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**Preliminary Control Risk Assessments by
Computer Audit Specialists and Non-Specialists**

by

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(ABSTRACT)

Auditors are encountering more and more computerized accounting applications as the pervasiveness of computing technology increases in business. Auditors therefore need to adapt their audit approaches in the face of the changes caused by the new technology.

The AICPA has addressed the issue by requiring auditors to consider the nature of the data processing system in their client environments when planning the audits. Specialists, if necessary, are recommended to be brought in as part of the audit team in audits involving computerized accounting applications. The implicit assumption behind this is that the specialists would make "better" judgments in auditing computerized systems than non-specialists. A need was seen to compare the judgments of specialists and non-specialists in evaluating controls in a simple computerized environment.

The results indicate that while both specialists and non-specialists have a high degree of consensus, a significant difference existed between the two groups of auditors. Both groups of auditors exhibited high reliability and self-insights.

Experienced non-specialists had lower consensus than specialists while inexperienced non-specialists had lower reliability than specialists. Firm affiliation effects were noted for the non-specialists in their consensus scores. Unlike previous studies, segregation of duties cue did not account for a majority of the variance in judgments. This cue was considered important only by the experienced non-specialists. A need was seen for further research into how the difference in consensus affects subsequent audit program planning.

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Dedication

Dedicated to my parents,

.....
*for their encouragement, understanding
and personal sacrifices in letting me
chase my crazy dreams.*

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Chapter 1

Introduction

1.1 Nature of the Problem

The continuous decline in the unit cost of computing power has enabled many businesses to computerize their accounting systems.¹ Consequently, external independent auditors frequently encounter clients with significant computerized accounting applications.² A survey of one large accounting firm's clients found that about seventy percent had significant computerized accounting applications.³ Because the number of computers installed in the United States

¹ E. G. Jancura, "Widespread Computerization and Automation of Business Operations," *The Woman CPA*, July 1986, p. 14.

² R. K. Elliot, "Unique Audit Methods: Peat Marwick International," *Auditing: A Journal of Practice and Theory*, Spring 1983, p. 2.

³ *Ibid.*

has doubled every three years since 1960⁴, most audit firms, small or large, are likely to encounter computerized accounting applications in their audits.

The increased use of computers in accounting applications requires auditors to adjust their approaches and procedures to be effective and efficient.⁵ The American Institute of Certified Public Accountants (AICPA) has expressed the need for auditors to understand the nature of data processing complexities in their clients' organizations by issuing Statements on Auditing Standards (SAS) No.3 and 48. In SAS 3, issued in 1974, the AICPA required auditors to include the EDP portions of the system in their study and evaluation of internal controls.⁶ SAS 3 included a description of how EDP systems affected internal controls and, in general terms, how an auditor should study and evaluate the controls in EDP systems. In 1984 the AICPA issued SAS 48 which superseded SAS 3 and requires auditors, in the planning phase of the audit, to include consideration of the methods used by their clients to process significant accounting information.⁷ The AICPA in SAS 48 also recommends that auditors seek the help of a specialist if specialized skills are needed to determine the effect of computer processing on the audit.

⁴ D. R. Carmichael and J. J. Willingham, *Perspectives in Auditing*, Fourth Edition (New York, NY: McGraw-Hill Book Company, 1985), p. 308.

⁵ A. F. Borthick, "Audit Implications of Information Systems," *The CPA Journal*, April 1986, p. 40.

⁶ AICPA, *Statement on Auditing Standards No. 3* (New York: AICPA, 1974).

⁷ AICPA, *Statement on Auditing Standards No. 48, The Effect of Computer Processing on the Examination of Financial Statements* (New York: AICPA, July 1984).

Some of the larger accounting firms, such as Arthur Young & Co. (AY) Coopers & Lybrand (C & L), and Peat Marwick Main & Co.(PMM), have designated specialists who evaluate the control risks in clients' EDP systems. The commonly used designation for these specialists is Computer Audit Specialists (CASs). The general background of the CASs differs from firm to firm. For instance, C & L prefers to hire computer graduates and train them in accounting and auditing, while PMM trains specialists from the auditing personnel within the firm. PMM has three levels of computer specialists: Computer Processing Specialists, who are typically staff level accountants; CASs, who have had more training and experience in computer auditing; and Senior CASs, managers and senior managers with extensive training and experience in computer auditing.⁹

The implicit assumption supporting the use of CASs is that CASs will demonstrate more expertise than the non-specialists (NSs) in all areas of computer auditing. While one research study examined the expertise of CASs decision behavior in advanced computer environments,⁹ no empirical study has contrasted CASs judgments with those of NSs in simple computer environments. While audit firms have no hesitation in bringing in specialists in advanced computer environments, as per the recommendations in SAS 48, in simpler

⁹ Elliot, "Unique Audit Methods," p. 3.

⁹ S. F. Biggs, W. F. Messier, Jr., and J. V. Hansen, "A Descriptive Analysis of Computer Audit Specialists' Decision-Making Behavior in Advanced Computer Environments," *Auditing: A Journal of Practice & Theory*, Spring 1987, pp. 1-21.

computing environments they may not perceive the need for specialists. If differences exist between the judgments of CASs and NSs at this level also, the need for more detailed guidance from the AICPA to avoid any over or under-reliance of computer controls by NSs may be indicated. This study compares the judgments made by CASs with NSs in the assessment of control risks in computerized accounting applications. Differences in the judgments made by the two groups will suggest further research is needed to evaluate which group's judgments are superior. Negligible differences in the judgments made by the two groups will suggest that the use of specialists may not be that crucial in all computerized applications.

1.2 Significance of the Problem

Auditors have had problems complying with SAS 3 and SAS 48. In a 1977 survey of New York CPAs, an overwhelming majority of the independent auditors expressed an unwillingness to acquire the prerequisite computer knowledge needed to conduct audits of computer-based accounting systems.¹⁰ A survey of the accounting practitioners conducted by the New York State Society Committee on Computer Usage and Data Processing in early 1981 revealed 55 percent of the respondents had not answered a question dealing

¹⁰ M. J. Cerullo, "Computer Knowledge and Expertise of Public Accountants," *The National Public Accountant*, December 1977, pp. 32-38.

with compliance with SAS 3.¹¹ Of those responding, 33 percent indicated they had difficulty complying with SAS 3. A 1985 survey found that auditors dealing with computerized accounting applications may not be calling in a specialist as part of the audit team as recommended in SAS 48.¹²

Understanding the nature of the data processing system and the control structure is important with respect to evaluating internal control. The AICPA, in SAS 20, requires the auditor to communicate to management and the board of directors or audit committee any material weakness in internal accounting control identified during an examination of financial statements made in accordance with generally accepted auditing standards.¹³ In the case of *Adams vs Standard Knitting Mill Inc*, PMM was held negligent for failure to reveal significant EDP weaknesses in their client's system of internal controls.¹⁴ This judgment "... clearly indicates that the professional accountant will soon be forced to place more emphasis on EDP controls when carrying out the audit function."¹⁵

¹¹ J. D. Green, "Management Advisory Services: Computers and the Profession," *The CPA Journal*, April 1982, pp. 85-86.

¹² L. D. Vansyckle, "A Critical Evaluation of CPA's Performance of Internal Control Review of EDP Systems in Conformance with Generally Accepted Auditing Standards," Ph.D Dissertation, University of Kentucky, 1985.

¹³ AICPA, Statement on Auditing Standards No. 20, *Communication of Material Weaknesses in Internal Accounting Control* (New York, NY: AICPA, 1977).

¹⁴ J. O. Mason, Jr. and J. J. Davies, "Legal Implications of EDP Deficiencies," *The CPA Journal*, May 1977, pp. 21-24.

¹⁵ *Ibid.*, p. 23.

1.3 Contribution of the Study

With extensive computerization of accounting systems by clients, all auditors will be dealing with these computerized systems in the near future. The shortage of specialists and the reluctance of auditors to increase their costs suggest that more and more auditors will be conducting audits without the assistance of the specialists. Thus, a comparison of the judgments made by specialists and non-specialists, especially in simple computer environments, will be of interest to the profession. NSs may not perceive much of a difference in simple computer environments from manual systems which may lead them to either place more reliance on computer controls than they should or not rely on the controls at all. If a difference exists between judgments of CASs and NSs in such cases, there is potential for loss of credibility and legal liability when audits are conducted without the assistance of CASs. A description of the CASs' judgment formation processes, especially in terms of the control factors perceived important by them, may enable the issuance of guidelines for aiding non-specialists in planning audits of computerized accounting systems.

1.4 Research Methods and Procedures

The study utilizes correlational analyses and ANOVA procedures to identify and investigate the differences in the judgments made by the two groups of auditors - specialists and non-specialists. The policy capturing form of Brunswik's Lens model¹⁶ is utilized to build linear models of each subjects' decision model. The pattern of cue usage of each auditor in each group and the degree of self-insight exhibited by each auditor is also examined.

The subjects for the study, practicing auditors from large, international accounting firms in various cities along the East Coast, assessed control risks in each of twenty-one situations. The situations represented a one-half fractional replication of five manipulated control factors, with four repeat cases to measure the reliability of each auditor's assessments, and one case to establish the ceiling level of assessment (anchor) for each auditor. Responses of the auditors to the situations, and to self-insight and debriefing questionnaires, were used in correlational analysis to assess the degree of consensus, reliability and self-insight exhibited by each auditor. ANOVA procedures were used to investigate the differences between the two groups of auditors and to study the cue usage of the auditors.

¹⁶ R. H. Ashton, *Human Information Processing in Accounting, Studies in Accounting Research No. 17* (Sarasota, FL: AAA, 1982), p. 15.

A pilot test was conducted prior to the data collection stage to ensure that the research instrument had minimum ambiguity.

1.5 Organization of the Dissertation

The developments in auditing due to the effect of computerization of accounting systems are reviewed in Chapter II. The issuance of auditing standards, especially pertaining to internal controls and the effect of computers on internal controls, is considered as part of this development. Research into auditor judgments in internal control evaluations are reviewed in Chapter III. The specific objectives of this study and the research hypotheses are also outlined. Research methods and procedures, including the development of the research instrument, the administration of the instrument, the analytical model used for the study, and the statistical analyses employed are discussed in Chapter IV. The results of the study are analyzed and summarized in Chapter V. The findings and implications of the study, as well as recommendations for future research, are discussed in Chapter VI.

Chapter 2

Developments Relating to Internal Control Evaluations

2.1 Evolution of Internal Control Evaluations

A survey of the literature pertaining to the early history of auditing was conducted by Brown.¹⁷ He reports that there is nothing concerning the existence of internal controls until this century.¹⁸ One of the first discussions of a linkage between audit programs and internal controls was in a leading auditing book

¹⁷ G. R. Brown, "Changing Audit Objectives and Techniques," *The Accounting Review*, October 1962, pp. 696-703.

¹⁸ For a complete review of the history of auditing, see also W. J. Read, "Modelling Auditor Judgment in Non-Statistical Sampling," Ph.D. Dissertation, Virginia Polytechnic Institute & State University, 1984.

of the early 1900's, where it was recommended that "... a proper system of internal check [will] frequently obviate the necessity of detailed [audit]."¹⁹ In the revised and enlarged 1917 edition of this book, this assertion was expanded to note that:

If the auditor has satisfied himself that the system of internal check is adequate, he will not attempt to duplicate work which has been properly performed by some one else.²⁰

However, in actual practice auditors were not linking an appraisal of internal controls to the extent of testing.²¹ One reason may have been that professional standards and formalized guidance for reviews of internal accounting controls did not exist. It was not until 1929 that the American Institute of Accountants (AIA) formally recognized the importance of appraising the effectiveness of internal control. In its bulletin titled *Verification of Financial Statements*, the Institute stated in the preface:

the scope of the work indicated in these instructions includes a verification of the assets and liabilities of a business enterprise at a given date; a verification of the profit and loss account for the period under review and, incidentally, an examination of the accounting system for the purpose of *ascertaining the effectiveness of the internal check* (emphasis added)... The extent of the verification will be determined by the conditions of each concern.²²

¹⁹ L. R. Dicksee, *Auditing*, ed. R. H. Montgomery (New York: Ronald Press Co., 1905), p 54.

²⁰ R. H. Montgomery, *Auditing: Theory and Practice*, 2nd ed. (New York: Ronald Press Co., 1917), p. 50.

²¹ Brown, "Changing Audit Objectives," p. 698.

²² G. Cochrane, "The Auditor's Report: Its Evolution in the U.S.A.," *The Accountant*, November 4, 1950, p. 451.

2.2 Definition of Internal Control

In the 1936 version, the AIA stated in the pamphlet that it:

... deals with the accountant's examination of the balance sheet of a business enterprise at a specified date and of the profit and loss and surplus accounts for the period under review, and also with his review of the accounting procedure for the purpose of ascertaining the accounting principles followed and the adequacy of the system of internal check and control.²³

Internal control was defined as "... those measures and methods adopted within the organization itself to safeguard the cash and other assets of the company as well as to check the clerical accuracy of the bookkeeping."²⁴

2.3 Formation of Committee on Auditing Procedure

Recognizing the changes in the environment, the AIA also formed the committee on auditing procedure to review auditing procedures and related questions at this time. One of the first statements issued by the committee, *Statement on Auditing Procedure 1, Extensions of Auditing Procedure*, presented some of the underlying concepts of the profession that later became a

²³ American Institute of Accountants, *Examination of Financial Statements by Independent Public Accountants* (New York: AIA, 1936), p. 1.

²⁴ *Ibid*, p. 8.

framework for generally accepted auditing standards. One of the concepts stated:

It is the duty of the independent auditor to review the system of internal check and accounting control so as to determine the extent to which he considers that he is entitled to rely upon it.²⁶

The Securities and Exchange Commission also recognized the importance of the auditor's evaluation of internal control, and stated in Regulation S-X, issued in 1940, that the independent auditor was permitted to give due consideration "to an internal system of audit regularly maintained by means of auditors employed on the registrant's own staff."²⁶ In the amended Regulation S-X in 1941, the Commission reiterated that "in determining the scope of the audit necessary, appropriate consideration shall be given to the adequacy of the system of internal check and control."²⁷

In 1947 the committee on auditing procedure issued a special report, titled *Tentative Statement on Auditing Standards - Their Generally Accepted Significance and Scope*, which defined auditing standards grouped as (1) general standards, (2) standards of field work, and (3) standards of reporting.

The second standard of field work was stated as:

²⁶ American Institute of Accountants, "Extensions of Auditing Procedure," *Journal of Accountancy*, December 1939, p. 379.

²⁶ Securities and Exchange Commission, Regulation S-X, *Form and Content of Financial Statements* (Washington, D.C.: U.S. Government Printing Office, 1941), p. 3.

²⁷ *Ibid.*

There is to be a proper study and evaluation of the existing internal control as a basis for reliance thereon and for the determination of the resultant extent of the tests to which auditing procedures are to be restricted.²⁸

The membership of the Institute approved the report in September 1948.

2.4 Accounting Controls and Administrative Controls

In 1949, the committee published the results of an analytical study that was “directed particularly to the consideration of the nature and characteristics of internal control ...”.²⁹ Internal control was defined in this statement as:

Internal control comprises the plan of the organization and all of the coordinate methods and measures adopted within a business to safeguard its assets, check the accuracy and reliability of its accounting data, promote operational efficiency, and encourage adherence to prescribed managerial policies. This definition possibly is broader than the meaning sometimes attributed to the term. It recognizes that a “system” of internal control extends beyond those matters which relate directly to the functions of the accounting and financial departments. Such a system might include budgetary control, standard costs, periodic operating reports, statistical analyses and the dissemination thereof, a training program designed to aid personnel in meeting their responsibilities, and an internal audit staff to provide additional assurance to management as to the adequacy of its outlined procedures and the extent to which they are being effectively carried out. It properly comprehends activities in other fields as, for example, time and motion studies which are of an engi-

²⁸ American Institute of Accountants, *Tentative Statement of Auditing Standards - Their Generally Accepted Significance and Scope* (New York, NY: AIA, 1947), p. 11.

²⁹ American Institute of Accountants, *Internal Control: Elements of a Coordinated System and Its Importance to Management and the Independent Public Accountant* (New York, NY: AIA, 1949), p. 5.

neering nature, and use of quality controls through a system of inspection which fundamentally is a production function.³⁰

Because the above definition was not easily understood by the auditors, the committee issued Statement on Auditing Procedure 29 in 1958.³¹ This statement described two kinds of internal control, administrative and accounting controls. Accounting controls were defined as "... methods and procedures that are concerned mainly with ... the safeguarding of assets and the reliability of the financial records."³² Administrative controls were "... all methods and procedures that concerned mainly with operational efficiency and adherence to managerial policies...".³³ The committee indicated that accounting controls directly affected the reliability of financial records, while administrative controls related only indirectly, and hence accounting controls would require evaluation by auditors, while administrative controls would not require evaluation, except in particular circumstances.³⁴

The definitions of accounting and administrative controls were revised in the Statement on Auditing Procedure 54 issued in 1972:

Administrative control includes, but is not limited to, the plan of organization and the procedures and records that are concerned with the de-

³⁰ *Ibid.*, p. 6.

³¹ T. J. Mock and J. L. Turner, *Internal Accounting Control Evaluation and Auditor Judgment* (New York: AICPA, 1981), p. 9.

³² AICPA, Statement on Auditing Procedure 29, *Scope of the Independent Auditor's Review of Internal Control* (New York: AICPA, 1958), sec. 5.

³³ *Ibid.*

³⁴ *Ibid.*, sec. 6.

cision processes leading to management's authorization of transactions. Such authorization is a management function directly associated with the responsibility for achieving the objectives of the organization and is the starting point for establishing accounting control of transactions.

Accounting control comprises the plan of organization and the procedures and records that are concerned with the safeguarding of assets and the reliability of financial records and consequently are designed to provide reasonable assurance that:

1. Transactions are executed in accordance with management's general or specific authorization.
2. Transactions are recorded as necessary (1) to permit preparation of financial statements in conformity with generally accepted accounting principles or any other criteria applicable to such statements and (2) to maintain accountability for assets.
3. Access to assets is permitted only in accordance with management's authorization.
4. The recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action is taken with respect to any difference.³⁵

The committee again reiterated that accounting controls, and not administrative controls, needed to be evaluated by the auditors. A summary of the changes in the importance of internal controls over time is given in Table 1.

2.5 Audit Risk and Control Risk

In 1983, the AICPA issued SAS 47 titled *Audit Risk and Materiality in Conducting an Audit*. SAS 47 provides "... guidance on the consideration of audit risk and materiality when planning and performing an examination of financial

³⁵ AICPA, Statement on Auditing Procedure 54, *The Auditor's Study and Evaluation of Internal Control* (New York: AICPA, 1972), Sec. 27-28.

Table 1. Changes in the importance of internal controls

Period	Stated Audit Objectives	Extent of Verification	Importance of Internal Controls
Ancient - 1850	Detection of fraud	Detailed	Not recognized
1850 - 1905	Detection of fraud and clerical errors	Primarily detailed tests	Not recognized
1905 - 1933	Determination of fairness of reported financial position, Detection of fraud and errors	Detailed and other testing	Slight recognition
1933 - 1940	Detection of fairness of reported financial position, Detection of fraud and errors	Various Testing	Awakening of interest
1940 - 1983	Determination of fairness of reported financial position	Various Testing	Substantial emphasis
1983 - Present	Determination of fairness of reported financial position	Various Testing	Substantial emphasis, combined with risk assessment

Adapted from: G. R. Brown, "Changing Audit Objectives and Techniques,"
The Accounting Review, October 1962,
p. 697.

statements in accordance with generally accepted auditing standards.”³⁶ Audit risk is defined as “... the risk that the auditor may unknowingly fail to appropriately modify [his] opinion on financial statements that are materially misstated.”³⁷ Auditors should plan the audit so that the audit risk would be limited to a low level.³⁸ At the individual account balance or class of transactions level, three components of audit risk are defined:

- Inherent risk - The susceptibility of a balance or class to error that could be material, when aggregated, assuming there were *no* related internal accounting controls (IAC).
- Control risk - The risk that errors that could occur in a balance or class and that it could be material when aggregated, will not be prevented or detected on a timely basis by the system of IAC.
- Detection risk - The risk that an auditor’s procedures will lead to the conclusion that material errors do not exist when in fact such errors exist.³⁹

In every specific audit engagement, the auditor will decide what level of individual audit risk is appropriate.⁴⁰ A judgment of inherent risk and control risk

³⁶ AICPA, Statement on Auditing Standard 47, *Audit Risk and Materiality in Conducting an Audit* (New York: AICPA, 1983), p. 1.

³⁷ *Ibid.*

³⁸ *Ibid.*, p. 3.

³⁹ *Ibid.*, p. 7.

⁴⁰ J. L. Colbert, “Audit Risk - Tracing the Evolution,” *Accounting Horizons*, September 1987, p. 50.

is then made.⁴¹ In practice, since auditors have problems differentiating between inherent and control risks, a joint assessment of these two risks is made, which is allowed by SAS 47.⁴²

2.6 Effect of Computers on Internal Controls

The introduction of electro-mechanical systems in the early 1930's prompted interest in their effect on auditing. As early as 1940, Leon E. Vannais, a CPA in Connecticut, stated:

1. Auditing is essentially a matter of judgment.
2. This judgment should be based on knowledge. In the punched card field, knowledge must include both the possibilities and the limitations of punched cards.
3. In the exercise of this judgment based on knowledge, the auditor should analyze the utilization of these new mechanical devices, defining segregation of duties and reliance upon test-checks.⁴³

One author was convinced that use of such equipment "... in no way affects the need for controls in the accounting systems, nor the auditors' need to evaluate them."⁴⁴

⁴¹ *Ibid.*

⁴² *Ibid.*, p. 54.

⁴³ G. F. Cleaver, "Auditing and EDP," *Journal of Accountancy*, November 1958, p. 48.

⁴⁴ C. C. Sparks, "Fitting the Audit Program to Punched Card Accounting Systems," *Journal of Accountancy*, September 1948, p. 196.

