mode for designing the survey instrument was the first task to be accomplished. Careful consideration of the information requirements led to adoption of both personal and impersonal modes of communicating with the respondents. When attributes or opinions are the item of interest to a researcher and the target population is fairly large and geographically widespread, the questionnaire is most often the only practical means of gathering needed data. Although alternative approaches may be possible, the expense and difficulty involved in pursuing these alternates can far outweigh the potential benefits of the information acquired (Emory, 1980:213-214). The

ments are also important to this research effort. In addition, the opinions of experienced analysts are solicited to ascertain the usefulness of AFIT PCE courses to the job performance of Air Force cost analysts. Finally, suggestions by experienced analysts for improving the educational competence of all Air Force cost analysts will be gathered and evaluated. Given these objectives the following research questions were explored:

1. What educational requirements do experienced Air Force cost analysts identify as being most useful to doing their job?
2. What methods of education do experienced Air Force cost analysts suggest for teaching requirements they identify as being most useful to doing their jobs?
3. How do experienced Air Force cost analysts rate cost analysis related courses in the AFIT PCE program in terms of their usefulness to job performance?
4. According to experienced Air Force cost analysts, how can the educational competence (adequate knowledge for job performance) be improved for all Air Force cost analysts?

will help to strengthen the professionalism of the estimating community (Dollars and Sense, 1984).

Another prime contribution to the professional development of the field of cost analysis is the AFIT cost analysis Education With Industry (EWI) program. This program was the result of an inquiry by General Slay, a formal commander of Air Force Systems Command (AFSC). The AFSC commander solicited the Boeing Company's interest in a program to expose senior field grade officers to management techniques used in the commercial environment. The present EWI program allows selected Air Force officers in the cost analysis specialty to be assigned to a contractors plant to experience first-hand the business practices of the commercial sector with hopes that they will improve the management practices of defense weapon systems acquisition (Temple, 1981:5).

There is also a master's degree program offered by AFIT. This program, which began in June of 1982, awards its graduates a master's degree in systems management with a concentration in cost analysis (Goven, 1983:11). This program also grants its military graduates an advanced degree identifier (i.e., IASA) which further documents the development of the cost analysis profession in addition to its primary purpose of controlling job assignments ("IASA" is merely a code identifying an academic specialty in cost analysis, it is not an acronym with a direct meaning).

Research Objectives/Questions

The objective of this research is to determine the educational requirements that experienced (at least four years in the cost analysis field) Air Force cost analysts identify as being most useful to job performance. The various methods for acquiring these educational require-

providing encouragement for continued professional education and starting a formal certification process, the PD program has become a milestone in the professional development of the cost and price analysis fields (Kankey, 1982:27,39). The certification process requires the completion of a total of eight courses in cost and price analysis. Four of the courses are core requirements and the other four are chosen from a list of several electives (Novak, 1982:41).

Many on-the-job training programs depend heavily on the Professional Continuing Education program offered by AFIT to supplement the training of new cost analysts. The Professional Designation in Cost Analysis program has its roots in the PCE program. Establishing a standard education plan for supplementing OJT programs may be a viable step towards standardizing the educational competence of cost analysts Air Force wide.

The Institute of Cost Analysis is also actively involved in a Certified Cost Analysis program. This program, which is designed to enhance the professional stature of cost and price analysts throughout the financial community, is by far the most essential function of the institute. The certification of both government and private sector analysts makes the certification process even more important to the more than 250 cost and price analysts who have received certificates acknowledging their many contributions to the professional development of the field of cost analysis (Goven, 1983:10). The National Estimating Society is another professional cost analysis organization which also offers a certification program. This program has awarded some 642 Certified Professional Estimator certificates to both private sector and government estimators. As of August 4, 1984 this program gives a written test to evaluate potential certificate recipients. This new objective evaluation

- * GS-501, Accounting Clerical
- * GS-1515, Operations Research Analyst (Goetsch, 1980:11)

or

- * GS-343, Management Analyst
- * GS-345, Program Analyst
- * GS-560, Budget Analyst (Temple, 1981:8)

It is quite evident that this lack of a common civilian cost analyst job series in the Air Force only complicates the issue of identifying educational requirements. Clarence Goetsch expressed his concern on the job series issue, but hastened to add that there were some pros and cons to be considered:

PROS: * It would insure that only qualified and experienced cost analysts could compete for cost jobs.

- * The cost analysis profession would not be officially recognized until job qualifications, education and experience requirements, and typical duties are standardized.

CONS: * It would deemphasize the multidisciplinary (financial, mathematical, science, and engineering) background needed for cost analysis.

- * The installation of a specialized series and standards for cost analysts limits the opportunity for intake and utilization of all other "multidiscipline" professional people (Goetsch, 1980:11).

It seems that until a common ground is established in the specification of job series and educational qualifications, the professionalism of all Air Force cost analysts will remain questionable.

In light of the concern for professionalism and standardization of education the establishment of a Professional Designation (PD) program in cost and price analysis has enhanced professional development within the field of cost analysis. This designation, which is offered by the Air Force Institute of Technology in conjunction with the Institute of Cost Analysis, was first implemented in August of 1981 (Kankey, 1982:27). By

be found in Air Force Regulation 36-1, Officer Air Force Speciality. The regulation identifies undergraduate specialization in business administration, economics, mathematics, engineering, statistics, or operations research with a minimum of twelve hours in accounting as "desirable" (AFR 36-1). There is no mention of whether the twelve hours of accounting should be quarter hours or semester hours. Also the use of the word "desirable" leads one to believe that there really are no stringent educational considerations other than the undergraduate degree required of all Air Force officers. In February 1984 a telephone interview with Captain Bill Pazeretsky, an Air Force personnel advisor for military cost analysts at the Air Force Military Personnel Center (AFMPC), confirmed beliefs in this area (Pazeretsky). The Air Force chooses its military costs analysts based upon a subjective evaluation of the records of potential analysts. This evaluation is performed by the Palace Dollar team, a group of AFMPC officers consisting of three military personnel advisors in the cost analysis field. Although mathematical and technical competence are key qualifications deemed desirable, there is no requirement for an academic background which satisfies these qualifications (Pazeretsky).

Air Force civilian cost analysts lack what little educational direction is provided to their military colleagues. Investigation revealed that there is no equivalent civil service regulation to Air Force regulation 36-1 which identifies the educational qualifications of civilian cost analysts. In fact there is no unique job series identification specifically for the civilian cost analyst. The Air Force places its civilian cost analysts in either of several job series:

* GS-301, Admin and Managerial Analyst

Although the papers relate the Army perspective on the issue, the direct application of this information to the sister services cannot be neglected. Everything from the history and definition of cost analysis to the first drafts of professional and qualification standards for cost analysts are included in this collection of papers (Allen, 1980). For anyone interested in the professional development of the cost analysis field this collection of papers is the most exhaustive compilation of cost analysis information encountered in all the literature reviewed by this research effort.

Careful review of existing literature which included a Defense Technical Information Center search (3 January 1984) and a Federal Legal Information through Electronics search (23 January 1984) yielded only a limited number of articles specifically addressing the educational qualifications of either commercial or Air Force cost analysts.

In one of the few articles discovered, Clarence H. Goetsch, a leading defense cost analyst, stated, "To my knowledge, no one has published an article in any magazine (military or civilian) on qualifications of a cost analyst (Goetsch, 1980:10)." Goetsch goes on to discuss the lack of information on cost analyst qualifications and how he believes the military cost analyst can be improved as a more valuable resource. He also mentions how his research of the business and scientific periodical indexes (from 1969 to 1979) and defense files revealed only one article on a cost analyst and his qualifications. This article, written by Admiral Rickover, raised many key questions on the qualifications of a cost analyst, but failed to provide any of the answers (Goetsch, 1980:10).

There is only a vague list of the educational qualifications for military officers entering the cost analysis specialty (674X). This list can

Sciences (SPSS) provided an efficient means for generating the necessary tables. The data was used to generate thirty-five contingency tables comparing the frequencies of ratings (of one to five) to educational methods (which consisted of fifteen possible outcomes), controlling for subject. This provided a possible seventy-five blocks in each of the thirty-five tables, however, most of the tables contained less than seventy-five blocks since the program only printed those rows and columns which actually contained data inputs on a given subject. These tables are included in Appendix C. A detailed discussion of the Crosstabs procedure and its general uses is presented in Statistical Package for the Social Sciences Second Edition (Nie and others, 1975:218-245).

The first research objective is to identify those subjects which should be included in a cost analysis educational program. This was accomplished by utilizing a decision rule which resulted from a careful consideration of possible distributions of responses across the usefulness rating. The median rating in conjunction with a restriction on the distribution of responses, is used to make a recommendation as to the value of a given subject. There are several possible recommendations.

Core. A core subject should be included as a mandatory requirement in a cost analysis educational program. A subject is identified as "core" when respondents universally indicated that the subject was very valuable. The recommendation that a subject be included in the core will be made whenever one of the following criteria is met:

1. At least 50 percent of the respondents felt the subject was extremely valuable, while less than 20 percent of the respondents expressed an opposing view.

Specific Criteria: Median category is 1 or 2.
Sum of responses in categories 4 and 5
combined is less than 20 percent.

2. Less than 50 percent but more than 30 percent felt the subject was extremely valuable, and 80 percent or more of the respondents felt the subject was at least valuable.

Specific Criteria: Median category is 3.
Sum of responses in categories 1 and 2 combined is at least 30 percent.
Sum of responses in categories 1, 2 and 3 combined is at least 70 percent.

In both situations the core recommendation is justified by the fact that the preponderance of the respondents identified the course as very valuable, and there was no significant countervailing opinion.

Elective. An elective should be included in a cost analysis educational program, but taken only when it is relevant to the analyst's particular job. This determination can best be made by the individual analyst and his supervisor. A subject is identified as an "elective" either when the respondents express a strong bipolar opinion concerning the value of a given subject, or when there are no strong opinions expressed at either end of the spectrum. The recommendation that a subject be included as an elective will be made whenever one of the following criteria is met:

3. At least 50 percent of the respondents felt the subject was at least valuable, yet at least 30 percent felt that the subject was of little or no value. This represents the case of the strong bipolar opinions.

Specific Criteria: Median category is 3.
Sum of responses in categories 4 and 5 is at least thirty percent.

4. While less than 50 percent of the respondents felt the subject was of value, at least 50 percent of the respondents felt it was at least valuable. Also less than 30 percent of the respondents felt the subject was extremely valuable and less than 30 percent of the respondents felt the subject was of little or no value. This represents the case of no significant extreme opinions.

Specific Criteria: Median category is 3, but the total responses in this category are less than 50 percent.
Sum of the responses in categories 4 and 5 combined is less than 30 percent.
Sum of the responses in categories 1 and 2 combined is also less than 30 percent.

The elective recommendation is justified by the fact that in both situations there is no strong opinion overwhelmingly in favor of establishing the subject as either very valuable, or of little or no value.

Excluded. An excluded subject should not be offered as part of a cost analysis educational program. The subject is not relevant to either the general nor the specific knowledge requirements of a cost analyst. A subject is identified as "excluded" when the preponderance of respondents indicate that it is of little or no value. The recommendation that a subject be excluded will be made whenever the following criteria is met:

5. At least 50 percent of the respondents identify the course as of little or no value, and less than 20 percent feel that it is very valuable.

Specific Criteria: Median category is 4 or 5.
Sum of the responses in categories 1 and 2 combined is less than 20 percent.

The distribution of opinions expressed by the respondents may not always be compatible with a single, unambiguous recommendation. Under these circumstances, a subject will receive a dual recommendation, with the primary recommendation stated first. An acceptable cost analysis educational program can be developed by following the primary recommendations. However, if resource constraints mandate that the program be reduced in scope, the core/elective subjects should first be downgraded to an elective status. If a further reduction is required, the elective/excluded subjects should then be eliminated. Any further reduction would result in an inadequate educational program. In the event that additional resources are available, primary priority should be given to expanding the program by adding the excluded/elective subjects. Secondary priority should be

given to upgrading the elective/core subjects to a mandatory status. Any additional attempt to expand or upgrade the program would represent an inefficient use of resources. The four possible dual recommendations and their criteria are:

Core/elective. A subject receives this recommendation whenever there is significant opposition to the majority opinion that the subject is extremely valuable, or when the majority feels that the subject is valuable, and the opinions at either extreme are insignificant. A "core/elective" recommendation is made when a subject meets the following criteria.

6. At least 50 percent of the respondents identify the subject as extremely valuable while a significant number of respondents indicate the subject as being of little or no value.

Specific Criteria: Median category is 1 or 2.
Sum of the responses in categories 4 and 5 combined is at least 20 percent but less than 30 percent.

7. At least 50 percent of respondents identify the subject as being of value, and neither extreme position received a significant representation.

Specific Criteria: The total responses in category 3 exceed 50 percent, making it the median category.
Sum of the responses in categories 1 and 2 is less than 30 percent and the sum of responses in categories 4 and 5 is less than 30 percent.

Elective/Core. A subject receives this recommendation whenever there is substantial opposition to the majority opinion that the subject is extremely valuable. An "elective/core" recommendation is made when the following criteria is met.

8. At least 50 percent of the respondents identify the subject as extremely valuable while a substantial number of the respondents indicate that the subject is of little or no value.

Specific Criteria: Median category is 1 or 2.
Sum of the responses in categories 4 and 5 combined is at least 30 percent.

Elective/excluded. A subject receives this recommendation whenever there

is a substantial opposition to the majority opinion that the subject is of little or no value. An "elective/excluded" recommendation is made when the following criteria is met.

9. At least 50 percent of respondents consider a subject to be of little or no value while a substantial number of the respondents indicate that the subject is extremely valuable.

Specific Criteria: Median category is 4 or 5.
Sum of the responses in categories 1 and 2 combined is at least 30 percent.

Excluded/elective. A subject receives this recommendation whenever there is a significant opposition to the majority opinion that the subject is of little or no value. An "excluded/elective" recommendation is made when the following criteria is met.

10. At least 50 percent of respondents consider the subject to be of little or no value while a significant number of the respondents indicate that the subject is extremely valuable.

Specific Criteria: Median category is 4 or 5.
Sum of the responses in categories 1 and 2 combined is at least 20 percent but less than 30 percent.

The list below summarizes the criteria used to identify the content of the recommended cost analysis educational program. The criteria incorporates the median rating and restrictions on the distribution of responses to establish the appropriate recommendation. The following decision criteria and recommendations apply:

<u>Recommendation</u>	<u>Criteria Number</u>	<u>Median Categories</u>	<u>Characteritics of the Distribution</u>
Core	1	1 or 2	Categories 4 and 5 = less than 20 percent.
	2	3	Categories 1 and 2 = at least 30 percent. Categories 1, 2 and 3 = at least 70 percent.

Elective	3	3	Categories 4 and 5 = at least 30 percent.
	4	3	Categories 1 and 2 = less than 30 percent. Categories 4 and 5 = less than 30 percent. Category 3 = less than 50 percent.
Excluded	5	4 or 5	Categories 1 and 2 = less than 20 percent.
Core/elective	6	1 or 2	Categories 1 and 2 = at least 20 percent but less than 30 percent.
	7	3	Categories 1 and 2 = less than 30 percent. Categories 4 and 5 = less than 30 percent. Category 3 = at least 50 percent
Elective/core	8	1 or 2	Categories 4 and 5 = at least 30 percent.
Elective/excluded	9	4 or 5	Categories 1 and 2 = at least 30 percent.
Excluded/elective	10	4 or 5	Categories 1 and 2 = at least 20 percent but less than 30 percent.

A second set of criteria, based primarily on the mode, was established to identify the appropriate educational method for teaching a particular subject. The mode is the educational method which received the greatest number of responses. However, it is possible for a distribution to have more than one mode. Furthermore, it is possible for some educational methods to receive a substantial number of responses and yet not qualify as a mode. To account for this phenomenon, three separate criteria were developed for identifying the preferred educational methods.

1. The educational method recommended by the highest percentage of respondents (mode) is identified as most preferred.
2. Educational methods recommended by a significant segment of the population (at least 30 percent) are also identified as preferred.

3. If the number of respondents recommending a particular educational method equals or exceeds 80 percent of the number of respondents favoring the mode, this method is also identified as preferred.

Respondents were permitted to recommend more than one educational method for any given subject. Therefore, the number of responses may exceed the number of respondents. Percentages reflect the proportion of respondents recommending a particular educational method for a given subject.

Consequently, these percentages may total to more than 100 percent.

If the recommendation was made that a subject be included in the "core", the opinion of all of the respondents was taken into account when identifying the preferred educational method since every cost analyst would be required to develop an acceptable level of competence in the "core" subject. However, if the recommendation was made that a subject be included as an "elective", only the opinions of those respondents who felt the subject was at least valuable were taken into account when identifying the preferred educational method. This was done in the expectation that only those respondents would attempt to develop competence in these subjects. Those respondents who indicated that the subject was of little or no use would probably forego the opportunity to take these subjects. Therefore, their opinions on the preferred educational method were ignored.

The final question addressing the issue of how to improve the educational competence of Air Force cost analysts was designed to provide each respondent with the opportunity to present his views on subjects not addressed in the structured portion of the questionnaire. These responses are recorded in Appendix B. The analysis of the questionnaire will conclude with a summary and analysis of these responses.

III. Analysis Results

Responses

Questionnaires were distributed to the total CONUS population of 386 Air Force cost analysts. However, only 239, or 62 percent, of the questionnaires distributed were returned. Seventy-five of the questionnaires returned were omitted from the analysis because the respondents did not meet the minimum requirement of at least four years experience in the cost analysis field. Another thirteen questionnaires were omitted because they were either returned blank or were not properly filled out. This left the number of useable questionnaires at 151. This amount was less than half (39 percent) of the number distributed, but it provided a reasonable sample for the subsequent analysis. Useable responses ranged across several commands with the bulk of respondents being from Air Force Systems Command (AFSC). This was expected since most of Air Force Cost Analysts are in AFSC.

Subject by Subject Analysis Results

The following analysis identifies each subject in the questionnaire and presents the relevant statistics on each. The criteria developed in chapter two are applied and appropriate recommendations are made concerning the content of the cost analysis educational program and the preferred educational methods. The number in parenthesis preceeding each subject represents the order in which the subject appears in the questionnaire. A description of the subject is provided in the questionnaire, located in appendix A. A detailed analysis of each subject follows:

(1) Financial and Cost Accounting. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	19.7	19.7	100.1
2	Extremely Useful	35.4	55.1	80.4
3	Useful	36.1	91.2	45.0
4	Of Little Use	8.2	99.4	8.9
5	Useless	0.7	100.1	0.7

Since the median category is 2, and the total percent of responses in categories 4 and 5 combined is 8.9 percent, this distribution satisfies criteria number 1. Therefore the recommendation is that this subject be included in the core.

The distribution of responses for the educational method for this recommendation is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	17.7
PCE	19.7
UG	75.5
GRAD	8.2

An undergraduate education is identified as the most preferred method for acquiring competence in this subject. No other educational method met remaining criteria.

(2) Managerial Accounting. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	25.0	25.0	100.0
2	Extremely Useful	38.5	63.5	75.0
3	Useful	28.4	91.9	36.5
4	Of Little Use	7.4	99.3	8.1
5	Useless	0.7	100.0	0.7

Since the median category is 2, and the total percent of responses in categories 4 and 5 combined is 8.1 percent, this distribution satisfies criteria number 1. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method for this recommendation is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	14.2
PCE	19.6
UG	61.5
GRAD	23.0

An undergraduate education is identified as the most preferred method for acquiring competence in this subject. No other educational method met the remaining criteria.

(3) Microeconomics. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u> <u>1 to 5</u>	<u>5 to 1</u>
1	Critical	6.3	6.3	100.1
2	Extremely Useful	15.3	21.6	93.8
3	Useful	52.1	73.7	78.5
4	Of Little Use	24.3	98.0	26.4
5	Useless	2.1	100.1	2.1

Since the total percent of responses in category 3 is 52.1 percent, the total percent of responses in categories 1 and 2 combined is 21.6 percent, and the total percent of responses in categories 4 and 5 combined is 26.4 percent, this distribution satisfies criteria number 7. The primary recommendation is that this subject be included in the core, and the secondary recommendation is that it be taught as an elective.

The distribution of responses for the educational method for each of the two recommendations is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS</u>	
	<u>CORE</u>	<u>ELECTIVE</u>
OJT	9.7	9.4
PCE	10.4	12.3
UG	77.8	75.5
GRAD	13.2	16.0

An undergraduate education is identified as the most preferred method for acquiring competence in this subject regardless of whether the subject was included in the educational program as a core requirement or as an elective. No other educational method met either of the two remaining criteria.

(4) Macroeconomics. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	13.7	13.7	100.1
2	Extremely Useful	27.4	41.1	86.4
3	Useful	42.5	83.6	59.0
4	Of Little Use	15.1	98.7	16.5
5	Useless	1.4	100.1	1.4

Since the median category is 3, the total percent of responses in categories 1 and 2 combined is 41.1 percent, and the total percent of responses in categories 1, 2 and 3 combined is 83.6 percent, this distribution satisfies criteria number 2. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method for this recommendation is.:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS</u>
	<u>CORE</u>
OJT	11.0
PCE	16.4
UG	66.4
GRAD	22.6

An undergraduate education is identified as the most preferred method for

acquiring competence in this subject. No other educational method met either of the two remaining criteria.

(5) Technological Forecasting. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	19.2	19.2	100.0
2	Extremely Useful	43.8	63.0	80.8
3	Useful	31.5	94.5	37.0
4	Of Little Use	4.1	98.6	5.5
5	Useless	1.4	100.0	1.4

Since the median category is 2, and the distribution of responses in categories 4 and 5 combined is 5.5 percent, this distribution satisfies criteria number 1. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method for this recommendation is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	19.2
PCE	52.1
UG	24.7
GRAD	28.8

PCE is identified as the most preferred method for acquiring competence in this subject. No other educational method met the remaining criteria.

(6) Federal Financial Management. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	30.1	30.1	99.9
2	Extremely Useful	34.9	65.0	69.8
3	Useful	30.8	95.8	34.9
4	Of Little Use	3.4	99.2	4.1
5	Useless	0.7	99.9	0.7

Since the median category is 2, and the total percent of responses in

categories 4 and 5 combined is 4.1 percent, this distribution satisfies criteria number 1. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method for this recommendation is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	32.9
PCE	70.5
UG	6.2
GRAD	6.2

PCE is identified as the most preferred method for acquiring competence in this subject. The criteria also identify OJT as an appropriate educational method.

(7) Managerial Finance. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u> <u>1 to 5</u>	<u>5 to 1</u>
1	Critical	4.8	4.8	100.0
2	Extremely Useful	22.1	26.9	95.2
3	Useful	44.8	71.7	73.1
4	Of Little Use	26.2	97.9	28.3
5	Useless	2.1	100.0	2.1

Since the median category is 3, the total percent of responses in category 3 is 44.8 percent, the total percent of responses in categories 1 and 2 combined is 26.9 percent, and the total percent of responses in categories 4 and 5 combined is 28.3 percent, this distribution satisfies criteria number 4. Therefore, the recommendation is that this subject be taught as an elective.

An undergraduate education is identified as the most preferred method for acquiring competence in this subject. No other educational method met the remaining criteria.

The distribution of responses for the educational method is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS ELECTIVE</u>
OJT	14.4
PCE	20.1
UG	58.7
GRAD	25.0

(8) Management and Behavior in Organizations. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE 1 to 5</u>	<u>5 to 1</u>
1	Critical	6.3	6.3	100.1
2	Extremely Useful	18.8	25.1	93.8
3	Useful	47.9	73.0	75.0
4	Of Little use	24.3	97.3	27.1
5	Useless	2.8	100.1	2.8

Since the median category is 3, the total percent of responses in category 3 is 47.9 percent, the total percent of responses in categories 1 and 2 combined is 25.1 percent, and the total percent of responses in categories 4 and 5 is 27.1 percent, this distribution satisfies criteria number 4. The recommendation is, teach this subject as an elective.

The distribution of responses for the educational method for this recommendation is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS ELECTIVE</u>
OJT	7.6
PCE	26.7
UG	50.5
GRAD	34.3

An undergraduate education is identified as the most preferred method for acquiring competence in this subject. The criteria also identify a graduate education as an appropriate method.

(9) Research and Development Management. The distribution of responses to the usefulness rating is:

Since the median category is 2, and the total percent of responses in categories 4 and 5 combined is 4.8 percent, this distribution satisfies criteria number 1. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method for this recommendation is:

EDUCATIONAL METHOD	PERCENT OF RESPONDENTS CORE
OJT	26.5
PCE	76.9
UG	10.9
GRAD	10.9

PCE is identified as the most preferred method for acquiring competence in this subject. No other educational method met the remaining criteria.

After applying the decision rules discussed in chapter two, all the subjects discussed in this section, except one, were recommended to be taught in a cost analysis educational program. This alone indicates that there is concern about the education of Air Force cost analysts. It is quite evident that some action is required to improve the educational competence of Air Force cost analysts. The next section evaluates the current Professional Continuing Education (PCE) program offered to Air Force cost and price analysts to determine the usefulness of these courses to current analysts.

Rating of AFIT PCE Courses

This section describes the usefulness ratings given to existing AFIT PCE courses related to cost analysis. A detailed description of the courses in this section is provided in the questionnaire in Appendix A. The course name and number as it appears in the questionnaire is used to identify the eight courses in this section.

(26) Quantitative Decisionmaking. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	8.3	8.3	100.2
2	Extremely Useful	35.9	44.2	91.9
3	Useful	36.6	80.8	56.0
4	Of Little Use	16.6	97.4	19.4
5	Useless	2.8	100.2	2.8

Since the median category is 3, the total percent of responses in categories 1 and 2 combined is 44.2 percent, and the total percent of responses in categories 1, 2 and 3 combined is 80.8 percent, this distribution satisfies criteria number 2. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method for this recommendation is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	8.3
PCE	28.3
UG	46.2
GRAD	39.3

An undergraduate education is identified as the most preferred method for acquiring competence in this subject. The criteria also identify a graduate education as an appropriate method.

(27) Seminar in Cost Analysis. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	43.5	43.5	100.0
2	Extremely Useful	40.1	83.6	56.5
3	Useful	11.6	95.2	16.4
4	Of Little Use	4.1	99.3	4.8
5	Useless	0.7	100.0	0.7

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	27.2
PCE	38.1
UG	52.4
GRAD	10.9

An undergraduate education is identified as the most preferred method for acquiring competence in this subject. The criteria also identify PCE as an appropriate method.

(25) Research Methods. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE 1 to 5</u>	<u>5 to 1</u>
1	Critical	24.0	24.0	100.1
2	Extremely Useful	45.2	69.2	76.1
3	Useful	24.0	93.2	30.9
4	Of Little Use	6.2	99.4	6.9
5	Useless	0.7	100.1	0.7

Since the median category is 2, and the total percent of responses in categories 4 and 5 combined is 6.9 percent, this distribution satisfies criteria number 1. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method for this recommendation is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	22.6
PCE	42.5
UG	43.8
GRAD	19.2

The mode identified an undergraduate education as the preferred method for acquiring competence in this subject. The criteria also identify PCE as an appropriate method.

Since the median category is 1, and the total percent of responses in categories 4 and 5 combined is 2.8 percent, this distribution satisfies criteria number 1. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method for this recommendation is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	17.1
PCE	56.2
UG	37.0
GRAD	26.0

PCE is identified as the most preferred method for acquiring competence in this subject. The criteria also identify an undergraduate education as an appropriate method.

(24) Technical Communications. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	34.0	34.0	100.0
2	Extremely Useful	38.8	72.8	66.0
3	Useful	21.1	93.9	27.2
4	Of Little Use	6.1	100.0	6.1
5	Useless	0.0	100.0	0.0

Since the median category is 2, and the total percent of responses in categories 4 and 5 combined is 6.1 percent, this distribution satisfies criteria number 1. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method for this recommendation is:

An undergraduate education is identified as the most preferred method for acquiring competence in this subject. The criteria also identify PCE as an appropriate method.

(22) Regression II. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	29.9	29.9	100.0
2	Extremely Useful	35.4	65.3	70.1
3	Useful	25.0	90.3	34.7
4	Of Little Use	9.7	100.0	9.7
5	Useless	0.0	100.0	0.0

Since the median category is 2, and the total percent of responses in categories 4 and 5 combined is 9.7 percent, this distribution satisfies criteria number 1. Therefore the recommendation is that this subject be included in the core.

The distribution of responses for the educational method is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	6.9
PCE	43.8
UG	42.4
GRAD	34.0

PCE is identified as the most preferred method for acquiring competence in this subject. However, both undergraduate and graduate education are also identified by the criteria as appropriate methods.

(23) Quantitative Analysis. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	57.5	57.5	100.0
2	Extremely Useful	27.4	84.9	42.5
3	Useful	12.3	97.2	15.1
4	Of Little Use	2.1	99.3	2.8
5	Useless	0.7	100.0	0.7

categories 4 and 5 combined is 7.6 percent, this distribution satisfies criteria number 1. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	6.2
PCE	32.2
UG	57.5
GRAD	28.8

An undergraduate education is identified as the most preferred method for acquiring competence in this subject. The criteria also identify PCE as an appropriate method.

(21) Regression I. The distribution of response to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	41.4	4.4	100.0
2	Extremely Useful	36.6	78.0	58.6
3	Useful	17.9	95.9	22.0
4	Of Little Use	3.4	99.3	4.1
5	Useless	0.7	100.0	0.7

Since the median category is 2, and the total percent of responses in categories 4 and 5 combined is 4.1 percent, this distribution satisfies criteria number 1. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational methods for this recommendation is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	7.6
PCE	44.8
UG	55.9
GRAD	22.8

(19) Introductory Statistics. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	37.0	37.0	100.0
2	Extremely Useful	35.6	72.6	63.0
3	Useful	21.2	93.8	27.4
4	Of Little Use	5.5	99.3	6.2
5	Useless	0.7	100.0	0.7

Since the median category is 2, and the total percent of responses in categories 4 and 5 combined is 6.2 percent, this distribution satisfies criteria number 1. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method for this recommendation is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	7.5
PCE	20.5
UG	84.9
GRAD	10.3

An undergraduate education is indentified as the most preferred method for acquiring competence in this subject. No other educational method met remaining criteria.

(20) Managerial Statistics. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	32.2	32.2	100.1
2	Extremely Useful	41.8	74.0	67.9
3	Useful	18.5	92.5	26.1
4	Of Little Use	6.2	98.7	7.6
5	Useless	1.4	100.1	1.4

Since the median category is 2, and the total percent of responses in

Since the median category is 3, the total percent of responses in categories 1 and 2 combined is 39.6 percent, and the total percent of responses in categories 1, 2 and 3 combined is 82.7 percent, this distribution satisfies criteria number 2. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method for this recommendation is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	23.6
PCE	41.0
UG	56.3
GRAD	5.6

An undergraduate education is identified as the most preferred method for acquiring competence in this subject. The criteria also identify PCE as an appropriate method.

(18) COBOL Programming. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	0.0	0.0	100.0
2	Extremely Useful	11.1	11.1	100.0
3	Useful	38.5	49.6	88.9
4	Of Little Use	43.0	92.6	50.4
5	Useless	7.4	100.0	7.4

Since the median category is 4, and the total percent of responses in categories 1 and 2 combined is 11.1 percent, this distribution satisfies criteria number 5. Therefore, the recommendation is that this subject be excluded.

The distribution of responses for the educational method for this recommendation are not considered because this subject should not be included in a cost analysis education program.

(16) FORTTRAN Programming. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	3.5	3.5	100.0
2	Extremely Useful	14.1	17.6	96.5
3	Useful	48.6	66.2	82.4
4	Of Little Use	28.9	95.1	33.8
5	Useless	4.9	100.0	4.9

Since the median category is 3, and the total percent of responses in categories 4 and 5 combined is 33.8 percent combined, this distribution satisfies criteria number 3. Therefore, the recommendation is that this subject be taught as an elective.

The distribution of responses for the educational method for this recommendation is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS ELECTIVE</u>
OJT	16.0
PCE	41.5
UG	60.6
GRAD	5.3

An undergraduate education is identified as the most preferred method for acquiring competence in this subject. The criteria also identify PCE as an appropriate method.

(17) Basic Programming. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	6.3	6.3	100.1
2	Extremely Useful	33.3	39.6	93.8
3	Useful	43.1	82.7	60.5
4	Of Little Use	15.3	98.0	17.4
5	Useless	2.1	100.0	2.1

EDUCATIONAL
METHOD

PERCENT OF RESPONDENTS
ELECTIVE

OJT	2.1
PCE	12.8
UG	87.2
GRAD	13.8

An undergraduate education is identified as the most preferred method for acquiring competence in this subject. No other educational method met the remaining criteria.

(15) Linear Mathematical Models. The distribution of responses to the usefulness rating is:

CATEGORY	RATING	PERCENT RESPONSE	CUMULATIVE PERCENT RESPONSE	
			1 to 5	5 to 1
1	Critical	13.0	13.0	100.0
2	Extremely Useful	34.9	47.9	87.0
3	Useful	30.8	78.7	52.1
4	Of Little Use	19.2	97.9	21.3
5	Useless	2.1	100.0	2.1

Since the median category is 3, the total percent of responses to categories 1 and 2 combined is 47.9 percent, and the total percent of responses to categories 1, 2 and 3 combined is 78.7 percent, this distribution satisfies criteria number 2. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method for this recommendation is:

EDUCATIONAL
METHOD

PERCENT OF RESPONDENTS
CORE

OJT	11.0
PCE	28.1
UG	61.0
GRAD	24.0

An undergraduate education is identified as the most preferred method for acquiring competence in this subject. No other educational method met the remaining criteria.

Since the median category is 3, the total percent of responses in categories 1 and 2 is 37.6 percent and the total percent of responses in categories 1, 2 and 3 combined is 74.6 percent, this distribution of responses satisfies criteria number 2. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method for this recommendation is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	6.2
PCE	15.8
UG	80.8
GRAD	12.3

An undergraduate education is identified as the most preferred method for acquiring competence in this subject. No other educational method met the remaining criteria.

(14) Calculus. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	5.6	5.6	100.1
2	Extremely Useful	21.0	26.6	94.5
3	Useful	39.2	65.8	73.5
4	Of Little Use	29.4	95.2	34.3
5	Useless	4.9	100.1	4.9

Since the median category is 3, and the total percent of responses in categories 4 and 5 combined is 34.3 percent, this distribution satisfies criteria number 3. Therefore, the recommendation is that this subject be taught as an elective.

The distribution of responses for the educational method for this recommendation is:

Both PCE and an undergraduate education were recommended as appropriate methods for acquiring competence in this subject whether it was included in the core or taught as an elective. However, the recommendations in each case were based on different criteria.

(12) Defense Production Management. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	13.8	13.8	100.1
2	Extremely Useful	33.1	46.9	86.3
3	Useful	35.9	82.8	53.2
4	Of Little Use	15.2	98.0	17.3
5	Useless	2.1	100.1	2.1

Since the median category is 3, and the total percent of responses in categories 1, 2 and 3 combined is 82.8 percent, this distribution satisfies criteria number 2. The recommendation is that this subject be in the core.

The distribution of responses for the educational method is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	35.9
PCE	66.2
UG	6.9
GRAD	4.8

PCE is identified as the most preferred method for acquiring competence in this subject. The criteria also identify OJT as an appropriate method.

(13) Matrices and Linear Algebra. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	12.3	12.3	100.0
2	Extremely Useful	25.3	37.6	87.7
3	Useful	37.0	74.6	62.4
4	Of Little Use	23.3	97.9	25.4
5	Useless	2.1	100.0	2.1

The distribution of responses for the educational method for this recommendation is:

EDUCATIONAL METHOD	PERCENT OF RESPONDENTS	
	CORE	
OJT	33.1	
PCE	41.2	
UG	31.1	
GRAD	20.9	

PCE is identified as the most preferred method for acquiring competence in this subject. The criteria also identify OJT and an undergraduate education as preferred methods.

(11) Production Management. The distribution of responses to the usefulness rating is:

CATEGORY	RATING	PERCENT RESPONSE	CUMULATIVE PERCENT RESPONSE	
			1 to 5	5 to 1
1	Critical	6.9	6.9	100.0
2	Extremely Useful	22.8	29.7	93.1
3	Useful	50.3	80.0	70.3
4	Of Little use	17.2	97.2	20.0
5	Useless	2.8	100.0	2.8

Since the total number of responses in category 3 is 50.3 percent, the total percent of responses in categories 1 and 2 combined is 29.7 percent, and the total percent of responses in categories 4 and 5 is 20.0 percent, this distribution satisfies criteria number 7. Therefore, the primary recommendation is that this subject be included in the core, and the secondary recommendation is that it be taught as an elective.

The distribution of responses for the educational method for each of the two recommendations is:

EDUCATIONAL METHOD	PERCENT OF RESPONDENTS	
	CORE	ELECTIVE
OJT	25.5	23.3
PCE	33.8	37.1
UG	35.9	36.2
GRAD	22.8	25.0

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	15.6	15.6	100.1
2	Extremely Useful	21.8	37.4	84.5
3	Useful	46.3	83.7	62.7
4	Of Little use	15.0	98.7	16.4
5	Useless	1.4	100.1	1.4

Since the median category is 3, the total percent of responses in categories 1 and 2 combined is 37.4 percent, and the total percent of responses in categories 1, 2 and 3 combined is 83.7, this distribution satisfies criteria number 2. Therefore, the recommendation is that this subject be included in the core.

The distribution of responses for the educational method is:

<u>EDUCATIONAL METHOD</u>	<u>PERCENT OF RESPONDENTS CORE</u>
OJT	35.4
PCE	63.3
UG	2.7
GRAD	10.9

PCE is identified as the most preferred method for acquiring competence in this subject. The criteria also identify OJT as an appropriate method.

(10) Management Information Systems. The distribution of responses to the usefulness rating is:

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	14.9	14.9	100.1
2	Extremely Useful	39.2	54.1	85.2
3	Useful	33.1	87.2	46.0
4	Of Little Use	11.5	98.7	12.9
5	Useless	1.4	100.1	1.4

Since the median category is 2, and the total percent of responses in categories 4 and 5 is 12.9 percent, this distribution satisfies criteria number 1. Therefore, the recommendation is that this subject be included in the core.

For every course evaluated, the distribution of responses has a median category of 2, and the total percent of responses in categories 4 and 5 combined is less than 20 percent, which satisfies criteria number 1.

Therefore, it is recommended that every course be included in the core.

The distribution of responses to the usefulness rating for each course is:

(28) QMT 170 Principles of Contract Pricing.

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	21.2	21.2	99.9
2	Extremely Useful	43.8	65.0	78.7
3	Useful	28.1	93.1	34.9
4	Of Little Use	6.8	99.9	6.8
5	Useless	0.0	99.9	0.0

(29) QMT 345 Introductory Quantitative Analysis.

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	39.7	39.7	100.0
2	Extremely Useful	42.5	82.2	60.3
3	Useful	15.1	97.3	17.8
4	Of Little Use	2.7	100.0	2.7
5	Useless	0.0	100.0	0.0

(30) QMT 550 Advanced Quantitative Methods.

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	27.6	27.6	100.0
2	Extremely Useful	39.3	66.9	72.4
3	Useful	24.1	91.0	33.1
4	Of Little Use	9.0	100.0	9.0
5	Useless	0.0	100.0	0.0

(31) QMT 551 Advanced Cost and Economic Analysis.

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	23.2	23.2	99.9
2	Extremely Useful	42.3	65.5	76.7
3	Useful	24.6	90.1	34.4
4	Of Little Use	7.0	97.1	9.8
5	Useless	2.8	99.9	2.8

(32) QMT 180 Learning Curve Analysis.

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	39.6	39.6	100.1
2	Extremely Useful	30.6	70.2	60.5
3	Useful	22.9	93.1	29.9
4	Of Little Use	4.9	98.0	7.0
5	Useless	2.1	100.1	2.1

(33) QMT 353 Introduction to Life Cycle Cost Management.

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	19.0	19.0	100.0
2	Extremely Useful	45.8	64.8	81.0
3	Useful	31.0	95.8	35.2
4	Of Little Use	3.5	99.3	4.2
5	Useless	0.7	100.0	0.7

(34) QMT 540 Advanced Pricing Methods.

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	14.2	14.2	100.0
2	Extremely Useful	36.2	50.4	85.8
3	Useful	39.0	89.4	49.6
4	Of Little Use	9.9	99.3	10.6
5	Useless	0.7	100.0	0.7

(35) SYS 362 Cost Schedule Control System Criteria.

<u>CATEGORY</u>	<u>RATING</u>	<u>PERCENT RESPONSE</u>	<u>CUMULATIVE PERCENT RESPONSE</u>	
			<u>1 to 5</u>	<u>5 to 1</u>
1	Critical	22.7	22.7	100.0
2	Extremely Useful	34.0	56.7	77.3
3	Useful	36.2	92.9	43.3
4	Of Little Use	7.1	100.0	7.1
5	Useless	0.0	100.0	0.0

Written Comments

There were a number of written comments received in answer to the open-ended question at the end of the questionnaire. This question asked the respondent to briefly describe how they thought the educational competence of all Air Force cost analysts could be improved. The comments centered around five general areas of concern, each of which will be individually analyzed.

The qualifications, or lack thereof, of people entering the field was a major concern of many of the respondents. Three deficiencies were identified which, if corrected, would greatly enhance the proficiency of the work force. First, an undergraduate degree in a quantitative discipline should be a prerequisite for entering the cost analysis career field. Not only would the curriculum include many of the techniques required of a cost analyst, but possession of the degree also indicates that the individual has the capacity to learn new techniques as required. Second, every analyst should have a strong math background. Math represents both the language and the foundation of quantitative analysis. Without a math background, an analyst's ability to expand his knowledge is severely limited. Finally, an analyst needs to know something about the technical and engineering aspects of the systems he is estimating. This knowledge provides him with a viable tool for understanding the complex relationship between technical specifications and resource requirements. This qualification also requires that the analyst specialize in estimating certain categories of systems.

OJT provides the opportunity to apply newly learned techniques to real world problems and acquire the experience which separates the apprentice

from the senior analyst. Many of the respondents felt that OJT was absolutely necessary for an analyst to become fully qualified. However, the haphazard approach to OJT was highly criticized. Again, three problems were identified which resulted in poor OJT programs. First, many respondents complained of a lack of formal OJT programs. Where the programs existed, many lacked a comprehensive plan which identified specific educational goals. Consequently, the lack of a program or a specific plan resulted in many deficiencies among Air Force cost analysts. Second, educational goals were seldom accomplished in a systematic manner over a reasonable period of time because of conflicting job requirements. This failure is frequently masked by the absence of a formal OJT program. Instead of assigning work to create opportunities for accomplishing educational goals, immediate job requirements determined work assignments without regard for their value to the OJT program. Finally, a good OJT program requires that a qualified individual spend time working with the trainee in an instructor role. Frequently, the workload of a qualified analyst leaves him little time to spend instructing a trainee. Also, many qualified analysts lack the skills necessary to effectively communicate in their role as an instructor. Consequently, the trainee is frequently given the responsibility to train himself.

Respondents also made several observations concerning the PCE program. A general category of complaints centered around the availability of course offerings. The lack of ability to send the right person to the right course at the right time was a major concern. This problem addresses the issue of frequency of course offerings, the schedule of offerings, and the quota system for allocating student slots. This problem, while important, goes beyond the scope of this research. Many respondents also expressed

the need for recurring continuing education to gain periodic exposure to new developments and techniques and to share experiences with other senior analysts. Annual attendance was recommended by most respondents.

Many of the respondents seem to believe that PCE courses should address only those skills or knowledge specifically required to perform the job to which the analyst is assigned. This belief was reflected in the recommendations that courses should be structured around specific job requirements, that separate courses should be developed to present the operating command versus systems command perspective, and that analysts should be taught only the basic techniques early in their career while the more advanced techniques should be taught as needed. There was also an expressed concern that the courses should concentrate on "real world" applications, with an emphasis on case studies, as opposed to "theory".

A key issue which dismayed a number of respondents was the professionalism of Air Force cost analysts. They identified having a broad perspective as one of the key characteristics of a professional, and seemed convinced that a narrow job focus limited the ability of an analyst to perform complex estimating tasks. Consequently, they recommended free exchange of ideas and periodic job rotation as means for enhancing the professional development of the analyst. Another concern has to do with the lack of mandatory qualifications which must be met before an individual is recognized as a fully qualified cost analyst. The only prerequisite for a military cost analyst is that he spend 18 months on the job. The lack of a cost analysis civilian career field means that there are no established qualifications for identifying qualified civilian cost analysts. Respondents suggested that mandatory PCE courses and/or professional certification should be required before a cost analyst is recognized as fully

qualified. A final concern is that there is an inadequate career progression. For the military, the lack of a reasonable number of high grade positions forces the analyst to leave the cost analysis career field upon being promoted. For the civilian, career progression is not as significant a problem. However, the establishment of a distinct civilian cost analysis career field was still considered desirable in order to enhance the professional status of the analysts.

Throughout all of the comments, one idea consistently emerged as a central theme. None of the problems identified in this research are going to be solved without a direct and concerted effort on the part of management. This means that management must recognize the importance of developing a career cost analyst to his fullest potential and be prepared to make the decisions necessary to achieve that goal. The long term benefits to the Air Force exceed the short term costs incurred by the supervisor for participating in this effort.

IV. Conclusions/Recommendations

This research had the objective of identifying the educational requirements that experienced Air Force cost analysts thought were most useful for adequate job performance. An objective evaluation of the mail survey utilizing the decision rules in chapter two resulted in the following Air Force cost analyst educational requirements list, presented by each educational method. In the lists that follow the number contained in the parentheses signifies the order in which the subject appeared in the questionnaire. The "*" identifies those subjects recommended to be taught by more than one method.

Those subjects identified to be taught by OJT are listed below:

Core:

1. Federal Financial Management (6)*
2. Research and Development Management (9)*
3. Management Information Systems (10)*
4. Defense Production Management (12)*

Those subjects identified to be taught by PCE are listed below:

Core:

1. Technological Forecasting (5)
2. Federal Financial Management (6)*
3. Research and Development Management (9)*
4. Management Information Systems (10)*
5. Defense Production Management (12)*
6. Basic Programming (17)*
7. Managerial Statistics (20)*
8. Regression I (21)*
9. Regression II (22)*
10. Quantitative Analysis (23)*
11. Technical Communications (24)*
12. Research Methods (25)*
13. Seminar in Cost Analysis (27)

Core/elective:

14. Production Management (11)*

Elective:

15. FORTRAN Programming (16)*

Those subjects identified to be taught as part of an undergraduate degree program are listed below:

Core:

1. Financial and Cost Accounting (1)
2. Managerial Accounting (2)
3. Macroeconomics (4)
4. Management Information Systems (10)*
5. Matrices and Linear Algebra (13)
6. Linear Mathematical Models (15)
7. Basic Programming (17)*
8. Introductory Statistics (19)
9. Managerial Statistics (20)*
10. Regression I (21)*
11. Regression II (22)*
12. Quantitative Analysis (23)*
13. Technical Communications (24)*
14. Research Methods (25)*
15. Quantitative Decisionmaking (26)*

Core/elective:

16. Microeconomics (3)
17. Production Management (11)*

Elective:

18. Managerial Finance (7)
19. Management and Behavior in Organizations (8)*
20. Calculus (14)
21. FORTRAN Programming (17)*

Those subjects identified to be taught as part of a graduate program are listed below:

Core:

1. Regression II (22)*
2. Quantitative Decisionmaking (26)*

Elective:

3. Management and Behavior in Organizations (8)*

Some subjects were recommended for more than one educational method. Only one subject had a median usefulness rating of one (Quantitative Analysis).

Also, only one subject was not recommended to be taught (COBOL Programming).

AFIT cost analysis related PCE courses were also evaluated for their usefulness to experienced cost analysts. The recommendation was that all of the existing PCE courses be included as mandatory requirements in the cost analysis PCE program. These courses are listed below:

1. QMT 170 Principles of Contract Pricing (28)
2. QMT 345 Introductory Quantitative Analysis (29)
3. QMT 550 Advanced Quantitative Methods (30)
4. QMT 551 Advanced Cost and Economic Analysis (31)
5. QMT 180 Learning Curve Analysis (32)
6. QMT 353 Introduction to Life Cycle Cost Management (33)
7. QMT 540 Advanced Pricing Methods (34)
8. SYS 362 Cost Schedule Control System Criteria (35)

Written comments included in the questionnaire centered around the issues of qualifications for cost analysts, OJT programs, PCE programs and course content, professionalism of the work force, and the need for management attention to these problems.

The educational requirements listed above can be used by Air Force military and civilian cost analyst career managers for evaluating potential analysts, for judging the promotion potential of current analysts, for evaluating current analysts for future assignments, and for evaluating a current analyst's need or request for higher education. The requirements can also be used by the analysts themselves for guiding their education and professional development. In addition, those who actually train and supervise the analysts can use the list as an aid for instituting an on-the-job training (OJT) program, tailoring the list to job specific needs.

The list can also be used by AFIT and other institutions of higher learning for evaluating the appropriateness of existing cost analysis educational programs. The number of courses suggested as PCE indicates that AFIT should consider expanding their existing PCE program. The data

suggest that this is a preferred method for improving current cost analysis education. Finally the list may be used to explore the need for an undergraduate cost analysis program. This idea of an undergraduate cost analysis curriculum may be a worthwhile pursuit in light of the substantial number of subjects recommended to be taught at the undergraduate level. The institution of an undergraduate program at the Air Force Academy and/or at the Air Force Institute of Technology is a thought well worth investigating since the Air Force has more influence at these institutions than it would at convincing any civilian university to carry such a program.

Recommendations for Further Research

The cost analysis field is fairly new, and interest in the field is growing daily. Further research to either develop a formal Air Force cost analyst OJT program or a detailed evaluation of the feasibility of an undergraduate cost analysis curriculum would be areas of study invaluable to the field. Also an investigation into the means used to acquire Air Force cost analysts and the policies used to evaluate the adequacy of those potential analysts may well be worth exploring. Finally a comparison of worker attitudes for and against a unique job series for Air Force civilian cost analysts will too be a subject of considerable importance to all Air Force cost analysts. The cost analysis field is wide open for research, and hopefully this effort will not be the last to examine the educational development or for that matter, any development within the field.

Appendix A: Interview Guide and Questionnaire

Interview Guide

NAME:

DATE:

ORGANIZATION/POSITION:

EXPERIENCE (in terms of years, positions held, formal education):

PURPOSE OF INTERVIEW: This is a thesis research effort to determine the educational requirements that are necessary for an Air Force cost analyst to perform his job effectively.

CONSIDERING THE FOLLOWING EDUCATIONAL CATEGORIES, WHAT TOPICS, CONCEPTS, OR TECHNIQUES SHOULD A COST ANALYST KNOW:

MATH (i.e. matrix algebra, differential/integral calculus, etc.)

STATISTICS (i.e. probability theory, interval estimates, etc.)

OPERATIONS RESEARCH/MANAGEMENT SCIENCE (linear programming, queuing theory, decision theory, etc.)

ACCOUNTING/FINANCE (inventory costing, depreciation methods, congressional budget process, profitability, liquidity etc.)

ECONOMICS (microeconomics/macroeconomics: time value of money, discounting, rates of return, etc.)

COMPUTER SCIENCE (basic, fortran, cobol, information systems, etc.)

MANAGEMENT (management by objective, goal setting, various contemporary theories of management, etc.)

TECHNICAL COMMUNICATIONS (writing skills, oral skills, style and format in technical communications, etc.)

ENGINEERING (evaluation of design drawings, interpreting military specifications, etc.)

VARIOUS OTHER TOPICS OF USE TO AIR FORCE COST ANALYSTS

UNDERGRADUATE DEGREE PREFERENCES FOR COST ANALYSTS

APPLICATION OF AFIT PCE COURSES TO JOBS AND OJT PLANS



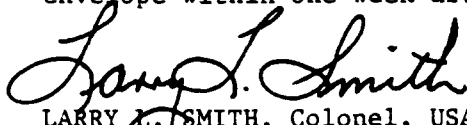
DEPARTMENT OF THE AIR FORCE
AIR FORCE INSTITUTE OF TECHNOLOGY (AU)
WRIGHT-PATTERSON AIR FORCE BASE, OH 45433

1 JUN 1984

REPLY TO
ATTN OF LSA (AFIT/GSM/LSY/84S-24)/Lieutenant Phillip Perry/AUTOVON 785-7212
SUBJECT Air Force Cost Analyst Educational Requirements Survey

to Experienced Air Force Cost Analysts

1. The attached questionnaire was prepared by a graduate student at the Air Force Institute of Technology, Wright-Patterson AFB, OH. The purpose of the questionnaire is to acquire data concerning an experienced Air Force cost analyst's perception of his job and the educational requirements that he identifies as necessary to adequately perform that job.
2. You are requested to provide an answer or comment for each question. Headquarters USAF Survey Control Number 84-42 has been assigned to this questionnaire. Your participation in this research is voluntary.
3. Your responses to the questions will be held confidential. Please remove this cover sheet before returning the completed questionnaire. Your cooperation in providing this data will be appreciated and will be very beneficial in examining the adequacy of Air Force cost analysis education efforts. Please return the completed questionnaire in the attached envelope within one week after receipt.


LARRY L. SMITH, Colonel, USAF
Dean
School of Systems and Logistics

- 2 Atch
1. Questionnaire
2. Return Envelope



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C

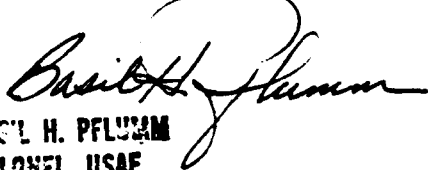
REPLY TO
ATTN OF ACM

1 JUN 1984

SUBJECT Completing Air Force Survey 84-42, Cost Analysis Education Requirements in the Air Force

TO Experienced Air Force Cost Analysts

1. I would like you to complete the attached survey (84-42) of Air Force cost analysts to support our research into the education requirements for cost analysts. You were selected to complete this survey because your records show you have experience either as a cost analyst or in a closely related field. Your personal experience and insight into what we need in the future is valuable information. I appreciate your voluntary participation in this research effort; your responses will be held confidential.
2. This research is being conducted by Phil Perry, a graduate student in cost analysis at the Air Force Institute of Technology. The purpose of the survey is to gather opinions from experienced analysts like yourself as to what is needed to become an effective cost analyst. The results of his research will be published in September, 1984, as part of his thesis on education requirements for Air Force cost analysts.
3. This is your opportunity to impact the future of cost analysis in the Air Force. If you chose to participate in this research effort please answer each question thoughtfully, detach it from this letter, and return it in the envelope provided. If you chose not to answer the survey return the survey package in the envelope.
4. Respond to this survey quickly (this week) as it affects Lt Perry's thesis effort. He cannot start his analysis until he receives your data input. You may address questions and surveys to Lt Phil Perry (AV 785-7212) AFIT/LSY (84S-24), Wright-Patterson AFB OH 45433.