This view was not universally shared by others. Some were convinced that the use of electro-mechanical systems would result in a strengthening of internal controls as fewer persons handle transactions.⁴⁵

As electronic data processing systems and computers began to become popular in the '50s and early '60s, the belief that the automated accounting systems did not affect audit procedures became more popular. Even the Chairman of the AICPA's committee on electronic accounting was convinced that auditing techniques did not require changes because of the new technology.⁴⁶ Auditing "around" the computer was popular. When auditing "around" the computer, the computer is considered a "black box" and the output is reconciled with the input without investigating the processing of the data.

It was not until the late '60s that some authors began questioning this approach. Davis, for example, recommended that auditors not view the computer as a giant calculator, but consider the control framework of computer processing in their review of internal controls.⁴⁷ Recommendations were made for standards in this area as "... no auditor today can ignore the need for special

⁴⁵ J. Pelej, "How Will Business Electronics Affect the Auditor's Work?" *Journal of Accountancy*, July 1954, pp. 36-44.

⁴⁶ P. E. Hamman, "The Audit of Machine Records," *Journal of Accountancy*, March 1956, p. 61.

⁴⁷ G. B. Davis, "The Auditor and the Computer," *Journal of Accountancy*, March 1968, p. 45.

training in the EDP area.”⁴⁸ Even at this stage, some authors debated whether there was any need for changes in auditing techniques. Auditing around the computer would “... no doubt persist for years to come because in many cases it offers a satisfactory way of making the audit without technical training in EDP.”⁴⁹

The debate over whether auditors should consider the effect of computer processing of accounting transactions was settled by the Equity Funding fraud in 1973. Equity Funding employed the computer to create about \$2.1 billion of fictitious insurance policies.⁵⁰

2.7 Statement on Auditing Standards No. 3 and No. 48

The Equity Funding fraud prompted the AICPA to issue SAS 3 in 1974, which required auditors to include the EDP portions of the system in their study and evaluation of internal controls.⁵¹ SAS 3 described how EDP systems affect internal controls, and in general terms, how an auditor should study and

⁴⁸ E. M. Lamb and J. R. Nolan, “Auditing Standards in an EDP Environment,” *Journal of Accountancy*, October 1970, p. 91.

⁴⁹ E. M. Milko, “Auditing: Through the Computer or Around,” *Management Accounting*, August 1970, p. 48.

⁵⁰ M. Romney, “Fraud and EDP,” *The CPA Journal*, November 1976, p. 24.

⁵¹ AICPA, *Statement on Auditing Standards No. 3* (Chicago: Commerce Clearing House, 1982), AU sec. 321, December 1974.

evaluate the controls in EDP systems. EDP controls were classified as general and application controls. General controls provide the standards and guidelines under which employees function in their work. Application controls relate primarily to the accuracy and completeness of the data within a specific application, such as payroll processing. Application controls were further classified as input controls, process controls, and output controls. A subsequent guide, issued in 1977, gave a step-by-step procedure for making a study of internal controls in EDP systems in conformity with SAS 3 and provided 19 control objectives for general controls and 12 for application controls.⁵²

Despite the issuance of SAS 3 and the subsequent audit guide, auditors still had many problems complying with the requirements of the standard, as noted earlier in Chapter 1. These problems prompted the issuance of SAS 48, which superseded SAS 3 and is still in effect today.⁵³ SAS 48 requires the planning phase of the audit to include consideration of:

1. Methods used by the entity to process significant accounting information, including:
 - a. Extent to which the computer is used in each significant accounting application,

⁵² AICPA, *The Auditor's Study and Evaluation of Internal Control in EDP Systems* (New York: Computer Services Executive, 1977).

⁵³ AICPA, Statement on Auditing Standards No. 48, *The Effect of Computer Processing on the Examination of Financial Statements*, (New York: AICPA, July 1984).

- b. Complexity of the entity's computer operations, including use of an outside service center,
 - c. Organization structure of the computer processing activities,
 - d. Availability of data and documents for audit purposes, and
 - e. Use of computer-assisted audit techniques.
2. Whether specialized skills are needed to consider the effect of computer processing on the audit, to understand the flow of transactions, to understand the nature of internal accounting control procedures, or to design and perform audit procedures.

Thus, if specialized skills are needed, the auditor should seek the help of a computer professional. If a computer professional is used, the auditor still should have sufficient computer-related knowledge to communicate the audit objectives to the professional, to evaluate whether the professional's procedures meet the auditor's objectives, and to evaluate the results of the procedures as they relate to the nature, timing and extent of other planned audit procedures.⁵⁴ Also, the auditor's responsibilities with respect to using a professional are equivalent to those of other assistants. The professional is considered a part of the audit team, rather than a specialist.⁵⁵

⁵⁴ J. H. Thompson, G. L. Waters and C. W. Alderman, "The Effects of Computer Processing on The Auditor's Examination of Financial Statements," *The EDP Auditors Journal*, 1986, Vol III, p 61.

⁵⁵ *Ibid*

2.8 Proposed Statement on Auditing Standard

The AICPA has proposed a new auditing standard to supersede SAS 48 and further explain the auditor's responsibility in assessing control risk.⁵⁶ In this proposed standard, the AICPA replaces the concept of internal control with a broader concept of control structure that consists of the control environment, the accounting system, and control procedures. In addition, some of the extant terminology will be replaced (Table 2).

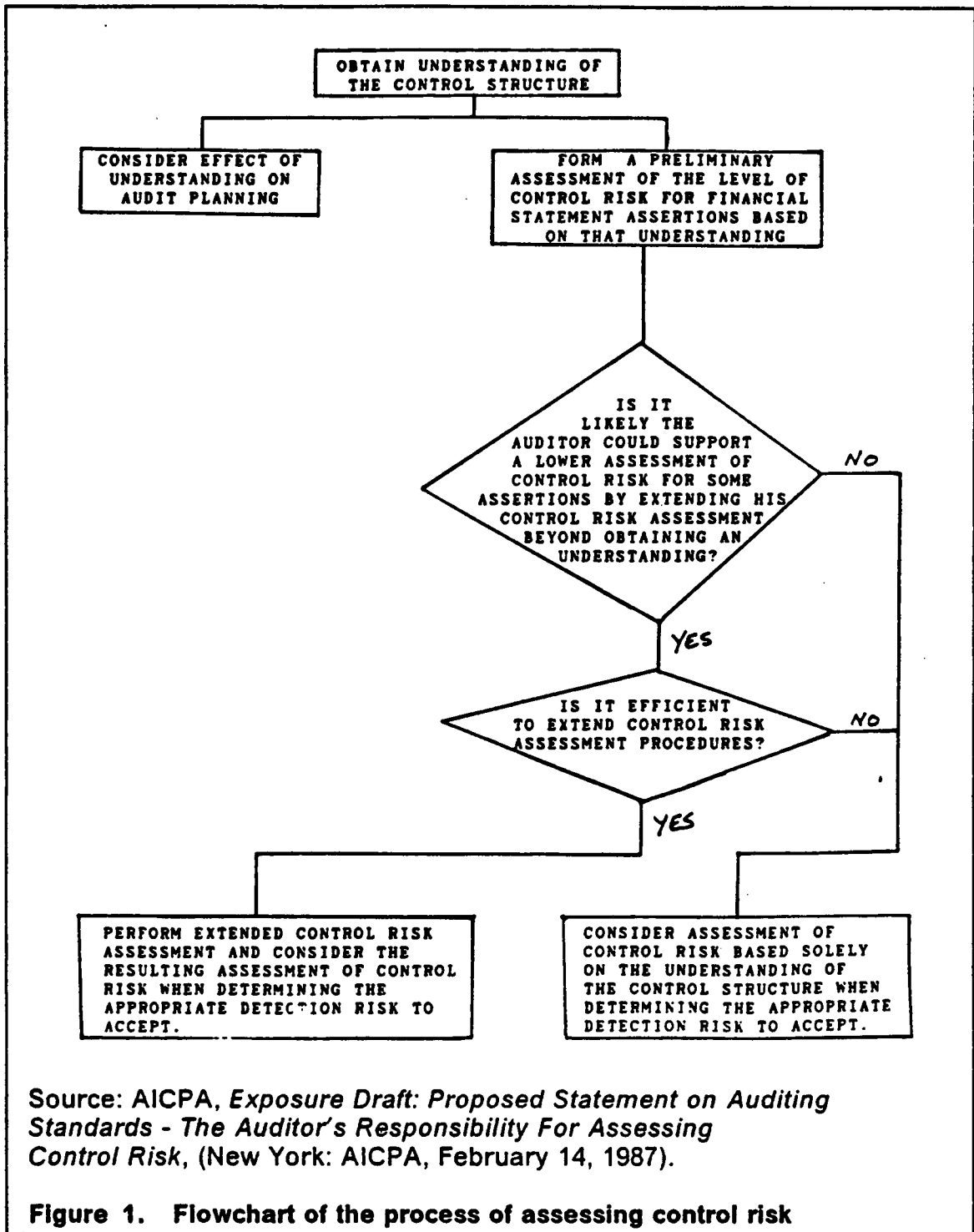
The Auditor's responsibility concerning the control structure is discussed in terms of control risk as defined in SAS 47. According to the proposed standard, the auditor would obtain an understanding of the control structure of the client. This understanding will provide information about how audit planning is affected by the control structure. At this stage, the auditor also will form a preliminary assessment of the control risk for financial statement assertions based on that understanding (Figure 1). While understanding the control structure of a client in the formation of the preliminary assessment of control risk, the auditor also must consider "... the complexity and sophistication of the entity's operations and systems, including whether the method of control-

⁵⁶ AICPA, *Exposure Draft: Proposed Statement on Auditing Standards - The Auditor's Responsibility For Assessing Control Risk* (New York: AICPA, February 14, 1987).

Table 2. Updated terminology proposed in the Exposure Draft

<i>AU Section 320 Terminology</i>	<i>Proposed Statement Terminology</i>
<p>Internal Control System</p> <p>Study and Evaluation of Internal Control</p> <p>Review of System and Compliance Tests</p> <p>Substantive Tests</p> <p>Reliance on Internal Control</p> <p>Accounting Controls and Administrative Controls</p>	<p>Control Structure</p> <p>Assessing Control Risk</p> <p>Control Risk Assessment Procedures</p> <p>Tests of Financial Statement Balances</p> <p>Conclusion about the level of Control Risk/Assessment of Control Risk</p> <p>Control-Structure Elements Relevant to Financial Statement Assertions</p>

Source: AICPA, *Exposure Draft: Proposed Statement on Auditing Standards - The Auditor's Responsibility For Assessing Control Risk*, (New York: AICPA, February 14, 1987).



ling data processing is based on manual procedures independent of the computer or is highly dependent on computerized controls”⁵⁷.

The proposed standard is based on the actual practice of assessing risk and materiality by some large accounting firms. Cushing and Loebbecke investigated the audit methodologies of 12 large accounting firms and found that 6 of the 12 had either “highly structured” or “semi-structured” audit methodologies which included incorporating quantification of risk levels based on the assessment of internal controls at the planning stage.⁵⁸

2.9 Chapter Summary

The developments relating to the auditors’ evaluation of internal controls were reviewed. From the early 1900’s, there has been a growing trend of recognizing the importance of auditors’ evaluations of internal controls, and relating such evaluations to the procedures and techniques applied. Starting in the 1930s, the AICPA has been issuing pronouncements that recognize the importance of auditors’ evaluation of internal controls, and the effect of such

⁵⁷ *Ibid*, para. 28.

⁵⁸ B. E. Cushing and J. K. Loebbecke, *Studies in Accounting Research, Comparison of Audit Methodologies of Large Accounting Firms* (Sarasota, FL: AAA, 1986), pp. 37-38.

evaluation on subsequent audit program planning. In 1983, the Institute issued SAS 47, which introduced a concept of overall audit risk, and inherent, control, and detection risks at the individual account balance or class of transaction level. Auditors were required to explicitly set a level of overall risk for all audits, and then assess the level of inherent and control risk present in each class of transactions. Thus, for each audit, auditors would conduct an assessment of control risk for each subsystem.

The impact of the use of computers in accounting systems, and their effect on the auditors' evaluations of internal controls also were discussed. Initially, there were mixed opinions as to whether the nature of data processing affected the techniques followed by the auditors. As a result, the most common procedure followed by the auditors was to audit "around" the computer. Outputs were matched with inputs without regard to the processing of the data by the computer. The Equity Funding fraud, in which the computer played a major role, prompted the AICPA to issue SAS 3, requiring auditors to include the EDP portions of the system in their study and evaluation of internal controls. A subsequently issued audit guide gave a step-by-step procedure for making a study of internal controls in EDP systems.

Recognizing that auditors were still having problems complying with SAS 3, the AICPA issued SAS 48 in 1984, which requires auditors to consider if specialized skills are needed to determine the effect of computer processing on

the audit. The Institute recommends that if specialized skills are needed, the auditor should seek the help of a computer professional.

The AICPA has recently proposed a statement to supersede SAS 48, and further expand on the auditors' responsibility in assessing control risks. The proposed statement builds on the concepts of control risks developed in SAS 47, and describes the procedures to be followed by auditors' in the planning and subsequent phases of each audit.

Chapter 3

Prior Studies, Objectives and Hypotheses

This chapter is divided into three sections. First, the results of the prior studies of auditors' expertise in internal control evaluations and the major differences between this research and previous studies are outlined. Next, the specific objectives of this study are listed. Finally, the hypotheses used to achieve the objectives are discussed.

3.1 Auditors' Expertise in Internal Control Evaluations

Auditors are considered experts in performing certain tasks.⁵⁹ Internal control evaluations have been considered one of the tasks at which auditors are ex-

⁵⁹ R. D. Meservy, A. D. Bailey Jr., and P. E. Johnson, "Internal Control Evaluation: A

perts. However, the determinants of expertise in auditing has not been defined. As Abdolmohammadi notes:

... the question arises as to how one should identify an audit expert? What are the educational and experience determinants of such an expert? While these questions can be easily answered in some professions, such as medicine, research has not yet investigated these issues in auditing.⁶⁰

In the absence of well-defined criteria for studying expertise in auditing, researchers have studied judgment consistency of auditors as a substitute criterion for expertise. Support for the study of judgment consistency is derived from Einhorn, who suggests that consensus is a necessary condition for expertise.⁶¹ Einhorn also suggests that the judgments of experts should show high intra judge reliability and be relatively free of judgment bias.⁶² As noted by Ashton, "Ideally, studies ... would evaluate the quality or accuracy of internal control judgments."⁶³ However, to evaluate judgment accuracy, criterion values must be available and measurable, something that is not possible in internal control evaluations. Thus, researchers have focussed on judgment consistency as a substitute for judgment accuracy.

Computational Model of the Review Process," *Auditing: A Journal of Practice and Theory*, Fall 1986, p. 47.

⁶⁰ M. J. Abdolmohammadi, "Decision Support and Expert Systems in Auditing: A Review and Research Directions," *Accounting and Business Research*, Spring 1987, p. 181.

⁶¹ H. J. Einhorn, "Some Necessary Conditions and an Example," *Journal of Applied Psychology*, Oct 1974, pp. 562-571.

⁶² *Ibid*, p. 563.

⁶³ R. H. Ashton, "Comment: Some Observations on Auditors' Evaluations of Internal Accounting Controls," *Journal of Accounting, Auditing, and Finance*, Fall 1979, p. 56.

Libby also supports studying judgment consistency in auditing judgments stating:

Judgmental consensus has become an increasingly important issue to professional decision makers. Where the lack of objective criterion data makes the direct measurement of achievement impossible, the consensus of experts often serve as a substitute criterion. Since most accounting situations can be so characterized, consensus judgments provide the backbone of accounting practice.⁶⁴

In the absence of criterion values, lack of consensus may be costly to the profession.⁶⁵ As Joyce notes:

Concern about individual differences (i.e., lack of consensus) among auditors' judgment implies that such differences are costly. Casual observation reveals audit firms and the AICPA doing things consistent with the hypothesis that individual differences are costly.⁶⁶

Thus, researchers in internal control judgments have focussed on three aspects of judgment consistency: (1) judgment stability reliability, the agreement over time between judgments of the same auditor using the same data; (2) judgment consensus, the agreement among the judgments of different auditors using the same data at the same point in time; and (3) judgment self-insight, the agreement between the auditors subjective description of his or her judgment process and an objective description derived from mathematical or statistical techniques.⁶⁷

⁶⁴ R. Libby, *Accounting and Human Information Processing: Theory and Applications* (Englewood Cliffs, NJ: Prentice-Hall, 1981), p. 3.

⁶⁵ Joyce, "Expert Judgment in Audit," p. 31.

⁶⁶ *Ibid.*

⁶⁷ Ashton, "Comment: Some Observations in Auditors' Evaluations," p. 56.

3.1.1 Prior Studies of Auditor Judgments in Internal Control

Evaluations

One of the first to recognize the importance of the study of auditors' judgment processes was Robert Mautz, who as early as in 1959 stated:

... judgment must inevitably play a major role in auditing ... we will do well to recognize this and acquaint ourselves with the process of judgment formation and its application in auditing.⁶⁸

However, it was not until the '70s that researchers started investigating auditor judgments in internal control evaluations.⁶⁹ In these studies of auditor judgments, consensus, reliability and self-insight indexes have ranged from very high to very low, as is indicated in Table 3. The studies dealing with internal control evaluations⁷⁰ reveal very high consistency in the auditor judgments of internal controls, implying auditor expertise in this area. In subsequent sample

⁶⁸ R. K. Mautz, "Evidence, Judgment, and the Auditor's Opinion," *The Journal of Accountancy*, April 1959, p. 44.

⁶⁹ The prior studies of auditor judgments in internal control evaluations are described in detail in Appendix A.

⁷⁰ R. H. Ashton, "An Experimental Study of Internal Control Judgments," *Journal of Accounting Research*, Spring 1974, pp. 143-157., R. H. Ashton and P. R. Brown, "Descriptive Modeling of Auditors' Internal Control Judgments: Replication and Extension," *Journal of Accounting Research*, Spring 1980, pp. 269-277., R. E. Hamilton and W. F. Wright, "Internal Control Judgments and Effects of Experience: Replications and Extensions," *Journal of Accounting Research*, Autumn 1982, pp. 756-765., B. R. Gaumnitz, T. R. Nunamaker, J. J. Surdick and M. F. Thomas, "Auditor Consensus in Internal Control Evaluation and Audit Program Planning," *Journal of Accounting Research*, Autumn 1982, pp. 745-755., and R. H. Tabor, "Internal Control Evaluations and Audit Program Revisions: Some Additional Evidence," *Journal of Accounting Research*, Spring 1983, pp. 348-354.

Table 3. Prior Research - Auditor Judgment in Internal Control Evaluation

Study	Subjects	n =	Factors	Cases	Results
Ashton(1974) +	Auditors	63	6	32	High Consensus High Self-insight High Stability
Joyce(1976)*	Auditors	35	5	32	Low Consensus Low Self-insight Low Reliability
Weber(1978)*	Auditors	40	--	1	Low Consensus
Reckers and Taylor(1979) +	Auditors Profs	30 40	36	5	Low Consensus No experience effects
Mock and Turner(1979)*	Auditors	73	--	1	Low Consensus
Ashton and Brown (1980) +	Auditors	31	8	128	High Consensus High Reliability High Self-Insight
Ashton and Kramer(1980) +	Students	30	6	32	High Consensus High Self-insight
Hamilton and Wright(1982) +	Auditors Students	78 Large	5	32	High Consensus High Self-insight No experience effects
Gaumnitz, et al.(1982) +	Auditors	35	5	20	High Consensus High Self-insight
Trotman, et al.(1983) +	Students	105	10	32	High Consensus No group effects
Tabor(1983)*	Auditors	109	3	12	High Consensus No experience effects
Nanni(1984) +	Auditors	30	4	16	Experience effects Firm Affiliation effects

+ - Internal Control Evaluations * - Sample Size Decisions

size decisions studied by Joyce (1976)⁷¹ and Mock and Turner (1979)⁷², auditors showed considerably less consistency in their judgments. However, Gaumnitz *et al.* (1982) and Tabor (1983) found high consistency of judgments for sample size decisions, as well as for internal control evaluations. Auditors have thus shown expertise in internal control evaluations in all of the above studies. Low consistency was found only by Reckers and Taylor (1979)⁷³, but their conclusions were disputed by Ashton⁷⁴ since the authors had varied thirty-six factors in five cases, without providing any rationale for the selection of the cases or the representativeness of the cases to real-life situations.

The expertise of auditors in internal control evaluations also is supported in studies using student surrogates. Since students are not experts, their judgments should be different from those of audit experts. Ashton and Kramer

⁷¹ E. J. Joyce, "Expert Judgment in Audit Program Planning," *Studies in Human Information Processing in Accounting*, Supplement to *Journal of Accounting Research*, 1976, pp. 29-60.

⁷² T. J. Mock and J. L. Turner, "The Effect of Changes in Internal Controls on Audit Programs," in *Behavioral Experiments in Accounting*, Burns, Ed. (Columbus: Ohio State University, 1979), pp. 277-302.

⁷³ P. M. J. Reckers and M. E. Taylor, "Consistency in Auditors' Evaluations of Internal Accounting Controls," *Journal of Accounting, Auditing, and Finance*, Fall 1979, pp.42-53.

⁷⁴ R. H. Ashton, "Comment: Some Observations on Auditors' Evaluations of Internal Accounting Controls," *Journal of Accounting, Auditing, and Finance*, Fall 1979, p. 56-66.

(1980)⁷⁵ and Trotman *et al.* (1983)⁷⁶ found that students did show lower consistency than auditors.

The expertise of auditors also was indicated by the pattern of cue usage. In earlier studies such as Ashton (1974) and Ashton and Brown (1980), segregation of duties cues accounted for most of the variance in auditors' judgments, while the students in the Ashton and Kramer (1980) study did not consider these cues as important as auditors did. The importance of the segregation of duties cues to the auditors also was noted by Nichols in his discriminant analysis of actual audit workpapers.⁷⁷

The effect of experience on the consistency of auditors' judgments has not been significant. Reckers and Taylor (1979) and Hamilton and Wright (1982) found slightly higher judgment consistency in experienced auditors, but these were not significant. Nanni (1984) was the only one who found an effect of internal control evaluation experience on judgment consistency.⁷⁸ However,

⁷⁵ R. H. Ashton and S. S. Kramer, "Students as Surrogates in Behavioral Accounting Research: Some Evidence," *Journal of Accounting Research*, Spring 1980, pp. 1-15.

⁷⁶ K. T. Trotman, P. W. Yetton and S. R. Zimmer, "Individual and Group Judgments of Internal Control System," *Journal of Accounting Research*, Spring 1983, pp. 286-292.

⁷⁷ D. R. Nichols, "A Model of Auditors' Preliminary Evaluations of Internal Control from Audit Data," *The Accounting Review*, January 1987, pp.183-190.

⁷⁸ A. J. Nanni, Jr., "An Exploration of the Mediating Effects of Auditor Experience and Position in Internal Accounting Control Evaluation," *Accounting, Organization and Society*, 1984, Vol 9, No. 2, pp. 149-163.

since only thirty auditors participated by mail in his study, it is difficult to draw any conclusions about the effect of experience on judgment consistency.

The above studies indicate that auditors reveal high consistency in internal control evaluations. Also, the expertise of auditors was implied in their pattern of cue usage. Thus, expertise of auditors in internal control evaluations is revealed by studying consensus, reliability, self-insight, and cue usage. The differences in judgments of the two groups of auditors in this study, CASs and NSs, is studied in terms of consistency and cue usage. However, there are some differences between this study and prior research.

3.1.2 Differences Between This Study and Prior Research

This study is different from prior studies in two important ways. First, all other experimental studies, except for the one by Biggs *et al.*⁷⁹, used a manual information processing system as background to their cases. In all these studies, the controls manipulated were manual controls. This study, like the Biggs *et al.* study, uses an information system with significant computerized applications, and the manipulated controls in this study are control factors found predominantly in EDP systems.

⁷⁹ S. F. Biggs, W. F. Messier, Jr., and J. V. Hansen, "A Descriptive Analysis of Computer Audit Specialists' Decision-Making Behavior in Advanced Computer Environments," *Auditing: A Journal of Practice & Theory*, Spring 1987, pp. 1-21.

Biggs *et al.* used an advanced computer environment. This study utilizes a simpler computer environment. In advanced environments there would be no hesitation on the part of the auditors to call in a specialist as part of the team to assist in the audit. In simpler environments, the auditor may not perceive the need for a specialist.⁸⁰ This misinference may lead to over-reliance on computer controls by the auditors.

The second major difference between this and prior studies is the comparison of the consensus of two groups of auditors, a specialist and a non-specialist group. While earlier studies looked at consensus in terms of lengths of experience, none studied the effect of expertise of the auditors on the judgments. While Biggs *et al.* study dealt with experts, it was limited to identifying controls in an EDP environment. No control evaluations were made by the auditors. Suggestion for this type of study comes from Williams and Lillis, who surveyed EDP auditors on audits of operating systems, and noted:

While this study does not necessarily bring us any closer to defining accuracy in control or audit testing decision, it does suggest that benefits may accrue from a consensus-seeking process which includes EDP professionals as well as auditors. Such a proposition is reinforced by a recent survey of US bank EDP auditors who do not place any value on accounting experience in their perception of an ideal EDP auditor.⁸¹

An implicit assumption behind the issuance of SAS 48 is that specialists will exhibit more expertise than NSs in evaluating computerized controls. In fact,

⁸⁰ Vansyckle, "A Critical Evaluation of CPA's."

⁸¹ D. J. Williams and A. Lillis, "EDP Audits of Operating Systems - An Exploratory Study of the Determinants of the Prior Probabilities of Risk," *Auditing: A Journal of Practice and Theory*, Spring 1985, p. 116.

in its study of specialization by the Canadian Chartered Accountants, the Canadian Institute of Chartered Accountants (CICA) concluded that "...specialists normally have more expertise in a particular area ..."⁸² Thus, in comparing the two groups of auditors, it is expected that CASs will have higher consensus, reliability and self-insights than NSs. Experience effects will be investigated by blocking the auditors in each group according to the median experience level in each group. Each auditor's assessments in each group will be correlated with the assessment of the other auditors in the group. As has been noted by prior researchers, the mediating effect of experience has been inconclusive. However, it is expected that in the NSs group, the younger auditors may show more consensus since they have received more computer education and training in college than the senior auditors. In the specialists group, it is expected that the more experienced auditors will have more consensus than the lesser experienced CASs.

3.2 Research Objectives

The specific objectives of this study are to:

1. Investigate the degree of judgment consensus exhibited by CASs and NSs

⁸² Canadian Institute of Chartered Accountants, "Report of the Committee to Study Specialization in Canadian Chartered Accounting Profession," *CA Magazine*, July 1982, p. 34.

in their evaluations of preliminary control risks in computerized accounting applications.

2. Evaluate the reliability of the judgments made by CASs and NSs. Reliability refers to the judge's ability to make the same assessment for a particular set of cues.

3. Evaluate the self-insight exhibited by CASs and NSs into their own judgment processes. Self-insight refers to the correspondence between the relative weights of the significant cues, as determined objectively, and the relative weights as provided subjectively by the judges' themselves.

4. Evaluate the effect of experience, training and educational background of the auditors on the degree of consensus exhibited by CASs and NSs.

5. Determine the control factors considered important by CASs and NSs in their judgment process (cue usage).

3.3 Hypotheses

This study has five research objectives which were specified above. Judgment consensus, reliability and self-insights of both the CASs and NSs will be in-

vestigated. Also, the mediating effects of experience and the pattern of cue usage in each group will be analyzed.

3.3.1 Judgment consensus

First the judgment consensus of both groups of auditors will be examined through correlational analysis. Both r and ρ correlations will be computed for each group of auditor. As explained earlier in this chapter, it is expected that CASs will have higher consensus than NSs.

The null hypothesis to test this assumption is:

H1: CASs will have similar consensus scores as NSs.

The non-parametric Mann Whitney U test will be used to test if the two sets of correlations obtained for the two groups differ significantly.

3.3.2 Judgment Reliability

Repeat cases will be used to verify the degree of reliability exhibited by each auditor. Correlations will be computed for each auditor's assessments of the original and repeat cases. As explained earlier, it is expected that CASs will have higher reliability than NSs. The null hypothesis to test this is:

H2: The reliability scores of CASs will be the same as the reliability scores of NSs.

Mann Whitney U tests of both r and ρ scores will reveal if the correlations in the two groups differ significantly.

3.3.3 Self-insight

The self-insights of auditors into their own judgment processes will be investigated by having each auditor assign one hundred points across the five manipulated control factors described in the next chapter. Using the assessments made by the auditors, individual ANOVA models will be computed for each auditor, representing his or her linear judgment model. ω^2 values will be computed for each main effect. The ω^2 statistic is an estimate of the proportion of variance in judgment accounted for by each factor.⁴³ The ω^2 values for the main effects for each auditor then will be transformed so that the total equals one hundred. The transformed values will be correlated with the scores given by each auditor to each factor in the self-insight questionnaire.

Again, for the reasons given before, it is expected that CASs will exhibit more self-insights into their own judgment processes than the NSs in evaluating computerized controls. The null hypothesis to test this is:

H3: The self-insight scores of CASs will be the same as the self-insight scores of NSs.

⁴³ G. Keppel, *Design & Analysis: A Researcher's Handbook*, 2nd ed. (Englewood Cliff, NJ: Prentice-Hall Inc., 1982), p. 91.

Mann Whitney U tests of the r and ρ scores will indicate if there is any significant difference in the self-insights of the two groups.

Failure to reject one or more of the above hypotheses will indicate that significant differences do not exist between CASs and NSs in evaluating control risks in simple computer environments.

3.3.4 Experience Effects

As was noted before, experienced CASs are expected to have a higher consensus than inexperienced CASs, while in the NSs group, inexperienced NSs may have the higher consensus than experienced NSs. The null hypotheses to test these expectations are:

H4: Experience will have no effects on consensus of NSs

H5: Experience will have no effects on consensus of CASs.

Non-parametric analysis of variance procedures will reveal if significant differences exists between the experienced and inexperienced auditors in each group.

Failure to reject the above hypotheses will indicate that the lesser experienced auditors understand the essential concepts of internal controls in computerized systems as well as their more experienced colleagues. This may also indicate that the lack of auditing experience of the younger auditors is offset by

their education which exposed them to computers and computer controls. Alternatively, this may also indicate that there is no learning effect from experience for auditing applications with simple computing environments.

3.4 Chapter Summary

Consensus, reliability and self-insight of auditors in their internal control evaluation judgments have been studied previously. The results from these prior studies have varied from high consistency for control evaluations to low consistency for sample size decisions. The effects of experience on consistency has also been mixed. The use of students in some of the studies does give slight evidence of the auditors' expertise in internal control evaluations, in that auditors have shown slightly higher consensus and self-insights than students. Segregation of duties cues have been able to explain most of the variance in auditor judgments.

Also, in this chapter, the basic differences between this study and previous research were outlined, followed by the specific objectives of the study and the hypotheses used to achieve these objectives. In the following chapter the research method of the study is discussed in detail.

Chapter 4

Research Methodology

The research methodology to test the hypotheses is detailed in this chapter. This chapter is divided into three major sections. The choice of the research method and the reasons for the choice are discussed first. Next, the development of the experimental materials and the administration of the instrument is summarized. Then the statistical procedures employed in the analysis are outlined.

4.1 Choice of Research Method

Two approaches are available to investigate auditor judgments in internal control evaluations. The first approach is an input-output method of modelling

the relationship of inputs (i.e., cues or control factors) with the outputs (i.e., auditors' judgments).⁸⁴ This method is referred to as a "black box" research method, because it is not possible to model the exact judgment process used by the decision maker to arrive at the assessment.⁸⁵ Models objectively constructed using this method have often outperformed the human decision-maker.⁸⁶ However, since the modelling of the output decision with too many input factors does not lead to interpretable linear relationships, this approach would require the experimenter to use a lesser number of control factors than is found in real auditing situations (5 or 6 factors have been the most popular in earlier studies). Thus, the resulting tasks performed by the judges are simple, structured tasks, which may be artificial and not representative of real-life.⁸⁷

4.1.1 Artificiality in Experiments

However, some researchers have argued for such artificiality, since in real-life situations one may not be able to vary the conditions systematically and study

⁸⁴ O. Svenson, "Process Description and Decision Making," *Organizational Behavior and Human Performance* 23, 1979, pp. 86-112.

⁸⁵ J. R. Hayes, "Strategies in Judgment Research," in *Formal Representation of Human Judgment*, B. Kleinmuntz, ed. (New York: John Wiley & Sons Inc., 1968).

⁸⁶ Libby, *Accounting and Human Information Processing*, p. 24.

⁸⁷ H. J. Einhorn, "A Synthesis: Accounting and Behavioral Science," *Studies on Human Information Processing in Accounting*, Supplement to *Journal of Accounting Research*, 1976, pp. 196 - 206.

the effects of such variations.⁸⁸ Swieringa and Weick argue for artificiality in experimental research, stating that:

The basic advantage of deliberate artificiality is that it may allow for more direct tests of theory, and this more direct access to theoretical propositions may improve generalization because it is theoretical statements, not raw findings, that are used to explain phenomena in real world.⁸⁹

The authors described two kinds of realism, experimental realism and mundane realism.⁹⁰ Experimental realism results when the laboratory events appear realistic to the subjects, i.e., they become involved in the experiment and take it seriously. Mundane realism results when events occurring in the laboratory are similar to real world events. The authors believe that laboratory experiments should strive for experimental realism, not for mundane realism. Mundane realism may even make it more difficult to learn from the experiment. Other researchers in the area of sociology and psychology also have expressed support for artificiality in experiments.⁹¹

4.1.2 Process Tracing and the Disadvantages

⁸⁸ K. Warneryd, "Can Results From Psychological Laboratory Experiments be Generalized to Situations Outside the Laboratory," in *Theory and Methods in Behavioral Science*, P. Lindblom, ed., 1970, p. 77.

⁸⁹ R. J. Swieringa and K. E. Weick, "An Assessment of Laboratory Experiments in Accounting," Supplement to *Journal of Accounting Research*, 1982, p. 81.

⁹⁰ *Ibid*

⁹¹ See, for example, M. W. Martin and J. Sell, "The Role of the Experiment in the Social Sciences," *Sociological Quarterly*, Autumn 1979, pp. 581-590, and R. L. Hansel, "The Purposes of Laboratory Experimentation and the Value of Deliberate Artificiality," *Journal of Experimental Social Psychology*, September 1980, pp. 466-478.

The second approach for modelling judgments is the use of process tracing.⁹² The emphasis of this approach is understanding the decision process of a judge in acquiring and evaluating data in order to reach a decision. Some researchers require their subjects to “think aloud” the various alternatives they consider in reaching a decision (verbal protocol analysis). Others have subjects access various bits of information set out in an information board or computer memory and monitor such accesses to the information. The advantage of this method is that fairly complex tasks, which approach real-life tasks, can be constructed for analysis by the subjects. However, there are disadvantages associated with this method. One disadvantage is the subjectivity associated with coding the protocols generated by the experiment. Second, huge amounts of protocols can be generated by this type of research, even in fairly simple situations. In the Biggs *et al.* study, for instance, only 3 subjects participated in a protocol analysis, and each generated 608, 964, and 1842 lines of protocols respectively.⁹³ Third, the time required by the subjects to complete a task for process tracing increases significantly when compared to the other approach. In the Biggs *et al.* study, the subjects spent between 2 hours and 3 1/2 hours in completing the task. Fourth, the use of an unfamiliar method of data presentation in the information board or computer information retrieval method may induce the subjects to access information which they

⁹² J. W. Payne, “Task Complexity and Contingent Processing in Decision Making: An Information Search and Protocol Analysis,” *Organizational Behavior and Human Performance* 16, 1976, pp. 366-387.

⁹³ Biggs *et al.*, “A Descriptive Analysis,” p. 4.

may not access normally. Also, since the subject has easy accessibility to the information, repeated accesses may be made even though the information may not be used in the subjects' actual decision process. To overcome this effect, verbal protocols need to be collected, which may result in other disadvantages. Last, this research method may significantly affect the choices made by the subjects. Boritz conducted an experiment with auditors, requiring one group of auditors to "think aloud" while completing the experimental task, while a second group completed the task silently.⁹⁴ His analysis revealed that "In general, the findings suggest that a researcher's method of eliciting responses may affect the actual responses provided by the subjects ...".⁹⁵

4.1.3 Research Method Chosen

Despite these disadvantages, process tracing is a powerful methodology for understanding the subjects' underlying judgment processes in complex environments. However, this study was more interested in discovering if differences existed in the judgments made by CASs and NSs in evaluating computer controls. The underlying decision processes of the two groups of auditors was not of primary interest in this study. Thus, the input-output method of judgment modelling was chosen for this study. The method enabled the re-

⁹⁴ J. E. Boritz, "The Effect of Research Method on Audit Planning and Review Judgments," *Journal of Accounting Research*, Autumn 1986, pp. 335-348.

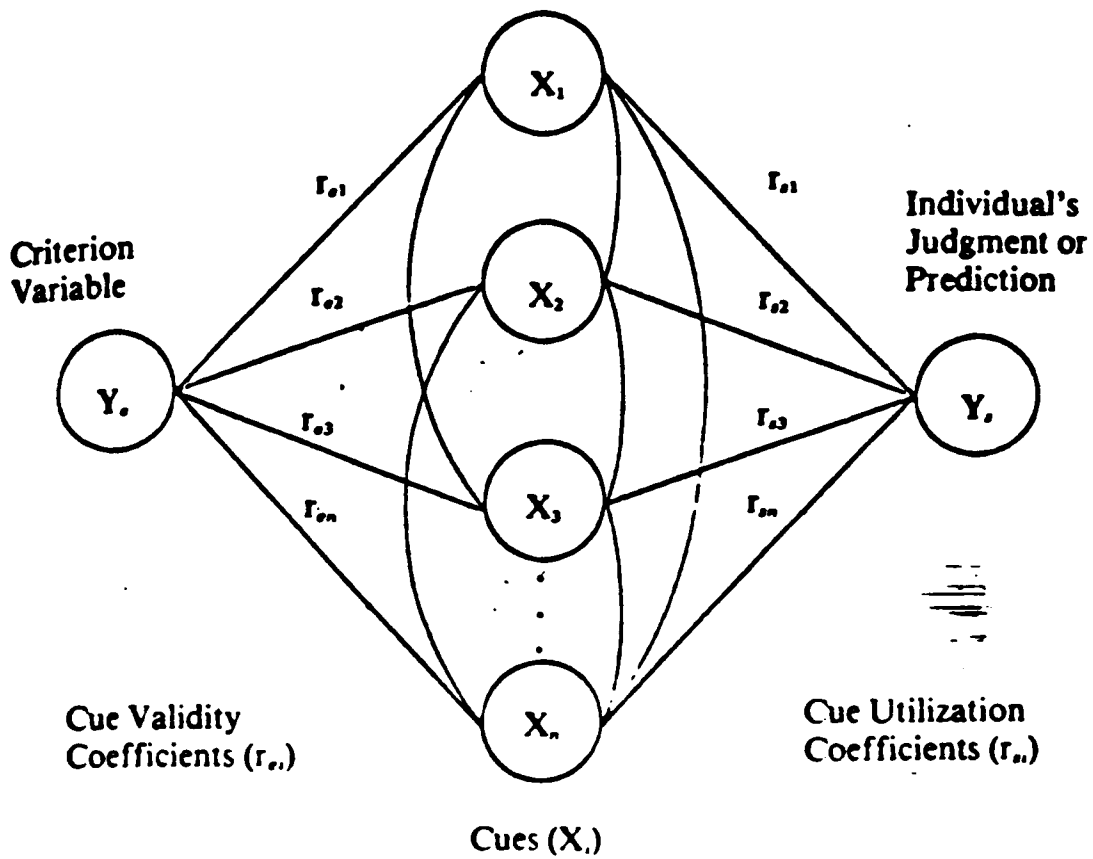
⁹⁵ *Ibid.*, p. 344.

searcher to get more participants for the study than would have been possible with the process tracing approach. The nature of this study is exploratory. If it is revealed that significant differences do exist between CASs' and NSs' judgments, a methodology such as process tracing that attempts to understand the underlying processes of CASs may then be appropriate.

4.1.4 Brunswik's Lens Model

The model for the study, as with other input-output studies, is the Brunswik's lens model (Figure 2). The model divides the world into two parts: the environment, represented by the left side of the lens, and the individual's judgment system, represented by the right side of the lens.⁹⁸ The three basic elements of the model are the criterion variable (Y_c) about which the individual is concerned; the cues, or items of information (X_i), that may be used to judge the current value of the criterion variable; and the individual's judgment (Y_j). As with previous studies in this area, there are no criterion values for the judgments the subjects will be making in this study and hence a "full" lens model analysis is not possible. Instead, the policy capturing form of the model (i.e., the right side of the model) is used to capture and represent individual subject's judgment policy as linear relationships of the judgments with the

⁹⁸ For a more detailed description of the lens model and its use in accounting research, see Ashton, *Human Information Processing*, and Libby, *Accounting and Human Information Processing*.



Source: Ashton, R. H., *Human Information Processing in Accounting*, Studies in Accounting Research No. 17, Sarasota, Florida: AAA, 1982.

Figure 2. Brunswik's Lens model.

cues. These linear models are a paramorphic representation of judgments since the actual cognitive processes involved in making the judgment are not captured, only a linear weighted model of it is captured.⁹⁷ The captured rating policy of individual decision makers represents an explicit objective description of the way in which the rater combines and weights dimensional information in arriving at overall ratings.⁹⁸ This form of the lens model has been used by previous researchers and:

... is the crux of the entire methodology - with proponents arguing that actual rating behavior can be accurately described in this manner. The implicit assumption is that the captured rating policies are construct valid representations of "true" rating policies.⁹⁹

The linear models so derived of the raters' policy have been quite robust in predicting human judgments.¹⁰⁰ Adding non-linear terms to linear models results in only minimal increases in predictive power.¹⁰¹ Wiggins and Hoffman evaluated the increase in predictive power resulting from adding non-linear terms to linear models. In an extensive non-linear model that included 11 lin-

⁹⁷ P. J. Hoffman, "The Paramorphic Representation of Clinical Judgment," *Psychological Bulletin*, March 1960, pp. 116-131.

⁹⁸ C. J. Hobson and F. W. Gibson, "Policy Capturing as an Approach to Understanding and Improving Performance Appraisal: A Review of the Literature," *Academy of Management Review* (Vol. 8, No. 4, 1983), p. 640.

⁹⁹ *Ibid.*

¹⁰⁰ Ashton, *Human Information Processing*, p. 20. See also P. Slovic and S. Lichtenstein, "Comparison of Bayesian and Regression Approaches to the Study of Information Processing in Judgment," *Organizational Behavior and Human Performance*, November 1971, pp. 649-744 for a very complete review of the robustness of linear models in predicting human judgments.

¹⁰¹ Ashton, *Human Information Processing*, p. 20.

ear, 11 curvilinear, and 55 configural terms, the greatest increase in predictive power from adding the non-linear terms was 4%.¹⁰² Hence, in representing each auditor's judgment policy in this study, no non-linear terms are used.

4.2 Development of the Experimental Materials

The experiment was designed as a control risk assessment exercise. Auditors normally assess control risks in all audits in the planning stage.¹⁰³ The experimental package consisted of five sections. The first section was a one-page instruction sheet describing the nature of the study and detailing the task required of the auditors. The second section consisted of background information on a fictitious company, describing its accounts receivable subsystem. An analysis of the aging of the account balances, along with a description of the data-handling procedures of the subsystem were given in this section. The descriptions in this section were developed based on information provided in the Mock and Turner (1981) study¹⁰⁴ and in the Johnson and Jaenicke (1980)

¹⁰² N. Wiggins and P. Hoffman, "Three Models of Clinical Judgment," *Journal of Abnormal Psychology*, February 1968, pp. 70-77.