BASIL H. PFLAUM
COLONEL, USAF
Director of Cost and
Management Analysis

- 2 Atch
1. Survey of Cost Analysts
 2. Return Envelope

PRIVACY ACT STATEMENT

In accordance with paragraph 8, AFR 12-35, the following information is provided as required by the Privacy Act of 1974:

a. Authority:

- (1) 5 U.S.C. 301, Departmental Regulations; and/or
- (2) 10 U.S.C. 8012, Secretary of the Air Force, Powers, Duties, Delegation by Compensation; and/or
- (3) DOD Instruction 1100.13, 17 Apr 68, Surveys of Department of Defense Personnel; and/or
- (4) AFR 30-23, 22 Sep 76, Air Force Personnel Survey Program.

b. Principal purposes. The survey is being conducted to collect information to be used in research aimed at illuminating and providing inputs to the solution of problems of interest to the Air Force and/or DOD.

c. Routine uses. The survey data will be converted to information for use in research of management related problems. Results of the research, based on the data provided, will be included in written master's theses and may also be included in published articles, reports, or texts. Distribution of the results of the research, based on survey data, whether in written form or presented orally, will be unlimited.

d. Participation in this survey is entirely voluntary.

e. No adverse action of any kind may be taken against any individual who elects not to participate in any or all of this survey.

"Basic courses are generally good - if you can get to them. While recognize budget constraints are limited when all too often emphasis is put on letting the new military member go at the expense of continuing development of the civilian member of the team. We've definitely been made aware that we are second class citizens although we carry on the major portion of the load. This is one cost analyst that is tired of paying for my education. Course in all the years at government expense is ridiculous. You can't even get time off for professional seminars unless you take leave. Those I don't mind paying for but why leave?"

"Applications of a sound professional continuing education program needs to be enforced."

We need a cost estimating handbook."

"Establish a thorough interdisciplinary OJT program for C/SCSC cost analysts, estimator cost analysts, price analysts, & budget analysts. Knowing each other's discipline would increase cross-feed of information that is valuable and relevant to all four disciplines."

"The AFIT program should be expanded so that those of use who don't go to the graduate program can't take some of the kinds of courses shown above as part of our continuous education requirements."

"The courses offered by AFIT are not as stringent as they could be - make it tougher on the individuals taking the course. In this manner you are assured that the courses are producing competent graduates not just check marks on a promotion list!!"

"The most critical and difficult phase of cost estimating is getting a good and detailed understanding of what is being costed. Estimators need a better understanding of technology, manufacturing methods, and of the hardware that make up the weapon systems they estimate. A course exposing the estimators to this type of information is critically needed. Estimators coming out of AFIT are long on theory and very short on practical applications. They need a better feel for the actual problems encountered in doing an estimate. The cost analysis seminar should focus on actual experience by having the students do estimates - not just run the numbers but do actual interviews with engineers and program managers, hunt for data, choose the estimating methods, and present the estimate."

"In class training is very difficult in the cost analysis field. Almost any quantitative course can add to the basic for becoming competent in the cost analysis field, but none can do the job without adequate on-the-job training. Every task in estimating is different and so many variables are involved. The need to expand the work force to enable the experienced analyst to have enough time to spend with new analysts on the job. Without the up front investment of time new analyst will take longer to become productive."

"The mathematics, basic sciences and engineering courses are most effective from the "university" environment. Efforts by AFIT to make mathematician/statisticians/engineers out of people in a few weeks does not work. Cost analysis is still best learned through OJT under the

tially trained people who have received training from colleges in business and quantitative analysis. The output of a Cost Analyst is, more and more, used as a decision tool for larger (expensive) decisions. The quality of those decisions should not be jeopardized by marginally qualified estimations. Training with industry would be a good addition to the sources of training used in the questionnaire."

"Summary level courses should be established to provide basic information in several of the mathematical courses rather than indepth courses. In many cases, a basic knowledge is useful and necessary but time to take many different courses is not available."

"There could be trail exercises (like case studies) which are distributed periodically to the various dimensions to be worked and sent back to AFIT for grading and critique. This could be done on a voluntary or as requested basis or as a requirement for new troops. You could even have progressively more difficult exercises."

"The greatest experience/education weakness is that gov't cost analysts do not have an appreciation for the risk element which business must live with. The risk factor motivates their every action most government analysis/decisions ignore the risk/profit relationship. It is hard to teach this subject in a classroom environment and it cannot be learned in government. One solution may be to hire cost analysts with more private industry experience."

"1. Maintain entry level to those having Bachelor Degree in Cost Related Fields of Study, i.e. Bus. Admin, Indust. Engineering, Economics, Statistics. 2. Continue making available AFIT courses as those above and AFIT masters in Cost Analysis, DSMC and civilian University training. 3. Make career progression available to military. Do not penalize for narrow field of speciality."

"The current training program is extremely good. Once the basic methods are understood, practice on "real" programs will have their experience and increase their capabilities. The biggest aid to cost analysis/estimating has been computer programs and the electronic spread sheet. Our people need to continue their training in this area."

"Get the people capable of OJT instruction doing the instruction rather than the many personnel tasks they are assigned. Also don't make class attendance a course for cost analyst certification, try demonstrated performance."

"The basic functions of a cost analyst revolve around:

- General Air Force Operating Procedure
- Statistics
- Accounting
- Computer Programming & Operation
- Communications (Oral & Written)
- Finance

"Promote only those who demonstrate competence, not just attend the required number of AFIT courses."

"Some technical training (i.e. Engineering, Manufacturing)."

"Establish more stringent background requirements for entrants into the field. For the most part, the technical courses presented in the last section (AFIT) simply do not suffice in providing the depth of knowledge desired. Require study beyond the basics. Any worthwhile program will also contain developmental training closely allied with the industry where most of the defense contracting is undertaken. This can be accomplished by close attention to assignments."

"Formal DOD classes (Ex. AFIT) are too theoretical. Little application to on the job requirements. We need more practical training."

"Requirement of an undergraduate degree--especially one with a strong mathematical & statistical background (i.e. business administration, operations research, math, or engineering). Continued emphasis on upgrading skills through PCE courses, seminars, symposiums, etc. An additional suggestion would be that to reach the journeyman level, each cost analyst must have acquired a certificate of professional achievement (ex-ICA certificate, NES certificate, or certificate of Professional Designation from AFIT)."

"AF should recommend analysts continue their education at least once every year both to add knowledge and refresh themselves. Too many analysts drop to poor quality partially because they let their education lapse or are unwilling to travel to PCE. One reason for not wanting to attend many PCE courses is their length. Any course beyond 2 weeks is unsatisfactory for most mid to older analysts. More use should be placed in university courses in the local area."

"No course is useless for a cost analyst. They should not only be concerned with all this technical schooling but should also join in operational type schooling. This would give the technocrat a broader understanding of the role of the DOD/AF and provide him more of an operational viewpoint. Give cost analysts OJT with operational divisions to experience how it really is."

"Only hire civilians or place military personnel into the cost analysis field that have the math education and then send them to the appropriate AFIT classes listed above."

"Cost analysts have widely varied responsibilities dependent upon the level of tasks. Background for Wing/Base level analyst is less demanding than that necessary for Air Logistic Centers or Air Force Command levels. A major evolutionary change is presently underway in which the cost analyst, who was qualified to audit calculations on a small proposal for a piece of equipment, must have the background to develop estimating relationships from scarcity data, understand private industry cost methods and, without direction, apply the appropriate methods. Since it is not practical to train personnel completely the Air Force should start with par-

"There could be some improvement in education if the courses and instructors were more familiar with the real world-the way things are as opposed to how they should be. Also some quick turnaround techniques would be nice since alot of the time suspenses are very short and the techniques taught at AFIT are usually time-consuming. In fact the best way to become a qualified cost analyst is to take the classes for background and then do estimates. All the classes in the world can't take the place of experience."

"You can train all the people in the world to be good technical cost analysts. But a good functional cost analyst can do the job with very little technical training. You need common sense, curiosity, and desire to be a good analyst."

"Cross training in all Comptroller functions."

"General Comments on approach: All of my cost analysis experience has been obtained at a MAJCOM HQ dealing primarily with D&S costs investment decisions, and ad hoc managerial questions or decisions; my answers are couched in that context. Any of the above areas of knowledge or skills can be useful to a cost analyst. However, it is not necessary - and perhaps not even desirable - that a given analyst possesses all of them. It is sufficient - and perhaps best - that the skills be available in the office though several analyst, e.g. an economist, and industrial engineer, an accountant, etc. Also, although not necessarily the "best" way, much can be learned through OJT."

"Provide training relevant to the individuals job. All cost analysts do not require the same training. There are many cost analysts who require greater knowledge of the logistics processes, research methods, and data sources. An emphasis on practical application rather than "theory" would also improve the competence of Air Force cost analysts."

"(1) An undergraduate degree in one of the quantitative disciplines (Accounting, Economics, Statistics, Mathematics) - required. (2) A graduate degree in Business Administration - preferred. (3) For those not having (1) and (2) attendance of as many of the AFIT QMT series courses as possible, or (4) Taking selected courses in quantitative methods at local colleges and universities."

"AFLC may be a typical. Most of the more advanced mathematical & cost estimating techniques are of little value. The non-availability of base data makes the use of rudimentary techniques difficult to achieve at times. This is compounded by the constant use of "political" decisions versus "economic."

"I believe every AF analyst should be exposed to a variety of methods which have been used to estimate real programs rather than theory. For example, several ICA briefings could be presented during the AFIT classes to give the analysts a feel for real world applications of the theory they are learning. Also, in our hiring process we should begin to emphasize more math and technical (science and engineering) education in the position description."

Appendix B: Written Comments

The following are comments to the open-ended question at the end of the questionnaire. No effort was made to correct grammar, spelling or expression. The question was written:

As a final task, briefly describe how you feel the educational competence (that is, adequate knowledge for job performance) can be improved for Air Force cost analysts.

Comments:

"New analysts should be enrolled in a formal training program that requires a mandatory job rotation an organization."

"The courses currently offered are adequate to cover all aspects of need training. Problems center around the time needed for full professional development versus the rapidly increasing workload and the low manning levels of most CA organizations. I also believe that many of the perceived educational competence problems are more imagined than real and stem in part from desires to obtain professional job series recognition rather than what is really required to do most of the day-to-day CA business. * this can vary significantly depending on assigned responsibilities of the cost analyst."

"By management action. Hire people who have appropriate skills continuing education, maybe one course a year."

"Have recognized separate career field for federal cost analysts. Have active professional organization that speaks for cost analysis (NES and ICA haven't done enough yet). Universities won't offer cost analysis until it is a better defined discipline."

"Through costing techniques."

"I believe there are basically two groups of people who are not qualified in cost analysis due to lack of education. Military (blue suit) personnel typically are not required to complete the "cost education" course work that civilians must accomplish to be promotable. As such, military cost analysts tend to be more managers than workers. Also, (the second group) Senior cost analysts tend not to be current on the latest techniques, research etc, due to the dated course that they cover up the ranks with (no computer experience). I attend one course a year to keep current."

"Improved by broadening people in the area to understand how their role fits into the overall Air Force mission. Not just R & D and Procurement but also operations once the system is fielded."

"By accepting only those officers, Airmen, and civilians who have integral calculus or above."

"More emphasis on training of personnel to real world and less time on theories."

1	critical	OJT	on-the-job training
2	extremely	PCE	professional continuing education program
3	useful	UG	undergraduate level
4	of little use	GRAD	graduate level
5	useless		

(34)

(QMT 540)

ADVANCED PRICING METHODS: regression analysis; sources and uses of data;
and analysis of contractor financial data

1	2	3	4	5		OJT	PCE	UG	GRAD
---	---	---	---	---	--	-----	-----	----	------

(35)

(SYS 362)

COST SCHEDULE CONTROL SYSTEM CRITERIA: maintenance, surveillance, and
evaluation of comprehensive management systems to include skills
necessary for demonstration/
validation examinations at DOD
contractors

1	2	3	4	5		OJT	PCE	UG	GRAD
---	---	---	---	---	--	-----	-----	----	------

As a final task, briefly describe how you feel the educational competence
(that is, adequate knowledge for job performance) can be improved for Air
Force cost analysts.

1	critical	OJT		on-the-job training
2	extremely useful	PCE		professional continuing education program
3	useful	UG		undergraduate level
4	of little use	GRAD		graduate level
5	useless			

(29)

(QMT 345)

INTRODUCTORY QUANTITATIVE

ANALYSIS: probability; descriptive and inferential statistics; sampling; unit and cumulative learning curves; index numbers; time series forecasting; two variable linear regression

1	2	3	4	5		OJT	PCE	UG	GRAD
---	---	---	---	---	--	-----	-----	----	------

(30)

(QMT 550)

ADVANCED QUANTITATIVE METHODS: introduction to matrices, non-linear relationships; logarithms; curvilinear functions; linear and non-linear regression; of two variable and multivariable relationships; net scatter diagrams;

1	2	3	4	5		OJT	PCE	UG	GRAD
---	---	---	---	---	--	-----	-----	----	------

(31)

(QMT 551)

ADVANCED COST AND ECONOMIC

ANALYSIS: advanced regression techniques; treatment of uncertainty in cost analysis; economic analysis; simultaneous estimation techniques; use of models and estimation of operating and support costs

1	2	3	4	5		OJT	PCE	UG	GRAD
---	---	---	---	---	--	-----	-----	----	------

(32)

(QMT 180)

LEARNING CURVE ANALYSIS: thorough understanding of learning curve theory and application

1	2	3	4	5		OJT	PCE	UG	GRAD
---	---	---	---	---	--	-----	-----	----	------

(33)

(QMT 353)

INTRODUCTION TO LIFE CYCLE

COST MANAGEMENT: life cycle cost management environment, cost drivers, estimating techniques, and contracting aspects of life cycle costs

1	2	3	4	5		OJT	PCE	UG	GRAD
---	---	---	---	---	--	-----	-----	----	------

1	critical	OJT	on-the-job training
2	extremely useful	PCE	professional continuing education program
3	useful	UG	undergraduate level
4	of little use	GRAD	graduate level
5	useless		

 OPERATIONS RESEARCH

(26)

QUANTITATIVE DECISION

MAKING: linear programming; inventory theory; queuing
 theory; and decision theory

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

 OTHER SUBJECT AREAS

(27)

SEMINAR IN COST ANALYSIS: role of the cost analyst; code of ethics; life
 cycle cost estimation and management; effects
 of discounting; risk and uncertainty; economic
 analysis; independent cost estimates; documen-
 tation management of the cost analysis function

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

The QMT courses that follow are offered by the Air Force Institute of
 Technology (AFIT) for professional development

(28)

(QMT 170)

PRINCIPLES OF CONTRACT PRICING: tools and techniques for pricing; methods
 for analyzing direct and indirect costs;
 arithmetic and log-log graphing; unit
 learning curve formulation

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

1	 critical	OJT	 on-the-job training
2	 extremely useful	PCE	 professional continuing education program
3	 useful	UG	 undergraduate level
4	 of little use	GRAD	 graduate level
5	 useless		

(21)

REGRESSION I: regression analysis to include problems involving both two variable and multivariable linear regression and the assumptions of each; examination of casualty and indicator variables

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

(22)

REGRESSION II: regression analysis to include considerations of specification, identification, and collinearity; translation of data into information for decisions

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

(23)

QUANTITATIVE ANALYSIS: development of engineering estimates; learning curve theory; index numbers; time series forecasting; and technological forecasting

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

COMMUNICATION

(24)

TECHNICAL COMMUNICATIONS: writing and consideration of related problems of grammar, syntax, and mechanics; written and oral assignments to demonstrate competence in organizing and presenting technical information.

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

(25)

RESEARCH METHODS: data gathering; information measurement scales; classification of variables; validity and reliability; research populations and sampling; and designs to test research hypotheses and answer research questions

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

1	critical	OJT	on-the-job training
2	extremely useful	PCE	professional continuing education program
3	useful	UG	undergraduate level
4	of little use	GRAD	graduate level
5	useless		

 COMPUTER SCIENCE

(16)
 FORTRAN PROGRAMMING: fundamental principles of computer programming basic
 elements of structured FORTRAN

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

(17)
 BASIC PROGRAMMING: using "basic" language to model and analyze typical
 management problems; common programming using struc-
 tured BASIC.

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

(18)
 COBOL PROGRAMMING: introduction to COBOL; common applications using the
 structured COBOL language.

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

 STATISTICS

(19)
 INTRODUCTORY STATISTICS: application of basic probability theory; basic
 statistical tests; hypothesis tests and for-
 mulations; data manipulation and evaluation for
 statistical decisions.

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

(20)
 MANAGERIAL STATISTICS: probability theory for advanced statistics; tech-
 niques for summarizing and describing data; use of
 statistics for communicating information

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

1	critical	OJT	on-the-job training
2	extremely useful	PCE	professional continuing education program
3	useful	UG	undergraduate level
4	of little use	GRAD	graduate level
5	useless		

(10)

MANAGEMENT INFORMATION

SYSTEMS: development and management of information systems; computer applications to develop an accounting data base useful for management decision making.

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

(11)

PRODUCTION MANAGEMENT: robotics; material requirements planning; work measurement; producibility; quality assurance; computer aided design; computer process monitoring; group technology; computer aided manufacturing.

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

(12)

DEFENSE PRODUCTION MANAGEMENT: weapon system manufacturing technology; manufacturing management reviews; various defense production management regulations; defense technology modernization efforts.

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

 MATHEMATICS

(13)

MATRICES AND LINEAR ALGEBRA: fundamental knowledge of matrices; systems of equations; determinants; vector spaces;

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

(14)

CALCULUS: differential and integral calculus

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

(15)

LINEAR MATHEMATICAL MODELS: linear equations; inequalities; convex sets; matrix algebra; linear programming; duality; applications of linear mathematical models

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

1 critical

OJT on-the-job training

2 extremely useful

PCE professional continuing
education program

3 useful

UG undergraduate level

4 of little use

GRAD graduate level

5 useless

MANAGEMENT

(5)

TECHNOLOGICAL FORECASTING: state-of-the-art techniques for technological forecasting in R&D and other related areas; the Delphi Method; growth curves; various other relevant mathematical models.

1 2 3 4 5

OJT PCE UG GRAD

(6)

FEDERAL FINANCIAL MGT: fiscal policy; the federal unified budget; the congressional budget process; the appropriation process; fund control requirements; the planning, programming, and budgeting system.

1 2 3 4 5

OJT PCE UG GRAD

(7)

MANAGERIAL FINANCE: financial management of business units with emphasis on finance organization structure; collecting and using financial data; judging profitability, liquidity, and sources of capital; internal financial operations.

1 2 3 4 5

OJT PCE UG GRAD

(8)

MANAGEMENT AND BEHAVIOR

IN ORGANIZATIONS: classical and contemporary theories dealing with the management of complex organizations; systems approach to management and value of the human resource.

1 2 3 4 5

OJT PCE UG GRAD

(9)

R & D MANAGEMENT: research and development management as it is done in Air Force; horizontal integration in complex organizations and practical applications of management theory to Air Force problems and roles.

1 2 3 4 5

OJT PCE UG GRAD

RATING GUIDE

1	 critical	OJT	 on-the-job training
2	 extremely useful	PCE	 professional continuing education program
3	 useful	UG	 undergraduate level
4	 of little use	GRAD	 graduate level
5	 useless		

ACCOUNTING AND ECONOMICS

(1)
 FINANCIAL AND COST ACCOUNTING: inventory costing; depreciation methods
 analysis of financial statements; direct
 and indirect costs; overhead allocation;
 job and process costing; cost-volume-
 profit relationships; variance analysis
 and standard costs.

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

(2)
 MANAGERIAL ACCOUNTING: cost concepts; cost behavior and costing tech-
 niques; uses and limitation of cost data in
 planning, controlling, and nonroutine decision
 making.

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

(3)
 MICROECONOMICS: cardinal utility measurement; income and substitution
 effects; derivation of demand curves; production and cost
 functions; industry structures; resource allocation.

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

(4)
 MACROECONOMICS: optimization subject to constraints; risk analysis; tech-
 niques of demand estimation; empirical cost estimation
 and analysis; pricing practices; capital budgeting.

1	2	3	4	5	OJT	PCE	UG	GRAD
---	---	---	---	---	-----	-----	----	------

AIR FORCE COST ANALYSTS EDUCATIONAL REQUIREMENTS SURVEY

PURPOSE:

The purpose of this survey is to solicit opinions from experienced Air Force Cost analysts to determine the educational requirements necessary to establish a standard educational requirements list for judging educational competence among Air Force cost analysts.

Please circle the appropriate background information below:

Major Command: AFSC AFLC MAC SAC TAC ATC OTHER: _____

Experience (in terms of years in the cost analysis field):

- a. 1 to 3 years
- b. 4 to 6 years
- c. 7 to 10 years
- d. 11 or more years

TASK:

Rate the following courses from 1 to 5 as they apply to the job of an Air Force cost analyst. Identify the appropriate educational level or levels for acquiring knowledge in the courses rated. There are nine categories with several courses under each category. Each course is followed by a brief description.

(CIRCLE YOUR CHOICES BASED ON THE FOLLOWING GUIDE):

- 1 Knowledge of this area is critical
- 2 Knowledge of this area is extremely useful
- 3 Knowledge of this area is useful
- 4 Knowledge of this area is of little use
- 5 Knowledge of this area is useless

OJT Knowledge should be acquired through on-the-job training

PCE Knowledge should be acquired through a professional continuing education (PCE) program.

UG Knowledge should be acquired at undergraduate level

GRAD Knowledge should be acquired at graduate level

guiding hand of an expert estimator. Thus if a good cost estimating course were to be developed, the instructors would have to be seasoned estimators to be effective."

"Need to train individual specifically as cost analysis. Current AFIT program is definately needed. Needs to be expanded to more civilians and more trainers need to be trained as cost analysts as opposed to financial specialists by means of continuing education courses."

"The AFIT courses listed should be placed in a linear program, i.e., prerequisites set for firm, controlled progression to the next course level, where entrants must have had, as a minimum, mathematics thru basic integral calculus (usually 6 semester hours) and introductory statistics/probability theory and demonstrated an understanding of the material by maintaining at least a 3.0 GPA, on a 4 pt scale, for the math & stat courses taken. Only in this fashion can the prospective Jr. Cost Analyst get the maximum benefit of the AFIT QMT program. Too many students have been placed in the AFIT CA program w/o enough background to effectively concentrate on the techniques being taught, i.e., learning basics at the same time detracts from learning--the CA material being stressed--I know, that's how I had to do it in '74!! (I've picked up 9 hours of CAL and 6 hours or stats since--but I needed them in '74!!)."

"Bring the courses closer to the students' location. Make the courses shorter, more condensed (1 or 2 months is too long to be away from the job for most organizations) Provide more courses as non-resident, correspondence courses. Structure the course so that student could attend classes on Saturday and Sunday, study on Monday through Friday then return again on Saturday and Sunday for as long as necessary to complete course material. Educational competence cannot be improved unless you can get the students into the class room."

"Cost analysis shop must assure their people are properly trained. Because of the apparent lack of understanding by the Staffing and Classification people we will continue to receive untrained/underskilled personnel for our vacant cost positions. We have found through experience at SA-ALC anyone coming into our shop whether a GS-5 trainee or a GS-12 Accountant or Logistician all require approximately 2 years of PCE, UG, and OJT before becoming competent Cost Analysts. Because of this problem we prefer to hire GS-5 trainees and train our own cost analysts. This is a problem due to the requirement for stepping stone positions which we lose to other programs. For instance we recently lost our GS-5-9 slot to the AFIT Cost Analysis Officer program. Therefore we will receive an educated officer who will have no experience. We will train through OJT for several years then lose him to PCS. In the mean time if we lose a journeyman civilian we will have to drop the grade and train another thereby losing a large portion of our work force."

"We need more communication between AFIT instructors and the supervisors of the people who take AFIT short courses so that course material can be better fitted to the needs of the students."

"Establishment of formal curriculum at universities perhaps a bachelor degree program."

"With all of the constraints and outside influences there is nothing that can be done that will improve Air Force cost analysts but then again we perform extremely well given the above."

"I think a college background is the most important because the person puts in enough time and is graded according to performance. This powerfully reinforces learning much more effectively than PCE. College would cover statistics and business primarily. Hopefully some science too, so problem solving approaches are taught. A strong mathematics background helps in analytical ability and helps understand numbers. The background described prepares a person for looking at the reasonableness of a problem solution. With this background existing courses at AFIT help fine tune skills so they are specific to the requirements of cost analysis."

"The Comptroller training program at ASD is super. Persons who accomplish the required OJT and AFIT courses should be well equipped to do cost analysis work. There are, however, other qualities which I believe are essential to a good cost analyst--aggressiveness, and just a tad obnoxious. Cost analysts frequently operate in an adversarial role and without these qualities are generally ineffective. Don't believe the ASD cost analysis training program can/needs to be improved."

"Make it easier to get slots in AFIT courses. Increase course offering in quarter 1, 2 & 3 - people can't be spared 4th quarter."

"Making completion of selected QMT courses such as QMT 170, 180, 345, 550, & 551 mandatory prior to awarding of the fully qualified 674X AFSC."

"Entry level cost analyst should have strong math backgrounds before going into the field."

"The AFIT courses in cost analysis should be expanded so as more cost analysts have the opportunity to attend. In addition, Air Force AC should require each command to establish a training package to ensure all cost analysts have a basic core of formal education courses or are offered the opportunity to take the classes."

"More on-the-job training and experience. In short, getting your feet "wet" early on and staying with it."

"Generally speaking, I feel Air Force cost analysts have good training in academic tools such as regression analysis and learning curves. This major deficiency is lack of understanding of the technical aspects of their weapons systems. Cost analysts' capabilities would be improved by greater understanding of technology, manufacturing processes, etc."

"Periodic, mandatory PCE for cost analysts on a prescribed curriculum. These courses should be semiannual & only excusable due to personal hardships. If not, then "mission priorities" will always supercede PCE. Furthermore, the PCE curriculum should be tailored by command (AFSC vs MAC, SAC) to allow the education to directly help current duties."

"Insure analysts get to available courses on time. Don't let job requirements prevent analysts from taking courses. Require price training."

"Individualize the AFIT courses more to suit the needs of cost analysts. Then, standardize the requirements for qualification as a AFSC 6746. I became a 6746 without a single AFIT course and with minimum OJT."

"Lieutenants starting a career as a cost analyst should be given the opportunity to work in various SPOs and the staff like the civilians are before being assigned to a permanent position."

"Assure that all cost analysts have, as a minimum, the knowledge contained in QMT 170 and QMT 345. Depending on where they work and their job assignments additional knowledge can be required. The best way to assure this knowledge is completion of the appropriate AFIT courses (PCE for most analysts)."

"Through organizations such as National Estimating Society, ideas and techniques can be transferred so that we do not become over-specialized."

"Introduce people into the field with stronger math backgrounds."

"Better communicative skills - writing, speaking, briefing, listening (in laymen's terms). More "Big Picture" orientation; e.g.; don't get lost in minutes when rough order of magnitude is all that's required. Experience in real, base level world vice full career in costing at SPO or MAJCOM levels."

"Develop a training program for all cost analysts. Program should be required to upgrade to 6746. In addition, program should include basics required to perform cost analysis work both in acquisition and operational commands."

"The 'Certified Cost Analysts' and the 'Professional Designation' are a step in the right direction. A combination of experience and training should allow these people to be recognized as leaders in their field. Additional career board type credit should be given to those people who have gained the two certifications."

"1. Rotational assignments of instructors to "the real world" 2. On-site instruction courses (warm bodies, not teleteach) 3. Training plans that are adhered too-not just squares to check when convenient."

"Each analyst in the field have specific needs related to the function being performed at that time (R&D/Production phone) and unique to the organization (space, armament, etc). The field organizations should prepare a planning document to tailor training requirements for consideration by AFIT to meet those needs. In substance, the courses and programs in place are adequate to enhance educational competence. However, many are attending classes that do not relate to the criteria stated above and many are denied the class who do. Solution is strengthening the justification process for students to attend the scarce course availability."

"AFIT needs to develop videotape cassettes of their QMT courses in cost analysis. This would provide the opportunity for analysts, who find it difficult to spend 4-6 weeks away from their job, to obtain the basic

understanding of cost analysis techniques. Videotape cassettes should be set up to cover several of the various analysis techniques. For example, one could be set up for linear and non-linear regression models; another cassette could include estimating and forecasting techniques, etc, etc. These videotape cassettes would not replace the QMT courses, but would upgrade and enhance analyst skills. This is desperately needed in the field. AFIT needs to restructure their courses (i.e. more two week courses rather than 4-6 week courses) and more on-the-road training at MAJCOM/HQ AF locations rather than at Wright-Patterson."