¹⁰³ Colbert, "Audit Risk," p. 50.

¹⁰⁴ T. J. Mock and J. L. Turner, *Internal Accounting Control Evaluation and Auditor Judgment* (New York: AICPA, 1981).

book.¹⁰⁵ The background information was made deliberately strong to prevent confounding that could occur in the assessments made by the subjects.¹⁰⁶ The information processing system was described as a simple remote-entry batch system. The third section consisted of twenty-one situations. Each situation represented a one-page abstract from an internal control questionnaire, where the presence or absence of controls had already been noted. Sixteen situations represented a 1/2 fractional factorial of the five manipulated control factors described below. One additional case, representing an extreme situation of all five manipulated controls missing, was added to the original sixteen. The seventeen situations were presented in randomized order to control for any order effects. Four situations were repeated and added at the end of the case, requiring each subject to evaluate twenty-one situations.

The fourth section was a self-insight questionnaire and this immediately followed the situations. Subjects were instructed to distribute 100 points across the five manipulated factors according to the degree of importance of each factor to the subject. The fifth section, a debriefing questionnaire, completed the study. The subjects responded to demographic and professional questions. Also, feedback was collected regarding the degree of reality (extremely realistic-extremely unrealistic), the degree of difficulty (extremely difficult-not

¹⁰⁵ K. P. Johnson and H. R. Jaenicke, *Evaluating Internal Control: Concepts, Guidelines, Procedures, Documentation* (New York: John Wiley and Sons, 1980).

¹⁰⁶ The company was described as being the audit firm's client since 1976 and always having received an unqualified report. The aging of the receivables also revealed that only about 3% of the accounts were over 90 days. The complete research instrument is attached as Appendix C.

difficult) of the experimental task, and any additional comments about the experiment.

4.2.1 Manipulated Factors (Cues)

Internal control questionnaires dealing with the EDP area of the audit of five large international accounting firms¹⁰⁷ and a number of books in the area of EDP auditing and Auditing Computer systems¹⁰⁸ were studied before the five control factors were then chosen for manipulation in this study. Referring to the internal control questionnaires and the books revealed that the assessment procedures were designed to detect the presence or absence of specific control objectives such as segregation of duties, authorized access to assets, authorized changes to information, control over input data, non-redundancy of input data, etc. Of these numerous objectives, five were chosen as the manipulated factors in this study. The reason for choosing only five, and not

¹⁰⁷ The firms that provided their questionnaires were Arthur Anderson, Arthur Young, Ernst & Whinney, PMM, and Price Waterhouse.

¹⁰⁸ K. W. Davis and W. E. Perry, *Auditing Computer Applications: A Basic Systematic Approach* (New York: John Wiley & Sons, 1982.); E. G. Jancura and R. Boos, *Establishing Controls and Auditing the Computerized Accounting System* (New York: Van Nostrand Reinhold, 1981.); K. P. Johnson and H. R. Jaenicke, *Evaluating Internal Control: Concepts, Guidelines, Procedures, Documentation* (New York: John Wiley & Sons, 1980.); P. R. Macchiaverna, *Auditing Corporate Data-Processing Activities* (New York: The Conference Board, 1980.); W. T. Porter and W. E. Perry, *EDP Controls and Auditing* (Boston: Kent Publishing Co., 1981.); M. B. Roberts, *EDP Controls* (New York: John Wiley & Sons, 1985.); J. L. Sardinas, J. G. Burch, Jr., and R. J. Asebrook, *EDP Auditing: A Primer* (New York: John Wiley & Sons, 1981.); and R. Weber, *EDP Auditing: Conceptual Foundations and Practice* (New York: McGraw-Hill and Co., 1982.)

more, factors is that the nature of the task required of the auditors becomes increasingly complex and time-consuming as each additional factor is added to the experiment. For instance, a full-factorial design of six factors requires sixty-four situations to be assessed by the auditors and seven factors require 128 situations. Judgment consistency, the main focus of interest in this study, would be adversely affected as the task complexity increases and thus some confounding effects would be introduced due to fatigue. Hence, a decision was made to manipulate five factors in this study so that any confounding due to fatigue would be controlled, since the auditors would be making decisions on only a limited number of situations (twenty-one, as noted above).

As noted earlier, all of these factors are found predominantly in computerized systems. The first factor chosen for manipulation was the factor dealing with segregation of duties. In previous studies this factor was able to explain most of the variance in auditors' judgments. However, one of the areas affected by the computerization of systems is the area of segregation of duties.¹⁰⁹ Most on-line systems require less staff than a manual system, and hence incompatible task assignments, from an audit point of view, may take place.¹¹⁰ CASs may be accustomed to this phenomenon and may look for compensating controls and not consider this factor as important as the NSs.

¹⁰⁹ AICPA, "The Auditor's Study and Evaluation," and K. H. Krueger, "Internal Control of Fourth Generation Language Applications," *The Accountant's Journal*, April 1985, p. 28.

¹¹⁰ F. M. Laloli, "Following the Microchip Trail," *The Accountant's Journal*, July 1984, p. 266.

Data file security control and implementation control (access to and changes to sensitive files) were manipulated because of the importance placed on these controls by the AICPA.¹¹¹ Access and changes to sensitive files are suggested as important areas to verify by the AICPA.

Operations control (credit checks) and supervisory control (reasonableness checks) were manipulated because the uniform processing operations of the computer may result in recurring errors not ordinarily found in manual systems. Thus, it is expected that CASs would view these controls more important than NSs.

The pattern of cue usage by the auditors will be verified when individual decision models are derived for each auditor using ANOVA. The relative significance of each main effect in each auditor's ANOVA model will indicate the importance placed by the auditor on each cue.

While it is important that the auditors vary their risk assessments as the presence or absence of controls varies, it is equally important that this variation be systematic with respect to the factors being manipulated. To ensure that the auditors view each situation in its own merit, and also to make the manipulation of the controls less obvious to the subjects, four additional control factors were added to the five manipulated factors. These four factors were not manipulated at all and were present in all the situations. Three of these addi-

¹¹¹ AICPA, "The Auditor's Study and Evaluation," 1977.

tional factors dealt with the control objective of segregation of functions between user and data processing departments. The fourth factor dealt with the objective of security of assets. The introduction of these non-manipulated control factors also resulted in controlling for extraneous variability since nuisance variables were controlled by holding them constant for all subjects.¹¹²

In the research instrument, questions 1, 3, 5, 7 and 8 dealt with the five manipulated factors in all situations, and questions 2, 4, 6, and 9 were the non-manipulated factors. The questions were not randomized from situation to situation since this would have resulted in additional task complexity. As the auditors were making assessments on twenty-one situations, a decision was made not to make the task more complex than it already was. Presenting the situations with all of the questions in the same order gave the auditors an opportunity to be consistent in their assessments. However, reliability of judgments may have been artificially enhanced since auditors could have noticed the repeat cases. Since none of the auditors commented on the repeat cases either at the time of the debriefing session or in the comments portion of the debriefing questionnaire, the effect on reliability due to this is assumed to be negligible.

¹¹² R. E. Kirk, *Experimental Design Procedures for the Social Sciences* (Belmont, CA: Brooks/Cole Publishing Co., 1968), p. 7.

4.2.2 Dependent Variable

The subjects were asked to assess the control risk they perceived in each situation on a continuous scale ranging from 0-100% (very low- very high). To avoid any confusion about the scale, a sample situation with *all* controls absent¹¹³ and assessed as 100% (very high) was given to every auditor, immediately following the background information section. All of the twenty-one situations that the auditors assessed immediately followed this sample solved situation. Subjects also were instructed that the control risk could be assessed at a lower level than 100% only if some of the controls were present. The dependent variable for the study was the percentage change in control risk assessment from the extreme situation of all five manipulated controls absent to the other situations:

$$\text{Dependent variable} = \frac{X_0 - X_i}{X_0} \% \text{ where}$$

X_0 = risk assessment for situation with all manipulated controls absent

X_i = risk assessment for situation i , $i = 1$ to 16.

This resulted in sixteen original assessments for each auditor.¹¹⁴

¹¹³ All nine controls were absent in this sample situation, while in the extreme situation that the auditors assessed only the five manipulated controls were absent.

¹¹⁴ These sixteen assessments were used in the analysis, rather than all of the seventeen assessments, to maintain the orthogonal character of the fractional factorial design.

4.2.3 Subjects

The subjects chosen for the study were practicing auditors from twenty-five offices of the Big 8 accounting firms in ten different cities along the East Coast (See Table 4 in Chapter 5). A total of 121 auditors participated in the experiment; 78 NSs and 43 CASs. The designation for the specialists differs from firm to firm, some calling them Computer Audit Specialists (CASs), and some calling them Computer Auditors. For the purpose of this study, all of these auditors are called CASs.

4.2.4 Pilot Test

Prior to administering the actual study, a pilot test was conducted to ensure that ambiguities in the experiment or the instructions were minimized. Nine certified public accountants participated in the pre-test.¹¹⁵ All subjects were associated with Virginia Polytechnic Institute and State University, 7 as graduate students and/or instructors in the Accounting Department, and 2 in the Controller's office. All subjects had public accounting experience. Minor modifications to the instructions and the background information were made after discussions with the pilot test subjects. One subject found the task too unrealistic and did not complete the instrument. However, the other pilot test

¹¹⁵ One subject was certified from a foreign country.

subjects indicated that they had no problems with the materials. None of the auditor subjects had problems completing the study.

4.2.5 Administration of the Study

The study was administered by the researcher to all but twenty-two of the subjects in their offices. The subjects generally completed the experiment in an uninterrupted block of time. In the case of the twenty-two auditors, where the researcher could not personally administer the experiment, a partner or a manager-in-charge administered the study, following the same instructions. A Mann-Whitney U test revealed no significant differences in the distribution of the assessments of the auditors in the two administrations ($Z = 1.79$, $p = 0.07$). The responses of the subjects were pooled together for further analysis.

4.2.6 Logical Relationships in the Assessments (Manipulation Check)

Since each auditor made 17 assessments on the 17 original situations, comparisons were made between the assessments to ensure internal validity. Of the total 136 possible paired comparisons ($17 \times 16 / 2$) in each case, 61 comparisons had logical relationships. That is, it was possible to establish a logical relationship between a pair of assessments for 61 pairs of assessments. The basis for the relationship was that, since 5 control factors were being manipu-

lated, there were situations possible when one case would represent an improvement (in controls) over another case. For instance, in one situation, only 1 manipulated control may have been present (statistically represented as *a*), and in another situation, it may have been present along with two other manipulated controls (statistical representation *abc*). In such a case, the assessment of control risk by the auditors in the second instance can only be equal or lower than the control risk assessed in the first instance. *It cannot be higher than the first instance* since logically the presence of more controls should result in the same or lower assessment of control risk. Thus, comparison errors would occur if subjects made assessments of higher risks in the second instance as compared to the first instance.

A decision rule was employed to minimize the effects due to this systematic error. The reason for employing the decision rule, rather than eliminating all subjects who exhibited this systematic error, was that some systematic error may in fact be of interest in the study since it must be reflected in real-life. However, where a large number of these errors occurs, or the error is very large in magnitude, this may indicate that the subject had not taken the experiment seriously, or not understood, and had randomly assigned values to the situations. Thus, employing the decision rule eliminating only those subjects who exhibited systematic error, rather than random error which was of interest in this study.

The decision rule employed was:

- **Subjects were eliminated from analysis if:**
 1. **The total number of comparison errors exceeding 15% was 6 or more**
or
 2. **A single comparison error of over 25% occurred.**

One pilot test subject would have met the rejection criteria. Of the auditors who participated in the experiment, 7 (5 NSs and 2 CASs) were rejected due to logical errors in their assessments.

4.3 Statistical Procedures Employed

In addition to numerous descriptive statistical procedures, four inferential statistical procedures were employed. The four procedures involved correlational analyzes, a two-sample non-parametric test of median differences, a parametric analysis of variance (ANOVA), and a non-parametric analysis of variance. Each of these procedures is described in detail below.

4.3.1 Correlational Analysis

Two correlational coefficients were used in the analysis of the data: Pearson

product moment correlation (r) and Spearman's rank correlation (ρ).¹¹⁶ The correlation coefficients were used as the statistical measure of consensus, reliability and self-insights of the auditors. The Pearson product moment correlation is used to measure the degree of relationship between two variables that are measured on interval or ratio scales. One major assumption that underlies the use of this coefficient is that the distributions of both variables correlated are normal. If the assumption of normality is not valid, the Spearman's rank correlation can be computed. In this study, the ρ statistic was computed along with the product moment correlation, and both the indexes were subjected to further analyses.¹¹⁷ The value of the Pearson product moment correlation depends on the magnitude of the assessments made by the auditors, while the Spearman rank correlation is independent of this, since ρ uses the ranks of the assessments in its calculation. Thus, there is a possibility that the two correlation coefficients may not give similar results. If r is significant when ρ is not, this indicates that the relative magnitudes of the assessments made by the pair of auditors being correlated were different, but the directions of the changes in the assessments were similar. The reverse is true if ρ is significant when r is not.

¹¹⁶ D. E. Hinkle, W. Wiersma, S. G. Jurs, *Applied Statistics for the Behavioral Sciences* (Chicago: Rand McNally, 1979), p. 96 and p. 101.

¹¹⁷ One reason for computing the Pearson product moment r was to afford comparability between this study and previous studies, since most of the previous studies have used r in their analysis.

In addition to the above two correlation coefficients, the Kendall's coefficient of concordance W also was computed for each group of auditor's assessments of control risks in the 16 situations. The value of W ranges from 0 to 1, and the hypothesis that there is no actual agreement among the auditors was tested using a χ^2 distribution.¹¹⁸

4.3.2 Non-Parametric Two-Sample Test

Comparison of two groups of correlations was conducted using the Mann-Whitney U test, the non-parametric analog to the two sample t test.¹¹⁹ The t test requires the following assumptions:

1. The two samples are drawn from independent populations
2. The populations have normal distributions
and
3. The variances of the two populations are homogeneous.

Since two groups of correlation scores were being compared, the non-parametric test was deemed more appropriate than the t test as the assumption of normality may not be valid in such a situation.

¹¹⁸ W. L. Hays, *Statistics for the Social Sciences*, 2nd ed. (New York: Holt, Rinehart and Winston, Inc., 1973), p. 803.

¹¹⁹ *Ibid.*, p. 778.

4.3.3 Parametric Analysis of Variance (ANOVA)

The ANOVA procedure was used to construct linear models for each auditor's decision process. The linear models explained which of the main effects were considered important by each auditor. For each main effect, ω^2 were then computed and transformed to equal 100. These transformed values were then correlated with the auditor's scores in the self-insight questionnaire to compute the self-insight index for each auditor.

The assumptions underlying the ANOVA model are the same as those for the t test, that is, normality, homogeneity of variance, and independence.¹²⁰

4.3.4 Non-Parametric ANOVA - Kruskal-Wallis (KW) H Test

In testing whether the correlation scores of the auditors blocked according to experience levels is different, the assumptions required under the parametric ANOVA procedure, especially normality, may not be valid. Hence a non-parametric ANOVA procedure, the Kruskal-Wallis H test was used instead.¹²¹

¹²⁰ *Ibid.*, p. 467.

¹²¹ *Ibid.*, p. 782.

4.4 Chapter Summary

The research methodology used in the study was described in detail in this chapter. Of the two methods available for studying judgments, the input-output approach and process tracing approach, the reasons for choosing the former approach were discussed. The preparation of the experimental materials was also discussed in detail, including the reasons for the choice of the manipulated factors, and the method of administration of the instrument. The method used to identify usable responses from the subjects was outlined, along with the decision rule used to eliminate subjects from the study. Finally, the statistical procedures used in the study to analyze the data were described. The following chapter contains the results of the study.

Chapter 5

Results of the Study

The results of the empirical study are presented in this chapter. The chapter is divided into seven main sections. In the first section, the background information collected on the auditors is analyzed. Consensus of the auditors, reliability of their judgments, and their self-insights into their own decision processes are analyzed and compared at the overall group level for both the CASs and NSs in the second section. The effect of experience on judgment consensus, reliability, and self-insight is presented in the third section. The results of the comparisons between the judgment consistency of experienced and inexperienced NSs and the CASs group are presented in the fourth section. Firm affiliation effects are analyzed in the fifth section, followed by the summary of the results of the comparisons between the NSs' firms and the CASs group in the sixth section. Finally, in the last section, the pattern of cue usage of the CASs and NSs is presented and analyzed.

5.1 Subject Background

The subjects' firm affiliation, staff level, educational and professional background, and experience is summarized and analyzed in this section. Also, the feedback of the auditors on the realistic nature of the experimental study and the difficulty of the task is summarized here.

5.1.1 Firm Affiliation and Staff Level

As mentioned earlier in Chapter IV, 78 non-specialists (NSs) and 43 Computer audit specialists (CASs) participated in the experimental study; 5 NSs' and 2 CASs' responses were eliminated from the analysis, using the procedure outlined in Chapter IV. Hence, usable responses were collected from 73 NSs and 41 CASs. All the auditors were from Big 8 firms. The auditors worked in 25 offices in 10 different cities along the East Coast, as shown in Table 4. As each office of a firm supplied a small sample of auditors from its staff, analysis for differences due to office affiliation is not possible. Since more than one firm office was visited in most of the cities, the effect of any region difference is randomized across the subjects and hence should not affect the results of the study. A KW H test of the consensus correlations of the auditors grouped according to city revealed no significant differences in either the r scores ($p=0.55$) or the ρ scores ($p=0.53$). The effect of firm affiliation on judgment

Table 4. Firm Affiliation of NSs and CASs

NSs									
Firm									
City	B	C	D	E	F	G	H	Total	
1	-	-	-	3	-	8	-	11	
2	-	-	8	-	10	3	-	21	
3	11	-	5	-	-	-	-	16	
4	2	-	7	-	-	-	-	9	
5	-	-	-	-	-	6	4	10	
6	-	-	-	-	-	-	6	6	
	13	12	8	3	10	17	10	73	
CASs									
Firm									
City	A	B	E	F	G	Total			
1	7	-	2	3	-	12			
2	-	-	-	1	3	4			
3	-	6	-	-	-	6			
4	-	1	-	-	-	1			
7	8	-	-	-	-	8			
8	4	-	-	-	1	5			
9	-	-	2	-	-	2			
10	2	-	-	1	-	3			
	21	7	5	4	4	41			
<p><i>Note: Assignment of identification letters to each firm in this table has been done randomly, without any alphabetical or numerical ranking.</i></p>									

consistency was significant, and the results of this analysis are reported in more detail in a later section in this chapter.

Table 5. Staff Levels of Participants

Level	NS		CAS		Total	
	No	%	No	%	No	%
Partner	7	9.6	-	-	7	6.1
Manager	25	34.2	22	53.7	47	41.2
Senior	18	24.7	14	34.1	32	28.1
Staff > 1 yr exp	17	23.3	3	7.3	20	17.6
Staff < 1 yr exp	6	8.2	2	4.9	8	7.0
Total	73	100.0	41	100.0	114	100.0

The staff levels of the auditors in the firm is presented in Table 5. managers comprised 41% of the auditors who participated in the study. For the NSs, managers comprised 34% of the participants, and for CASs 54%.

5.1.2 Education and Professional Certification

The majority of the NSs (94.5%) who participated in the study had undergraduate accounting degrees; the rest of the NSs had business-related degrees as shown in Table 6. There was more diversity in the educational background of the CASs. Twenty-five (61%) had undergraduate accounting or business-related degrees, while 5 had (12%) had Computer Science/MIS degrees. Ten CASs (24%) were dual majors, Accounting/Computer Science or Business Administration/Computer Science. Only 7 NSs (10%) and 6 CASs (15%) had graduate degrees, as indicated in Table 6.

The background differences between NSs and CASs is more evident when the professional certification acquired by the auditors is examined. Sixty (82%) of the NSs were CPAs, and only one of these CPAs had acquired another certification, a Certified Bank Auditor (CBA). Of the CASs, 30 (73%) had professional certifications; 27 (66%) were CPAs. Of these 27 CPAs, 7 (17%) had acquired more professional computer-related certifications, as shown in Table 7. Three CASs had only computer-related certifications.

Table 6. Participants' Educational Background***Undergraduate Degrees***

	NS		CAS		
Major	Number	Percent	Number	Percent	
Accounting	69	94.5	20	48.8	
Acc. or BAD/ Computer Sc.	-	-	10	24.4	
Eco or Fin	2	2.8	1	2.4	
Bus Adm	2	2.7	4	9.8	
Comp Sc or MIS	-	-	5	12.2	
Other	-	-	1	2.4	
Total	73	100.0	41	100.0	

Graduate Degrees

	NS		CAS		
Degree	Number	Percent	Number	Percent	
MACCT	3	4.1	2	4.9	
MBA	4	5.5	2	4.9	
MIS	-	-	1	2.4	
MBA & MIS	-	-	1	2.4	
None	66	90.4	35	85.4	
Total	73	100.0	41	100.0	

Table 7. Professional Certification of Participants

	<i>NS</i>		<i>CAS</i>		
<i>Certificate</i>	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	
CPA	60*	82	20	49	
CISA	-	-	2	5	
CPA/CMA	-	-	1	2	
CPA/CDP	-	-	2	5	
CPA/CISA	-	-	3	7	
CDP/CISA	-	-	1	2	
CPA/CDP/CISA	-	-	1	2	
None	13	18	11	27	
Total	73	100	41	100	

*1 was also a Certified Bank Auditor (CBA)

CPA - Certified Public Accountant
 CMA - Certified Management Accountant
 CDP - Certificate in Data Processing
 CISA - Certified Information Systems Auditor

Table 8. Computer Courses - College and CPE

	<i>NS</i>		<i>CAS</i>		
	<i>Summary</i>	<i>Std Dev</i>	<i>Summary</i>	<i>Std Dev</i>	
College					
Mean	2.5	1.4	7.1	6.8	
Highest	18.0	-	90.0	-	
Lowest	0.0	-	3.0	-	
Mean Hrs	7.2	3.5	22.2	22.2	
Highest	9.0	-	30.0	-	
Lowest	0.0	-	1.0	-	
CPE					
Mean	0.85	1.29	3.11	2.78	
Highest	5.00	-	12.00	-	
Lowest	0.00	-	3.00	-	
Mean Hrs	13.07	30.63	91.78	90.43	
Highest	120.00	-	400.00	-	
Lowest	0.00	-	0.00	-	

5.1.3 College and CPE Courses in Computers

Table 8 contains a summary of the responses of the auditors to the questions dealing with computer-related courses in college and as part of the CPE requirements. The NSs had taken a mean 2.5 (standard deviation 1.4) computer-related courses in college, as compared to a mean 7.1 (standard deviation 6.8) courses taken by CASs. The mean number of hours of computer-related courses in college for NSs was 7.5 hours (standard deviation 3.5 hours), and for CASs 22.2 hours (standard deviation 22.2 hours).