"Air Force cost analysts basically work with contractor furnished information within AFSC. The best way to do a good job is to understand how a contractor manages a contract. Learning his management system, from planning to analysis and corrective actions, is the best way to ensure thorough and proper attention to the real problems. (AFSC Biased) this can be accomplished by participating in C/SCSC review activity and learning the inner workings of companies who submit data for analysis."

"1. Affiliation and participation in professional organizations, i.e., Institute for cost analysis, American Society of Military Comptrollers. 2. Greater exposure to the qualitative aspects affecting a quantitative art! Leadership, motivation, and individual will greatly impact productivity and cost. 3. Practice!!! Homework!!! Hard, often ridiculed, work."

"Continue to emphasize case type learning methods in AFIT short courses. Cases should be relevant to "real world" situations. This real world aspect has been lacking in previous courses time attended. There is a tremendous need to improve amount of computer applications for cost analyst's use. Lack of experienced analysts makes the computer an invaluable tool. Often times programs used at AFIT are unavailable for use back in the field."

"After being assigned as a cost analyst within Systems Command and Communications Command, I've seen vastly different aspects of this profession. The educational requirements for one in the acquisition process are altogether different from operations and maintenance. A fully qualified cost analyst is not really "fully qualified" when moving between commands because of the differences in the nature of the roles/missions of each command. I think there should be some core courses one should take at the entry level that provides a good foundation to build on. Then, each command should establish a series of courses that would be at the journeyman level and somewhat command and mission oriented. These courses would be broad-based enough to accommodate more than one command, yet specific enough in individual blocks to be useful when performing command related activities."

"The training program is more than adequate in the class environment. What is lacking on your questionnaire and in the work environment, is adequate training/guidance of the trainee with respect to OJT. Students come back with knowledge of new techniques and methods, but do not receive any immediate opportunities to apply them. When opportunities arise, supervisors very rarely attempt to correlate a training course with 'real' applications."

"1. Comprehensive cost training program at entry level to include quantitative analysis & statistics courses at AFIT or local college. 2. Develop courses that:

- a. identify the major data bases/systems used by AF costers.
- b. give an overview of the data base's content, validity, and use.
- c. structured to address specific types of costing, e.g., R&D Logistics, Production, etc."

"The analyst currently all taught techniques of estimating, but see themselves as only a support office. Analyst need to get more involved with program management. Analysts need to be taught Program Mgt skills so they can understand all decisions made by the Program Mgt and have the ability to question decisions that could lead to program cost growth."

"Air Force Cost Analysts perform (at least) two distinctly different types of work. Either working in SPOs or on the Comptroller Staff, Cost Analysts are usually Cost Estimators (Comptroller ACCE) or C/SCSC Analysts (Comptroller ACCI). In SPOs, C/SCSC Analysts often are used as Financial Managers performing C/SCSC monitoring functions, where C/SCSC, Financial Management, Communications, and the basic estimating, statistics, and computer courses would be most helpful. On staff (e.g. ACCI), these are also very important, especially the C/SCSC, communication, and computer training. Training in DCAS/AFPRO, and DCAA related tasks would also help. Cost Estimators are much more in need of the more quantitative courses for estimating and forecasting for specific defense programs. Estimators are often trained by the Comptroller (often ACCE) and "matrixed" to SPOs on a "long-term temporary" basis. Often (my case included), 6746s/Cost Analysts receive training in both areas and then uses the skills of only one or the other. College graduates with more quantitative business backgrounds should be directed toward Cost Estimating. Graduates with more managerial and systems management backgrounds should be designated "C/SCSC types." In both cases, training could be concentrated for each group in the respective, specialized Cost Analysis career area, with less wasted training spent on officers entering the Cost Analyst career "shredouts."

"After the Air Force cost analyst has the technical competence and skills in math, statistics, accounting, etc. he still faces the formidable task of being able to apply these subjects to produce timely and useful cost estimates. Success from this point is largely determined by how well one can interpret and fulfill the desires of the system program manager (SPO) in acquiring and managing the resources (i.e., money) to acquire a given weapons/support system(s). Knowledge of the budget system, contract pricing principles, staff integration and planning procedures and other non-quantitative skills combine to help "sell" the cost estimate to the organizations/offices that coordinate on SPO projects. Failure to get their cooperation can cause a technically accurate cost estimate to be rejected by the program director. These skills (non-quantitative) are usually acquired by OJT and PCE courses/seminars, along with trial-and-error attempts."

"Improve computer training with micro's as tools for the analyst. Use of electronic spread sheets, data base managers, and graphics should be

stressed. Use of powerful on line or micro resident statistical packages (SPSS) should be emphasized. Analysts need better preparation in math. Not so much Calculus but algebra, and statistics."

"1. Eliminate 0-5 & above crossflows from rated areas. Recognize that this is indeed a profession & not just anyone can step in and manage/lead a cost shop (nor should someone with no comptroller experience be expected to do well) I would rather see 0-6 positions filled with qualified, experienced captains than unqualified individuals. This would eliminate the bulk of my headaches. 2) Education - insist that as a minimum. 674X's have - 9 credit hrs UG Stats, 9 hrs UG Accounting, including Managerial Cost Accounting - Matrix Math - Calc optional. 3) How about a PCE/QJT Course that gives an exhaustive review of all Air Force data bases & how to access them. 4) A worker level cost symposium held annually (worker level)."

"Increase application of theoretical techniques to current situations the student can identify with. Clearly specify whether a technique is being illustrated as appropriate to the Comptroller Analyst or the Procurement Analyst -- journeyman analysts know which is being illustrated but trainees only get confused about where or how the technique should be used!"

"Having had the good fortune of gaining an inordinate amount of experience over the last 16 years by participating on many programs as the ICA or ICS Team Chief, source selection cost Panel Team Chief, and/or ESD representative on high visibility DOD work studies for future together with and outside of DOD, I feel the most important tool for success in the field of cost analysis is "On The Job Training". Formal class training is a must however, there is no substitute for actual hands on experience. Two of the most educational, demanding, diversified, dynamic and important types of efforts to acquire this competence are Independent cost analysis/studies and source selections which I would highly recommend as "musts" for any trainee type cost analyst."

"Cost Analysis courses offered by AFIT are not very rebutable to the real world. Too much Procurement. Too much emphasis on Non High Technology. instructors need current real world experience. Do poor job."

"The AFIT courses are good: Require cost analysts to take/attend the AFIT courses provided for cost & pricing analysts instead of QJT and a desire to attend these courses. Layout rqmt to take QMT 170, 353 & 180 in first 18 mos in order to be upgraded (6741 to 6746). Then take the remaining QMT/SYS courses in the following 18 mos."

"The cost analyst requires a well rounded background in financial and cost accounting, statistics, mathematic, economic, operations research, and managerial techniques. However, even with their background, no substitute exists for experience gained from QJT."

"More emphasis on the following:

- task definition and planning.
- data gathering and validation.

- documentation of methodology.
- presentation of results."

"One or two courses dealing in statistical sampling."

"Encourage analysts to take college level courses in math and statistics as part of career development plans."

"Create courses that assist in real job performance, not just a group of nice to have courses that people use to fill up their resume."

"A formal OJT program should be a requirement at each location where cost analysts work. The program should be tailored to the unique products estimated or managed. The luxury of being fully trained prior to "jumping into" the job is usually unaffordable. Therefore, it is imperative that the cost analyst be given the maximum opportunity to have the knowledge and tools to do the job. Although most cost analyst work involved cost analysis, training & education should cover cost estimating, cost analysis and cost performance analysis."

"A basic problem is application of the knowledge base material. That is, once educated how do you quickly apply the learning? A possible approach would be to establish tailored training courses to various environments (e.g. operating command, acquiring command, supporting command, special commands, joint commands etc). In addition, effort should be given to establishing training in Business Advisory capabilities and other Business/Financial Council Activities."

"1st give the analyst OJT experience, then work in the cost and pricing schools at AFIT. After 3-4 years a Master Degree Program in Ops Research or Business Administration. The practical work experience must go hand in hand with the educational training. Learning curve theory cannot be fully understood and appreciated without being in the job environment (Pentagon or ASD) where the theory is being used daily."

"Cost analysis education must be tailored to each individual as each person's background will vary upon entry to the cost analysis field. Courses must be available to satisfy any deficiencies. Many of the courses listed in the attached survey are recognized as being part of a graduate or undergraduate degree curriculum. Requirements for those courses should continue to be fulfilled at those levels and not PCE or OJT. PCE/OJT should be reserved for those educational requirements tailored to the AF/DOD environment. Additionally, PCE is appropriate for topics where graduate/undergraduate courses are not available."

"There is no unified, coherent program to develop cost analysts' education. Analysts as a group come from many disciplines including engineering, mathematics, business, accounting, statistics, and economics. As a result, the same cost analysis problem may be viewed differently, depending on the perspective of whoever is doing the viewing. I would like to see a more basic, structured approach to incorporate the way the Air Force (DOD) does business. I recognize the difficulties of this since 67xx's perform estimating and analysis as well as many 27xx duties but, having worked in all three areas, research methods, statistics,

regression, modeling, learning curves, financial analysis, earned value, and the use of micro-computer spreadsheets are most important - especially when taken in the context of DOD systems acquisition - This is the perspective lacking in any civilian education. On the other hand I don't see many (any) analyst using calculus on an every-day basis. The AFIT short courses are fine but too limited in scope, too hard to get quotas for and especially, too far apart in time. QJT can be exceptionally frustrating if the trainee is not motivated. Why not a 3-4 month course consolidating data research, statistics, line regression, modeling, learning curves, financial analysis, earned-value, micro-computer spreadsheets - for junior analysts. Create a giant "integrating problem" using all these techniques in the gov't procurement environment. Also refresher training - and state-of-the art- updates would be nice periodically. I'd be happy to discuss this with anyone who cares to."

"I may not be a good "sample point" for you, I started in 1960, when we were overwhelmed by the arrival of Frieden calculators, so we didn't have to run out learning curves by hand. But what I've felt is missing too often is the understanding of cost drivers. Why does speed cost more? Can it ever cost less? How does a production live work? What price missile range? CEP? Does frequency drive avionics cost? Does range? What else? I think people need math techniques, but even more they need to understand why a particular technique is best in a given situation. Good luck on your survey. Its got lots of good uses."

"Note (28), (34) & (35) are really narrowly oriented but, they are necessary for the overall education & training of the cost analyst. We need basic courses in the time value of money for our new cost analysts and because of the impact of interest rates, etc; economics courses should also be programmed early on in an analysts career. There is also a need for more operations research type education and training for the cost analyst. In the area of QJT & crossfeed; we in CA need more basics in financial mgt - our jobs cross many functional lines in gathering financial, workload, etc, data that are compiled, merged, purged, etc into some kind of forecast for future programs and more education & training in financial mgt would be beneficial. Establish a realistic career/professional program guide from which to program ones progress through the varied cost areas. Apparently, ASD is seeking more operating command involvement in source selection, life cycle costing, D & S/M costing, etc. They (ASD) need to establish some criteria that the operating commands can follow when selecting analysts to support ASD. In the final analysis - the AF needs to develop realistic course curr. where the analyst gains basic knowledge in techniques, tools, etc and then enforces these newly turned procedures etc. through a firmly established QJT or trng with industry program. I personally have been to only a couple of the educational courses and I have been basically forced to develop my own talents - sometimes at great frustrations and excessive time seeking a starting point. It would be, in my opinion, more cost effective to provide the education and a solid QJT or intern program than it is for us to flounder around in the semi-dark!!!"

"I am the HQ AFSC Director of Cost Analysis - and you need to understand where I'm coming from to put my response in context. I am a trained engineer (MS-Astro) with a lot of math & science (BS). I've had virtually

no AFIT PCE, but have been to the DSMC long course, I've served as an engineer, test monitor, program manger, program controller (plans) and Director of Budget and Director of Cost Analysis - as well as aide & IG time - all in AFSC at ASD, ESD & HQ. My answers are in recognition of a current situtation that includes - severe growth of quantitative workload
- severe growth of qualitative degree of difficulty - i.e. estimates very early in the evaluation of the programs.
- intense heat from everywhere to do better.

- a workforce that is largely untrained (or-undertrained), inexperienced, and undersized to the task at hand. At the MACRO level - the only way we are going to get the job done over the intermediate term (0 to 7 years) is to train (Read OJT) our way out of our current predicament - while taking advantage of whatever AFIT has to offer to the maximum extent possible. Realistically it can't all be done that way. For the few who can get into the AFIT residence GCA program, cover as much PCE material as you can without skipping over other important content. Use PCE for those not in GCA and to fill in deficiencies in UG education. Take some PCE on the road, so students can attend class 4 hrs and work 6 hrs. Encourage off duty education. But considering the need, in the new term, most analysts will need to learn most of what they learn via OJT. We could use some help in this area through the development of programmed texts and computer aided instruction packages on a variety of quantitative analysis and acquisition management topics. I ought to point out that not everyone in the career field shares my views. Many feel that formal AFIT coursework is the only way to educate our young analysts. But AFIT does not have the resources to train/educate everyone even if AFIT could accommodate them. Our biggest single problem, in my opinion, is that we have too many estimators who simply don't understand the acquisition process - at either the program level or the DOD level. Chalk it up to lack of experience. Our second biggest problem is that lack of technical familiarity with the programs leads to poor assumptions, groundrules, risk analyses, etc. Chalk this up to lack of technical training, lack of experience, a workforce spread too thin, and a lack of knowledge of problem solving techniques. Our last big problem is lack of estimating skill - caused by insufficient education & training of the current workforce, a long pipeline, and, to an extent, a mismatch between course content and functional needs (mostly PCE). Do not get the impression I'm panning AFIT - I am not. But AFIT cannot possibly make my problems go away by itself. The Graduate program looks good, and is getting better. That's my source of the functional leadership of the future, and I can afford a mix of theory, breadth, and pragmatism gained over a 15 month period. But it also only gets me half a dozen analysts a year. Some of the PCE courses could probably use some revision. With regard to your survey questions and the preferred source of the education. The preferred location for much is always UG, followed by GRAD (where the level of instruction justifies inclusion in a grad program.)

The cost analyst should have all but the first discipline introduced to him in undergraduate education. If the cost analyst does not have them, it is necessary for the individual to obtain them. After a cost analyst has a general understanding of all the disciplines, the next process involves refining that understanding through on-the-job training/education. To improve the performance of cost analysts, the

comptroller/supervisor should ensure that all cost analysts have the basic understanding of all disciplines before they are allowed to assume positions in which they lack the capability to perform. On-the-job training and government/professional education will enhance the cost analysts performance as they gain experience."

"1) Improve the timing of course-work to coincide with opportunities on the job for application of course material. 2) Need increased emphasis on estimating R&D and on data gathering/stratifying."

"Analyze the current taskings of a cost analyst at various MAJCOMDs and determine the commonality and differences of duties. Also, determine future taskings that a cost analyst will be expected to perform. This assessment of tasking totality should address, as a minimum the tools (e.g. computer literacy) that are required to effectively carry-out his or her duties. Based on this assessment a commonality of MAJCOMD taskings should be used to identify required Air Force educational requirement. Also, MAJCOMDS for the unique cost analysis tasking for there MAJCOMDs should implement provisions to ensure educational opportunities are in place to supplement the basic (COMMON) Air Force educational program for a cost analyst. The point is the educational program must have applicability to the job. The initial step is to perform a thorough functional analysis of MAJCOMDs cost analysis program."

"1) Training must be made available when the organization needs it, not when it can be scheduled. In many cases the individual comes on the job, is scheduled for training 2 years in the future (if we can get a space) and leaves the organization 2-3 years later without receiving any training. 2) At least videotape some of the most useful classes and get them to the field this is certainly better than nothing and the long, long wait to get trainees in classes. Sometimes we are expected to do the work without any training."

"Improvement of the educational competence of Air Force Analysts can be attained only when management at all levels realize the importance of having qualified and well-trained cost analysts. Management must then be willing to insure that the proper mix of OJT, education, and completion of professional AFIT-type course is available to all cost analysts. As long as management looks at cost analysts as something less than professionals, educational competence will always stand in need of improvement."

"By system enhancements. Systems should be programmed to flag areas of concern, i.e., where repair costs exceed new buy costs or where current year price exceed previous year price by more than 10%."

"Job rotation to broaden OJT. Emphasis (i.e. to be eligible for promotion) on formal courses."

Appendix C: Computer Cross-tabulations

***** CROSS TABULATION OF *****
 TO EL35,ED LEVEL BY RI TO R35,RATING
 CONTINUING FOR...
 SUBJ1 TO SUBJ35,SUBJECT: VALUE.. 1 FIN 8 CA
 ***** PAGE 11

R1												
COUNT	HOW	PCI	ICN	ITL	EXTREME	USEFUL	LITTLE	USELESS	NON			
	COL	PCI	1	2	USEFL	1	2	3	4	5	TOTAL	
101	PCI	1	2	1	2	1	2	3	4	5		
EL1	1	1	2	1	0	1	2	1	4	1	8	5.4
	1	25.0	1	0.0	1	25.0	1	50.0	1	0.0	1	
	1	6.9	1	0.0	1	3.8	1	33.3	1	0.0	1	
	1	1.4	1	0.0	1	1.4	1	2.7	1	0.0	1	
	2	1	2	1	6	1	11	1	0	1	19	12.9
	1	10.5	1	31.6	1	57.9	1	0.0	1	0.0	1	
	1	6.9	1	11.5	1	20.8	1	0.0	1	0.0	1	
	1	1.4	1	4.1	1	7.5	1	0.0	1	0.0	1	
	3	1	15	1	35	1	32	1	8	1	91	61.9
	1	16.5	1	38.5	1	35.2	1	8.8	1	1.1	1	
	1	51.7	1	67.3	1	60.4	1	66.7	1	100.0	1	
	1	10.2	1	23.6	1	21.8	1	5.4	1	0.7	1	
	4	1	2	1	1	1	1	1	0	1	4	2.7
	1	50.0	1	25.0	1	25.0	1	0.0	1	0.0	1	
	1	6.9	1	1.9	1	1.9	1	0.0	1	0.0	1	
	1	1.4	1	0.7	1	0.7	1	0.0	1	0.0	1	
	5	1	0	1	2	1	2	1	0	1	4	2.7
	1	0.0	1	50.0	1	50.0	1	0.0	1	0.0	1	
	1	0.0	1	3.8	1	3.8	1	0.0	1	0.0	1	
	1	0.0	1	1.4	1	1.4	1	0.0	1	0.0	1	
	6	1	2	1	4	1	1	1	0	1	7	4.8
	1	28.6	1	57.1	1	14.3	1	0.0	1	0.0	1	
	1	6.9	1	7.7	1	1.9	1	0.0	1	0.0	1	
	1	1.4	1	2.7	1	0.7	1	0.0	1	0.0	1	
	7	1	1	1	0	1	0	1	0	1	1	0.7
	1	100.0	1	0.0	1	0.0	1	0.0	1	0.0	1	
	1	3.4	1	0.0	1	0.0	1	0.0	1	0.0	1	
	1	0.7	1	0.0	1	0.0	1	0.0	1	0.0	1	
COLLAP	TOTAL	29	52	35.4	53	36.1	12	0.7	1	147	100.0	
		19.7										

(CONTINUED)

(CONTINUED)

***** CROSSTABULATION OF *****
 EL2 BY R2
 CONTROLLING FUR.. VALUE.. 2 MGR ACCT
 SUBJ2 ***** PAGE 2

		COUNT											
		ROW		EXTREME		USEFUL		LITTLE		USELESS		ROW	
		COL		USEFUL		LITTLE		LITTLE		USELESS		TOTAL	
		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL	
		1		2		3		4		5			
EL2	9	1	1	0	1	0	1	0	1	0	1	1	0.7
		1	100.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.7
		1	2.7	1	0.0	1	0.0	1	0.0	1	0.0	1	0.7
		1	0.7	1	0.0	1	0.0	1	0.0	1	0.0	1	0.7
LG	10	3	1	2	1	2	1	0	1	0	1	7	4.7
		1	42.9	1	28.6	1	28.6	1	0.0	1	0.0	1	4.7
		1	8.1	1	3.5	1	4.8	1	0.0	1	0.0	1	4.7
		1	2.0	1	1.4	1	1.4	1	0.0	1	0.0	1	4.7
FUG	12	2	1	0	1	0	1	0	1	0	1	2	1.4
		1	100.0	1	0.0	1	0.0	1	0.0	1	0.0	1	1.4
		1	5.4	1	0.0	1	0.0	1	0.0	1	0.0	1	1.4
		1	1.4	1	0.0	1	0.0	1	0.0	1	0.0	1	1.4
CUG	14	0	1	1	1	0	1	0	1	0	1	1	0.7
		1	0.0	1	100.0	1	0.0	1	0.0	1	0.0	1	0.7
		1	0.0	1	1.8	1	0.0	1	0.0	1	0.0	1	0.7
		1	0.0	1	0.7	1	0.0	1	0.0	1	0.0	1	0.7
CPUG	15	0	1	1	1	0	1	0	1	0	1	1	0.7
		1	0.0	1	100.0	1	0.0	1	0.0	1	0.0	1	0.7
		1	0.0	1	1.8	1	0.0	1	0.0	1	0.0	1	0.7
		1	0.0	1	0.7	1	0.0	1	0.0	1	0.0	1	0.7
COLLUM		37	57	38.5	28.4	7.4	0.7	1	148				
TOTAL		25.0	30.5	28.4	7.4	0.7	1	100.0					

50 OUT OF 60 (83.3%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.007
 MAX CHI SQUARE = 38.97455 WITH 44 DEGREES OF FREEDOM. SIGNIFICANCE = 0.6264
 CRAMER'S V = 0.25658

NUMBER OF MISSING OBSERVATIONS = 3

AD-A153 800

AN ANALYSIS OF THE EDUCATIONAL REQUIREMENTS OF AIR
FORCE COST ANALYSIS(U) AIR FORCE INST OF TECH
WRIGHT-PATTERSON AFB OH SCHOOL OF ENGINEERING P PERRY
DEC 84 AFIT/GSM/LSV/845-24 F/G 5/9

2/2

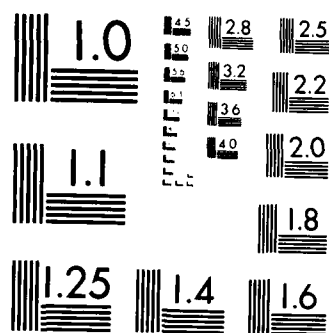
UNCLASSIFIED

NL

END

FILMED

DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

***** CROSS TABULATION OF *****
 EL3 CONTROLLING FOR.. BY M3
 SUBJ3 VALUE.. 3 MICROEC
 ***** PAGE 1 OF *****

		R3											
		COUNT	ICHTICAL	EXTREME	USEFUL	LITTLE	USELESS					ROW	TOTAL
		ROW	PC1	PC1	USEFUL	USE							
		COL	PC1	PC1	USEFUL	USE							
		TOT	PC1	PC1	USEFUL	USE							
		1	2	3	4	5							
EL3		1	1	1	1	1	1	1	1	1	1	1	1
0		1	12.5	1	12.5	1	50.0	1	25.0	1	0.0	1	8
		1	11.1	1	4.5	1	5.3	1	5.7	1	0.0	1	5.6
		1	0.7	1	0.7	1	2.8	1	1.4	1	0.0	1	
		1	1	1	1	1	1	1	1	1	1	1	9
F		1	11.1	1	0.0	1	66.7	1	11.1	1	11.1	1	6.3
		1	11.1	1	0.0	1	8.0	1	2.5	1	33.3	1	
		1	0.7	1	0.0	1	4.2	1	0.7	1	0.7	1	
		1	1	1	1	1	1	1	1	1	1	1	100
U		1	4.0	1	11.0	1	54.0	1	29.0	1	2.0	1	69.4
		1	44.4	1	50.0	1	72.0	1	82.9	1	66.7	1	
		1	2.8	1	7.6	1	37.5	1	20.1	1	1.4	1	
		1	1	1	1	1	1	1	1	1	1	1	13
G		1	7.7	1	46.2	1	38.5	1	7.7	1	0.0	1	9.0
		1	11.1	1	27.3	1	6.7	1	2.9	1	0.0	1	
		1	0.7	1	4.2	1	3.5	1	0.7	1	0.0	1	
		1	0	1	1	1	0	1	0	1	0	1	1
CP		1	0.0	1	100.0	1	0.0	1	0.0	1	0.0	1	0.7
		1	0.0	1	4.5	1	0.0	1	0.0	1	0.0	1	
		1	0.0	1	0.7	1	0.0	1	0.0	1	0.0	1	
		1	1	1	1	1	1	1	1	1	1	1	3
CU		1	33.3	1	33.3	1	0.0	1	33.3	1	0.0	1	2.1
		1	11.1	1	4.5	1	0.0	1	2.9	1	0.0	1	
		1	0.7	1	0.7	1	0.0	1	0.7	1	0.0	1	
		1	0	1	0	1	0	1	0	1	0	1	1
CG		1	0.0	1	0.0	1	0.0	1	100.0	1	0.0	1	0.7
		1	0.0	1	0.0	1	0.0	1	2.9	1	0.0	1	
		1	0.0	1	0.0	1	0.0	1	0.7	1	0.0	1	
		1	9	22	75	35	52.1	24.3	2.1	3	144	100.0	
		COLLVA	6.3	15.3	52.1	24.3	2.1	3	144	100.0			
		TOTAL	6.3	15.3	52.1	24.3	2.1	3	144	100.0			

(CONTINUED)

***** CROSS TABULATION OF *****
 EL3 CONTROLLING FOR.. BY N3
 SUBJ3
 VALUE.. 3 MICROEC
 PAGE 2 of 4

	COUNT	NON PCT	CRITICAL	EXTREME	USEFUL	LITTLE	USELESS	NON
		COL PCT	USEFUL	USEFUL	USE	USE		TOTAL
EL3	8	1	1	2	1	3	1	5
PU		0	1	1	1	2	1	3
		0.0	33.3	1	66.7	1	0.0	2.1
		0.0	4.5	1	2.7	1	0.0	
		0.0	0.7	1	1.4	1	0.0	
L6	10	0	1	1	3	1	0	4
		0.0	25.0	1	75.0	1	0.0	2.8
		0.0	4.5	1	4.0	1	0.0	
		0.0	0.7	1	2.1	1	0.0	
CPU	11	1	1	0	1	0	1	1
		100.0	1	0.0	0.0	1	0.0	0.7
		11.1	1	0.0	0.0	1	0.0	
		0.7	1	0.0	0.0	1	0.0	
FUG	12	0	1	0	1	1	0	1
		0.0	1	0.0	100.0	1	0.0	0.7
		0.0	0.0	1	1.3	1	0.0	
		0.0	0.0	1	0.7	1	0.0	
COLLUM	9	22	75	35	2.1	3	144	
TOTAL	6.3	15.3	52.1	24.3	2.1	100.0		

50 OUT OF 55 (.90.9%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.021
 K-S CHI SQUARE = 54.48186 WITH 40 DEGREES OF FREEDOM. SIGNIFICANCE = 0.0631
 K-SAMEN'S V = 0.30755

NUMBER OF MISSING OBSERVATIONS = 7

 EL4
 CONTROLLING FOR..
 SUBJ4

 CROSSTABULATION OF
 BY H4
 VALUE.. 4 MACROEC

 PAGE 1 01

R4									
COUNT	ICRITICAL	EXTREME	USEFUL	LITTLE	USELESS	NOM			
ROW PCI	1	2	3	4	5	TOTAL			
COL PCI	1	2	3	4	5				
TOT PCI	1	2	3	4	5				
EL4	1	1	1	1	1	5	1	7	
C	1	14.3	1	71.4	1	0.0	1	4.8	
	1	5.0	1	8.1	1	0.0	1	0.0	
	1	0.7	1	3.4	1	0.0	1	0.0	
	1	1	1	1	1	1	1	1	
F	2	1	2	7	1	0	1	13	
	1	23.1	1	53.8	1	7.7	1	8.9	
	1	15.0	1	11.3	1	4.5	1	0.0	
	1	2.1	1	4.8	1	0.7	1	0.0	
	1	1	1	1	1	1	1	1	
D	3	1	19	40	1	17	1	83	
	1	7.2	1	22.9	1	20.5	1	56.8	
	1	30.0	1	47.5	1	64.5	1	50.0	
	1	4.1	1	13.0	1	27.4	1	11.6	
	1	1	1	1	1	1	1	1	
G	4	1	5	6	1	4	1	21	
	1	23.8	1	28.6	1	19.0	1	14.4	
	1	25.0	1	12.5	1	9.7	1	50.0	
	1	3.4	1	3.4	1	4.1	1	0.7	
	1	1	1	1	1	1	1	1	
CP	5	1	2	0	1	0	1	3	
	1	33.3	1	66.7	1	0.0	1	2.1	
	1	5.0	1	5.0	1	0.0	1	0.0	
	1	0.7	1	1.4	1	0.0	1	0.0	
	1	1	1	1	1	1	1	1	
CU	6	1	3	0	1	0	1	3	
	1	0.0	1	100.0	1	0.0	1	2.1	
	1	0.0	1	7.5	1	0.0	1	0.0	
	1	0.0	1	2.1	1	0.0	1	0.0	
	1	1	1	1	1	1	1	1	
CG	7	1	1	0	1	0	1	2	
	1	50.0	1	50.0	1	0.0	1	1.4	
	1	5.0	1	2.5	1	0.0	1	0.0	
	1	0.7	1	0.7	1	0.0	1	0.0	
	1	1	1	1	1	1	1	1	
COLUMN TOTAL	20	40	62	22	2	146			
	13.7	27.4	42.5	15.1	1.4	100.0			

(CONTINUED)

***** CROSS TABULATION OF *****
 EL5 BY RS *****
 CONTROLLING FOR.. *****
 SUBJS *****
 ***** VALUE.. 5 TECHNOLOGFORECAST *****
 ***** PAGE 2 *****

	COUNT	1	2	3	4	5	NON
	PC1	PC1	PC1	PC1	PC1	PC1	TOTAL
EL5	1	0	1	2	1	1	3
PU	1	0.0	33.3	66.7	1	0.0	2.1
	1	0.0	1.6	4.3	1	0.0	1
	1	0.0	0.7	1.4	1	0.0	1
FG	1	0	2	1	1	0	3
	1	0.0	66.7	33.3	1	0.0	2.1
	1	0.0	3.1	2.2	1	0.0	1
	1	0.0	1.4	0.7	1	0.0	1
LG	1	0	3	2	1	1	6
	1	0.0	50.0	33.3	16.7	0.0	4.1
	1	0.0	4.7	4.3	16.7	0.0	1
	1	0.0	2.1	1.4	0.7	0.0	1
OPU	1	1	0	1	0	1	1
	1	100.0	0.0	0.0	0.0	0.0	0.7
	1	3.6	0.0	0.0	0.0	0.0	1
	1	0.7	0.0	0.0	0.0	0.0	1
CPG	1	1	1	1	0	1	2
	1	50.0	50.0	0.0	0.0	0.0	1.4
	1	3.6	1.6	0.0	0.0	0.0	1
	1	0.7	0.7	0.0	0.0	0.0	1
CPUG	1	1	1	1	0	1	2
	1	50.0	50.0	0.0	0.0	0.0	1.4
	1	3.6	1.6	0.0	0.0	0.0	1
	1	0.7	0.7	0.0	0.0	0.0	1
COLLPA	28	64	46	6	2	146	
TOTAL	15.2	43.8	31.5	4.1	1.4	100.0	

57 OUT OF 65 (87.7%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.014
 MAX CHI SQUARE = 45.46808 WITH 48 DEGREES OF FREEDOM. SIGNIFICANCE = 0.5772
 CRAMER'S V = 0.27903

NUMBER OF MISSING OBSERVATIONS = 5

***** C R C S T A B L E L A T I C A O F *****
 EL6 BY R6
 CONTROLLING FOR..
 SUBJ6
 VALUE.. 6 FEDERAL FIN PCT
 ***** PAGE 2 *****

R6									
COUNT	IC	EXTREME	USEFUL	LITTLE	USELESS	NON			
HOW PCT	IC	EXTREME	USEFUL	LITTLE	USELESS	HOW			
COL PCT	IC	EXTREME	USEFUL	LITTLE	USELESS	COL			
TOT PCT	IC	EXTREME	USEFUL	LITTLE	USELESS	TOT			
EL6	1	1	2	1	3	1	5	1	
10	1	1	1	1	1	1	1	1	
1	0.0	100.0	1	0.0	1	0.0	1	0.0	1
1	0.0	1	2.0	1	0.0	1	0.0	1	0.7
1	0.0	1	0.7	1	0.0	1	0.0	1	1
13	1	1	0	1	0	1	0	1	1
1	100.0	1	0.0	1	0.0	1	0.0	1	0.7
1	2.3	1	0.0	1	0.0	1	0.0	1	1
1	0.7	1	0.0	1	0.0	1	0.0	1	1
COLLAP	44	51	45	5	1	146			
TOTAL	30.1	34.9	30.8	3.4	0.7	100.0			

38 OUT OF 45 (84.4%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.007
 MAX CHI SQUARE = 36.87/22 WITH 32 DEGREES OF FREEDOM. SIGNIFICANCE = 0.2535
 CRAMER'S V = 0.25129

NUMBER OF MISSING OBSERVATIONS = 5

***** CROSS TABULATION OF *****
 EL7 BY R7
 CONTROLLING FOR...
 SUBJ7
 VALUE... 7 MANAGERIAL FINANCE
 PAGE 10

EL7	COUNT R7	HOW PCT	ICATICAL PCT	EXTREME USEFUL	USEFUL	LITTLE USE	USELESS	HOW TOTAL
		1	1	2	3	4	5	
C	1	1	2	1	6	1	1	19
		1	10.5	1	31.6	1	5.3	13.1
		1	28.6	1	9.2	1	33.3	
		1	1.4	1	4.1	1	0.7	
P	2	1	0	1	8	1	0	15
		1	0.0	1	53.3	1	0.0	10.3
		1	0.0	1	12.3	1	0.0	
		1	0.0	1	5.5	1	0.0	
U	3	1	2	1	36	1	1	79
		1	2.5	1	15.2	1	35.4	54.5
		1	28.6	1	37.5	1	73.7	
		1	1.4	1	8.3	1	19.3	
G	4	1	1	1	9	1	0	17
		1	5.9	1	35.3	1	5.9	11.7
		1	14.3	1	18.8	1	2.6	
		1	0.7	1	4.1	1	0.7	
CP	5	1	1	0	1	0	0	1
		1	100.0	1	0.0	1	0.0	0.7
		1	14.3	1	0.0	1	0.0	
		1	0.7	1	0.0	1	0.0	
CU	6	1	0	1	1	0	0	1
		1	0.0	1	100.0	1	0.0	0.7
		1	0.0	1	1.5	1	0.0	
		1	0.0	1	0.7	1	0.0	
PU	8	1	0	1	1	0	0	2
		1	0.0	1	50.0	1	0.0	1.4
		1	0.0	1	3.1	1	0.0	
		1	0.0	1	0.7	1	0.0	
COLUMN TOTAL	7	4.8	32	65	38	26.2	2.1	145
								100.0

(CONTINUED)

***** CROSSTABULATION OF *****
 EL7 BY K7
 CONTROLLING FUR..
 SUBJ7
 VALUE.. 7 MANAGRL FINANCE
 PAGE 2

K7																
	COUNT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ROW	PC1	IC1	IC2	IC3	IC4	IC5	IC6	IC7	IC8	IC9	IC10	IC11	IC12	IC13	IC14	IC15
COL	PC1	IC1	IC2	IC3	IC4	IC5	IC6	IC7	IC8	IC9	IC10	IC11	IC12	IC13	IC14	IC15
TOT	PC1	IC1	IC2	IC3	IC4	IC5	IC6	IC7	IC8	IC9	IC10	IC11	IC12	IC13	IC14	IC15
EL7	9	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
PG	1	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LG	10	0	4	1	2	1	0	1	1	1	1	1	1	1	1	1
	1	0.0	57.1	1	28.6	1	0.0	1	14.3	1	14.3	1	14.3	1	14.3	1
	1	0.0	12.5	1	3.1	1	0.0	1	33.3	1	33.3	1	33.3	1	33.3	1
	1	0.0	2.8	1	1.4	1	0.0	1	0.7	1	0.7	1	0.7	1	0.7	1
CP6	13	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1	100.0	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1
	1	14.3	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1
	1	0.7	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1
CP6	15	0	1	1	1	1	0	1	0	1	0	1	0	1	0	1
	1	0.0	50.0	1	50.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1
	1	0.0	3.1	1	1.5	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1
	1	0.0	0.7	1	0.7	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1
CP6	15	7	32	65	38	26.2	2.1	145	100.0	145	100.0	145	100.0	145	100.0	145

***** CROSSTABULATION OF *****
 ELB BY M8
 CONTROLLING FOR...
 SURGE

 VALUE... 8 PCI AND BEHAVIOR

 PAGE 2 C

	COUNT	1	2	3	4	5	USEFUL	USELESS	MON
	PCI	ICRITICAL	EXTREME	USEFUL	LITTLE	USELESS			TOTAL
	COL	PCI	USEFUL		USE				
ELB	101	PCI	1	2	3	4	5		
	10	1	0	1	4	1	0	1	4
		1	0.0	1	100.0	1	0.0	1	2.8
		1	0.0	1	5.8	1	0.0	1	
		1	0.0	1	2.8	1	0.0	1	
	12	1	0	2	1	0	1	0	3
		1	0.0	66.7	1	0.0	1	0.0	2.1
		1	0.0	7.4	1	0.0	1	0.0	
		1	0.0	1.4	1	0.0	1	0.0	
	15	1	0	1	1	0	1	0	1
		1	0.0	100.0	1	0.0	1	0.0	0.7
		1	0.0	3.7	1	0.0	1	0.0	
		1	0.0	0.7	1	0.0	1	0.0	
COLLUM	9	27	69	47.9	35	4			144
TOTAL	6.3	18.8	47.9	24.3	2.8				100.0

43 OUT OF 50 (86.0%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.028
 MAX CHI SQUARE = 49.94672 WITH 36 DEGREES OF FREEDOM, SIGNIFICANCE = 0.0611
 KRAMEY'S V = 0.29447
 NUMBER OF MISSING OBSERVATIONS = 7

	COUNT	1	2	3	4	5	ROW TOTAL
EL15	8	1	1	1	1	1	10
PU	1	10.0	1	40.0	1	10.0	6.8
	1	5.3	1	7.8	1	3.6	0.0
	1	0.7	1	2.7	1	0.7	0.0
PL	9	1	1	0	1	0	2
	1	50.0	1	0.0	1	0.0	1.4
	1	5.3	1	0.0	1	0.0	0.0
	1	0.7	1	0.0	1	0.0	0.0
LG	10	1	1	2	1	1	6
	1	16.7	1	33.3	1	0.0	4.1
	1	5.3	1	3.9	1	0.0	33.3
	1	0.7	1	1.4	1	0.0	0.7
CPU	11	1	2	1	1	0	3
	1	66.7	1	33.3	1	0.0	2.1
	1	10.5	1	2.0	1	0.0	0.0
	1	1.4	1	0.7	1	0.0	0.0
FUG	12	1	1	0	1	0	1
	1	100.0	1	0.0	1	0.0	0.7
	1	5.3	1	0.0	1	0.0	0.0
	1	0.7	1	0.0	1	0.0	0.0
GPUG	15	1	1	0	1	0	2
	1	50.0	1	0.0	1	0.0	1.4
	1	5.3	1	0.0	1	0.0	0.0
	1	0.7	1	0.0	1	0.0	0.0
COLUMN TOTAL	19	51	45	28	3	146	
TOTAL	13.0	34.9	30.8	19.2	2.1	100.0	

57 OUT OF 65 (87.7%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.021
 MAX CHI SQUARE = 48.3115E WITH 48 DEGREES OF FREEDOM. SIGNIFICANCE = 0.4602
 CRAMER'S V = 0.28762
 NUMBER OF MISSING OBSERVATIONS = 5

***** CROSS TABULATION OF *****
 ELIS BY NIS
 CONTROLLING FOR...
 SUBJIS
 VALUE... 15 LIN PATH MODELS
 ***** PAGE 11

		NIS											
		COUNT	ICHTICAL	EXTREME	USEFUL	LITTLE	USELESS						
		ROW PCT	USEFUL	USEFUL	USEFUL	USE	USELESS						
		COL PCT	USEFUL	USEFUL	USEFUL	USE	USELESS						
		TOT PCT	1	2	3	4	5						
			1	2	3	4	5						
ELIS	1	1	1	1	1	1	1	1	1	1	1	1	1
C	1	0.0	12.5	37.5	37.5	12.5	12.5	1	1	1	1	1	1
	1	0.0	2.0	6.7	10.7	33.3	33.3	1	1	1	1	1	1
	1	0.0	0.7	2.1	2.1	0.7	0.7	1	1	1	1	1	1
2	1	1	9	7	7	5	0	1	1	1	1	1	1
	1	4.5	40.9	31.8	22.7	17.5	0.0	1	1	1	1	1	1
	1	5.3	17.6	15.6	17.5	17.5	0.0	1	1	1	1	1	1
	1	0.7	6.2	4.8	3.4	3.4	0.0	1	1	1	1	1	1
3	1	13.6	33.3	28.8	22.7	1.5	1.5	1	1	1	1	1	1
	1	47.4	43.1	42.2	53.6	33.3	33.3	1	1	1	1	1	1
	1	6.2	15.1	13.0	10.3	0.7	0.7	1	1	1	1	1	1
4	1	2	10	7	4	0	0	1	1	1	1	1	1
	1	8.7	43.5	30.4	17.4	0.0	0.0	1	1	1	1	1	1
	1	10.5	19.6	15.6	14.3	0.0	0.0	1	1	1	1	1	1
	1	1.4	6.8	4.8	2.7	0.0	0.0	1	1	1	1	1	1
5	1	0	0	1	1	0	0	1	1	1	1	1	1
	1	0.0	0.0	100.0	0.0	0.0	0.0	1	1	1	1	1	1
	1	0.0	0.0	2.2	0.0	0.0	0.0	1	1	1	1	1	1
	1	0.0	0.0	0.7	0.0	0.0	0.0	1	1	1	1	1	1
6	1	0	1	0	0	0	0	1	1	1	1	1	1
	1	0.0	100.0	0.0	0.0	0.0	0.0	1	1	1	1	1	1
	1	0.0	2.0	0.0	0.0	0.0	0.0	1	1	1	1	1	1
	1	0.0	0.7	0.0	0.0	0.0	0.0	1	1	1	1	1	1
7	1	0	1	0	0	0	0	1	1	1	1	1	1
	1	0.0	100.0	0.0	0.0	0.0	0.0	1	1	1	1	1	1
	1	0.0	2.0	0.0	0.0	0.0	0.0	1	1	1	1	1	1
	1	0.0	0.7	0.0	0.0	0.0	0.0	1	1	1	1	1	1
COLUMN TOTAL		19	51	45	28	3	3	146	146	146	146	146	146
TOTAL		13.0	34.9	30.8	19.2	2.1	2.1	100.0	100.0	100.0	100.0	100.0	100.0

(CONTINUED)

***** C R O S S T A B L E I N O F *****
 EL14 BY H14
 CONTROLLING FOR..
 SUBJ14 VALUE.. 14 CALC ***** PAGE 2

[illegible]

35 OUT OF 40 (87.5%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
MINIMUM EXPECTED CELL FREQUENCY = 0.049
MAX CHI SQUARE = 24.04679 WITH 20 DEGREES OF FREEDOM. SIGNIFICANCE = 0.6791
CHAMEN'S V = 0.20504

NUMBER OF MISSING OBSERVATIONS = 6

***** CROSS TABULATION OF *****
 EL14 BY H14
 CONTROLLING FOR..
 SUBJ14
 VALUE.. 14 CALC
 ***** PAGE 11

	COUNT	IC	CRITICAL	EXTREME	USEFUL	LITTLE	USELESS	NOM
		1	2	3	4	5		TOTAL
EL14	1	0	0	1	1	3	1	5
C	1	0.0	0.0	20.0	60.0	20.0	1	3.5
	1	0.0	0.0	1.8	7.1	14.3	1	
	1	0.0	0.0	0.7	2.1	0.7	1	
2	1	0	1	4	4	1	1	10
F	1	0.0	10.0	40.0	40.0	10.0	1	7.0
	1	0.0	3.3	7.1	9.5	14.3	1	
	1	0.0	0.7	2.8	2.8	0.7	1	
3	1	6	23	42	30	3	1	104
U	1	5.8	22.1	40.4	28.6	2.9	1	72.7
	1	75.0	76.7	75.0	71.4	42.9	1	
	1	4.2	16.1	29.4	21.0	2.1	1	
4	1	1	4	1	3	1	1	10
G	1	10.0	40.0	10.0	30.0	10.0	1	7.0
	1	12.5	13.3	1.8	7.1	14.3	1	
	1	0.7	2.8	0.7	2.1	0.7	1	
6	1	0	0	4	1	0	1	5
FU	1	0.0	0.0	80.0	20.0	0.0	1	3.5
	1	0.0	0.0	7.1	2.4	0.0	1	
	1	0.0	0.0	2.8	0.7	0.0	1	
10	1	1	1	2	1	1	1	6
LG	1	16.7	16.7	33.3	16.7	16.7	1	4.2
	1	12.5	3.3	3.6	2.4	14.3	1	
	1	0.7	0.7	1.4	0.7	0.7	1	
12	1	0	1	1	0	0	1	2
FUG	1	0.0	50.0	50.0	0.0	0.0	1	1.4
	1	0.0	3.3	1.8	0.0	0.0	1	
	1	0.0	0.7	0.7	0.0	0.0	1	
COLLMA	8	30	56	42	7			143
TOTAL	5.6	21.0	39.2	29.4	4.9			100.0

(CONTINUED)

***** C R O S S T A B L A T I O N O F *****
 E113 BY H13
 CONTROLLING FOR..
 SURJ13 VALUE.. 13 MAT & LIN ALGEBRA
 ***** PAGE 2 *****

M13									
	COLN	1	ICN	ITICAL	EXTREME	USEFUL	LITTLE	USELESS	RCN
	PCT	1	1	1	2	3	4	5	TOTAL
	COL	PCT	1	1	2	3	4	5	
	TCT	PCT	1	1	2	3	4	5	
ELL13	11	1	0	1	0	1	1	1	1
			0.0	1	0.0	0.0	100.0	1	0.7
CPU	1	1	0.0	1	0.0	0.0	2.9	1	0.0
	1	1	0.0	1	0.0	0.0	0.7	1	0.0
	12	1	0	1	1	0	1	1	1
			0.0	1	100.0	0.0	0.0	0.0	0.7
FUG	1	1	0.0	1	2.7	0.0	0.0	1	0.0
	1	1	0.0	1	0.7	0.0	0.0	1	0.0
	15	1	0	1	1	0	1	0	1
			0.0	1	100.0	0.0	0.0	0.0	0.7
CPU	1	1	0.0	1	2.7	0.0	0.0	1	0.0
	1	1	0.0	1	0.7	0.0	0.0	1	0.0
	COLL	18	37	54	34	5	146	100.0	
	TOTAL	12.5	25.3	37.0	23.3	2.1	100.0		

46 OUT OF 50 (92.0%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
MINIMUM EXPECTED CELL FREQUENCY = 0.021
MAX CHI SQUARE = 48.52712 WITH 36 DEGREES OF FREEDOM. SIGNIFICANCE = 0.0793
GRAVEN'S V = 0.28826

NUMBER OF MISSING OBSERVATIONS = 5

***** CROSS TABULATION OF *****
 EL12 BY M12
 CONTROLLING FOR..
 SUBJ12 VALUE... 12 DEF /PROD MGT
 ***** PAGE 2 *****

		COUNT					M12	
		NON	CRITICAL	EXTREME	USEFUL	LITTLE	USELESS	NON
		COL	USEFUL	USEFUL	USEFUL	USE		TOTAL
		TOT	1	2	3	4	5	
EL12	1	15	1	0	0	0	0	1
	2	1	1	0	0	0	0	1
OPUG	1	1	100.0	0.0	0.0	0.0	0.0	0.7
	2	1	5.0	0.0	0.0	0.0	0.0	0.0
	1	1	0.7	0.0	0.0	0.0	0.0	0.0
	2	1	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		20	20	48	52	22	3	145
		13.6	33.1	35.9	15.2	2.1		100.0

32 OUT OF 40 (80.0%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.021
 MAX CHI SQUARE = 44.33637 WITH 28 DEGREES OF FREEDOM. SIGNIFICANCE = 0.0257
 CRAMER'S V = 0.27648

NUMBER OF MISSING OBSERVATIONS = 6

***** CROSS TABULATION OF *****
 E111 BY ALL
 CONTROLLING FOR..
 SUBJ11
 ***** VALUE.. 11 PRODLCTN PGT ***** PAGE 2

		R11											
		COLT	1	2	3	4	5	6	7	8	9		
		NON PCT	ICHTICAL	EXTREME	USEFUL	LITTLE	USELESS						
		COL PCT	1	2	3	4	5						
		TOT PCT	1	2	3	4	5						
E111	8	1	0	1	1	3	1	4	1	5	1		
			0	1	1	3	1	0	1	0	1		
			0.0	25.0	1	75.0	1	0.0	1	0.0	1		
			0.0	3.0	1	4.1	1	0.0	1	0.0	1		
PU	1	1	0.0	1	0.7	2.1	1	0.0	1	0.0	1		
			0.0	1	0.7	2.1	1	0.0	1	0.0	1		
			0.0	1	0.7	2.1	1	0.0	1	0.0	1		
			0.0	1	0.7	2.1	1	0.0	1	0.0	1		
PG	9	1	0	1	2	1	1	1	0	1	1		
			0.0	1	40.0	1	40.0	1	20.0	1	0.0		
			0.0	1	6.1	1	2.7	1	4.0	1	0.0		
			0.0	1	1.4	1	1.4	1	0.7	1	0.0		
UG	10	1	0	1	1	3	1	0	1	0	1		
			0.0	1	25.0	1	75.0	1	0.0	1	0.0		
			0.0	1	3.0	1	4.1	1	0.0	1	0.0		
			0.0	1	0.7	1	2.1	1	0.0	1	0.0		
CPUG	15	1	1	1	0	1	0	1	0	1	0		
			100.0	1	0.0	1	0.0	1	0.0	1	0.0		
			10.0	1	0.0	1	0.0	1	0.0	1	0.0		
			0.7	1	0.0	1	0.0	1	0.0	1	0.0		
COLLUM		10	33	22.8	50.3	17.2	2.8						
TOTAL		6.9	6.9	22.8	50.3	17.2	2.8						

46 OUT OF 55 (83.6%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.028
 MAX CHI SQUARE = 53.52038 WITH 40 DEGREES OF FREEDOM. SIGNIFICANCE = 0.0697
 CRAMER'S V = 0.30490

NUMBER OF MISSING OBSERVATIONS = 6

***** CROSSTABULATION OF *****
 EL11 BY H11
 CONTROLLING FOR..
 SUBJ11
 VALUE.. 11 PRODUCTIN MGT
 ***** PAGE 11

H11													
COUNT		COUNT											
ROW	PCT	ICRITICAL	EXTREME	USEFUL	LITTLE	USELESS							NOM
COL	PCT	USEFUL	USEFUL	USEFUL	USE	USELESS							TOTAL
TOT	PCT	1	2	3	4	5							

EL11		1	1	1	1	1	1	4	1	5	1		
0		1	1	3	1	12	1	10	1	0	1	26	
		1	3.8	11.5	46.2	38.5	1	38.5	1	0.0	1	17.9	
		1	10.0	9.1	16.4	40.0	1	40.0	1	0.0	1		
		1	0.7	2.1	6.3	6.9	1	6.9	1	0.0	1		
		2	1	1	1	1	1	1	1	1	1	33	
P		1	3	9	16	4	1	4	1	1	1	22.8	
		1	9.1	27.3	48.5	12.1	1	12.1	1	3.0	1		
		1	30.0	27.3	21.9	16.0	1	16.0	1	25.0	1		
		1	2.1	6.2	11.0	2.8	1	2.8	1	0.7	1		
		3	1	8	23	5	1	5	1	1	1	41	
L		1	0.0	19.5	56.1	22.0	1	22.0	1	2.4	1	28.3	
		1	0.0	24.2	31.5	36.0	1	36.0	1	25.0	1		
		1	0.0	5.5	15.9	6.2	1	6.2	1	0.7	1		
		4	1	8	7	1	1	1	1	2	1	21	
G		1	14.3	38.1	33.3	4.8	1	4.8	1	9.5	1	14.5	
		1	30.0	24.2	9.6	4.0	1	4.0	1	50.0	1		
		1	2.1	5.5	4.8	0.7	1	0.7	1	1.4	1		
		5	1	1	3	0	1	0	1	0	1	6	
CP		1	33.3	16.7	50.0	0.0	1	0.0	1	0.0	1	4.1	
		1	20.0	3.0	4.1	0.0	1	0.0	1	0.0	1		
		1	1.4	0.7	2.1	0.0	1	0.0	1	0.0	1		
		6	1	0	2	0	1	0	1	0	1	2	
CU		1	0.0	0.0	100.0	0.0	1	0.0	1	0.0	1	1.4	
		1	0.0	0.0	2.7	0.0	1	0.0	1	0.0	1		
		1	0.0	0.0	1.4	0.0	1	0.0	1	0.0	1		
		7	1	0	2	0	1	0	1	0	1	2	
CG		1	0.0	0.0	100.0	0.0	1	0.0	1	0.0	1	1.4	
		1	0.0	0.0	2.7	0.0	1	0.0	1	0.0	1		
		1	0.0	0.0	1.4	0.0	1	0.0	1	0.0	1		
		10	1	33	73	25	1	25	4	1	1	145	
COLUMN		6.9	22.8	50.3	17.2	2.8							100.0
TOTAL													

(CONTINUED)

 CONTROLLING FOR...
 SUBJIO

 COUNT 1
 MON PCT ICHNICAL EXTREME USEFUL LITTLE USELESS MON
 COL PCT I
 TOT PCT I 1 1 2 3 4 5
 VALUE... 10 PGT INFO SYST

 BY M10

 PAGE 2 LI

		1	2	3	4	5	TOTAL
ELIO	8	1	1	3	0	0	6
		16.7	33.3	50.0	0.0	0.0	4.1
PU	1	4.5	3.4	6.1	0.0	0.0	
	1	0.7	1.4	2.0	0.0	0.0	
PG	9	0	0	1	0	0	1
		0.0	0.0	100.0	0.0	0.0	0.7
	1	0.0	0.0	2.0	0.0	0.0	
	1	0.0	0.0	0.7	0.0	0.0	
LG	10	0	1	2	0	0	3
		0.0	33.3	66.7	0.0	0.0	2.0
	1	0.0	1.7	4.1	0.0	0.0	
	1	0.0	0.7	1.4	0.0	0.0	
CPU	11	1	0	1	0	0	2
		50.0	0.0	50.0	0.0	0.0	1.4
	1	4.5	0.0	2.0	0.0	0.0	
	1	0.7	0.0	0.7	0.0	0.0	
PUG	12	0	1	0	0	0	1
		0.0	100.0	0.0	0.0	0.0	0.7
	1	0.0	1.7	0.0	0.0	0.0	
	1	0.0	0.7	0.0	0.0	0.0	
CPG	13	0	1	0	0	0	1
		0.0	100.0	0.0	0.0	0.0	0.7
	1	0.0	1.7	0.0	0.0	0.0	
	1	0.0	0.7	0.0	0.0	0.0	
CPUG	15	2	0	0	0	0	2
		100.0	0.0	0.0	0.0	0.0	1.4
	1	4.1	0.0	0.0	0.0	0.0	
	1	1.4	0.0	0.0	0.0	0.0	
COLUMN TOTAL		22	50	49	17	2	148
		14.9	39.2	33.1	11.5	1.4	100.0