Responding to the question on CPE courses in Computer/EDP auditing, the NSs indicated only a mean 0.85 courses with a mean 13.07 hours, as shown in Table 8. The CASs, however, had taken a mean 3.11 courses in this area, with a mean 91.78 hours. Most of the firms indicated that once an auditor is recognized as a CAS, or has the potential to be a CAS, the auditor is given a 2-3 week course in this area before the on-the-job training begins. Thus, it is not surprising that CASs have, on the average, more CPE courses and hours in Computer/EDP auditing.

Verification of the effect of the number of computer courses taken in college or computer-related CPE courses attended by the auditors on judgment consistency was not possible since there appeared to be no uniformity in the responses of the auditors to these questions. For instance, none of the auditors had indicated whether the hours reported were semester hours or quarter

hours. Also, some of the auditors were apparently reporting *all* the CPE courses they had taken rather than just the computer-related ones.

5.1.4 Experience, Years with the Firm and Number of Audits Conducted

The years of auditing experience and the time spent with the current firm are given in Table 9. About 66% of the NSs and 73% of the CASs had more than 3 years of auditing experience. On the average, NSs had 5.26 years of auditing experience and CASs 4.85 years. The median experience of both NSs and CASs was 4 years.

The responses indicate that 57% of NSs and 61% of the CASs had been with their current employer for more than 3 years. Both the NSs and CASs had spent a median 3 years with the current firm. The average tenure of the NSs with the current firm was 4.62 years; CASs had an average of 4.44 years. These means compared with the mean auditing experience of the auditors suggests a very small degree of mobility in the auditors.

In the past year, NSs had participated in a mean of 11.18 audits (standard deviation 10.85), and a mean of 8.20 audits (standard deviation 9.05) had involved clients with significant computerized applications. The CASs had participated in a mean 9.45 audits (standard deviation 6.11), and a mean 8.97

Table 9. Auditing Experience and Years with Current Firm

Auditing Experience					
	NS		CAS		
Years	Number	Percent	Number	Percent	
0 - 2	25	34.2	11	26.8	
3 - 5	20	27.4	15	36.6	
6 - 8	16	21.9	7	17.1	
9 - 10	4	5.5	6	14.6	
> 10	8	11.0	2	4.9	
Total	73	100.0	41	100.0	
Years with Current Firm					
	NS		CAS		
Years	Number	Percent	Number	Percent	
0 - 2	31	42.5	12	29.3	
3 - 5	19	26.0	15	36.6	
6 - 8	15	20.6	8	19.5	
9 - 10	2	2.7	5	12.2	
> 10	6	8.2	1	2.4	
Total	73	100.0	41	100.0	

Table 10. Number of Audits Conducted - Previous Year

	<i>NS</i>		<i>CAS</i>		
	<i>Summary</i>	<i>Std Dev</i>	<i>Summary</i>	<i>Std Dev</i>	
Total No. of Audits (Mean)	11.18	10.85	9.45	6.11	
Highest	70.00	-	30.00	-	
Lowest	0.00	-	1.00	-	
Significant Use of Computers by Clients (Mean)	8.20	9.05	8.97	6.09	
Highest	55.00	-	30.00	-	
Lowest	0.00	-	1.00	-	

audits (standard deviation 6.09) had involved clients with significant computerized applications, as shown in Table 10.

The effect of experience on judgment consistency was examined, and this is reported in more detail in a later section in the chapter.

5.1.5 Feedback on the Study

Perceptions of the participants on how realistic the experimental task was, and the degree of difficulty of the task was elicited on a Likert-type nine-point scale. These are summarized in Table 11. NSs rated the experimental task with a mean 5.43 (standard deviation 1.34), and CASs with a mean 5.23 (standard deviation 1.42). Since the scale was anchored with 1-Extremely Realistic and 9-Extremely Unrealistic, the responses indicate that both NSs and CASs perceived the task as moderately realistic.

The NSs rated the task difficulty with a mean 4.32 (standard deviation 1.55), and CASs with a mean 3.90 (standard deviation 1.46). The scale was anchored with 1-Not difficulty and 9-Extremely Difficult. The NSs and CASs thus thought the task to be moderately difficult, with the CASs having lesser difficulty on the average than NSs.

Table 11. Feedback on Experimental Task

	NS		CAS										
	Summary	Std Dev	Summary	Std Dev									
Realism													
Mean	5.43	1.34	5.23	1.42									
Highest	9.00	-	7.00	-									
Lowest	3.00	-	1.00	-									
Difficulty													
Mean	4.32	1.55	3.90	1.46									
Highest	8.00	-	8.00	-									
Lowest	0.00	-	2.00	-									
<table> <tr> <td><i>Realism</i></td> <td><i>Difficulty</i></td> </tr> <tr> <td>1-Extremely Unrealistic</td> <td>1-Not Difficult</td> </tr> <tr> <td>5-Moderately Realistic</td> <td>5-Moderately Difficult</td> </tr> <tr> <td>9-Extremely Realistic</td> <td>9-Extremely Difficult</td> </tr> </table>						<i>Realism</i>	<i>Difficulty</i>	1-Extremely Unrealistic	1-Not Difficult	5-Moderately Realistic	5-Moderately Difficult	9-Extremely Realistic	9-Extremely Difficult
<i>Realism</i>	<i>Difficulty</i>												
1-Extremely Unrealistic	1-Not Difficult												
5-Moderately Realistic	5-Moderately Difficult												
9-Extremely Realistic	9-Extremely Difficult												

5.2 Analysis of Judgment Consistency at Overall Group Levels

As indicated in Chapter III, most of the previous studies in auditor judgments in internal control evaluations have used consistency as a surrogate for judgment accuracy. The three aspects of judgment consistency examined are (1) judgment consensus, the agreement among the judgments of different auditors using the same data at the same point of time; (2) reliability of judgments, the agreement over time between judgments of the same auditor using the same data; and (3) judgment self-insight, the agreement between the auditors subjective description of his or her judgment process and an objective description derived from mathematical or statistical techniques.¹²²

5.2.1 Judgment Consensus

The consensus of auditors in each group was computed as the mean of the correlations between each pair of auditors in each group. Pearson's product moment correlation r and Spearman's rank correlation ρ were computed for each group of auditors. Kendall's coefficient of concordance W also was computed to gauge the degree of association in each group. All r and ρ corre-

¹²² Ashton, "Some Comments on Auditors' Evaluations," p. 56.

lations were computed using a statistical package designed for the personal computer, *Statistical Processing System*.¹²³ The resulting full correlation matrices were then converted to half-matrices for the non-parametric analysis of variance procedures using the PROC NPAR1WAY procedure in SAS.¹²⁴ Descriptive statistics were computed using the PROC UNIVARIATE procedure in SAS.¹²⁵

The degree of consensus exhibited by each group of auditors was quite high, comparable to those achieved in previous studies.¹²⁶ The 73 NSs in the study had a W of 0.619 ($p=0.001$) and the 41 CASs had a W of 0.648 ($p=0.001$). Thus the CASs had a slightly higher degree of association in their assessments than the NSs.

Computation of r and ρ respectively resulted in 2,628 correlation scores for the NSs and 820 scores for the CASs. The mean r for NSs was 0.65, and the scores ranged from 0.03 to 0.97; the mean r for CASs was 0.68, scores ranging from 0.05 to 0.97. The mean ρ for both group of auditors was the same as the r : NSs 0.65, and CASs 0.68.

¹²³ R. C. Kirk, G. J. Buhyoff, H. M. Rauscher, R. B. Hull IV, and K. Killeen, *Statistical Processing System* Version PC4.0 (Southern Technical Associates, 1983).

¹²⁴ SAS Institute Inc., *SAS User's Guide: Statistics, Version 5 Edition*. (Cary, NC: SAS Institute Inc., 1985).

¹²⁵ *Ibid.*

¹²⁶ See Table 1 for a summary of results of previous studies.

Table 12. Comparison of NSs and CASs Correlations - Consensus

<i>Pearson Scores</i>			
	<i>NSs</i>	<i>CASs</i>	
Mean	0.65	0.68	
Highest	0.97	0.97	
Lowest	0.03	0.05	
<p>Mann-Whitney U test: $z = 4.92$, $p = 0.001$ Reject hypothesis of no difference in scores</p>			
<i>Spearman Scores</i>			
	<i>NSs</i>	<i>CASs</i>	
Mean	0.65	0.68	
Highest	0.97	0.96	
Lowest	-0.02	0.13	
<p>Mann-Whitney U test: $z = 4.48$, $p = 0.001$ Reject hypothesis of no difference in scores</p>			

Thus, both NSs and CASs had very high consensus with CASs having a slightly higher mean than the NSs. The first hypothesis was:

H1: CASs will have similar consensus scores as the NSs.

The r and ρ scores in each group were then compared to each other using Mann-Whitney U tests. The null hypothesis that the correlation scores of the two groups is not different was rejected for each group of correlations. For r , the resulting z value was 4.91 ($p=0.0001$), and for ρ , z was 4.48 ($p=0.0001$) (Refer to Table 12).¹²⁷

The consensus of NSs and CASs was not the same, and the CASs have higher mean consensus than NSs. The difference in consensus scores of the NSs and the CASs was statistically significant.

5.2.2 Reliability of Judgments

The second area of interest in this study was the reliability of judgments of the two groups of auditors. As mentioned earlier in Chapter III, each auditor evaluated 4 repeat situations taken from the 16 original situations. The assessments made by the auditors in the repeat situations were correlated with the assessments made in the original situations. The r and ρ scores were computed for each auditor. The mean r for NSs was 0.73, and scores ranged from

¹²⁷ Parametric t tests of the r and ρ scores also revealed statistically different means for NSs and CASs ($p=0.001$).

-1 to +1. Thus, one or more auditors in the NSs group had a reliability score of -1 indicating a complete reversal of the original assessments by the auditor. For the CASs, r averaged to 0.77, and ranged from -0.57 to +1.

The average ρ for NSs was 0.69, the scores ranging from -1 to +1. CASs had an average ρ of 0.77, ranging from -0.57 to +1, as shown in Table 13. Thus, overall, both groups showed high reliability of their judgments, CASs revealing a slightly higher reliability than NSs.

The second hypothesis was:

H2: The reliability scores of the CASs will be the same as the reliability scores of the NSs.

The r and ρ scores of auditors in each group were compared using Mann-Whitney U tests. The hypothesis that the two groups had similar reliability scores could not be rejected for either r or ρ measures. For r , the resulting z value was 1.32 ($p=0.1865$) and for ρ , z was 1.58 ($p=0.1128$). Thus, the difference in the reliability scores of the NSs and CASs was not statistically significant.

5.2.3 Self-Insight

The next area of interest of the study was the degree of self-insight exhibited by the auditors in each group. As explained earlier, five control factors were manipulated in the study, and auditors were requested to subjectively weight

Table 13. Comparison of NSs and CASs Correlations - Reliability

	<i>Pearson Scores</i>		
	<i>NSs</i>	<i>CASs</i>	
Mean	0.73	0.77	
Highest	1.00	1.00	
Lowest	-1.00	-0.58	
<p>Mann-Whitney U test: $z = 1.32$, $p = 0.1865$ Do not reject hypothesis of no difference in scores</p>			
	<i>Spearman Scores</i>		
	<i>NSs</i>	<i>CASs</i>	
Mean	0.69	0.77	
Highest	1.00	1.00	
Lowest	-1.00	-0.58	
<p>Mann-Whitney U test: $z = 1.59$, $p = 0.1128$ Do not reject hypothesis of no difference in scores</p>			

each factor by spreading a total of 100 points across these five factors. Objective weights for each manipulated factor was derived by constructing linear models for each auditor using an analysis of variance (ANOVA) procedure. Using the ANOVA model, a ω^2 value was derived for each factor. The ω^2 value indicates the proportion of the total variance explained by each effect.¹²⁹ The ω^2 values for the five factors were transformed so that the total equalled 100.¹²⁹ These objectively calculated scores for each auditor were then correlated with the subjective weights assigned by the auditor. The r and ρ correlations were computed as a measure of self-insight of the auditors into their own decision processes.

The mean r for NSs was 0.76, and r scores ranged from -0.154 to 0.993. The mean ρ for NSs was 0.704, scores ranging from -0.057 to +1.0. CASs had a mean r of 0.756, scores ranging from -0.333 to 0.999. Mean ρ for CASs was 0.705, scores ranging from -0.25 to 0.974. Thus, both groups exhibited very high self-insights into their decision processes, and the means of the two groups were almost equal.

The third hypothesis was:

H3: The self-insight scores of CASs will be the same as the self-insight scores of NSs.

¹²⁹ Keppel, "Design & Analysis," p. 91.

¹²⁹ This is the same procedure followed in the earlier studies, such as Ashton, "An Experimental Study." The ω^2 value for each effect is converted to a percentage of the total ω^2 value of all effects.

Table 14. Comparison of NSs and CASs Correlations - Self-insight

	<i>Pearson Scores</i>		
	<i>NSs</i>	<i>CASs</i>	
Mean	0.76	0.76	
Highest	0.99	0.99	
Lowest	-0.15	-0.33	

Mann-Whitney U test: $z = 0.61$, $p = 0.5403$
 Do not reject hypothesis of no difference in scores

	<i>Spearman Scores</i>		
	<i>NSs</i>	<i>CASs</i>	
Mean	0.70	0.71	
Highest	1.00	0.97	
Lowest	-0.06	-0.25	

Mann-Whitney U test: $z = 0.03$, $p = 0.9736$
 Do not reject hypothesis of no difference in scores

The r and ρ scores of the two groups of auditors were analyzed for differences using the Mann-Whitney U test. The hypothesis that the r scores were similar for the two groups could not be rejected ($z = 0.612$, $p = 0.54$), as shown in Table 14. There also was no significant difference in the ρ scores of the two groups ($z = 0.033$, $p = 0.97$).

Thus, the CASs and NSs exhibited very high self-insights into their decision processes, and there was strong evidence to conclude that the degree of self-insight exhibited by each group of auditor was quite similar.

5.2.4 Section Summary

Both the NSs and CASs showed high judgment consistency in their decisions. The mean consensus of the CASs, for both the r and ρ scores, was slightly higher than that of NSs. Mann-Whitney U tests also revealed that the difference in the consensus scores of the CASs was significantly different from that of the NSs. However, in the other aspects of judgment consistency, reliability and self-insight, no significant differences were noticed between the two groups. Thus, on the whole, the NSs made reliable judgments that were comparable to CASs' judgments, and had as much self-insights into their decision processes as the CASs.

5.3 Experience Effects

The effects of experience on consistency have been examined in earlier studies with mixed results. Most of the earlier studies found no effect of experience on consensus.¹³⁰ The effect of experience on consistency was examined in this study by blocking auditors in each group according to whether they had more or less auditing experience than the median experience. This procedure was followed earlier by Reckers and Taylor.¹³¹

5.3.1 Judgment Consensus - Experienced vs Inexperienced Auditors

Blocking the auditors according to the median experience of 4 years in each group resulted in 32 experienced and 41 inexperienced auditors in the NSs group; 17 experienced auditors and 24 inexperienced auditors in the CASs group. The r and ρ scores were computed for each subgroup of auditors.

The inexperienced NS auditors had a mean r of 0.678 and a mean ρ of 0.669. The experienced NS auditors had a mean r of 0.636 and a mean ρ of 0.643. The ranges of these scores are given in Table 15. The inexperienced NSs thus

¹³⁰ The only exception is Nanni, "An Exploration of Mediating Effects", who found some significant difference in consensus due to previous internal control evaluation experience.

¹³¹ Reckers and Taylor, "Consistency in Auditor's Evaluation".

Table 15. Comparison of Inexperienced vs Experienced NSs - Consensus

	<i>Pearson Scores</i>		
	<i>Inexp</i>	<i>Exp</i>	
Mean	0.68	0.64	
Highest	0.97	0.97	
Lowest	0.20	0.23	
<p>Mann-Whitney U test: $z = 4.72$, $p = 0.001$ Reject hypothesis of no difference in scores</p>			
	<i>Spearman Scores</i>		
	<i>Inexp</i>	<i>Exp</i>	
Mean	0.67	0.64	
Highest	0.95	0.97	
Lowest	0.16	0.16	
<p>Mann-Whitney U test: $z = 2.70$, $p = 0.007$ Reject hypothesis of no difference in scores</p>			

showed slightly higher consensus than the experienced NSs in both the r and ρ scores.

The fourth hypothesis was:

H4: Experience will have no effects on consensus of NSs.

To test this hypothesis, the r and ρ scores of the experienced and inexperienced NSs were compared using Mann-Whitney U tests. The tests indicated that both the r and ρ scores of the inexperienced and experienced auditors were statistically different from one another. The z value for the U test comparing r scores was 4.73 ($p=0.001$), and the z value for ρ scores was 2.70 ($p=0.007$). Inexperienced auditors thus have higher consensus than experienced auditors in the NS group.

The 24 inexperienced CASs had an average r of 0.682, and an average ρ of 0.684. The 17 experienced CASs had an average r of 0.671, and an average ρ of 0.670. The ranges of these scores are given in Table 16. Thus, for the CASs group also, the inexperienced auditors had a slightly higher consensus than their experienced colleagues.

The fifth hypothesis was:

H5: Experience will have no effects on consensus of CASs.

To test the hypothesis whether the experienced and inexperienced CASs had the same degree of consensus, both the r and ρ scores in the two groups were subjected to Mann Whitney U tests. The tests revealed that the hypothesis of

Table 16. Comparison of Inexperienced vs Experienced CASs - Consensus

	<i>Pearson Scores</i>		
	<i>Inexp</i>	<i>Exp</i>	
Mean	0.68	0.67	
Highest	0.97	0.92	
Lowest	0.14	0.25	

Mann-Whitney U test: $z = 0.82$, $p = 0.4135$
 Do not reject hypothesis of no difference in scores

	<i>Spearman Scores</i>		
	<i>Inexp</i>	<i>Exp</i>	
Mean	0.68	0.67	
Highest	0.96	0.93	
Lowest	0.13	0.27	

Mann-Whitney U test: $z = 1.37$, $p = 0.1691$
 Do not reject hypothesis of no difference in scores

no difference could not be rejected for either r or ρ scores. For r , the U test had a z value of 0.82 ($p=0.414$), and for ρ , z was 1.38 ($p=0.169$). Thus, unlike the NSs, there was no significant difference in the consensus of the experienced and inexperienced CASs.

5.3.2 Judgment Reliability - Experienced vs Inexperienced Auditors

The effect of experience on reliability of judgments was investigated for both group of auditors. Both r and ρ scores were computed for the reliability of each subgroup of auditors. The inexperienced NSs had a mean r of 0.67 and mean ρ of 0.63. The experienced NSs had a mean r of 0.77 and a mean ρ of 0.75. The ranges of these scores are given in Table 17. Thus, the experienced NSs exhibited more reliability in their judgments than the inexperienced NSs. To verify if this difference was significant, both the r and ρ scores of the experienced and inexperienced auditors were compared using Mann-Whitney U tests. The tests indicated that both the r and ρ scores of the experienced NSs were statistically different from the inexperienced NSs. The z value for the test comparing the r scores was 2.34 ($p=0.019$); the z value for ρ scores was 2.27 ($p=0.0227$).

Comparison of reliability of judgments of auditors blocked according to experience was also conducted for the CASs. Inexperienced CASs had a mean r of 0.82 and a mean ρ of 0.81, as compared to a mean r of 0.65 and a mean ρ

Table 17. Comparison of Inexperienced vs Experienced NSs - Reliability

Pearson Scores			
	<i>Inexp</i>	<i>Exp</i>	
Mean	0.67	0.78	
Highest	1.00	1.00	
Lowest	-1.00	-0.87	
<p>Mann-Whitney U test: $z = 2.34$, $p = 0.019$ Reject hypothesis of no difference in scores</p>			
Spearman Scores			
	<i>Inexp</i>	<i>Exp</i>	
Mean	0.63	0.75	
Highest	1.00	1.00	
Lowest	-1.00	-0.83	
<p>Mann-Whitney U test: $z = 2.28$, $p = 0.0224$ Reject hypothesis of no difference in scores</p>			

Table 18. Comparison of Inexperienced vs Experienced CASs - Reliability

Pearson Scores			
	<i>Inexp</i>	<i>Exp</i>	
Mean	0.72	0.65	
Highest	1.00	1.00	
Lowest	0.06	-0.58	
<p>Mann-Whitney U test: $z = 1.31$, $p = 0.19$ Do not reject hypothesis of no difference in scores</p>			
Spearman Scores			
	<i>Inexp</i>	<i>Exp</i>	
Mean	0.81	0.66	
Highest	1.00	1.00	
Lowest	0.26	-0.58	
<p>Mann-Whitney U test: $z = 0.05$, $p = 0.9573$ Do not reject hypothesis of no difference in scores</p>			

of 0.66 for the experienced CASs. The ranges of these scores are given in Table 18. Unlike the NSs, inexperienced CASs made more reliable judgments, on the average, than experienced CASs. However, Mann-Whitney U tests on the r and ρ scores of the two subgroups of CASs revealed no significant differences in the scores. The z value for r scores was 1.31 ($p=0.19$) and for ρ scores, 0.06 ($p=.9573$).