61 OUT OF 70 (87.1%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.

MINIMUM EXPECTED CELL FREQUENCY = 0.014
 RAW CHI SQUARE = 39.30041 WITH 52 DEGREES
 OF FREEDOM
 SIGNIFICANCE = .9027
 CRAMER'S V = .25765
 NUMBER OF MISSING OBSERVATIONS = 3

***** CROSS TABULATION OF *****
 EL9 BY N9
 CONTROLLING FOR..
 SUBJ9
 ***** VALUE... 9 N & D MGT ***** PAGE 2 (

		COUNT		CRITICAL		EXTREME		USEFUL		LITTLE		USELESS		NOW	
		EL9		COL PCT		USEFUL		USEFUL		LSE		USELESS		TOTAL	
		11		1		2		3		4		5		1	
		100.0		1		0.0		0.0		0.0		0.0		0.7	
		4.3		1		0.0		0.0		0.0		0.0		0.0	
		0.7		1		0.0		0.0		0.0		0.0		0.0	
		13		1		0		0		0		0		1	
		100.0		1		0.0		0.0		0.0		0.0		0.7	
		4.3		1		0.0		0.0		0.0		0.0		0.0	
		0.7		1		0.0		0.0		0.0		0.0		0.0	
TOTAL		23		32		68		22		147		100.0			

35 OUT OF 45 (77.8%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.014
 MAX CHI SQUARE = 47.82720 WITH 32 DEGREES OF FREEDOM, SIGNIFICANCE = 0.0357
 CHAMEN'S V = 0.28520
 NUMBER OF MISSING OBSERVATIONS = 4

***** CROSS TABULATION OF *****
 EL9 BY R9
 CONTROLLING FOR..
 SUBJ9
 ***** VALUE.. 9 M & C MGI ***** PAGE 11

R9														
COUNT		COUNT												
ROW	COL	ICNITIAL	EXTREME	USEFUL	LITTLE	USELESS	NOW							
TOT	PCI	1	2	3	4	5	TOTAL							
EL9	1	4	10	13	9	1	37							
	1	10.8	27.0	35.1	24.3	2.7	25.2							
C	1	17.4	31.3	19.1	40.9	50.0								
	1	2.7	6.8	8.8	6.1	0.7								
	2	10	18	41	8	1	78							
F	1	12.8	23.1	52.6	10.3	1.3	53.1							
	1	43.5	56.3	60.3	36.4	50.0								
	1	6.8	12.2	27.9	5.4	0.7								
	3	0	0	0	3	0	3							
L	1	0.0	0.0	0.0	100.0	0.0	2.0							
	1	0.0	0.0	0.0	13.6	0.0								
	1	0.0	0.0	0.0	2.0	0.0								
	4	2	1	8	2	0	13							
G	1	15.4	7.7	61.5	15.4	0.0	8.8							
	1	8.7	3.1	11.8	9.1	0.0								
	1	1.4	0.7	5.4	1.4	0.0								
	5	4	3	5	0	0	12							
CP	1	33.3	25.0	41.7	0.0	0.0	8.2							
	1	17.4	9.4	7.4	0.0	0.0								
	1	2.7	2.0	3.4	0.0	0.0								
	7	0	0	1	0	0	1							
CG	1	0.0	0.0	100.0	0.0	0.0	0.7							
	1	0.0	0.0	1.5	0.0	0.0								
	1	0.0	0.0	0.7	0.0	0.0								
	9	1	0	0	0	0	1							
PG	1	100.0	0.0	0.0	0.0	0.0	0.7							
	1	4.3	0.0	0.0	0.0	0.0								
	1	0.7	0.0	0.0	0.0	0.0								
COLLAPSE TOTAL		23	32	68	22	2	147							
		15.6	21.8	46.3	15.0	1.4	100.0							

(CONTINUED)

***** CROSS TABULATION OF *****
 EL16 BY R16
 CONTROLLING FOR.. VALUE.. 16 FONTMAN
 SUBJ16 ***** PAGE 10

		R16											
COUNT		ICRITICAL		EXTREME		USEFUL		LITTLE		USELESS		NCR	
HOW PCT		COL PCT		USEFUL				LSE				TOTAL	
101 PCT		1	2	3	4	5	6	7	8	9	10		
EL16		1	2	3	4	5	6	7	8	9	10		
1		1	13.3	0.0	0.0	33.3	1	33.3	1	20.0	1	15	10.6
2		1	40.0	0.0	7.2	12.2	1	42.9	1	2.1	1	37	26.1
3		1	1.4	0.0	3.5	3.5	1	8.4	1	0.7	1	67	47.2
4		1	0.0	16.2	56.8	24.3	1	2.7	1	14.3	1	2	1.4
5		1	0.0	30.0	30.4	22.0	1	0.0	1	0.0	1	1	0.7
6		1	0.0	4.2	14.8	6.3	1	0.0	1	0.0	1	3	2.1
7		1	2	9	31	23	1	2	1	0	1	8	5.6
8		1	3.0	13.4	46.3	34.3	1	5.0	1	28.6	1	142	100.0
9		1	40.0	45.0	44.9	56.1	1	1.4	1	1.4	1		
10		1	1.4	6.3	21.8	16.2	1	0.7	1	0.0	1		
11		1	0.0	0.0	1	1	1	50.0	1	0.0	1		
12		1	0.0	0.0	1.4	2.4	1	0.0	1	0.0	1		
13		1	0.0	0.0	0.7	0.7	1	0.0	1	0.0	1		
14		1	0.0	0.0	100.0	0.0	1	0.0	1	0.0	1		
15		1	0.0	0.0	1.4	0.0	1	0.0	1	0.0	1		
16		1	0.0	0.0	0.7	0.7	1	0.0	1	0.0	1		
17		1	0.0	2	1	1	1	0	1	0	1		
18		1	0.0	66.7	33.3	0.0	1	0.0	1	0.0	1		
19		1	0.0	10.0	1.4	0.0	1	0.0	1	0.0	1		
20		1	0.0	1.4	0.7	0.0	1	0.0	1	0.0	1		
21		1	0.0	1	5	2	1	0	1	0	1		
22		1	0.0	12.5	62.5	25.0	1	0.0	1	0.0	1		
23		1	0.0	5.0	7.2	4.9	1	0.0	1	0.0	1		
24		1	0.0	0.7	3.5	1.4	1	0.0	1	0.0	1		
25		1	5	20	69	48.6	1	41	1	7	1		
TOTAL		3.5	14.1	48.6	28.9	4.9							

(CONTINUED)

***** C R C S S T A B L E L A T I O N O F *****
 EL16 BY R16
 CONTROLLING FOR...
 SUBJ16
 VALUE.. 16 FORTMAN
 PAGE 2 01

		R16											
		COUNT	1	2	3	4	5	6	7	8	9	ROW	TOTAL
		HOW PCT	ICHTICAL	EXTREME	USEFUL	LITTLE	USELESS						
		COL PCT	1	2	3	4	5						
		TOT PCT	1	2	3	4	5						
EL16		9	0	0	1	1	0	1	0	1	1	1	0.7
			0.0	0.0	100.0	0	0.0	1	0.0	1	0.0	1	
			0.0	0.0	1.4	1	0.0	1	0.0	1	0.0	1	
			0.0	0.0	0.7	1	0.0	1	0.0	1	0.0	1	
LG		10	0	0	1	1	1	1	1	1	1	3	2.1
			0.0	0.0	33.3	1	33.3	1	33.3	1	33.3	1	
			0.0	0.0	1.4	1	2.4	1	14.3	1	14.3	1	
			0.0	0.0	0.7	1	0.7	1	0.7	1	0.7	1	
CPU		11	0	1	1	2	0	1	0	1	0	3	2.1
			0.0	33.3	1	66.7	1	0.0	1	0.0	1	0.0	
			0.0	5.0	1	2.9	1	0.0	1	0.0	1	0.0	
			0.0	0.7	1	1.4	1	0.0	1	0.0	1	0.0	
PUG		12	1	0	1	0	1	0	1	0	1	1	0.7
			100.0	0.0	1	0.0	1	0.0	1	0.0	1	0.0	
			20.0	0.0	1	0.0	1	0.0	1	0.0	1	0.0	
			0.7	0.0	1	0.0	1	0.0	1	0.0	1	0.0	
LUG		14	0	1	1	0	1	0	1	0	1	1	0.7
			0.0	100.0	1	0.0	1	0.0	1	0.0	1	0.0	
			0.0	5.0	1	0.0	1	0.0	1	0.0	1	0.0	
			0.0	0.7	1	0.0	1	0.0	1	0.0	1	0.0	
COLLMA		5	20	69	41	7	142						
TOTAL		3.5	14.1	48.6	28.9	4.9	100.0						

53 OUT OF 60 (88.3%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.035
 MAX CHI SQUARE = 70.16068 WITH 44 DEGREES OF FREEDOM. SIGNIFICANCE = 0.0073
 CRAMER'S V = 0.35146

NUMBER OF MISSING OBSERVATIONS = 9

***** CROSS TABULATION OF *****
 EL17 BY R17
 CONTROLLING FUR..
 SUBJ17
 VALUE.. 17 BASIC
 ***** PAGE 1 C

		COUNT											
		ROW		EXTREME		USEFUL		LITTLE		USELESS		NON	
		PCT		USEFUL				LSE				TOTAL	
		COL	PCI	1	2	3	4	5	6	7	8	9	10
		101	PCI	1	2	3	4	5	6	7	8	9	10
EL17													
C		1	1	11.8	23.5	47.1	11.2	5.9	33.3	1	17		
		2	1	22.2	8.3	12.9	9.1	33.3	1	11.8			
		3	1	1.4	2.8	5.6	1.4	0.7	1				
F		2	1	15	17	17	4	1	1	39			
		3	1	5.1	38.5	43.6	10.3	2.6	1	27.1			
		4	1	22.2	31.3	27.4	18.2	33.3	1				
		5	1	1.4	10.4	11.8	2.6	0.7	1				
U		3	1	5	11	30	13	1	1	58			
		4	1	5.2	19.0	51.7	22.4	1.7	1	40.3			
		5	1	33.3	22.9	48.4	59.1	33.3	1				
		6	1	2.1	7.6	20.8	9.0	0.7	1				
G		4	1	0	3	0	0	0	0	3			
		5	1	0.0	100.0	0.0	0.0	0.0	0.0	2.1			
		6	1	0.0	6.3	0.0	0.0	0.0	0.0				
		7	1	0.0	2.1	0.0	0.0	0.0	0.0				
CP		5	1	0	3	1	1	0	0	4			
		6	1	0.0	75.0	25.0	0.0	0.0	0.0	2.8			
		7	1	0.0	6.3	1.6	0.0	0.0	0.0				
		8	1	0.0	2.1	0.7	0.0	0.0	0.0				
CU		6	1	0	2	2	1	1	0	5			
		7	1	0.0	40.0	40.0	20.0	0.0	0.0	3.5			
		8	1	0.0	4.2	3.2	4.5	0.0	0.0				
		9	1	0.0	1.4	1.4	0.7	0.0	0.0				
FU		8	1	0	5	3	1	1	0	9			
		9	1	0.0	55.6	33.3	11.1	0.0	0.0	6.3			
		10	1	0.0	10.4	4.8	4.5	0.0	0.0				
		11	1	0.0	3.5	2.1	0.7	0.0	0.0				
COLUMN		9	6.3	33.3	43.1	22	3	144					
TOTAL													

(CONTINUED)

***** CROSSTABULATION OF *****
 EL17 BY R17
 CONTROLLING FORM..
 SUBJ17 VALUE.. 17 BASIC
 ***** PAGE 2 C.

COLAT		R17										TOTAL	
ROW	COL	1	2	3	4	5	6	7	8	9	10	11	12
EL17	101	1	1	1	1	1	1	1	1	1	1	1	1
LG	10	1	0	1	0	1	0	1	1	1	0	1	1
		1	0.0	1	0.0	1	0.0	1	100.0	1	0.0	1	0.7
		1	0.0	1	0.0	1	0.0	1	4.5	1	0.0	1	1
		1	0.0	1	0.0	1	0.0	1	0.7	1	0.0	1	1
CPU	11	1	0	1	3	1	1	1	0	1	0	1	4
		1	0.0	1	75.0	1	25.0	1	0.0	1	0.0	1	2.8
		1	0.0	1	6.3	1	1.6	1	0.0	1	0.0	1	1
		1	0.0	1	2.1	1	0.7	1	0.0	1	0.0	1	1
CUG	14	1	0	1	1	1	0	1	0	1	0	1	1
		1	0.0	1	100.0	1	0.0	1	0.0	1	0.0	1	0.7
		1	0.0	1	2.1	1	0.0	1	0.0	1	0.0	1	1
		1	0.0	1	0.7	1	0.0	1	0.0	1	0.0	1	1
CPUG	15	1	2	1	1	1	0	1	0	1	0	1	3
		1	66.7	1	33.3	1	0.0	1	0.0	1	0.0	1	2.1
		1	22.2	1	2.1	1	0.0	1	0.0	1	0.0	1	1
		1	1.4	1	0.7	1	0.0	1	0.0	1	0.0	1	1
COLLUM		9	48	62	22	3	144						
TOTAL		6.3	33.3	43.1	15.3	2.1	100.0						

47 OUT OF 55 (85.5%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.021
 MAX CHI SQUARE = 52.94296 WITH 40 DEGREES OF FREEDOM. SIGNIFICANCE = 0.0026
 CAMER'S V = 0.30317

NUMBER OF MISSING OBSERVATIONS = 7

R1E												
COUNT		1	2	3	4	5	6	7	8	9	ROW	TOTAL
HOW	PCI	EXTREME	USEFUL	LITTLE	USELESS							
COL	PCI	USEFUL										
TOT	PCI	1	2	3	4	5	6	7	8	9		
EL18	C	1	1	0	1	6	1	1	1	4	1	21
		2	1	0.0	1	28.6	1	52.4	1	19.0	1	15.6
		3	1	0.0	1	11.5	1	19.0	1	40.0	1	
		4	1	0.0	1	4.4	1	8.1	1	3.0	1	
P	2	1	1	7	1	14	1	10	1	2	1	33
		2	1	21.2	1	42.4	1	30.3	1	6.1	1	24.4
		3	1	46.7	1	26.9	1	17.2	1	20.0	1	
		4	1	5.2	1	10.4	1	7.4	1	1.5	1	
U	3	1	1	4	1	24	1	32	1	4	1	64
		2	1	6.3	1	37.5	1	50.0	1	6.3	1	47.4
		3	1	26.7	1	46.2	1	55.2	1	40.0	1	
		4	1	3.0	1	17.6	1	23.7	1	3.0	1	
G	4	1	1	0	1	1	1	1	1	0	1	2
		2	1	0.0	1	50.0	1	50.0	1	0.0	1	1.5
		3	1	0.0	1	1.9	1	1.7	1	0.0	1	
		4	1	0.0	1	0.7	1	0.7	1	0.0	1	
CP	5	1	1	0	1	2	1	0	1	0	1	2
		2	1	0.0	1	100.0	1	0.0	1	0.0	1	1.5
		3	1	0.0	1	3.8	1	0.0	1	0.0	1	
		4	1	0.0	1	1.5	1	0.0	1	0.0	1	
CU	6	1	1	1	0	1	1	1	1	0	1	2
		2	1	50.0	1	0.0	1	50.0	1	0.0	1	1.5
		3	1	6.7	1	0.0	1	1.7	1	0.0	1	
		4	1	0.7	1	0.0	1	0.7	1	0.0	1	
PU	8	1	1	1	3	1	2	1	0	1	6	
		2	1	16.7	1	50.0	1	33.3	1	0.0	1	4.4
		3	1	6.7	1	5.8	1	3.4	1	0.0	1	
		4	1	0.7	1	2.2	1	1.5	1	0.0	1	
COLLMA		15	52	38.5	43.0	7.4	135					
TOTAL		11.1	38.5	43.0	7.4	100.0						

(CONTINUED)

(CONTINUED)

***** CROSS TABULATION OF *****
 EL18 BY R18
 CONTROLLING FOR...
 SUBJ18
 VALUE.. 18 CCBOL
 ***** PAGE 2 C.

	COUNT	R18	EL18	USEFUL	LITTLE USE	USELESS	ROW TOTAL
EL18	10	1	2	1	3	1	5
UG	1	0	1	1	1	1	2
	1	0.0	50.0	1	50.0	1	1.5
	1	0.0	1.9	1	1.7	1	0.0
	1	0.0	0.7	1	0.7	1	0.0
CPU	11	1	1	1	1	0	2
	1	50.0	1	50.0	1	0.0	1.5
	1	6.7	1	1.9	1	0.0	1
	1	0.7	1	0.7	1	0.0	1
CUG	14	1	1	0	1	0	1
	1	100.0	1	0.0	1	0.0	0.7
	1	6.7	1	0.0	1	0.0	1
	1	0.7	1	0.0	1	0.0	1
COLLPA	15	52	58	10	135		
TOTAL	11.1	38.5	43.0	7.4	100.0		

33 OUT OF 40 (82.5%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.074
 MAX CHI SQUARE = 34.37610 WITH 27 DEGREES OF FREEDOM, SIGNIFICANCE = 0.1554
 Cramer's V = 0.29134

NUMBER OF MISSING OBSERVATIONS = 16

***** C R O S S T A B L E *****
 EL19 BY H19
 CONTROLLING FOR..
 SUBJ19 VALUE.. 19 INTRCUC STATS
 ***** PAGE 10 *****

514

	CULN1	I	CRITICAL	EXTREME	USEFUL	LITTLE LSE	USELESS	NOM TOTAL
	R0W PCT	I	I	2	3	4	5	
	COL PCT	1	1	2	3	4	5	
	TOT PCT	1	1	2	3	4	5	
ELI9	1	0	0	0	2	0	0	2
	1	0.0	0.0	0.0	100.0	0.0	0.0	1.4
	1	0.0	0.0	0.0	6.5	0.0	0.0	
	1	0.0	0.0	0.0	1.4	0.0	0.0	
F	2	2	5	45.5	18.2	2	0	11
	1	18.2	1	9.6	6.5	25.0	0.0	7.5
	1	3.7	1	3.4	1.4	1.4	0.0	
	1	1.4	1	3.4	1.4	1.4	0.0	
L	3	35	37	22	6	1	1	101
	1	34.7	1	36.6	21.8	5.5	1.0	69.2
	1	64.8	1	71.2	71.0	75.0	100.0	
	1	24.0	1	25.3	15.1	4.1	0.7	
G	4	3	2	1	1	0	0	6
	1	50.0	1	33.3	16.7	0.0	0.0	4.1
	1	5.6	1	3.8	3.2	0.0	0.0	
	1	2.1	1	1.4	0.7	0.0	0.0	
CP	5	1	0	0	0	0	0	1
	1	100.0	1	0.0	0.0	0.0	0.0	0.7
	1	1.9	1	0.0	0.0	0.0	0.0	
	1	0.7	1	0.0	0.0	0.0	0.0	
CU	6	1	1	1	0	0	0	2
	1	50.0	1	50.0	0.0	0.0	0.0	1.4
	1	1.9	1	1.9	0.0	0.0	0.0	
	1	0.7	1	0.7	0.0	0.0	0.0	
FU	8	4	4	1	1	0	0	9
	1	44.4	1	44.4	11.1	0.0	0.0	6.2
	1	7.4	1	7.7	3.2	0.0	0.0	
	1	2.7	1	2.7	0.7	0.0	0.0	
COLUMN TOTAL		54	52	35.6	21.2	5.5	0.7	146
		37.0						100.0

(CONTINUED)

		COUNT										ROW TOTAL	
		MIS											
		1	2	3	4	5	6	7	8	9	10		
ROW	COL	1	2	3	4	5	6	7	8	9	10	11	12
EL19	TOT	1	1	1	1	1	1	1	1	1	1	1	1
FG	TOT	1	1	1	1	1	1	1	1	1	1	1	1
LG	TOT	1	1	1	1	1	1	1	1	1	1	1	1
GPU	TOT	1	1	1	1	1	1	1	1	1	1	1	1
FUG	TOT	1	1	1	1	1	1	1	1	1	1	1	1
CPUG	TOT	1	1	1	1	1	1	1	1	1	1	1	1
TOTAL		54	52	31	21.2	5.5	0.7	146					

56 OUT OF 60 (93.3%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.007
 MAX CHI SQUARE = 28.91078 WITH 44 DEGREES OF FREEDOM. SIGNIFICANCE = 0.9614
 Cramer's V = 0.22250
 NUMBER OF MISSING OBSERVATIONS = 5

***** CROSS TABULATION OF *****
 EL20 BY H20
 CONTROLLING FOR..
 SUBJ20
 VALU... 20 MANAGER STATS
 ***** PAGE 1 L

		H20											
		COUNT	ICRITICAL	EXTREME	USEFUL	LITTLE	USELESS						
		ROW PCI	USEFUL	USEFUL	USEFUL	USE	USELESS						
		COL PCI	1	2	3	4	5						
		TOT PCI	1	2	3	4	5						
EL20			1	2	3	4	5						
C	1	1	1	1	1	0	0						
		33.3	33.3	33.3	33.3	0.0	0.0						3
	2	1	2.1	1.6	3.7	0.0	0.0						2.1
	3	1	0.7	0.7	0.7	0.0	0.0						
F	2	1	3	16	8	1	0						28
		10.7	57.1	28.6	3.6	0.0	0.0						19.2
	3	1	5.4	26.2	29.6	11.1	0.0						
	4	1	2.1	11.0	5.5	0.7	0.0						
L	3	1	17	27	15	5	0						64
		26.6	42.2	23.4	7.8	0.0	0.0						43.8
	4	1	36.2	44.3	55.6	55.6	0.0						
	5	1	11.6	18.5	10.3	3.4	0.0						
G	4	1	12	8	2	3	1						26
		46.2	30.8	7.7	11.5	3.8	3.8						17.8
	5	1	25.5	13.1	7.4	33.3	50.0						
	6	1	6.2	5.5	1.4	2.1	0.7						
CP	5	1	1	1	0	0	0						2
		50.0	50.0	0.0	0.0	0.0	0.0						1.4
	6	1	2.1	1.6	0.0	0.0	0.0						
	7	1	0.7	0.7	0.0	0.0	0.0						
HU	6	1	1	3	0	0	0						4
		25.0	75.0	0.0	0.0	0.0	0.0						2.7
	7	1	2.1	4.9	0.0	0.0	0.0						
	8	1	0.7	2.1	0.0	0.0	0.0						
HG	9	1	2	1	0	0	0						3
		66.7	33.3	0.0	0.0	0.0	0.0						2.1
	10	1	4.3	1.6	0.0	0.0	0.0						
	11	1	1.4	0.7	0.0	0.0	0.0						
COLLMA		47	61	27	9	2	1.4						146
TOTAL		32.2	41.8	18.5	6.2	1.4	100.0						

(CONTINUED)

***** CROSSTABULATION OF *****
 EL20 BY K20
 CONTROLLING FOR..
 SUBJ20
 VALUE.. 20 MANAGERL STATS, ***** PAGE 2 (

	COUNT	1	2	3	4	5	ROW
	K20						TOTAL
EL20	10	1	2	1	1	1	6
CG	1	33.3	1	16.7	0.0	16.7	4.1
	1	4.3	1	3.7	0.0	50.0	
	1	1.4	1	0.7	0.0	0.7	
OPU	11	2	1	0	0	0	3
	1	66.7	1	33.3	0.0	0.0	2.1
	1	4.3	1	1.6	0.0	0.0	
	1	1.4	1	0.7	0.0	0.0	
HUG	12	5	1	0	0	0	6
	1	23.3	1	16.7	0.0	0.0	4.1
	1	10.6	1	1.6	0.0	0.0	
	1	3.4	1	0.7	0.0	0.0	
CPUG	15	1	0	0	0	0	1
	1	100.0	1	0.0	0.0	0.0	0.7
	1	2.1	1	0.0	0.0	0.0	
	1	0.7	1	0.0	0.0	0.0	
		47	61	27	5	2	146
		32.2	41.8	18.5	6.2	1.4	100.0

47 OUT OF 55 (85.5%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.014
 MAX CHI SQUARE = 44.41877 WITH 40 DEGREES OF FREEDOM. SIGNIFICANCE = 0.2909
 Cramer's V = 0.27579

NUMBER OF MISSING OBSERVATIONS = 5

***** CROSS TABULATION OF *****
 EL21 BY R21
 CONTINUING FOR..
 SUBJ21
 VALUE.. 21 REGRESS I
 ***** PAGE 1 *****

COUNT 1									
R21									
	NON	PC1	ICHTICAL	EXTREME	USEFUL	LITTLE	USELESS	NON	
	COL	PC1		USEFUL		USE		TOTAL	
EL21	1	2	3	4	5				
C	1	0	1	1	1	1	0	3	
	1	0.0	33.3	33.3	33.3	33.3	0.0	2.1	
	1	0.0	1.9	3.8	20.0	0.0	0.0		
	1	0.0	0.7	0.7	0.7	0.0	0.0		
P	2	1	14	16	10	0	0	40	
	1	35.0	40.0	25.0	0.0	0.0	0.0	27.6	
	1	23.3	30.2	38.5	0.0	0.0	0.0		
	1	9.7	11.0	6.9	0.0	0.0	0.0		
L	3	1	24	20	10	2	0	56	
	1	42.9	35.7	17.9	3.6	0.0	0.0	38.6	
	1	40.0	37.7	38.5	40.0	0.0	0.0		
	1	16.6	13.8	6.9	1.4	0.0	0.0		
G	4	1	8	3	3	2	0	16	
	1	50.0	18.8	18.8	12.5	0.0	0.0	11.0	
	1	13.3	5.7	11.5	40.0	0.0	0.0		
	1	5.5	2.1	2.1	1.4	0.0	0.0		
CP	5	1	0	1	0	0	0	1	
	1	0.0	100.0	0.0	0.0	0.0	0.0	0.7	
	1	0.0	1.9	0.0	0.0	0.0	0.0		
	1	0.0	0.7	0.0	0.0	0.0	0.0		
CU	6	1	0	1	0	0	0	1	
	1	0.0	100.0	0.0	0.0	0.0	0.0	0.7	
	1	0.0	1.9	0.0	0.0	0.0	0.0		
	1	0.0	0.7	0.0	0.0	0.0	0.0		
PU	8	1	3	3	1	0	0	7	
	1	42.9	42.9	14.3	0.0	0.0	0.0	4.8	
	1	5.0	5.7	3.8	0.0	0.0	0.0		
	1	2.1	2.1	0.7	0.0	0.0	0.0		
COLLMA	60	53	26	5	1			145	
TOTAL	41.4	36.6	17.9	3.4	0.7			100.0	

(CONTINUED)