5.3.3 Self-insight - Experienced vs Inexperienced Auditors

The effect of experience on self-insights of the two groups of auditors was examined next. For the NSs, inexperienced auditors had a mean r of 0.75 and a mean ρ of 0.70. Experienced NSs had a mean r of 0.77 and a mean ρ of 0.70. The ranges of these scores are given in Table 19. Thus, both the inexperienced and experienced NSs exhibited high self-insights into their own decision processes. To investigate whether the scores between the two subgroups of NSs differed significantly from one another, both the r and ρ scores were subjected to Mann-Whitney tests. The tests revealed that both the r and ρ scores of the inexperienced and experienced NSs were not different from one another. The z value for the test comparing the r scores was 0.06 ($p=0.9573$), and for the ρ scores, z was 0.08 ($p=0.9335$).

Inexperienced CASs had a mean r of 0.76 and a mean ρ of 0.70. Experienced CASs had a mean r of 0.70 and a mean ρ of 0.67. The ranges of these scores

Table 19. Comparison of Inexperienced vs Experienced NSs - Self-Insight

	<i>Pearson Scores</i>		
	<i>Inexp</i>	<i>Exp</i>	
Mean	0.75	0.78	
Highest	0.99	0.99	
Lowest	-0.15	0.04	
<p>Mann-Whitney U test: $z = 0.06$, $p = 0.9468$ Do not reject hypothesis of no difference in scores</p>			
	<i>Spearman Scores</i>		
	<i>Inexp</i>	<i>Exp</i>	
Mean	0.70	0.71	
Highest	1.00	1.00	
Lowest	0.00	-0.06	
<p>Mann-Whitney U test: $z = 0.08$, $p = 0.9291$ Do not reject hypothesis of no difference in scores</p>			

Table 20. Comparison of Inexperienced vs Experienced CASs - Self-Insight

	<i>Pearson Scores</i>		
	<i>Inexp</i>	<i>Exp</i>	
Mean	0.76	0.70	
Highest	1.00	0.99	
Lowest	-0.33	0.00	
<p>Mann-Whitney U test: $z = 1.20$, $p = 0.2235$ Do not reject hypothesis of no difference in scores</p>			
	<i>Spearman Scores</i>		
	<i>Inexp</i>	<i>Exp</i>	
Mean	0.70	0.67	
Highest	0.97	0.92	
Lowest	-0.25	0.00	
<p>Mann-Whitney U test: $z = 1.02$, $p = 0.3076$ Do not reject hypothesis of no difference in scores</p>			

are given in Table 20. Mann-Whitney U tests of the two groups of scores revealed no significant differences between the self-insight scores of the experienced and inexperienced CASs. The z value for the test comparing the r scores was 1.20 ($p=0.2235$), and for the ρ scores z was 1.02 ($p=0.3014$).

5.3.4 Section Summary

The CASs group showed no effect in their judgment consistency due to experience. The consensus, reliability and self-insight scores of the inexperienced and experienced CASs were not statistically different from one another. For the NSs group, a statistically significant difference was noted for consensus and reliability scores. Experienced NSs made more reliable judgments than the inexperienced NSs, but had significantly lower consensus. Both subgroups of the NSs showed high self-insights into their own decision processes, and no significant difference was noted between the self-insight scores of the two subgroups of NSs.

Since differences were noticed between the judgment consistency of inexperienced and experienced NSs, each subgroup of NSs was then independently compared with the CASs to verify if significant differences existed between them.

5.4 Comparison of Experienced and Inexperienced NSs with CASs

Mann-Whitney U tests were run to compare the consensus, reliability, and self-insight scores of the experienced and inexperienced NSs with the CASs.

5.4.1 Consensus

The tests revealed a significant difference between experienced NSs and CASs for both the r and ρ scores of consensus. For r scores, the z value was 5.4 ($p=0.0001$), and for ρ scores, the z value was 4.14 ($p=0.0001$). The difference between inexperienced NSs' and CASs' consensus was not significant for the r scores; z of 1.36 ($p=0.1716$). The test on the ρ scores revealed a significant difference, z of 2.00 ($p=0.0453$). Thus, experienced NSs had consensus scores that were significantly different from the CASs, while there was a lesser degree of difference in the comparison of scores between inexperienced CASs and NSs.

5.4.2 Reliability

The comparison of the reliability scores of the experienced and inexperienced NSs with the CASs showed a complete reversal as compared to consensus. Experienced NSs showed no significant differences from the CASs reliability scores for both the r and ρ indexes. The test comparing the r scores had a z value of 0.447 ($p=0.6726$), and the test comparing the ρ scores had a z value of 0.0169 ($p=0.982$). However, significant differences were noted for the comparisons between inexperienced NSs' and CASs' reliability scores. For the r scores, the U test had a z value of 2.2 ($p=0.0276$), and for the ρ scores, z was 2.28 ($p=0.0224$).

Thus, the reliability of the judgments made by the experienced NSs was comparable to that of the CASs as a whole, while inexperienced NSs had lower reliability which was significantly different from the CASs.

5.4.3 Self-insight

No significant differences were noticed between the self-insight scores of either the experienced or inexperienced NSs and CASs. For the tests comparing the experienced NSs self-insight scores with CASs, the z value for r scores was 0.2 ($p=0.8474$), and for ρ scores, z was 0.128 ($p=0.8982$). For the comparison between inexperienced NSs self-insights and CASs, the test of the r scores had

a z of 0.454 ($p=0.6495$), and the test of the ρ scores had a z of 0.1531 ($p=0.8783$). Thus, both the experienced and inexperienced NSs exhibited self-insights that were comparable to those exhibited by the CASs.

5.4.4 Section Summary

Experienced NSs had significantly different consensus scores than the CASs, but made judgments that were as reliable as the CASs' judgments. There was no difference in the degree of self-insight exhibited by the experienced NSs and the CASs.

Inexperienced NSs had marginally similar consensus scores as compared to the CASs, but made less reliable judgments than the CASs. The degree of self-insights exhibited by both groups of auditors was very similar.

5.5 Firm Affiliation Effects

Unlike previous studies, where researchers used subjects primarily from one firm, this study utilized small samples from different firms. To verify if any firm affiliation effect was present, correlations were computed for each pair of auditors in each firm. The resulting correlation scores, r and ρ , were analyzed for differences using the KW H test. Each aspect of judgment consistency, con-

sensus, reliability, and self-insight was analyzed for firm affiliation effects for both the NSs and the CASs.

5.5.1 Consensus

For the NSs, significant differences were indicated in both the r and ρ consensus scores by the KW H tests ($p=0.0001$ for both tests). A non-parametric multiple comparison procedure, Dunn's Distribution-free Multiple Comparison procedure,¹³² was then carried out on the scores using an experiment-wise error rate of 0.05. The analysis on the r scores, given in Table 21, revealed significant differences in 8 pairs of the firms out of the 21 comparisons made. The analysis on the ρ scores, shown in Table 22, revealed significant differences in 7 pairs of the firms out of the 21 comparisons made. One firm was significantly different from 5 other firms in the r analysis, and 3 firms in the ρ analysis.

The analysis of the mediating effects of firm affiliation of the CASs revealed fewer differences in their consensus scores. For the ρ scores, the KW test revealed the differences to be marginally insignificant ($p=0.054$). However, the KW test of the r scores revealed that at least one firm had scores different from the others ($p=0.0001$). Dunn's Distribution-free Multiple Comparison proce-

¹³² M. Hollander and D. A. Wolfe, *Nonparametric Statistical Methods* (New York: John Wiley & Sons, 1982), p 125.

Table 21. Dunn's Multiple Comparison of NSs' Firm Consensus - Pearson

Experiment-wise error rate = 0.05

Comparison error rate = $0.05/(k(k-1)/2) = 0.05/42 = 0.0012$

z for comparison error rate = 3.03

Critical Value (CV) = $z \times [N(N+1)/12]^{1/2} \times [1/u + 1/v]^{1/2}$; N = 401

<i>Comparison</i>	<i>u</i>	<i>v</i>	<i>R.u - R.v</i>	<i>CV</i>	<i>Means</i>
Firm B, Firm C	78	66	52.73	58.73	0.65,0.71
Firm B, Firm D	78	28	77.97	77.36 *	0.65,0.55
Firm B, Firm E	78	3	140.69	206.61	0.65,0.80
Firm B, Firm F	78	45	98.76	65.74 *	0.65,0.76
Firm B, Firm G	78	136	6.04	49.88	0.65,0.63
Firm B, Firm H	78	45	30.03	65.73	0.65,0.68
Firm C, Firm D	66	28	130.70	79.20 *	0.71,0.55
Firm C, Firm E	66	3	87.96	207.30	0.71,0.80
Firm C, Firm F	66	45	46.03	67.89	0.71,0.76
Firm C, Firm G	66	136	58.77	52.68 *	0.71,0.63
Firm C, Firm H	66	45	22.70	67.89	0.71,0.68
Firm D, Firm E	28	3	218.66	213.33 *	0.55,0.80
Firm D, Firm F	28	45	176.73	84.52 *	0.55,0.76
Firm D, Firm G	28	136	71.93	72.87	0.55,0.63
Firm D, Firm H	28	45	108.00	84.52 *	0.55,0.68
Firm E, Firm F	3	45	41.93	209.40	0.80,0.76
Firm E, Firm G	3	136	146.73	204.97	0.80,0.63
Firm E, Firm H	3	45	110.66	209.40	0.80,0.68
Firm F, Firm G	45	136	36.07	60.39	0.76,0.63
Firm F, Firm H	45	45	68.73	74.03	0.76,0.68
Firm G, Firm H	136	45	104.80	60.39 *	0.63,0.68

* - significant difference at experiment-wise error rate

Table 22. Dunn's Multiple Comparison of NSs' Firm Consensus - Spearman

Experiment-wise error rate = 0.05

Comparison error rate = $0.05 / (k(k-1)/2) = 0.05 / 42 = 0.0012$

z for comparison error rate = 3.03

Critical Value (CV) = $z \times [N(N+1)/12]^{1/2} \times [1/u + 1/v]^{1/2}$; N = 401

<i>Comparison</i>	<i>u</i>	<i>v</i>	<i>R.u - R.v</i>	<i>CV</i>	<i>Means</i>
Firm B, Firm C	78	66	68.56	58.73 *	0.62,0.71
Firm B, Firm D	78	28	56.07	77.36	0.62,0.54
Firm B, Firm E	78	3	155.40	206.61	0.62,0.80
Firm B, Firm F	78	45	107.57	65.74 *	0.62,0.76
Firm B, Firm G	78	136	1.60	49.88	0.62,0.62
Firm B, Firm H	78	45	48.33	65.73	0.62,0.68
Firm C, Firm D	66	28	124.63	79.20 *	0.71,0.54
Firm C, Firm E	66	3	87.74	207.30	0.71,0.80
Firm C, Firm F	66	45	39.01	67.89	0.71,0.76
Firm C, Firm G	66	136	66.96	52.68 *	0.71,0.62
Firm C, Firm H	66	45	20.23	67.89	0.71,0.68
Firm D, Firm E	28	3	211.47	213.33	0.54,0.80
Firm D, Firm F	28	45	163.64	84.52 *	0.54,0.76
Firm D, Firm G	28	136	57.67	72.87	0.54,0.62
Firm D, Firm H	28	45	104.40	84.52 *	0.54,0.68
Firm E, Firm F	3	45	47.83	209.40	0.80,0.76
Firm E, Firm G	3	136	153.80	204.97	0.80,0.62
Firm E, Firm H	3	45	107.07	209.40	0.80,0.68
Firm F, Firm G	45	136	105.97	60.39 *	0.76,0.62
Firm F, Firm H	45	45	59.24	74.03	0.76,0.68
Firm G, Firm H	136	45	46.73	60.39	0.62,0.68

* - significant difference at experiment-wise error rate

Table 23. Dunn's Multiple Comparison of CASs' Firm Consensus - Pearson

Experiment-wise error rate = 0.05

Comparison error rate = $0.05 / (k(k-1)/2) = 0.05 / 20 = 0.0025$

z for comparison error rate = 2.81

Critical Value (CV) = $z \times [N(N+1)/12]^{1/2} \times [1/u + 1/v]^{1/2}$; N = 253

<i>Comparison</i>	<i>u</i>	<i>v</i>	<i>R.u - R.v</i>	<i>CV</i>	<i>Means</i>
Firm A, Firm B	210	21	18.37	47.06	0.71,0.74
Firm A, Firm E	210	10	22.41	66.55	0.71,0.68
Firm A, Firm F	210	6	100.61	85.14 *	0.71,0.43
Firm A, Firm G	210	6	15.28	85.14	0.71,0.66
Firm B, Firm E	21	10	40.78	79.00	0.74,0.68
Firm B, Firm F	21	6	118.98	95.18 *	0.74,0.43
Firm B, Firm G	21	6	33.65	95.18	0.74,0.66
Firm E, Firm F	10	6	78.20	106.18	0.68,0.43
Firm E, Firm G	10	6	7.13	106.18	0.68,0.66
Firm F, Firm G	6	6	85.33	118.72	0.43,0.66

* - significant difference at experiment-wise error rate

dure, using an experiment-wise error rate of 0.05 and summarized in Table 23, revealed that at least two pairs of firms, out of the 10 possible pairs of comparison, had significant differences in their scores. Thus, compared to the NSs, smaller mediating effects were noticed due to firm affiliation of the CASs.

5.5.2 Reliability

The analysis of the effects of firm affiliation on reliability of judgments revealed no significant differences in the scores for both groups of auditors. For the NSs, the KW test of the r scores had a χ^2 value of 6.01 ($p=0.422$, $df=6$), and the χ^2 value for the ρ scores was 9.45 ($p=0.1497$, $df=6$). For the CASs, the KW test of the r scores gave a χ^2 of 3.57 ($p=0.4677$, $df=4$); ρ scores had a χ^2 of 3.90 ($p=0.4197$, $df=4$). The reliability of the auditors' judgments across the firms was thus not significantly different for the NSs or the CASs.

5.5.3 Self-insight

Firm affiliation effects were noticed for the KW test of the ρ scores of NSs, but not for the test of the r scores. For NSs' r scores, the KW test had a χ^2 of 4.7 ($p=0.5834$, $df=6$), but for ρ scores, χ^2 was 15.72 ($p=0.0153$, $df=6$). Thus, the KW test revealed that at least one firm had self-insight scores that were significantly different from the other firms. A Dunn's Multiple Comparison pro-

Table 24. Dunn's Multiple Comparison of NSs' Firm Self-insight - Spearman

Experiment-wise error rate = 0.05

Comparison error rate = $0.05/(k(k-1)/2) = 0.05/21 = 0.0024$

z for comparison error rate = 2.82

Critical Value (CV) = $z \times [N(N+1)/12]^{1/2} \times [1/u + 1/v]^{1/2}$; N = 73

<i>Comparison</i>	<i>u</i>	<i>v</i>	<i>R.u - R.v</i>	<i>CV</i>	<i>Means</i>
Firm B, Firm C	13	12	10.92	23.95	0.68,0.58
Firm B, Firm D	13	8	12.92	26.87	0.68,0.50
Firm B, Firm E	13	3	1.92	38.32	0.68,0.68
Firm B, Firm F	13	10	16.38	25.17	0.68,0.88
Firm B, Firm G	13	17	10.17	22.04	0.68,0.78
Firm B, Firm H	13	10	1.88	25.17	0.68,0.74
Firm C, Firm D	12	8	2.00	27.31	0.58,0.50
Firm C, Firm E	12	3	9.00	38.62	0.58,0.68
Firm C, Firm F	12	10	27.30	25.61 *	0.58,0.88
Firm C, Firm G	12	17	21.09	22.56	0.58,0.78
Firm C, Firm H	12	10	12.80	25.62	0.58,0.74
Firm D, Firm E	8	3	11.00	40.51	0.50,0.68
Firm D, Firm F	8	10	29.30	28.38 *	0.50,0.88
Firm D, Firm G	8	17	23.09	25.65	0.50,0.78
Firm D, Firm H	8	10	14.80	28.38	0.50,0.74
Firm E, Firm F	3	10	18.30	39.38	0.68,0.88
Firm E, Firm G	3	17	12.09	37.47	0.68,0.78
Firm E, Firm H	3	10	3.80	39.38	0.68,0.74
Firm F, Firm G	10	17	6.21	23.84	0.88,0.78
Firm F, Firm H	10	10	14.50	26.75	0.88,0.74
Firm G, Firm H	17	10	8.29	23.84	0.78,0.74

* - significant difference at experiment-wise error rate

cedure, summarized in Table 24, revealed that out of the 21 comparisons possible, two comparisons of a pair of firms' scores had significantly different scores at the experiment-wise error rate of 0.05.

The effect of firm affiliation on CASs' self-insights was not significant. For the r scores, the KW test had a χ^2 of 1.93 ($p=0.7486$, $df=4$), and for the ρ scores, the KW test had a χ^2 of 4.06 ($p=0.3973$, $df=4$).

5.5.4 Section Summary

The effect of firm affiliation on consensus scores was more pronounced for NSs as compared to the CASs. The multiple comparison tests on consensus scores revealed that one NS firm had significantly different scores than at least four of the remaining six firms. The effect of firm affiliation on CASs consensus was more muted, revealing differences in only two of the ten possible comparisons. The effect of firm affiliation on judgment reliability was not significant for either NSs or CASs. Analysis on the self-insight scores revealed a significant difference in the ρ scores of one NS firm from another NS firm. This difference was not revealed for the r scores. There was no effect of firm affiliation on the CASs insights.

5.6 Comparison of NS firms and CASs

Since significant differences were noticed in the consensus scores of the NS firms, comparisons of consensus, reliability and self-insight scores were made between the NS firms and the CASs group.

5.6.1 Consensus

Since no significant effects were noticed in the CASs judgment consistency due to firm affiliation, comparisons of the NS firms were done with the CASs as a group. To test if the consensus of the NSs grouped by firm were significantly different from the CASs' consensus, both r and ρ scores were subjected to KW H tests. Dunn's Multiple Comparison procedure was carried out at an experiment-wise error rate of 0.05, and only comparisons between the NS firms and CASs were carried out. As Table 25 indicates, significant differences in r scores were noticed between 3 NS firms and the CASs. The multiple comparison procedure on the ρ scores revealed significant differences between 4 NS firms and the CASs. Thus, for both the r and ρ scores, the consensus of firms D, F and G, differed significantly from the CASs. The NSs in firm F exhibited a higher mean consensus (0.76 for both r and ρ scores) than the CASs, while NSs from firms D and G had lower consensus scores.

Table 25. Dunn's Multiple Comparison of NSs Firms and CASs Consensus

Experiment-wise error rate = 0.05

Comparison error rate = $0.05 / (k(k-1)/2) = 0.05 / 28 = 0.0018$

z for comparison error rate = 2.91

Critical Value (CV) = $z \times [N(N+1)/12]^{1/2} \times [1/u + 1/v]^{1/2}$; N = 1221

Pearson Scores

Comparison	u	v	R.u - R.v	CV	Means
Firm B, CAS	78	820	94.71	121.58	0.65,0.68
Firm C, CAS	66	820	65.17	131.29	0.71,0.68
Firm D, CAS	28	820	324.66	197.20 *	0.55,0.68
Firm E, CAS	3	820	337.06	593.51	0.80,0.68
Firm F, CAS	45	820	210.06	157.10 *	0.76,0.68
Firm G, CAS	136	820	109.47	95.00 *	0.63,0.68
Firm H, CAS	45	820	0.47	157.10	0.68,0.68

* - significant difference at experiment-wise error rate

Spearman Scores

Comparison	u	v	R.u - R.v	CV	Means
Firm B, CAS	78	820	153.82	121.58 *	0.62,0.68
Firm C, CAS	66	820	54.47	131.29	0.71,0.68
Firm D, CAS	28	820	317.40	197.20 *	0.54,0.68
Firm E, CAS	3	820	328.82	593.51	0.80,0.68
Firm F, CAS	45	820	180.06	157.10 *	0.76,0.68
Firm G, CAS	136	820	144.54	95.00 *	0.62,0.68
Firm H, CAS	45	820	5.21	157.10	0.68,0.68

* - significant difference at experiment-wise error rate

5.6.2 Reliability

To verify if the NS firms reliability differed significantly from the CASs, KW H tests were conducted on both the r and ρ scores of the firms and CASs. No significant difference was revealed for either the test on the r scores ($p=0.3683$) or the test on the ρ scores ($p=0.1081$).

5.6.3 Self-insight

An analysis was also conducted to verify if the self-insights of the NSs according to their firm affiliation differed from the CASs. The KW H test of the r scores revealed no significant differences between the scores of the NS firms and CASs ($p=0.7071$). A significant difference was revealed for the ρ scores ($p=0.0283$), but a Dunn's Multiple Comparison procedure carried out at an experiment-wise error rate of 0.05 revealed that none of the NS firms had significantly different self-insight scores than the CASs. Thus, the significant result was achieved mainly due to the difference in the ρ scores of firm C and firm F, as reported earlier in Table 24.

5.6.4 Section Summary

The analysis of the comparison of the judgment consistency of the NSs grouped according to their firm affiliation and CASs revealed that at least three of the NS firms had significantly different consensus than CASs. One of these firms' NSs exhibited higher consensus than the CASs, while the other two firms had significantly lower consensus. Reliability of the judgments of the NS firms and the self-insights exhibited by them were not significantly different from the CASs.

5.7 Cue Usage

To examine the pattern of cue usage of the auditors, linear models were constructed for each auditor using a parametric ANOVA procedure. The ANOVA procedure revealed that for both group of auditors, the model with the main effects explained a significant portion of the variance in their judgments. On the average, for the NSs, the main effects model accounted for 74% of the variance, ranging from 31% to 97%. The main effects model accounted for a mean 76% of the variance in the CASs judgments, ranging from 32% to 98% (See Table 26). Thus, as in previous studies, the linear models constructed for the subjects accounted for most of the variance in their judgments.

Table 26. Percentage of variance explained by the cues

Factors						
	<i>All</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
NSs - All	74.35	14.44	28.84	16.20	9.07	5.80
Inexperienced	71.39	10.38	29.21	17.89	10.40	3.51
Experienced	78.14	19.63	28.36	14.03	7.37	8.75
CASs - All	75.80	8.02	34.83	17.86	5.57	9.52
Experienced	78.78	10.46	35.81	18.21	6.01	8.29
Inexperinced	71.60	4.57	33.45	17.38	4.94	11.26

Factor A - Segregation of duties cue
Factor B - Access to sensitive files cue
Factor C - Changes to sensitive files cue
Factor D - Programmed procedure to check credit status cue
Factor E - Reasonableness checks on input data cue

On the average, the cue dealing with access to sensitive files accounted for 29% of the variance in NSs judgments, and 35% of the variance in the CASs judgments. The cue dealing with changes to sensitive files accounted for about 16% of the variance in NSs judgments, and 18% in the CASs judgments. The segregation of duties cue accounted for 14% of the variance in NSs judgments, and only 8% of the variance in CASs judgments. Segregation of duties cue was considered less important than the cue dealing with reasonableness checks by the CASs, as shown in Table 26, since this cue accounted for about 10% of the variance in CASs judgments. Taken as a whole the NSs however considered segregation of duties cue more important than the remaining two cues.

5.7.1 Experience effects

Averaged across experience levels in NSs, 78% of the variance in experienced NS and 71% of the variance in inexperienced NSs judgments was accounted for the linear models, as shown in Table 26. For the experienced NSs, the cue dealing with access to sensitive files was the most important cue, accounting for about 28% of the variance. However, unlike the overall average, the cue dealing with segregation of duties was the next most important cue for the experienced NSs, accounting for about 20% of the variance. Changes to sensitive files cue accounted for 14% of the variance in experienced NSs judg-

ments, followed by reasonableness checks (9%), and programmed procedure (7%) cues.

The cue usage of the inexperienced NSs resembled the CASs group. Access to sensitive files cue was the most important cue, accounting for about 29% of the variance. Changes to sensitive files cue was the next important cue to the inexperienced NSs, accounting for about 18% of the variance in their judgments, followed by programmed procedure cue (10%), segregation of duties cue (10%), and reasonableness check cue (4%). The inexperienced NSs placed lesser importance on the segregation of duties cue than the experienced NSs.

Cue usage across the experience levels of CASs was more uniform, as shown in Table 26. For both the experienced and inexperienced CASs, access to sensitive files was the most important cue, accounting for 33% and 36% of the variance in judgments respectively. Changes to sensitive files cue was the next important cue to both groups of CASs, accounting for 17% and 18% variance in experienced and inexperienced CASs judgments respectively. For the experienced CASs, the next important cue was reasonableness checks (11%), and then programmed procedure (5%). Segregation of duties cue was the least important cue to the experienced CASs, accounting for less than 5% of the variance in their judgments. For the inexperienced CASs, however, segregation of duties cue was more important than the cues dealing with reason-

ableness checks (8%) and programmed procedure (6%), and accounted for about 10% of the variance in their judgments.

5.7.2 Firm effects

The pattern of cue usage across the firms was very uniform for both the NSs and CASs, as shown in Table 27. The cue dealing with access to sensitive files was the most important cue to all the firms, *except for one NS firm, firm H, where segregation of duties cue accounted for the most variance (28%)*. Of the remaining cues, five of the seven NS firms, and three of the five CAS firms considered changes to sensitive files the next important cue. Segregation of duties cue was either the third or fourth important cue of the five manipulated cues for all the firms, except for firm H.

5.7.3 Section Summary

Linear models of judgments for the subjects, using the main effects, accounted for a significant amount of the variance. On the average, between 70% and 80% of the variance was accounted for by the linear models. Access to sensitive files was the most important cue for both the NSs and the CASs as a whole. The segregation of duties cue, unlike previous studies, accounted for a lesser amount of variance in judgments than the cue dealing with changes

Table 27. Proportion of variance explained by the cues for firms

NSs						
Factors						
	<i>All</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
Firm B	74.16	15.72	19.53	15.87	16.78	6.26
Firm C	77.49	10.92	28.13	19.43	12.50	6.51
Firm D	60.89	11.20	16.86	11.03	16.61	5.19
Firm E	75.66	5.94	31.51	30.65	5.81	1.75
Firm F	78.45	7.40	44.76	20.58	3.52	2.19
Firm G	74.28	14.98	34.57	15.20	3.01	6.52
Firm H	77.22	28.20	24.91	9.86	5.73	8.52
CASs						
Factors						
	<i>All</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
Firm A	74.98	7.92	37.25	18.78	4.12	6.91
Firm B	81.33	15.28	27.20	25.37	5.11	8.37
Firm E	80.02	2.21	35.12	13.34	10.95	18.40
Firm F	69.84	6.64	30.31	11.46	12.82	8.61
Firm G	71.12	4.40	39.67	11.97	0.00	15.08
<p>Factor A - Segregation of duties cue Factor B - Access to sensitive files cue Factor C - Changes to sensitive files cue Factor D - Programmed procedure to check credit status cue Factor E - Reasonableness checks on input data cue</p>						

to sensitive files. Blocked according to median experience, it was noted that experienced NSs considered the segregation of duties cue the second most important cue, next to access to sensitive files. The cue usage pattern of inexperienced NSs was more similar to that of the CASs group. Experienced CASs considered the segregation of duties cue the least important cue in their decision process.

Cue usage patterns across firms was more uniform for both the NSs and the CASs. Access to sensitive files was the most important cue for all the firms, except firm H, who considered segregation of duties cue as the most important cue. A majority of both NS and CAS firms considered changes to sensitive files the next most important cue.

5.8 Chapter Summary

The experimental results were analyzed in this chapter. The empirical results indicate that the CASs and NSs have slightly different educational and professional background. The NSs are typically Accounting majors with CPA certification, while the CASs have more diversity in their backgrounds. Both group of auditors had clients with significant computerized accounting applications. The experimental task was considered moderately realistic and moderately difficult by both group of auditors.

CASs had significantly higher consensus than the NSs. There was no significant difference in the reliability of judgments made by both groups of auditors. The degree of self-insight exhibited by the auditors was quite high, and there were no significant difference in the self-insight index scores of the two groups.

Experienced NSs had consensus that was significantly lower than that of the inexperienced NSs. No significant difference was found between experienced and inexperienced CASs. Experienced NSs however made significantly more reliable judgments than the inexperienced NSs. No differences were noticed in the self-insight scores of the inexperienced and experienced NSs. No differences were revealed in the reliability or self-insights of the experienced or inexperienced CASs. Comparison of the inexperienced and experienced NSs with the CASs revealed that experienced NSs had significantly lower consensus than the CASs, but made similar reliability of judgments and degree of self-insight as the CASs. Inexperienced NSs had similar consensus and self-insight scores as the CASs, but made significantly lower reliable judgments than the CASs.

Comparison of the judgment consistency of the auditors grouped according to their firm affiliation revealed more differences between the NS firms than the CASs firms. While there was no difference in the reliability and self-insight scores of NS and CAS firms, significant differences were revealed between the consensus scores of NS firms for both the r and ρ measures. One firm had

significantly different consensus scores than at least four other firms. The differences in the consensus scores of CAS firms was less pronounced, differences being revealed for only two pairs of CAS firms for ρ scores.

Comparison of the judgment consistency of the NS firms and the CASs group as a whole revealed significant differences in consensus scores between three NS firms and CASs. One NS firm had significantly higher consensus than the CASs, while the other two firms had lower scores than the CASs. No differences were noticed between the reliability and self-insight scores of the NS firms and CASs.

Linear models of the main effects accounted for most of the variance in auditor judgments. The cues dealing with access and changes to sensitive files, on the average, accounted for most of the variance in auditor judgments. However, when blocked according to experience, it was noticeable that the experienced NSs considered segregation of duties cue as an important cue after access control, which was significantly different from the CASs or the other NSs. In fact, the cue usage pattern of the inexperienced NSs was very similar to that of the CASs. The cue usage pattern was more uniform across the levels of the CASs.

The cue usage pattern across both the NS and CAS firms was uniform, the most important cue being access to sensitive files for all firms except one NS firm, where segregation of duties cue accounted for the most variance in

judgment. Changes to sensitive files cue was considered the second important cue for a majority of the firms.

Chapter 6

Summary and Conclusions

Auditors are encountering more and more computerized accounting applications as the pervasiveness of computing technology increases in business. Auditors therefore have a need to adapt their audit approaches in the face of the changes caused by the new technology.

As the developments summarized in Chapter II indicate, the AICPA has addressed the issue by requiring auditors to consider the nature of the data processing system in their clients environments when planning the audit. Specialists, if necessary, are recommended to be brought in as part of the audit team in audits involving computerized accounting applications. There is evidence, summarized in Chapter I, that auditors have had problems in dealing with the recommendations of the AICPA. Some of the firms have developed

in-house specialists, CASs, who deal with all audits involving significant computerized applications.

The implicit assumption behind this development is that CASs would make “better” judgments in auditing computerized systems than NSs. However, due to the shortage of CASs, not all audit firms are able to use specialists in all audits involving computerized applications.¹³³ In the case of simple computer environments, featuring remote-entry batch operations, auditors may not feel the need to have specialists as part of the audit teams. If significant differences exist in the assessments made by CASs and NSs, even in simple computing environments, this can lead to “costly” differences, resulting in legal liability if computer controls are overly relied on or in “overauditing” when no reliance is placed on the computer controls by NSs. Thus, there is a need to compare the judgments of CASs and NSs in evaluating controls in simple computing environments.

A review of the prior literature reveals that the expertise of auditors has been considered in terms of judgment consistency, since in most areas of auditing criterion values are not available to evaluate judgment accuracy. Previous researchers have seen a high degree of judgment consistency in auditors’ evaluations of internal controls, suggesting a measure of expertise of auditors in this area. Thus, judgment consistency was used in this study to verify if sig-

¹³³ See Vansyckle, “A Critical Review of CPA’s.”

nificant differences existed in CASs' and NSs' assessments of control risks in a simple computerized accounting application.

Previous studies also found that cues dealing with segregation of duties accounted for most of the variance in auditor judgments. However, this is an area most affected by computerization, since automated systems require fewer staff to maintain them. Hence, CASs may be familiar with this aspect and look for compensating controls and not weight this cue as heavily as NSs. This was the second major aspect of the study.

6.1 *Limitations of the Study*

The experiment utilized a limited set of cues, and limited background information. In real-life auditing situations, the auditors would have a more complete information set to process. Thus, generalizing the findings to actual audit situations is done with caution.

The subjects were not selected randomly from the population of auditors, but were chosen based on their willingness to participate. Also, all of the auditors were from Big 8 firms. Hence the results obtained by this study may not been achieved if the inexperienced auditors had come from other firms.

The background information for the fictitious company was made deliberately strong so that the mediating effects of this information on the assessments would be minimized. However, from the comments made by the subjects, it was evident that some auditors do not make control risk assessments as defined in SAS 47. Instead, they make a combined assessment of inherent risk and control risk. Thus, if the background information had not been strong, the consistency exhibited by the auditors may not have been achieved.

The use of the fractional factorial design necessarily limited the assessment of higher order interactions of the cues on the judgments made. However, this limitation was taken into account at the time of design of the experiment since none of the earlier studies in internal control evaluations which had used a full factorial design had noticed significant second and higher-order interactions.

6.2 Summary and Discussion of the Empirical Findings

A summary of the significant findings in the study is first given followed by a discussion of the results of the empirical tests of the hypotheses for consensus, reliability, self-insight and experience effects. The effect of firm affiliation and the pattern of cue usage of the auditors is also discussed here.

6.2.1 Summary of the significant findings

The findings of the study are summarized in Table 28. At the overall level, a statistically significant difference was noticed between the consensus scores of NSs and CASs. Experienced NSs differed significantly from the CASs in their consensus scores, while inexperienced NSs exhibited significantly lower reliability than the CASs. The cue usage pattern of the experienced NSs differed significantly from the CASs, segregation of duties cue accounting for more variance in experienced NSs' judgments than CASs'. Experienced CASs, in fact, considered the segregation of duties the least important of the five cues given. Firm affiliation effects were noticed for NSs' consensus and cue usage. These findings, and the other results, are discussed in more detail in the following sections.

6.2.2 Overall Judgment Consistency of CASs and NSs

Both the CASs and NSs showed very high consensus, comparable to earlier studies in internal control evaluations. Thus the expertise of the auditors in internal control evaluations was reaffirmed by this study. However, significant differences were indicated for the r and ρ scores between CASs and NSs. There is thus evidence that CASs have more expertise than NSs even in simple computerized environments.

Table 28. Summary of Results

	<i>Consensus</i>	<i>Reliability</i>	<i>Self-Insight</i>
NSs vs CASs	Sig.	Non-sig.	Non-sig.
Exp. Effects - NSs	Sig.	Sig.	Non-sig.
Exp. Effects - CASs	Non-sig.	Non-sig.	Non-sig.
Inexp. NSs vs CASs	Non-sig.	Sig.	Non-sig.
Exp. NSs vs CASs	Sig.	Non-sig.	Non-sig.

Table 29. Mean Risk Assessments by Situations for CASs and NSs

<i>Sit.</i>	<i>CAS</i>				<i>NS</i>			
	<i>Mean</i>	<i>Std Dev</i>	<i>High</i>	<i>Low</i>	<i>Mean</i>	<i>Std Dev</i>	<i>High</i>	<i>Low</i>
1	73.71	21.10	100	25	75.00	15.11	100	35
2	65.37	20.78	100	15	63.73	19.01	100	30
3	55.78	20.92	95	20	59.04	18.38	100	30
4	58.59	21.72	100	20	63.02	16.44	95	35
5	64.39	21.06	100	20	67.64	17.13	100	35
6	64.68	22.57	100	15	69.48	17.69	100	30
7	27.80	15.73	60	5	32.18	17.69	90	10
8	37.44	18.41	80	10	35.45	20.22	85	10
9	35.85	19.03	80	10	38.89	20.29	90	15
10	44.39	19.97	100	10	41.84	21.87	90	10
11	43.95	22.40	95	5	44.25	20.79	95	20
12	52.68	22.67	100	10	49.47	23.59	100	15
13	32.61	19.21	70	10	33.28	18.47	85	10
14	27.73	16.56	70	5	33.96	18.59	90	10
15	36.02	21.67	90	5	41.11	18.99	90	15
16	44.44	23.59	100	10	46.00	20.66	95	15
17	7.48	8.41	30	0	8.21	6.58	30	0

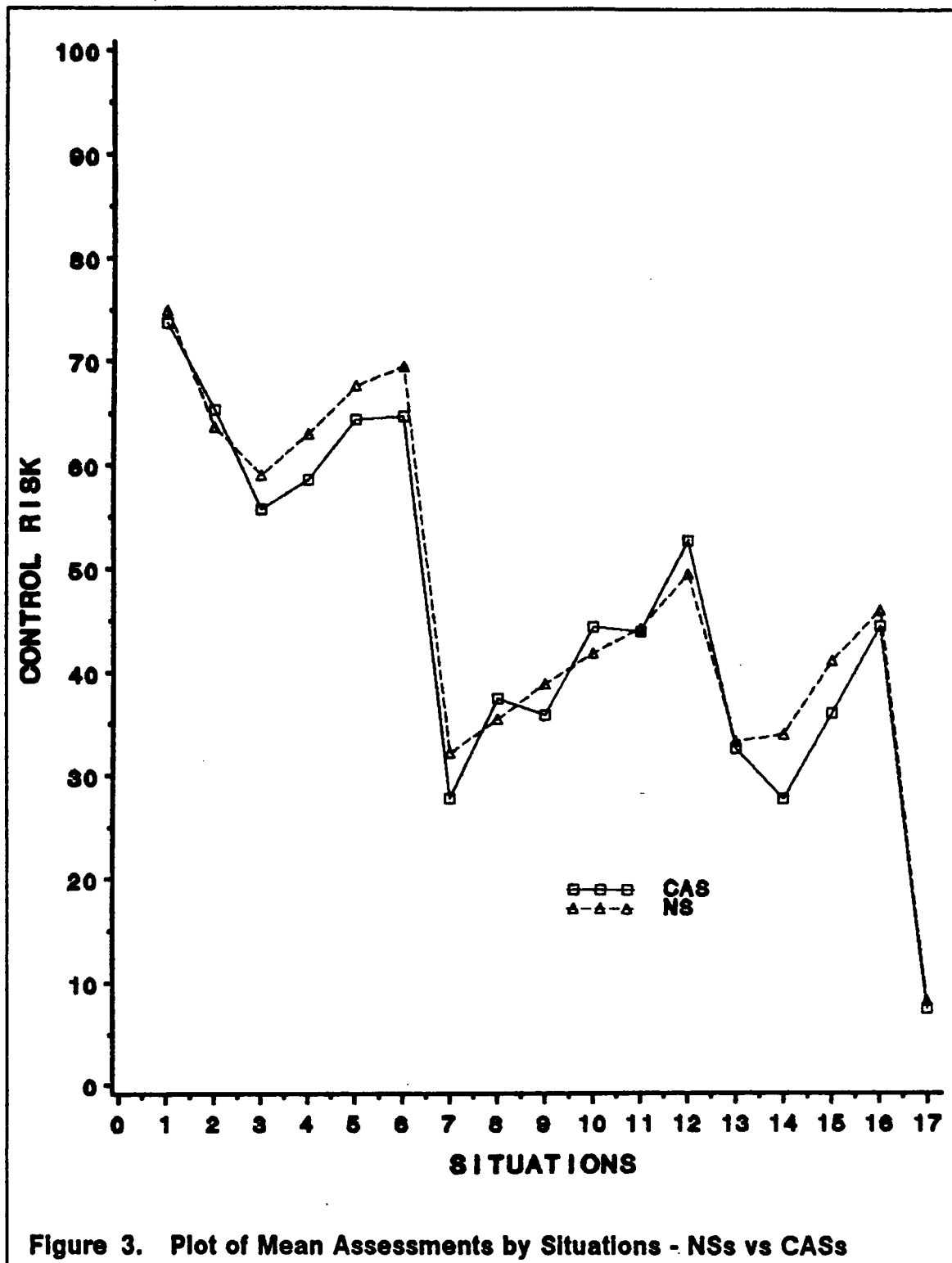


Figure 3. Plot of Mean Assessments by Situations - NSs vs CASs

The mean assessment of control risk made by the CASs was 45.46 (standard deviation 25.92), while the NSs had a mean of 47.20 (standard deviation 24.97). Thus, NSs made slightly higher mean assessments than the CASs and this suggests that in simple computerized environments NSs may tend to “over-audit” as compared to CASs. The assessments analyzed by situations reveals that only in 4 of the 17 situations the NSs had mean assessments lower than that of the CASs (See Table 29 and Figure 3). These lower mean assessments by the NSs were made when the segregation of duties cue was present, either alone or in combination with other cues. NSs placed more importance on this cue than the CASs. Thus, in most of the situations, the NSs assessed higher control risks than CASs suggesting that, on the average, the NSs may tend to “overaudit” as compared to the CASs. Also, when segregation of duties cue was present, NSs assessed lower risks suggesting they may plan lesser audit procedures in these situations.

The presence of these differences suggests the need for more research to investigate the consequences of it on audit planning by NSs. As noted above, differences in evaluating controls can be “costly” to the auditors in terms of over-auditing or the possibility of legal liability if controls are relied upon when they should not be. This is a concern for the AICPA also as the credibility of the profession as a whole is affected. The difference in the mean r and ρ scores between CASs and NSs, though statistically significant, was quite small. However, more research into subsequent audit planning decisions of the two groups is needed to investigate the practical significance of this difference.

This study was exploratory in nature to verify if differences existed between judgments made by NSs and CASs. The presence of this difference, however small, suggests a need for an extension of this study to investigate if any differences exist in sample size decisions made by NSs and CASs.

Both the NSs and CASs showed high reliability in their judgments and exhibited high self-insights into own judgment processes. The hypotheses that there would be no difference in the reliability and self-insights of the two groups of auditors were not rejected. In fact, mediating effects of experience and firm affiliation were noted mostly for judgment consensus, while the effect on judgment reliability and self-insights were negligible. Thus, NSs were as aware of their decision processes in terms of which cues were important to them as the CASs.

These findings are similar to earlier studies in internal control evaluations, where auditors had made highly reliable decisions and exhibited high self-insights into their own decision processes. This suggests that auditors recognize the basic control objectives even in computerized systems and have no difficulty in recognizing the presence or absence of controls identified as important by them.

Thus, overall, both groups of auditors showed a high degree of expertise in their assessments of control risks in a simple computerized environment. A statistically significant difference was noted in the consensus scores of NSs

and CASs, and though the difference was small in absolute magnitude, it suggests the need for more research to investigate the effect of this difference on audit program planning.

6.2.3 Experience Effects

No experience effects were noticed for CASs. The consensus of inexperienced CASs was not significantly different from the experienced CASs. However, for the NSs, a significant difference was indicated for both the Pearson and Spearman measures of consensus. Furthermore, the inexperienced NSs had higher consensus than the experienced NSs. However, the experienced NSs made more reliable judgments than the inexperienced NSs. Both subgroups showed high self-insights into their own decision processes. When comparisons were made between the inexperienced and experienced NSs and CASs, significant differences were noticed between the consensus of experienced NSs and CASs, and the reliability of inexperienced NSs and CASs. This indicates the expertise of CASs in evaluating internal controls in computerized systems, since for the two dimensions of expertise, judgment consensus and reliability, the CASs' scores were similar to the NSs' subgroup that had the higher scores. Thus, even in simple computerized environments, the expertise of CASs assessments of control risks was evident as compared to the NSs group.