***** CROSSTABULATION OF *****
 CONTROLLING FUM.. BY M21
 SUBJ21 VALUE.. 21 REGRESS I
 ***** PAGE 2 L

M21												
COUNT	ICRITICAL	EXTREME	USEFUL	LITTLE	USELESS	ROW						
MCM PCT I	MCM PCT I	MCM PCT I	MCM PCT I	MCM PCT I	MCM PCT I	TOTAL						
101 PCT I	1	1	2	1	3	1	4	1	5	1		
9	1	1	2	1	1	1	0	1	0	1	4	
PG	1	25.0	1	50.0	1	25.0	1	0.0	1	0.0	1	2.8
	1	1.7	1	3.8	1	3.8	1	0.0	1	0.0	1	
	1	0.7	1	1.4	1	0.7	1	0.0	1	0.0	1	
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	
10	1	2	1	1	1	0	1	0	1	1	1	4
LG	1	50.0	1	25.0	1	0.0	1	0.0	1	25.0	1	2.8
	1	3.3	1	1.9	1	0.0	1	0.0	1	100.0	1	
	1	1.4	1	0.7	1	0.0	1	0.0	1	0.7	1	
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	
11	1	2	1	2	1	0	1	0	1	0	1	4
OPU	1	50.0	1	50.0	1	0.0	1	0.0	1	0.0	1	2.8
	1	3.3	1	3.8	1	0.0	1	0.0	1	0.0	1	
	1	1.4	1	1.4	1	0.0	1	0.0	1	0.0	1	
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	
12	1	4	1	3	1	0	1	0	1	0	1	7
FUG	1	57.1	1	42.9	1	0.0	1	0.0	1	0.0	1	4.8
	1	6.7	1	5.7	1	0.0	1	0.0	1	0.0	1	
	1	2.8	1	2.1	1	0.0	1	0.0	1	0.0	1	
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	
15	1	2	1	0	1	0	1	0	1	0	1	2
CPUG	1	100.0	1	0.0	1	0.0	1	0.0	1	0.0	1	1.4
	1	3.3	1	0.0	1	0.0	1	0.0	1	0.0	1	
	1	1.4	1	0.0	1	0.0	1	0.0	1	0.0	1	
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	
COLUMN	60	53	26	5	1	145						100.0
TOTAL	41.4	36.6	17.9	3.4	0.7							

 EL22
 CONTROLLING FOR..
 SUBJ22

 CROSS TABULATION OF
 BY H22
 VALUE.. 22 REGRESS II

 PAGE 10

		COUNT				H22				LITTLE				ROW			
		NO. PCI	INITIAL	EXTREME	USEFUL	LSE				TOTAL							
		COL PCI	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		TOT PCI	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EL22		1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
C		1	1	0.0	1	33.3	1	33.3	1	33.3	1	33.3	1	33.3	1	33.3	1
		1	1	0.0	1	2.0	1	2.0	1	7.1	1	7.1	1	7.1	1	7.1	1
		1	1	0.0	1	0.7	1	0.7	1	0.7	1	0.7	1	0.7	1	0.7	1
		2	1	8	1	15	1	12	1	5	1	40	1	40	1	40	1
F		1	1	20.0	1	37.5	1	30.0	1	12.5	1	27.0	1	27.0	1	27.0	1
		1	1	18.6	1	29.4	1	33.3	1	35.7	1	35.7	1	35.7	1	35.7	1
		1	1	5.6	1	10.4	1	8.3	1	3.5	1	3.5	1	3.5	1	3.5	1
		3	1	14	1	12	1	12	1	3	1	41	1	41	1	41	1
L		1	1	34.1	1	29.3	1	29.3	1	7.3	1	28.5	1	28.5	1	28.5	1
		1	1	32.6	1	23.5	1	33.3	1	21.4	1	21.4	1	21.4	1	21.4	1
		1	1	9.7	1	8.3	1	8.3	1	2.1	1	2.1	1	2.1	1	2.1	1
		4	1	13	1	11	1	5	1	3	1	32	1	32	1	32	1
G		1	1	40.6	1	34.4	1	15.6	1	9.4	1	22.2	1	22.2	1	22.2	1
		1	1	30.2	1	21.6	1	13.9	1	21.4	1	21.4	1	21.4	1	21.4	1
		1	1	9.0	1	7.6	1	3.5	1	2.1	1	2.1	1	2.1	1	2.1	1
		5	1	1	1	1	1	0	1	0	1	2	1	2	1	2	1
CP		1	1	50.0	1	50.0	1	0.0	1	0.0	1	1.4	1	1.4	1	1.4	1
		1	1	2.3	1	2.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1
		1	1	0.7	1	0.7	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1
		6	1	0	1	1	1	0	1	0	1	1	1	1	1	1	1
CU		1	1	0.0	1	100.0	1	0.0	1	0.0	1	0.7	1	0.7	1	0.7	1
		1	1	0.0	1	2.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1
		1	1	0.0	1	0.7	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1
		8	1	1	1	3	1	2	1	0	1	6	1	6	1	6	1
FU		1	1	16.7	1	50.0	1	33.3	1	0.0	1	4.2	1	4.2	1	4.2	1
		1	1	2.3	1	5.9	1	5.6	1	0.0	1	0.0	1	0.0	1	0.0	1
		1	1	0.7	1	2.1	1	1.4	1	0.0	1	0.0	1	0.0	1	0.0	1
		COLLUM	43	51	36	14	144										
		TOTAL	29.9	35.4	25.0	9.7	100.0										

(CONTINUED)

 EL30
 CONTROLLING FOR..
 SUBJ30

 CROSS TABULATION OF
 BY R30
 VALUE.. 30
 QMT 550

 PAGE 16

		R30											
		COUNT	1	2	3	4	5	6	7	8	9	ROW	TOTAL
		ROW PCT	1	2	3	4	5	6	7	8	9		
		COL PCT	1	2	3	4	5	6	7	8	9		
		TOT PCT	1	2	3	4	5	6	7	8	9		
EL30			1	1	1	1	1	1	1	1	1		
C			1	1	1	1	1	1	1	1	1		4
			1	25.0	1	0.0	1	75.0	1	0.0	1		2.6
			1	2.5	1	0.0	1	8.6	1	0.0	1		
			1	0.7	1	0.0	1	2.1	1	0.0	1		
			1	1	1	1	1	1	1	1	1		
F			2	1	1	1	1	1	1	1	1		91
			1	28	1	38	1	17	1	8	1		62.8
			1	30.8	1	41.8	1	18.7	1	8.6	1		
			1	70.0	1	66.7	1	48.6	1	61.5	1		
			1	19.3	1	26.2	1	11.7	1	5.5	1		
			1	1	1	1	1	1	1	1	1		
L			3	1	1	1	1	1	1	1	1		15
			1	26.7	1	26.7	1	40.0	1	6.7	1		10.3
			1	10.0	1	7.0	1	17.1	1	7.7	1		
			1	2.8	1	2.8	1	4.1	1	0.7	1		
			1	1	1	1	1	1	1	1	1		
G			4	1	1	1	1	1	1	1	1		18
			1	16.7	1	44.4	1	27.8	1	11.1	1		12.4
			1	7.5	1	14.0	1	14.3	1	15.4	1		
			1	2.1	1	5.5	1	3.4	1	1.4	1		
			1	1	1	1	1	1	1	1	1		
CP			5	1	1	1	1	1	1	1	1		3
			1	33.3	1	33.3	1	0.0	1	33.3	1		2.1
			1	2.5	1	1.8	1	0.0	1	7.7	1		
			1	0.7	1	0.7	1	0.0	1	0.7	1		
			1	1	1	1	1	1	1	1	1		
PU			8	1	1	1	1	1	1	1	1		4
			1	0.0	1	50.0	1	50.0	1	0.0	1		2.6
			1	0.0	1	3.5	1	5.7	1	0.0	1		
			1	0.0	1	1.4	1	1.4	1	0.0	1		
			1	1	1	1	1	1	1	1	1		
PG			9	1	1	1	1	1	1	1	1		5
			1	40.0	1	40.0	1	0.0	1	20.0	1		3.4
			1	5.0	1	3.5	1	0.0	1	7.7	1		
			1	1.4	1	1.4	1	0.0	1	0.7	1		
			1	1	1	1	1	1	1	1	1		
COLUMN			40	57	35	13							145
TOTAL			27.6	39.3	24.1	9.0							100.0

(CONTINUED)

***** CROSS TABULATION OF *****
 EL28 BY H28
 UNIMULIING FOR.. 28 UPT 170
 SUBJ28 VALUE.. ***** PAGE 101

W28

[illegible]

MINIMUM EXPECTED CELL FREQUENCY = 0.068
 RAW CHI SQUARE = 15.31176 WITH 18 DEGREES OF
 FREEDOM
 SIGNIFICANCE = .6405
 CRAMER'S V = .18697

NUMBER OF MISSING OBSERVATIONS = 5

23 OUT OF 28 (82.1%) OF THE VALID CELLS HAVE EXPECTED CPLL FREQUENCY LESS THAN 50

***** CROSS TABULATION OF *****
 EL27 BY R27
 CONTROLLING FUR..
 SURJ27
 VALUE.. 27 SEMINAR IN CA
 PAGE 21

		R27						
		COUNT	1	2	3	4	5	
EL27	COL PCI	1	2	3	4	5		
	TOT PCI	1	2	3	4	5		
	1	1	0	1	1	1		
	2	1	1	0	1	0		
	3	1	0	1	0	0		
	4	1	0	1	0	0		
	5	1	0	1	0	0		
	6	1	0	1	0	0		
	7	1	0	1	0	0		
	8	1	0	1	0	0		
	9	1	0	1	0	0		
	10	1	0	1	0	0		
	11	1	0	1	0	0		
	12	1	0	1	0	0		
	13	1	0	1	0	0		
	14	1	0	1	0	0		
	15	1	0	1	0	0		
	16	1	0	1	0	0		
	17	1	0	1	0	0		
	18	1	0	1	0	0		
	19	1	0	1	0	0		
	20	1	0	1	0	0		
	21	1	0	1	0	0		
	22	1	0	1	0	0		
	23	1	0	1	0	0		
	24	1	0	1	0	0		
	25	1	0	1	0	0		
	26	1	0	1	0	0		
	27	1	0	1	0	0		
	28	1	0	1	0	0		
	29	1	0	1	0	0		
	30	1	0	1	0	0		
	31	1	0	1	0	0		
	32	1	0	1	0	0		
	33	1	0	1	0	0		
	34	1	0	1	0	0		
	35	1	0	1	0	0		
	36	1	0	1	0	0		
	37	1	0	1	0	0		
	38	1	0	1	0	0		
	39	1	0	1	0	0		
	40	1	0	1	0	0		
	41	1	0	1	0	0		
	42	1	0	1	0	0		
	43	1	0	1	0	0		
	44	1	0	1	0	0		
	45	1	0	1	0	0		
	46	1	0	1	0	0		
	47	1	0	1	0	0		
	48	1	0	1	0	0		
	49	1	0	1	0	0		
	50	1	0	1	0	0		
	51	1	0	1	0	0		
	52	1	0	1	0	0		
	53	1	0	1	0	0		
	54	1	0	1	0	0		
	55	1	0	1	0	0		
	56	1	0	1	0	0		
	57	1	0	1	0	0		
	58	1	0	1	0	0		
	59	1	0	1	0	0		
	60	1	0	1	0	0		
	61	1	0	1	0	0		
	62	1	0	1	0	0		
	63	1	0	1	0	0		
	64	1	0	1	0	0		
	65	1	0	1	0	0		
	66	1	0	1	0	0		
	67	1	0	1	0	0		
	68	1	0	1	0	0		
	69	1	0	1	0	0		
	70	1	0	1	0	0		
	71	1	0	1	0	0		
	72	1	0	1	0	0		
	73	1	0	1	0	0		
	74	1	0	1	0	0		
	75	1	0	1	0	0		
	76	1	0	1	0	0		
	77	1	0	1	0	0		
	78	1	0	1	0	0		
	79	1	0	1	0	0		
	80	1	0	1	0	0		
	81	1	0	1	0	0		
	82	1	0	1	0	0		
	83	1	0	1	0	0		
	84	1	0	1	0	0		
	85	1	0	1	0	0		
	86	1	0	1	0	0		
	87	1	0	1	0	0		
	88	1	0	1	0	0		
	89	1	0	1	0	0		
	90	1	0	1	0	0		
	91	1	0	1	0	0		
	92	1	0	1	0	0		
	93	1	0	1	0	0		
	94	1	0	1	0	0		
	95	1	0	1	0	0		
	96	1	0	1	0	0		
	97	1	0	1	0	0		
	98	1	0	1	0	0		
	99	1	0	1	0	0		
	100	1	0	1	0	0		
	101	1	0	1	0	0		
	102	1	0	1	0	0		
	103	1	0	1	0	0		
	104	1	0	1	0	0		
	105	1	0	1	0	0		
	106	1	0	1	0	0		
	107	1	0	1	0	0		
	108	1	0	1	0	0		
	109	1	0	1	0	0		
	110	1	0	1	0	0		
	111	1	0	1	0	0		
	112	1	0	1	0	0		
	113	1	0	1	0	0		
	114	1	0	1	0	0		
	115	1	0	1	0	0		
	116	1	0	1	0	0		
	117	1	0	1	0	0		
	118	1	0	1	0	0		
	119	1	0	1	0	0		
	120	1	0	1	0	0		
	121	1	0	1	0	0		
	122	1	0	1	0	0		
	123	1	0	1	0	0		
	124	1	0	1	0	0		
	125	1	0	1	0	0		
	126	1	0	1	0	0		
	127	1	0	1	0	0		
	128	1	0	1	0	0		
	129	1	0	1	0	0		
	130	1	0	1	0	0		
	131	1	0	1	0	0		
	132	1	0	1	0	0		
	133	1	0	1	0	0		
	134	1	0	1	0	0		
	135	1	0	1	0	0		
	136	1	0	1	0	0		
	137	1	0	1	0	0		
	138	1	0	1	0	0		
	139	1	0	1	0	0		
	140	1	0	1	0	0		
	141	1	0	1	0	0		
	142	1	0	1	0	0		
	143	1	0	1	0	0		
	144	1	0	1	0	0		
	145	1	0	1	0	0		
	146	1	0	1	0	0		
	147	1	0	1	0	0		
	148	1	0	1	0	0		
	149	1	0	1	0	0		
	150	1	0	1	0	0		
	151	1	0	1	0	0		
	152	1	0	1	0	0		
	153	1	0	1	0	0		
	154	1	0	1	0	0		
	155	1	0	1	0	0		
	156	1	0	1	0	0		
	157	1	0	1	0	0		
	158	1	0	1	0	0		
	159	1	0	1	0	0		
	160	1	0	1	0	0		
	161	1	0	1	0	0		
	162	1	0	1	0	0		
	163	1	0	1	0	0		
	164	1	0	1	0	0		
	165	1	0	1	0	0		
	166	1	0	1	0	0		
	167	1	0	1	0	0		
	168	1	0	1	0	0		
	169	1	0	1	0	0		
	170	1	0	1	0	0		
	171	1	0	1	0	0		
	172	1	0	1	0	0		
	173	1	0	1	0	0		
	174	1	0	1	0	0		
	175	1	0	1	0	0		
	176	1	0	1	0	0		
	177	1	0	1	0	0		
	178	1	0	1	0	0		
	179	1	0	1	0	0		
	180	1	0	1	0	0		
	181	1	0	1	0	0		
	182	1	0	1	0	0		
	183	1	0	1	0	0		
	184	1	0	1	0	0		
	185	1	0	1	0	0		
	186	1	0	1	0	0		
	187	1	0	1	0	0		
	188	1	0	1	0	0		
	189	1	0	1	0	0		
	190	1	0	1	0	0		
	191	1	0	1	0	0		
	192	1	0	1	0	0		
	193	1	0	1	0	0		
	194	1	0	1	0	0		
	195	1	0	1	0	0		
	196	1	0	1	0	0		
	197	1	0	1	0	0		
	198	1	0	1	0	0		
	199	1	0	1	0	0		
	200	1	0	1	0	0		
	201	1	0	1	0	0		
	202	1	0	1	0	0		
	203	1	0	1	0	0		
	204	1	0	1	0	0		
	205	1	0	1	0	0		
	206	1	0	1	0	0		
	207	1	0	1	0	0		
	208	1	0	1	0	0		
	209	1	0	1	0	0		
	210	1	0	1	0	0		
	211	1	0	1	0	0		
	212	1	0	1	0	0		
	213	1	0	1	0	0		
	214	1	0	1	0	0		
	215	1	0	1	0	0		
	216	1	0	1	0	0		

***** CROSSTABULATION OF *****
 EL2/ BY K27
 CONTROLLING FOR...
 SUBJ27
 VALUE... 27 SEMINAR IN CA
 ***** PAGE 10 *****

R27													
	COUNT	NON PCT		CRITICAL		EXTREME		USEFUL		LITTLE USE		USELESS	
	COL PCT	I		I		I		I		I		I	
	101 PCT	1	1	1	2	1	2	1	3	1	4	1	5
FL27													
C	1	3	1	11	1	2	1	2	1	2	1	0	1
	1	16.7	1	61.1	1	11.1	1	11.1	1	11.1	1	0.0	1
	1	4.7	1	16.6	1	11.6	1	11.6	1	11.6	1	0.0	1
	1	2.0	1	7.5	1	1.4	1	1.4	1	1.4	1	0.0	1
F	2	32	1	39	1	13	1	4	1	0	1	0	1
	1	36.4	1	44.3	1	14.6	1	4.5	1	0.0	1	0.0	1
	1	50.0	1	66.1	1	76.5	1	66.7	1	0.0	1	0.0	1
	1	21.8	1	26.5	1	6.6	1	2.7	1	0.0	1	0.0	1
L	3	7	1	2	1	1	1	0	1	0	1	0	1
	1	70.0	1	20.0	1	10.0	1	0.0	1	0.0	1	0.0	1
	1	10.9	1	3.4	1	5.9	1	0.0	1	0.0	1	0.0	1
	1	4.8	1	1.4	1	0.7	1	0.0	1	0.0	1	0.0	1
G	4	4	1	0	1	0	1	0	1	1	1	1	1
	1	80.0	1	0.0	1	0.0	1	0.0	1	0.0	1	20.0	1
	1	6.3	1	0.0	1	0.0	1	0.0	1	0.0	1	100.0	1
	1	2.7	1	0.0	1	0.0	1	0.0	1	0.0	1	0.7	1
CP	5	10	1	3	1	1	1	0	1	0	1	0	1
	1	71.4	1	21.4	1	7.1	1	0.0	1	0.0	1	0.0	1
	1	15.6	1	5.1	1	5.9	1	0.0	1	0.0	1	0.0	1
	1	6.6	1	2.0	1	0.7	1	0.0	1	0.0	1	0.0	1
CU	6	0	1	1	1	0	1	0	1	0	1	0	1
	1	0.0	1	100.0	1	0.0	1	0.0	1	0.0	1	0.0	1
	1	0.0	1	1.7	1	0.0	1	0.0	1	0.0	1	0.0	1
	1	0.0	1	0.7	1	0.0	1	0.0	1	0.0	1	0.0	1
FG	9	3	1	1	1	0	1	0	1	0	1	0	1
	1	75.0	1	25.0	1	0.0	1	0.0	1	0.0	1	0.0	1
	1	4.7	1	1.7	1	0.0	1	0.0	1	0.0	1	0.0	1
	1	2.0	1	0.7	1	0.0	1	0.0	1	0.0	1	0.0	1
COLLMA	64	59		17		11.6		4.1		0.7		1	
TOTAL	43.5	40.1		11.6		4.1		0.7		0.7		100.0	
CC(CONTINUED)													

 EL26
 CONTROLLING FOR...
 SUBJ26

 CROSSTABULATION OF
 BY M26
 VALUE... 26 QUANTITA DECISION

 PAGE 2 01

	COUNT	1	2	3	4	5	ROW TOTAL
EL26	NON PCI	1	1	1	1	1	5
	COL PCI	1	1	1	1	1	5
	TOT PCI	9	9	9	9	9	5
		0	1	2	1	0	3.4
		0.0	60.0	40.0	0.0	0.0	0.0
		0.0	5.8	3.8	0.0	0.0	0.0
		0.0	2.1	1.4	0.0	0.0	0.0
		1	1	1	1	1	5
		20.0	40.0	20.0	0.0	20.0	3.4
		8.3	3.8	1.9	0.0	25.0	0.7
		0.7	1.4	0.7	0.0	0.7	1
		0	1	1	0	0	0.7
		0.0	100.0	0.0	0.0	0.0	0.0
		0.0	1.9	0.0	0.0	0.0	0.0
		0.0	0.7	0.0	0.0	0.0	0.0
		1	1	1	1	1	3
		33.3	33.3	33.3	0.0	0.0	2.1
		8.3	1.9	1.9	0.0	0.0	0.0
		0.7	0.7	0.7	0.0	0.0	0.0
		0	1	1	0	0	2
		0.0	50.0	50.0	0.0	0.0	1.4
		0.0	1.9	1.9	0.0	0.0	0.0
		0.0	0.7	0.7	0.0	0.0	0.0
		12	52	53	24	4	145
	TOTAL	8.3	35.9	36.6	16.6	2.8	100.0

52 OUT OF 60 (86.7%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.028
 MAX CHI SQUARE = 38.02370 WITH 44 DEGREES OF FREEDOM. SIGNIFICANCE = 0.7246
 Cramer's V = 0.25604

NUMBER OF MISSING OBSERVATIONS = 6

***** CROSS TABULATION OF *****
 EL26 BY K26
 CONTROLLING FOR..
 SUBJ26 VALUE.. 26 QUANTITA DECISION ***** PAGE 10

[illegible]

***** CROSSTABULATION OF *****
 EL25 BY R25
 CONTROLLING FOR..
 SUBJ25
 VALUE.. 25 RESEARCH METH
 PAGE 2 0

R25															
COUNT		COUNT										ROW			
RCW	PCI	ICRITICAL	EXTREME	USEFUL	LITTLE	USELESS							TOTAL		
COL	PCI	1	2	3	4	5									
TOT	PCI	1	2	3	4	5									
EL25	8	1	1	1	3	1	4	1	5					1	
	1	0	1	6	2	1	0	1	0					8	
	1	0.0	1	75.0	1	25.0	1	0.0	1	0.0					5.5
	1	0.0	1	9.1	1	5.7	1	0.0	1	0.0					
FU	1	0.0	1	4.1	1	1.4	1	0.0	1	0.0					
	1	0.0	1	1.4	1	0.0	1	0.0	1	0.0					
	9	2	1	1	0	1	0	1	0					3	
	1	66.7	1	33.3	1	0.0	1	0.0	1	0.0					2.1
FG	1	5.7	1	1.5	1	0.0	1	0.0	1	0.0					
	1	1.4	1	0.7	1	0.0	1	0.0	1	0.0					
	10	1	1	1	0	1	0	1	1					3	
	1	33.3	1	33.3	1	0.0	1	0.0	1	33.3					2.1
LG	1	2.9	1	1.5	1	0.0	1	0.0	1	100.0					
	1	0.7	1	0.7	1	0.0	1	0.0	1	0.7					
	11	2	1	1	1	1	0	1	0					4	
	1	50.0	1	25.0	1	25.0	1	0.0	1	0.0					2.7
CPU	1	5.7	1	1.5	1	2.9	1	0.0	1	0.0					
	1	1.4	1	0.7	1	0.7	1	0.0	1	0.0					
	12	0	1	1	0	1	0	1	0					1	
	1	0.0	1	100.0	1	0.0	1	0.0	1	0.0					0.7
PUG	1	0.0	1	1.5	1	0.0	1	0.0	1	0.0					
	1	0.0	1	0.7	1	0.0	1	0.0	1	0.0					
	15	1	2	1	0	1	0	1	0					3	
	1	33.3	1	66.7	1	0.0	1	0.0	1	0.0					2.1
CPUG	1	2.9	1	3.0	1	0.0	1	0.0	1	0.0					
	1	0.7	1	1.4	1	0.0	1	0.0	1	0.0					
	COLUMN	35	66	35	24.0	6.2	0.7	146							
	TOTAL	24.0	45.2	24.0	6.2	0.7	100.0								

57 OUT OF 65 (87.7%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.007
 MAX CHI SQUARE = 88.71843 WITH 48 DEGREES OF FREEDOM. SIGNIFICANCE = 0.0003
 CHAMEN'S V = 0.38976

NUMBER OF MISSING OBSERVATIONS = 5

***** CROSSTABULATION OF *****
 EL25 BY N25
 CONTROLLING FOR...
 SUBJ25

 VALUE.. 25 RESEARCH METH *****
 PAGE 10

N25													
COUNT		1		2		3		4		5		TOTAL	
ROW	COL	PCI	ICRITICAL	EXTREME	USEFUL	USEFUL	LITTLE	USELESS	USELESS	USELESS	USELESS	USELESS	USELESS
TOT	PCI	1	1	1	2	1	3	1	4	1	5	1	1
EL25													
0	1	1	5	1	4	1	6	1	3	1	0	1	18
	1	1	27.8	1	22.2	1	33.3	1	16.7	1	0.0	1	12.3
	1	1	14.3	1	6.1	1	17.1	1	33.3	1	0.0	1	12.3
	1	1	3.4	1	2.7	1	4.1	1	2.1	1	0.0	1	12.3
	1	1		1		1		1		1		1	
F	2	1	2	1	25	1	10	1	3	1	0	1	40
	1	1	5.0	1	62.5	1	25.0	1	7.5	1	0.0	1	27.4
	1	1	5.7	1	37.9	1	28.6	1	33.3	1	0.0	1	27.4
	1	1	1.4	1	17.1	1	6.8	1	2.1	1	0.0	1	27.4
	1	1		1		1		1		1		1	
L	3	1	15	1	15	1	8	1	3	1	0	1	41
	1	1	36.6	1	36.6	1	19.5	1	7.3	1	0.0	1	28.1
	1	1	42.9	1	22.7	1	22.9	1	33.3	1	0.0	1	28.1
	1	1	10.3	1	10.3	1	5.5	1	2.1	1	0.0	1	28.1
	1	1		1		1		1		1		1	
G	4	1	3	1	7	1	7	1	0	1	0	1	17
	1	1	17.6	1	41.2	1	41.2	1	0.0	1	0.0	1	11.6
	1	1	8.6	1	10.6	1	20.0	1	0.0	1	0.0	1	11.6
	1	1	2.1	1	4.8	1	4.8	1	0.0	1	0.0	1	11.6
	1	1		1		1		1		1		1	
CP	5	1	2	1	1	1	0	1	0	1	0	1	3
	1	1	66.7	1	33.3	1	0.0	1	0.0	1	0.0	1	2.1
	1	1	5.7	1	1.5	1	0.0	1	0.0	1	0.0	1	2.1
	1	1	1.4	1	0.7	1	0.0	1	0.0	1	0.0	1	2.1
	1	1		1		1		1		1		1	
CU	6	1	2	1	1	1	1	1	0	1	0	1	4
	1	1	50.0	1	25.0	1	25.0	1	0.0	1	0.0	1	2.7
	1	1	5.7	1	1.5	1	2.9	1	0.0	1	0.0	1	2.7
	1	1	1.4	1	0.7	1	0.7	1	0.0	1	0.0	1	2.7
	1	1		1		1		1		1		1	
CG	7	1	0	1	1	1	0	1	0	1	0	1	1
	1	1	0.0	1	100.0	1	0.0	1	0.0	1	0.0	1	0.7
	1	1	0.0	1	1.5	1	0.0	1	0.0	1	0.0	1	0.7
	1	1	0.0	1	0.7	1	0.0	1	0.0	1	0.0	1	0.7
	1	1		1		1		1		1		1	
COLUMN TOTAL			35		66		35		9		1		146
			24.0		45.2		24.0		6.2		0.7		100.0
(CONTINUED)													

EL24
CONTROLLING FOR..
SUBJ24

N24									
	COUNT	IC	ICRITICAL	EXTREME	USEFUL	LITTLE	USE	ROW	TOTAL
	PC1	PC1	PC1	PC1	PC1	PC1	PC1		
EL24	1	1	1	2	1	3	1	4	1
	2	4	1	3	1	0	1	0	1
PU	1	57.1	1	42.9	1	0.0	1	0.0	1
	1	0.0	1	5.3	1	0.0	1	0.0	1
	1	2.7	1	2.0	1	0.0	1	0.0	1
	9	1	1	2	1	0	1	0	1
PG	1	33.3	1	66.7	1	0.0	1	0.0	1
	1	2.0	1	3.5	1	0.0	1	0.0	1
	1	0.7	1	1.4	1	0.0	1	0.0	1
	10	1	1	1	1	0	1	0	1
LG	1	50.0	1	50.0	1	0.0	1	0.0	1
	1	2.0	1	1.6	1	0.0	1	0.0	1
	1	0.7	1	0.7	1	0.0	1	0.0	1
	11	3	1	1	1	1	1	0	1
OPU	1	60.0	1	20.0	1	20.0	1	0.0	1
	1	6.0	1	1.8	1	3.2	1	0.0	1
	1	2.0	1	0.7	1	0.7	1	0.0	1
	15	1	1	3	1	0	1	0	1
OPUG	1	25.0	1	75.0	1	0.0	1	0.0	1
	1	2.0	1	5.3	1	0.0	1	0.0	1
	1	0.7	1	2.0	1	0.0	1	0.0	1
	COLLMA	50	57	31	31	9	9	147	147
	TOTAL	34.0	38.8	21.1	21.1	6.1	6.1	100.0	100.0

40 OUT OF 48 (83.33) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
MINIMUM EXPECTED CELL FREQUENCY = 0.061
NAN CHI SQUARE = 31.82810 WITH 33 DEGREES OF FREEDOM. SIGNIFICANCE = 0.5248
CAMMER'S V = 0.26869

NUMBER OF MISSING OBSERVATIONS = 4

***** CRC S T A B L I A T I O N O F *****
 EL24 BY H24
 CONTINUING FOR..
 SUBJ24 VALUE.. 24 TECHNICAL COMM PAGE 1

R24									
	COUNT	IC	CH	IT	EXTREME	USEFUL	LITTLE	USE	RUN
	ROW	PC1	PC1	PC1	PC1	PC1	PC1	PC1	TOTAL
EL24		TOT	PC1	PC1	PC1	PC1	PC1	PC1	
	1	1	5	1	5	1	8	1	22
		1	22.7	1	22.7	1	36.4	1	10.2
		1	10.0	1	8.8	1	25.8	1	44.4
		1	3.4	1	3.4	1	5.4	1	2.7
	2	1	9	1	15	1	9	1	34
		1	26.5	1	44.1	1	26.5	1	2.9
		1	18.0	1	26.3	1	29.0	1	11.1
		1	6.1	1	10.2	1	6.1	1	0.7
	3	1	18	1	21	1	12	1	4
		1	32.7	1	38.2	1	21.8	1	7.3
		1	36.0	1	36.8	1	38.7	1	44.4
		1	12.2	1	14.3	1	8.2	1	2.7
	4	1	2	1	3	1	1	1	0
		1	33.3	1	50.0	1	16.7	1	0.0
		1	4.0	1	5.3	1	3.2	1	0.0
		1	1.4	1	2.0	1	0.7	1	0.0
	5	1	3	1	0	1	0	1	0
		1	100.0	1	0.0	1	0.0	1	0.0
		1	6.0	1	0.0	1	0.0	1	0.0
		1	2.0	1	0.0	1	0.0	1	0.0
	6	1	2	1	3	1	0	1	0
		1	40.0	1	60.0	1	0.0	1	0.0
		1	4.0	1	5.3	1	0.0	1	0.0
		1	1.4	1	2.0	1	0.0	1	0.0
	7	1	1	1	0	1	0	1	0
		1	100.0	1	0.0	1	0.0	1	0.0
		1	2.0	1	0.0	1	0.0	1	0.0
		1	0.7	1	0.0	1	0.0	1	0.0
		1	50	1	57	1	31	1	9
		1	34.0	1	38.8	1	21.1	1	6.1
		1	147	1	100.0	1	100.0	1	100.0

R23													
COUNT		I											
ROW	COL	IC	IT	ICAL	EXTREME	USEFUL	LITTLE	USELESS	ROW				
TOT	PCT	I	I	I	2	3	4	5	TOTAL				
EL23		1	5	1	0	1	2	1	7				
C		1	71.4	1	0.0	1	28.6	1	4.8				
		1	6.0	1	0.0	1	11.1	1					
		1	3.4	1	0.0	1	1.4	1					
F		2	24	1	18	1	6	1	51				
		1	47.1	1	35.3	1	15.7	1	34.9				
		1	28.6	1	45.0	1	44.4	1					
		1	16.4	1	12.3	1	5.5	1					
L		3	15	1	10	1	5	1	30				
		1	50.0	1	33.3	1	16.7	1	20.5				
		1	17.9	1	25.0	1	27.8	1					
		1	10.3	1	6.8	1	3.4	1					
G		4	15	1	5	1	1	1	23				
		1	65.2	1	21.7	1	4.3	1	15.8				
		1	17.9	1	12.5	1	5.6	1					
		1	10.3	1	3.4	1	0.7	1					
CP		5	6	1	1	1	0	1	7				
		1	85.7	1	14.3	1	0.0	1	4.8				
		1	7.1	1	2.5	1	0.0	1					
		1	4.1	1	0.7	1	0.0	1					
CU		6	0	1	1	1	0	1	1				
		1	0.0	1	100.0	1	0.0	1	0.7				
		1	0.0	1	2.5	1	0.0	1					
		1	0.0	1	0.7	1	0.0	1					
FU		8	4	1	3	1	0	1	7				
		1	57.1	1	42.9	1	0.0	1	4.8				
		1	4.8	1	7.5	1	0.0	1					
		1	2.7	1	2.1	1	0.0	1					
COLUMN TOTAL		24	57.5	27.4	40	18	2.1	0.7	146				
									100.0				

***** CROSSTABULATION OF *****
 EL30 BY R30
 CONTROLLING FOR..
 SUBJ30 VALUE.. 30 GMT 550
 ***** PAGE 2 *****

	COUNT	NON	PCIT	CHITICAL	EXTREME	USEFUL	LITTLE	RM
		COL	PCIT	USEFUL	USEFUL	USEFUL	USE	TOTAL
EL30	TOT	PCIT	1	2	3	4	1	
UG	10	1	0	1	2	1	0	2
		1	0.0	1	100.0	1	0.0	1.4
		1	0.0	1	0.0	1	0.0	1
		1	0.0	1	5.7	1	0.0	1
		1	0.0	1	1.4	1	0.0	1
PUG	12	1	1	0	1	0	1	1
		1	100.0	1	0.0	1	0.0	0.7
		1	2.5	1	0.0	1	0.0	1
		1	0.7	1	0.0	1	0.0	1
CPG	13	1	0	1	1	0	1	1
		1	0.0	1	100.0	0.0	1	0.7
		1	0.0	1	1.8	0.0	1	0.0
		1	0.0	1	0.7	0.0	1	0.0
OPUG	15	1	0	1	1	0	1	1
		1	0.0	1	100.0	0.0	1	0.7
		1	0.0	1	1.8	0.0	1	0.0
		1	0.0	1	0.7	0.0	1	0.0
TOTAL	40	27.6	39.3	24.1	35	13	9.0	145

38 OUT OF 44 (86.4%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.090
 MAX CHI SQUARE = 30.80794 WITH 30 DEGREES OF FREEDOM. SIGNIFICANCE = 0.4249
 CHAMER'S V = 0.26613

NUMBER OF MISSING OBSERVATIONS = 6

***** C R O S S T A B L A T I O N O F *****
 EL31
 CONTROLLING FOR...
 SUBJ31

 VALUE.. 31 GMI 551

 BY M31

 PAGE 11

		R31											
		COUNT	1	2	3	4	5	6	7	8	9	10	11
EL31	COL PCT	ICRITICAL	EXTREME	USEFUL	LITTLE	USELESS	HOW						
	TOT PCT	1	2	3	4	5	TOTAL						
0	1	1	1	1	1	1	6						
	1	16.7	16.7	50.0	0.0	16.7	4.2						
	1	3.0	1.7	8.6	0.0	25.0							
	1	0.7	0.7	2.1	0.0	0.7							
2	1	20	39	22	7	1	89						
	1	22.5	43.8	24.7	7.9	1.1	62.7						
	1	60.6	65.0	62.9	70.0	25.0							
	1	14.1	27.5	15.5	4.9	0.7							
3	1	2	3	5	0	0	10						
	1	20.0	30.0	50.0	0.0	0.0	7.0						
	1	6.1	5.0	14.3	0.0	0.0							
	1	1.4	2.1	3.5	0.0	0.0							
4	1	6	9	1	1	1	18						
	1	33.3	50.0	5.6	5.6	5.6	12.7						
	1	18.2	15.0	2.9	10.0	25.0							
	1	4.2	6.3	0.7	0.7	0.7							
5	1	0	1	0	1	1	3						
	1	0.0	33.3	0.0	33.3	33.3	2.1						
	1	0.0	1.7	0.0	10.0	25.0							
	1	0.0	0.7	0.0	0.7	0.7							
6	1	0	0	1	0	0	1						
	1	0.0	0.0	100.0	0.0	0.0	0.7						
	1	0.0	0.0	2.9	0.0	0.0							
	1	0.0	0.0	0.7	0.0	0.0							
7	1	0	1	3	0	0	4						
	1	0.0	25.0	75.0	0.0	0.0	2.8						
	1	0.0	1.7	8.6	0.0	0.0							
	1	0.0	0.7	2.1	0.0	0.0							
COLLPA	33	60	35	10	4	142							
TOTAL	23.2	42.3	24.6	7.0	2.8	100.0							

(CONTINUED)

***** CROSS TABULATION OF *****
 EL31
 CONTROLLING FUR.. BY H31
 SUBJ31
 VALUE.. 31 QMT 551
 ***** PAGE 2 U

R31													
COUNT		COUNT											
HOM PCI		CRITICAL		EXTREME		USEFUL		LITTLE		USELESS		HOM	
COL PCI		PCI		PCI		PCI		USE		PCI		TOTAL	
TOT PCI		1		2		3		4		5		TOTAL	
EL31	9	1	1	1	2	1	3	1	4	1	5	1	
		2	1	3	1	0	1	1	1	0	1	6	
		33.3	1	50.0	1	0.0	1	16.7	1	0.0	1	4.2	
		6.1	1	5.0	1	0.0	1	10.0	1	0.0	1		
		1.4	1	2.1	1	0.0	1	0.7	1	0.0	1		
OPU	11	1	0	1	1	1	0	1	0	1	0	1	
		0.0	1	100.0	1	0.0	1	0.0	1	0.0	1	0.7	
		0.0	1	1.7	1	0.0	1	0.0	1	0.0	1		
		0.0	1	0.7	1	0.0	1	0.0	1	0.0	1		
		0.0	1	0.0	1	0.0	1	0.0	1	0.0	1		
PUG	12	1	1	1	0	1	0	1	0	1	0	1	
		100.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.7	
		3.0	1	0.0	1	0.0	1	0.0	1	0.0	1		
		0.7	1	0.0	1	0.0	1	0.0	1	0.0	1		
		0.0	1	0.0	1	0.0	1	0.0	1	0.0	1		
CPG	13	1	1	1	1	1	0	1	0	1	0	2	
		50.0	1	50.0	1	0.0	1	0.0	1	0.0	1	1.4	
		3.0	1	1.7	1	0.0	1	0.0	1	0.0	1		
		0.7	1	0.7	1	0.0	1	0.0	1	0.0	1		
		0.0	1	0.0	1	0.0	1	0.0	1	0.0	1		
OPUG	15	1	0	1	1	1	0	1	0	1	0	1	
		0.0	1	100.0	1	0.0	1	0.0	1	0.0	1	0.7	
		0.0	1	1.7	1	0.0	1	0.0	1	0.0	1		
		0.0	1	0.7	1	0.0	1	0.0	1	0.0	1		
		0.0	1	0.0	1	0.0	1	0.0	1	0.0	1		
COLUMN		33	60	42.3	24.6	35	10	4					
TOTAL		23.2	42.3	24.6	7.0	2.8	142						
									100.0				

55 OUT OF 60 (91.7%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.028
 MAX CHI SQUARE = 45.70608 WITH 44 DEGREES OF FREEDOM. SIGNIFICANCE = 0.2565
 CRAMER'S V = 0.29582
 NUMBER OF MISSING OBSERVATIONS = 9

***** CROSS TABULATION OF *****
 EL32 BY #32
 CONTROLLING FOM..
 SUBJ32 VALUE.. 32 QNT 180
 ***** PAGE 1 C *****

R32												
COUNT	1	IGNITICL		EXTREME		USEFUL		LITTLE		USELESS		NON TOTAL
COL PCI	I	1	1	2	1	3	1	4	1	5		
TOT PCI	I	1	1	2	1	3	1	4	1	5		
EL32	1	1	4	1	2	1	1	1	1	1	9	
	1	44.4	1	22.2	1	11.1	1	11.1	1	11.1	6.3	
	1	7.0	1	4.5	1	3.0	1	14.3	1	33.3		
	1	2.8	1	1.4	1	0.7	1	0.7	1	0.7		
F	2	1	38	1	28	1	25	1	5	1	96	
	1	39.6	1	29.2	1	26.0	1	5.2	1	0.0	66.7	
	1	66.7	1	63.6	1	75.8	1	71.4	1	0.0		
	1	26.4	1	19.4	1	17.4	1	3.5	1	0.0		
L	3	1	5	1	6	1	4	1	0	1	14	
	1	21.4	1	42.9	1	28.6	1	0.0	1	7.1	9.7	
	1	5.3	1	13.6	1	12.1	1	0.0	1	33.3		
	1	2.1	1	4.2	1	2.8	1	0.0	1	0.7		
G	4	1	2	1	2	1	0	1	0	1	4	
	1	50.0	1	50.0	1	0.0	1	0.0	1	0.0	2.8	
	1	3.5	1	4.5	1	0.0	1	0.0	1	0.0		
	1	1.4	1	1.4	1	0.0	1	0.0	1	0.0		
CP	5	1	7	1	2	1	1	1	0	1	11	
	1	63.6	1	18.2	1	9.1	1	0.0	1	9.1	7.6	
	1	12.3	1	4.5	1	3.0	1	0.0	1	33.3		
	1	4.9	1	1.4	1	0.7	1	0.0	1	0.7		
PU	6	1	0	1	2	1	1	1	1	0	4	
	1	0.0	1	50.0	1	25.0	1	25.0	1	0.0	2.8	
	1	0.0	1	4.5	1	3.0	1	14.3	1	0.0		
	1	0.0	1	1.4	1	0.7	1	0.7	1	0.0		
PG	5	1	1	1	1	1	1	1	0	1	3	
	1	33.3	1	33.3	1	33.3	1	0.0	1	0.0	2.1	
	1	1.8	1	2.3	1	3.0	1	0.0	1	0.0		
	1	0.7	1	0.7	1	0.7	1	0.0	1	0.0		
COLUMN TOTAL		57	39.6	44	30.6	33	22.9	7	4.5	2.1	144	
											100.0	

***** CROSS TABULATION OF *****
 EL32 BY M32
 CONTROLLING FOR..
 SUBJ32
 VALUE.. 32 GMT 180
 PAGE 21

M32											
COUNT	1	CRITICAL	EXTREME	USEFUL	LITTLE	USELESS	ROW				
NON PCI	1	1	2	3	4	5	TOTAL				
COL PCI	1	1	2	3	4	5					
TOT PCI	1	1	2	3	4	5					
EL32	11	1	1	0	0	0	2				
		50.0	50.0	0.0	0.0	0.0	1.4				
CPU	1	1.6	2.3	0.0	0.0	0.0					
	1	0.7	0.7	0.0	0.0	0.0					
GPU	15	1	0	0	0	0	1				
		100.0	0.0	0.0	0.0	0.0	0.7				
	1	1.6	0.0	0.0	0.0	0.0					
	1	0.7	0.0	0.0	0.0	0.0					
COLUMN	57	44	33	7	3	144	100.0				
TOTAL	39.6	30.6	22.9	4.5	2.1						

***** CHRSSTAE L L I O N O F *****
 EL33 BY R33
 CONTROLLING FOR.. VALUE.. 33 CMT 353
 SUBJ33 ***** PAGE 1 C

R33									
COUNT	ICRITICAL	EXTREME	USEFUL	LITTLE	USELESS	ROW			
ROW PCT	USEFUL	USEFUL		USE		TOTAL			
COL PCT									
TOT PCT	1	2	3	4	5				
EL33	1	1	1	1	1	1			
C	1	0	1	1	1	1			
	0.0	16.7	83.3	0.0	0.0	6			
	0.0	1.5	11.4	0.0	0.0	4.2			
	0.0	0.7	3.5	0.0	0.0				
P	1	17	46	31	3	97			
	17.5	47.4	32.0	3.1	0.0	68.3			
	63.0	70.8	70.5	60.0	0.0				
	12.0	32.4	21.8	2.1	0.0				
U	1	3	5	3	1	12			
	25.0	41.7	25.0	8.3	0.0	8.5			
	11.1	7.7	6.8	20.0	0.0				
	2.1	3.5	2.1	0.7	0.0				
G	1	1	5	2	1	9			
	11.1	55.6	22.2	0.0	11.1	6.3			
	3.7	7.7	4.5	0.0	100.0				
	0.7	3.5	1.4	0.0	0.7				
CP	1	4	6	2	0	12			
	33.3	50.0	16.7	0.0	0.0	8.5			
	14.8	9.2	4.5	0.0	0.0				
	2.8	4.2	1.4	0.0	0.0				
PU	1	0	1	1	0	4			
	0.0	50.0	25.0	25.0	0.0	2.8			
	0.0	3.1	2.3	20.0	0.0				
	0.0	1.4	0.7	0.7	0.0				
PUG	1	1	0	0	0	1			
	100.0	0.0	0.0	0.0	0.0	0.7			
	3.7	0.0	0.0	0.0	0.0				
	0.7	0.0	0.0	0.0	0.0				
COLLUM	27	65	44	5	1	142			
TOTAL	19.0	45.8	31.0	3.5	0.7	100.0			

(CONTINUED)

***** CROSS TABULATION OF *****
 EL35 BY M35
 CONTROLLING FOR..
 SUBJ35
 VALUE.. 35 SYS 362
 PAGE 1

COUNT									
R35									
ROW	PCT	ICRITICAL	EXTREME	USEFUL	LITTLE	RUN			
COL	PCT	1	2	3	4	TOTAL			
TOT	PCT	1	2	3	4				
EL35									
0	1	1	5	7	5	18			
		1	27.0	30.9	27.0	12.0			
		1	15.6	14.6	9.8	10.0			
		1	3.5	5.0	3.5	0.7			
		-	-	-	-	-			
4	2	1	20	32	38	96			
		1	20.0	33.3	39.6	68.1			
		1	62.5	66.7	74.5	60.0			
		1	14.2	22.7	27.0	4.3			
		-	-	-	-	-			
U	3	1	1	2	3	7			
		1	14.3	28.6	42.9	14.3			
		1	3.1	4.2	5.9	10.0			
		1	0.7	1.4	2.1	0.7			
		-	-	-	-	-			
6	4	1	1	2	0	4			
		1	25.0	50.0	0.0	25.0			
		1	3.1	4.2	0.0	10.0			
		1	0.7	1.4	0.0	0.7			
		-	-	-	-	-			
CP	5	1	4	3	4	11			
		1	36.4	27.3	36.4	7.8			
		1	12.5	6.3	7.8	0.0			
		1	2.8	2.1	2.8	0.0			
		-	-	-	-	-			
GU	6	1	0	0	1	1			
		1	0.0	0.0	100.0	0.0			
		1	0.0	0.0	2.0	0.0			
		1	0.0	0.0	0.7	0.0			
		-	-	-	-	-			
PU	8	1	1	1	0	3			
		1	33.3	33.3	0.0	33.3			
		1	3.1	2.1	0.0	10.0			
		1	0.7	0.7	0.0	0.7			
		-	-	-	-	-			
COLLUM		32	48	51	10	141			
TOTAL		22.7	34.0	36.2	7.1	100.0			

(CONTINUED)

***** C R O S S T A B U L A T I O N O F *****
 EL35 BY M35
 CONTROLLING FUM..
 SUBJ35
 VALUE.. 35 SYS 362
 PAGE 21

COUNT I									
M35									
	NON	PCI	IC	THICAL	EXTREME	USEFUL	LITTLE	RUN	
	COL	PCI	I	USEFUL			LSE	TOTAL	
	TOT	PCT	I	1	2	3	4	I	
EL35	13	1	0	1	1	0	1	0	1
		1	0.0	1	100.0	1	0.0	1	0.7
CPG		1	0.0	1	2.1	1	0.0	1	0.0
		1	0.0	1	0.7	1	0.0	1	0.0
		-1							
		32		48		51	10	141	
	TOTAL	22.7		34.0		36.2	7.1	100.0	

26 OUT OF 32 (81.3%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
 MINIMUM EXPECTED CELL FREQUENCY = 0.071
 MAX CHI SQUARE = 15.43053 WITH 21 DEGREES OF FREEDOM. SIGNIFICANCE = 0.8007
 CRAMER'S V = 0.19099
 NUMBER OF MISSING OBSERVATIONS = 10

Bibliography

- Allen, Wayne M. "Towards a Cost Analysis Career (Job) Series." Report to DCA Personnel No. DCA-P-43. Director of Cost Analysis Office of the Comptroller of the Army, May 1980.
- Cook, 2Lt Robert and 2Lt John E. Greene. "An Analytical Study of the Graduates of the Graduate Logistics Program of 1965, 1966, and 1967." MS Thesis SLSR 13-68, AFIT/SL, Wright-Patterson AFB OH, 1968.
- Crowder, Capt William N. and Capt James A. Davidson. "An Analysis of the Usefulness of the Graduate Logistics Program as Perceived by Alumni and their Supervisors." MS Thesis LSSR 1-78A, AFIT/LS, Wright-Patterson AFB OH, 1978.
- Cushman, Capt James H. and Capt James N. Townsend. "An Analysis of the Educational Requirements of a Base Level Chief of Aircraft Maintenance in the Disciplines of Production Management, Communicative Skills, and Statistics." MS Thesis SLSR 35-71A, AFIT/SL, Wright-Patterson AFB OH, 1971.
- Department of the Air Force. Officer Air Force Specialty. AFR 36-1 Washington: HQ USAF, 1 January 1984.
- "Member Certification," Dollars and Sense, National Estimating Society, (June 1984).
- Emory, C. William. Business Research Methods. Homewood IL: Richard D. Irwin, Inc., 1980.
- Goetsch, Clarence H. "How Can the Cost Analyst Be Improved as a More Valuable Resource?" Armed Forces Comptroller, 10-13 (May 1980).
- Goven, Richard C. "Institute of Cost Analysis (ICA)." The Air Force Comptroller, 10-12 (January 1983).
- Hart, Lt Col Allan C. "A Study of the Graduates of the School of Systems and Logistics Graduate Logistics Program." MS Thesis SLSR 24-65, AFIT/SL, Wright-Patterson AFB OH, 1965.
- Kankey, Roland D. "Professional Designation Cost and Price Analysis," Armed Forces Comptroller, 27, 39 (Winter 1982).
- Margolis, Milton A. "Improving Cost Estimating in the Department of Defense," Concepts, the Journal of Defense Systems Acquisition Management, 4 (2): 7-17 (Spring 1981).
- Nie, Norman H. and others. Statistical Package for the Social Sciences. McGraw-Hill Book Company, 1975.
- Novak, Theodore J. Jr. and Roland D. Kankey "Is There a Formal Education Program for Cost Analysis?" Armed Forces Comptroller, 40-42 (Summer 1981).

Pazeretsky, Capt Bill, Resource Advisor, Palace Dollar Team. Telephone Interview. AFMPC, Randolph AFB TX, 8 February 1984.

Ross, Capt James L. and Earl T. Steiner. "An Analysis of Educational Requirements for Civilian Logistics Managers Within the Air Force Logistics Command." MS Thesis SLSR 20-72A, AFIT/SL, Wright-Patterson AFB OH, 1972.

Speck, 1Lt Ernest E. Jr. "Perceived Utility of the AFIT Graduate Systems Management Program." MS Thesis LSSR 54-81, AFIT/LS, Wright-Patterson AFB OH, 1981.

Temple, Glenn O. Initiatives for Improvements in Cost Analysis. Unpublished report No. 47954A. Professional Military Comptroller School, Maxwell AFB AL, 1981.

VITA

First Lieutenant Phillip Perry was born 8 July 1959 in Augusta, Georgia. He graduated from Hephzibah High School in Georgia in 1977 and attended the United States Air Force Academy where he earned a Bachelor of Science degree in May 1981. Upon graduation, he received a regular commission in the USAF and was placed on active duty. He served as a financial manager for the Deputy for Reconnaissance and Electronic Warfare System Program Office until entering the School of Systems and Logistics, Air Force Institute of Technology, in June 1983.

Permanent address: 1542 Shoreline Drive
Augusta, Georgia 30906

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified		1b. RESTRICTIVE MARKINGS	
2a. SECURITY CLASSIFICATION AUTHORITY		3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.	
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE		5. MONITORING ORGANIZATION REPORT NUMBER(S)	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) AFIT/GSM/LSY/84S-24		7a. NAME OF MONITORING ORGANIZATION	
6a. NAME OF PERFORMING ORGANIZATION School of Systems and Logistics	6b. OFFICE SYMBOL (If applicable) AFIT/LS	7b. ADDRESS (City, State and ZIP Code)	
6c. ADDRESS (City, State and ZIP Code) Air Force Institute of Technology Wright Patterson AFB OH 45433		9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8a. NAME OF FUNDING/SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (If applicable)	10. SOURCE OF FUNDING NOS.	
8c. ADDRESS (City, State and ZIP Code)		PROGRAM ELEMENT NO.	PROJECT NO.
11. TITLE (Include Security Classification) See Box 19		TASK NO.	WORK UNIT NO.
12. PERSONAL AUTHOR(S) Phillip Perry, B.S., 1st Lt, USAF			
13a. TYPE OF REPORT MS Thesis	13b. TIME COVERED FROM _____ TO _____	14. DATE OF REPORT (Yr., Mo., Day) 1984 December	15. PAGE COUNT 164
16. SUPPLEMENTARY NOTATION			
17. COSATI CODES		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
FIELD	GROUP	SUB. GR.	
19. ABSTRACT (Continue on reverse if necessary and identify by block number) Title: AN ANALYSIS OF THE EDUCATIONAL REQUIREMENTS OF AIR FORCE COST ANALYSTS Thesis Chairman: Richard Murphy, GM-13 <i>Approved for Release</i> <i>John Wolan</i> 1984 E. Declass for Air Force Wright-Patterson AFB OH 45433 <i>51164</i>			
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS ☐		21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED	
22a. NAME OF RESPONSIBLE INDIVIDUAL Richard Murphy		22b. TELEPHONE NUMBER (Include Area Code) 513-255-6289	22c. OFFICE SYMBOL AFIT/LSY

The United States Air Force has emphasized a need to improve the quality of its cost estimates. It seems that cost analysts who are adequately educated can provide the high quality estimates needed by the Air Force. This research effort developed an educational requirements list for Air Force cost analysts. This list is needed to evaluate the educational qualifications of not only potential cost analysts, but current analysts as well. The list is based on an evaluation of a number of cost analysis related subjects by experienced Air Force cost analysts via a mail survey. Experienced analysts rated thirty-five cost analysis subjects in terms of usefulness to job performance. Analysts were also asked to identify appropriate educational methods for acquiring knowledge in the subjects. The result of this effort is an Air Force cost analyst educational requirements list by educational method.

Analysis of the survey data was accomplished utilizing a computer cross-tabulation procedure which compared responses to each subject. The analysis used decision rules which measured the central tendency of the responses. Based on the decision rules outlined in the methodology chapter subjects were recommended to be taught by various educational methods. Also, written comments are presented on how experienced cost analysts perceived the educational competence of all Air Force cost analysts can be improved.

END

FILMED

6-85

DTIC