Table 30. Mean Risk Assessments by Situations for NSs

Sit.	Inexp NSs				Exp NSs			
	Mean	Std Dev	High	Low	Mean	Std Dev	High	Low
1	74.88	15.59	100	55	75.16	14.73	100	60
2	67.24	17.72	100	25	59.21	19.92	95	35
3	58.51	17.56	100	25	58.44	19.65	90	40
4	62.95	15.42	90	30	63.13	17.90	95	30
5	66.66	15.85	100	50	68.91	18.82	100	40
6	71.27	16.42	100	50	67.19	19.21	100	30
7	35.71	17.31	90	20	27.66	17.41	70	10
8	37.51	20.94	80	10	32.81	19.25	85	10
9	44.12	21.16	90	15	32.19	17.22	80	10
10	43.39	21.29	89	10	39.84	22.77	90	10
11	49.27	20.51	90	15	37.81	19.63	95	10
12	52.51	22.77	93	15	45.56	24.40	100	10
13	30.48	16.42	70	5	36.88	20.51	85	15
14	34.61	19.05	90	10	33.13	18.26	80	10
15	43.68	19.80	80	8	37.81	17.64	90	10
16	47.51	20.51	93	20	44.06	21.00	95	15
17	8.63	6.02	30	0	7.66	7.29	30	0

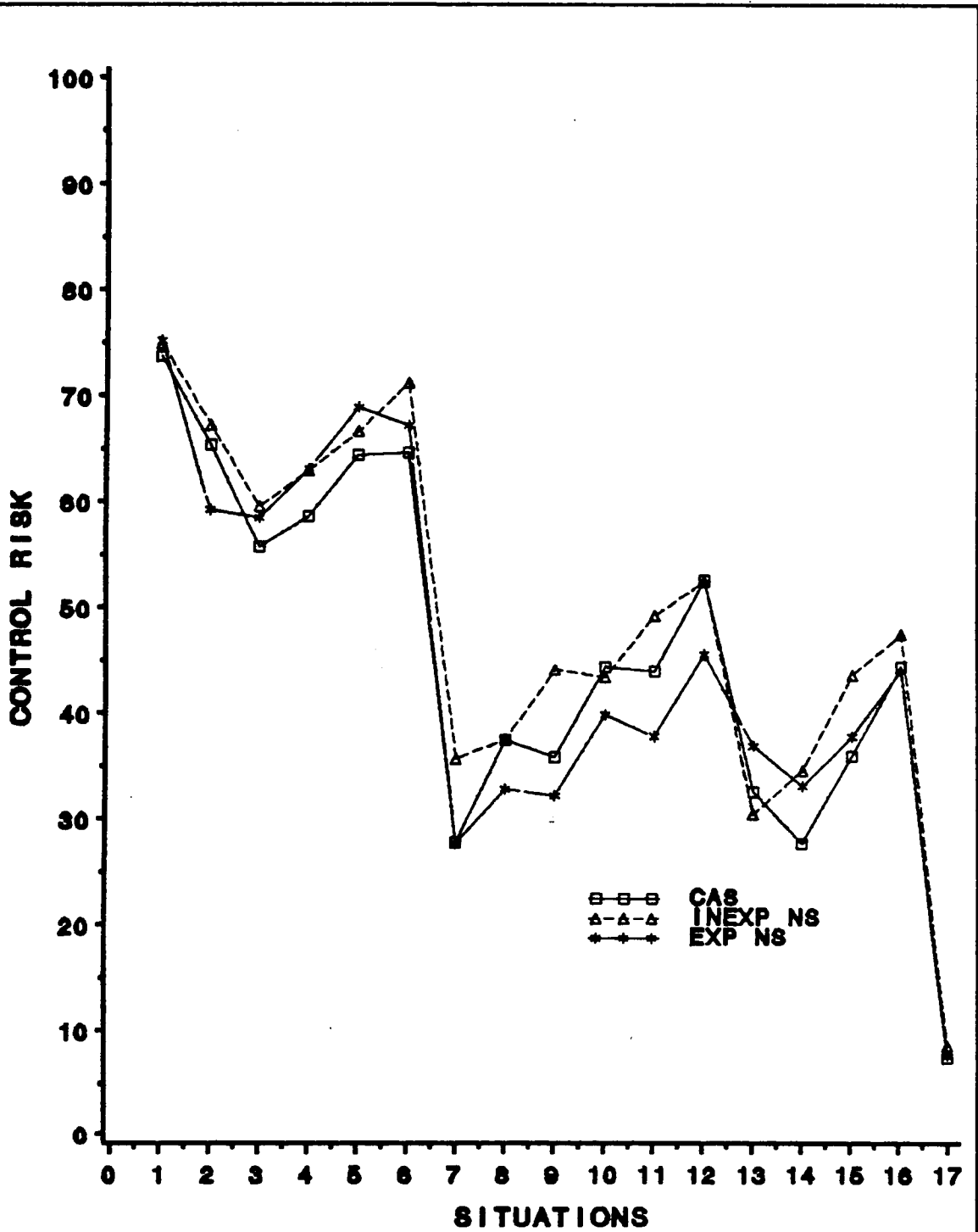


Figure 4. Plot of Mean Assessments by Situations - Inexp NSs vs Exp NSs

The mean assessments of the inexperienced and experienced NSs as compared to that of the CASs indicates that in most of the situations the NSs had higher values than that of the CASs (See Table 30 and Figure 4). The mean assessments of the inexperienced NSs was lower than that of CASs only in three situations. Thus, as compared to CASs, inexperienced NSs may plan more audit procedures in most of the situations. The mean assessments of the experienced NSs was lower than that of the CASs in 7 of the 17 situations. Almost all these situations had the segregation of duties cue present, indicating that the experienced NSs placed a lot more importance on this cue than did the CASs. Thus, in the absence of the segregation of duties cue, experienced NSs may plan more audit procedures than CASs, while the presence of this cue may lead them to plan lesser procedures.

Inexperienced NSs had consensus scores that were comparable to that achieved by the CASs. One reason for this seemingly surprising result may be the fact that inexperienced NSs are the more recently hired employees, who may have had the benefit of exposure to computers and computer-related training in their college education. An analysis of the number of computer courses taken in college by the inexperienced and experienced NSs revealed that inexperienced NSs had taken an average of 2.8 courses in college with a mean 7.9 hours, while experienced NSs had an average of 2.1 courses with a mean 6.2 hours. Thus, the amount of exposure to computers in college for the two groups of NSs seems similar. However since the inexperienced NSs have been out of college for a lesser amount of time than the experienced NSs, they

may still retain some aspects of this exposure to computers and this may have translated into the higher consensus obtained by them.

Also, some of the firms have recognized the trends in the environment and have incorporated some basic aspects of computer controls in their staff training programs. Experienced NSs graduated from college before the micro-computer revolution that led to the spread of computers in college campuses. Thus, unless an experienced NS particularly wants to learn about computer controls, the opportunity to incorporate this knowledge is limited. This is indicated by the fact that the average hours of CPE training in Computer Controls/EDP Auditing for inexperienced NSs is about 12 hours, while for the experienced NSs this is only about 8.5 hours. Inexperienced auditors are being exposed to some aspects of auditing computerized systems in their initial training programs.

No significant differences were noticed in the judgment consistency of inexperienced and experienced CASs. One reason for this may be that the experiment did not have sufficient complexity for the CASs to reveal any experience effects.

6.2.4 Firm Affiliation Effects

Firm affiliation effects on consensus were found in this study. This confirms the findings of Cushing and Loebbecke, who found significant differences in the audit methodologies used by large firms.¹³⁴ This effect was more pronounced for NSs than for CASs. One reason for the difference between one NS firm and three other NS firms may be that there are indications that this firm rarely relies on computer controls in its audits. Two of the subjects from this firm had explicitly commented about this fact in the section of the questionnaire inviting feedback from the participants. Also, an analysis of the background information of the auditors from this firm revealed limited exposure to computers in both college and CPE training. While the auditors from this firm had taken about 2 computer-related courses in college, only two of the eight auditors from this firm had CPE training in computer-related auditing.

There are also indications that firm G, the other firm that had significantly lower consensus scores than CASs, has problems incorporating computers into its audit programs. Even the CASs from this firm are less specialists than liaison agents between computer experts and NSs. The seventeen NSs from this firm had an average of less than 1 hour of CPE exposure to computer-related auditing perhaps indicating the reason for the significantly lower consensus scores of the NSs from this firm.

¹³⁴ Cushing and Loebbecke, "Audit Methodologies"

One firm, firm F, had significantly higher consensus scores than the CASs. This firm is one of the leaders in the field of computer auditing, and is presently working to develop micro-computer software to fully computerize all aspects of auditing. This firm expects all of its audit teams to be using a personal computer in all of their audits in the near future, using the software being developed. The ten NSs from this firm had an average CPE exposure of 14 hours in EDP auditing.

6.2.5 Cue Usage

The analysis on cue usage revealed that CASs viewed two cues, access and changes to sensitive files cues, as the most important cues in their judgment process. Taken as a whole, the NSs also had similar cue usage pattern. However, when analyzed according to experience, it was evident that the segregation of duties cue, even though it was not the most important cue, was the second most important to experienced NSs. This fact also was illustrated more dramatically when the cue usage pattern of auditors blocked according to their firm affiliation was analyzed. Although the cue usage pattern of NS and CAS firms were very similar, analysis of one NS firm's auditors, firm H, revealed that segregation of duties cue was the most important cue to these auditors. One explanation may be that three of the seven partners who participated in the study were from this firm. All of these partners considered segregation of

duties cue as the most important cue, along with two other experienced auditors from this firm.

Experienced NSs considered segregation of duties cue a very important cue, which is consistent with the results obtained in earlier studies. Thus, there is a possibility that the more experienced NSs may place importance on an area that is most affected by computerization. This may lead to “overauditing”, since in the absence of segregation of duties controls, these auditors may decide not to rely on the computer controls, when compensating controls may, in fact, be present. However, a rather limited set of information was presented to the auditors in this study, and more research is thus suggested to verify if experienced NSs also look for compensating controls in computerized systems when segregation of duties is affected.

Inexperienced NSs had cue usage patterns that were similar to CASs and their consensus scores were also similar to CASs. This may mean that the younger NSs have had more recent exposure to computer training in their college education and CPE courses and this offsets their inexperience in auditing. However, this may also mean that in simple computerized operations CASs do not perceive enough of a complexity to involve their “specialized” knowledge, and hence make judgments that are more similar to inexperienced NSs than experienced NSs.

An alternate hypothesis is that experienced NSs are involved in more audits than CASs and inexperienced NSs. Thus, while CASs may recognize controls unique to computerized operations, experienced NSs may have a broader approach to controls, which may include some aspects that are unfamiliar to CASs. Thus, more research is suggested in this area to understand the consequences of the difference in cue usage between the experienced NSs and the others.

6.3 *Suggestions for Future Research*

Some suggestions for more research have already been made at the time of discussion of the results in the preceding sections. For instance, the findings indicate evidence that differences exist between NSs and CASs in their control risk assessments and an extension of this study would be to verify if this difference translates into differences in audit procedures.

As noted in the limitations above, all of the auditors were from Big 8 firms, who may be more prepared to counter the changing environments than other smaller firms. An extension of this study would be to compare the assessments made by auditors in smaller firms to verify if significant differences exist between the Big 8 firms NSs and the smaller firms NSs.

From the comments made by some of the participants, it was evident that some subjects make a combined assessment of inherent and control risk. An experimental study of how this affects the overall audit risk assessment and the subsequent audit program planning would be of interest to the firms, especially if this leads to understating the overall risk level, and hence performance of lesser than necessary procedures.

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Appendix A

Prior Studies in Internal Control Evaluations

In 1955, the American Institute of Accountants prepared a description of an actual business and distributed it to eight members of the committee on auditing procedure, inviting them to submit their views on the extent of audit sampling that would be necessary to express an unqualified opinion.¹³⁵ The resulting audit procedures that were drawn up by the eight accountants varied significantly from one another. Thus, the Institute could only conclude that "... no clear cut pattern exists."¹³⁶

In 1959, Stringer presented 92 auditors with identical data about financial statements, internal accounting control, the number of items in accounts, and

¹³⁵ American Institute of Accountants, "A Case Study on the Extent of Audit Samples," in *Some Early Contributions to the Study of Audit Judgment*, R. H. Ashton, Ed. (New York: Garland Publishing Inc., 1984), pp. 11-132.

¹³⁶ *Ibid*, p. 14.

the ranges and distributions of book values with respect to certain balances and transactions of a hypothetical company.¹³⁷ The auditors were asked to judgmentally select sample sizes for three audit procedures. The author noted a "... disconcerting lack of consensus in auditors' judgments,"¹³⁸ but no statistical analyzes were conducted to isolate the reason for the divergence of judgments, even though for one procedure the author varied the internal control from "poor" to "good".

It was not until 1974 that experimental studies were conducted to study auditors' judgment processes in internal control evaluations when Ashton conducted a pioneering study with sixty-three practicing auditors.¹³⁹ The auditors were given thirty-two fictitious payroll internal control cases. Each case contained six questions (factors) dealing with features of internal control that had been pre-answered yes or no by the author. An affirmative response to a question indicated a strength in the system; a negative response a weakness. To verify the degree of consistency in the auditors' internal control evaluation, Ashton required each subject to evaluate each system's overall strength on a six-point scale. Ashton also measured the self-insight exhibited by each auditor by requiring the auditors to distribute 100 points to the six factors accord-

¹³⁷ K. W. Stringer, "A Study of Judgment Consensus at Deloitte, Haskins & Sells," in *Some Early Contributions to the Study of Audit Judgment*, R. H. Ashton, Ed. (New York: Garland Publishing Inc., 1984), pp. 133-138.

¹³⁸ *Ibid*, p. 135.

¹³⁹ R. H. Ashton, "An Experimental Study of Internal Control Judgments," *Journal of Accounting Research*, Spring 1974, pp. 143-157.

ing to the relative importance the auditor felt he had placed on each factor. Ashton noticed judgmental consensus of average Pearson Product Moment correlation of 0.70, indicating quite high consistency in judgments. Ashton also replicated the experimental exercise between forty-three and ninety-four days later to assess the stability of the auditors' decisions over time. Again, very high judgmental consistency was noted. Also, the auditors exhibited good self-insights into their judgment process. Two cues dealing with segregation of duties explained most of the variance in the auditors' judgments.

Ashton and Brown replicated Ashton's 1974 study, with some modification¹⁴⁰. Two additional questions were added to the original six factors, thus producing a more extensive decision task. The two additional cues dealt with rotation of duties. Thirty-one auditors participated in the study and were asked to evaluate one-hundred and twenty-eight cases. In addition, thirty-two repeat cases were also given to the auditors to assess judgment stability. Judgment consensus exhibited by the auditors was again high (mean correlation of 0.67). Again, very high self-insights were exhibited by the auditors (mean correlation of 0.86). As in the original study, the separation of duties cues explained most of the variance in auditor judgments. The rotation of duties cues explained very little of the variance in the judgments.

¹⁴⁰ R. H. Ashton and P. R. Brown, "Descriptive Modeling of Auditors' Internal Control Judgments: Replication and Extension," *Journal of Accounting Research*, Spring 1980, pp. 269-277.

Ashton and Kramer replicated Ashton's 1974 study with accounting students serving as surrogates for practicing auditors¹⁴¹. Each of the thirty auditing students completed the original experiment involving thirty-two cases and six factors. Both the students' judgmental consensus and self-insights were lower than that exhibited by the auditors. Also, the students did not place as much importance on the separation of duties cues as did the auditors, implying a lack of expertise on the part of the students.

Reckers and Taylor conducted a study in 1979 to assess the impact of length of auditing experience on judgment consensus of both practicing auditors and auditing professors¹⁴². Thirty auditors and forty professors were asked to evaluate the reliance of internal control systems on five fictitious cases. Each of the cases contained thirty-six factors representative of internal control features. The mean consensus was very low, 0.16 for auditors and 0.13 for professors. However, the authors did obtain some evidence of impact of experience on consensus. For a group of practitioners who exceeded median experience level of 7.5 years, the mean consensus was 0.36, while the mean consensus of the practitioners with less than the median level of experience was 0.14. This led the authors to conclude that more junior auditing personnel may tend to "overaudit". The conclusions drawn by the authors was dis-

¹⁴¹ R. H. Ashton and S. S. Kramer, "Students as Surrogates in Behavioral Accounting Research: Some Evidence," *Journal of Accounting Research*, Spring 1980, pp. 1-15.

¹⁴² P. M. J. Reckers and M. E. Taylor, "Consistency in Auditors' Evaluations of Internal Accounting Controls," *Journal of Accounting, Auditing, and Finance*, Fall 1979, pp.42-53.

puted by Ashton.¹⁴³ Noting that "...the authors do not provide any rationale concerning the selection of cases that were used, nor any indications of the representativeness of these cases vis-a-vis audit practice,"¹⁴⁴ Ashton questioned the generalizations drawn by them.

Joyce conducted a study with thirty-five practicing auditors evaluating fictitious accounts receivable internal control cases, each of which contained five dichotomously scaled internal control factors¹⁴⁵. The auditors had to indicate the number of man-hours they would allocate to five distinct categories of audit procedures for each case reviewed. As with the previous findings, one factor pertaining to separation of duties was shown to be important to the auditors' judgments. However, contrary to the earlier results, the consensus among auditors on their assessment of hours to be allocated to specific procedures was low (mean consensus of 0.37).

Mock and Turner studied the effect of internal control changes on the auditors' judgments¹⁴⁶. Seventy-three practicing auditors were given only one case

¹⁴³ R. H. Ashton, "Comment: Some Observations on Auditors' Evaluations of Internal Accounting Controls," *Journal of Accounting, Auditing, and Finance*, Fall 1979, pp. 56-66.

¹⁴⁴ *Ibid*, p. 62.

¹⁴⁵ E. J. Joyce, "Expert Judgment in Audit Program Planning," *Studies in Human Information Processing in Accounting*, Supplement to *Journal of Accounting Research*, 1976, pp. 29-60.

¹⁴⁶ T. J. Mock and J. L. Turner, "The Effect of Changes in Internal Controls on Audit Programs," in *Behavioral Experiments in Accounting*, Burns, Ed. (Columbus: Ohio State University, 1979), pp. 277-302.

which dealt with a company's revenue cycle and were asked to make judgments relative to the appropriate sample sizes for four substantive audit tests. For one half of the auditors, the cases reflected a marked improvement in internal controls; for the other half, the internal controls only slightly improved. The results showed that auditors whose case reflected a substantially improved internal control system recommended smaller substantive sample sizes. However, a considerable amount of inconsistency was found in the sample size recommendations among the subjects.

Weber had forty auditors study simulated data and working papers that indicated strengths and weaknesses in one hypothetical inventory system.¹⁴⁷ The subjects were required to perform several tasks, including estimating the dollar error in three types of inventory, estimating the sensitivity of the dollar error to the occurrence of several types of internal control weaknesses, and estimating the number of hours required to complete the inventory audit. After the responses had been made, the actual dollar error in the inventory was communicated to the subjects, and they were allowed to revise their initial audit plans. One group of subjects had access to an interactive computer-based simulation aid, while the other did not. The results showed that the subjects who had access to the decision aid made more "accurate" decisions and took less time than those who did not have access to the aid. However,

¹⁴⁷ R. Weber, "Auditor Decision Making on Overall System Reliability: Accuracy, Consensus, and the Usefulness of a Simulated Decision Aid," *Journal of Accounting Research*, Autumn 1978, pp. 368-388.

access to the aid did not affect the number of hours estimated to complete the audit, and those who had access to the aid specified a wider range of possible error amounts than did the other group.

Hamilton and Wright extended Ashton's study by reconstructing his six factors into five factors by eliminating two factors and expanding two separation-of-duties cues into three cues.¹⁴⁸ The authors hypothesized that increased situational experience and exposure to training programs over time should result in similar internal control evaluations, given the same situations. Seventy-eight auditors and a large sample of accounting students (representing inexperienced auditors) evaluated thirty-two internal control cases based on the five cues. A high degree of consensus was noted, but surprisingly, the mean correlation of experienced auditors (0.71) was less than the mean correlation of inexperienced auditors (0.73). Slightly more insight (mean 0.81) was exhibited by the experienced auditors than the inexperienced auditors (mean 0.70). Thus the results did not support the author's expectation of association between experience and consensus.

Gaumnitz, Numamaker, Surdick, and Thomas tried to reconcile Ashton's 1974 study and Joyce's 1976 study.¹⁴⁹ The authors hypothesized that while different

¹⁴⁸ R. E. Hamilton and W. F. Wright, "Internal Control Judgments and Effects of Experience: Replications and Extensions" *Journal of Accounting Research*, Autumn 1982, pp. 756-765.

¹⁴⁹ B. R. Gaumnitz, T. R. Nunamaker, J. J. Surdick and M. F. Thomas, "Auditor Consensus in Internal Control Evaluation and Audit Program Planning," *Journal of Accounting Research*, Autumn 1982, pp. 745-755.

auditors might generally agree on the quality of internal control, they may disagree on how much audit work should be performed. Thirty-five auditors from four offices of a national firm were given twenty audit cases, requiring them to make explicit judgments of the quality of internal control and also to estimate the number of hours required to audit the accounts. The mean correlation for internal control evaluations was high (0.704), but the mean correlation for audit hours estimate was 0.617, which was much higher than that noted by Joyce (0.373). Thus, consensus was achieved across the auditors for both internal control evaluation and credit program planning tasks. Hence the findings were consistent with Ashton's but inconsistent with Joyce's results.

Trotman, Yetton and Zimmer investigated the differences in individual and group judgments since they felt that in practice internal control evaluations may be performed by teams.¹⁵⁰ Thirty-two cases with ten cues dealing with internal control over payroll were evaluated by 105 accounting majors, first individually, and then in groups of two or three. The cases were constructed following a 1/32 fractional replication of the ten factors. The findings showed that individuals had less consensus (mean 0.56) than either the two-member (mean 0.69) or three-member (mean 0.79) groups. Self-insights for individuals was also less than for the groups. However, the composite unit weights of both the groups was higher than the interacting group consensus, leading the au-

¹⁵⁰ K. T. Trotman, P. W. Yetton and S. R. Zimmer, "Individual and Group Judgments of Internal Control System," *Journal of Accounting Research*, Spring 1983, pp. 286-292.

thors to conclude that there was no justification for the introduction of group judgments to replace individual judgments since performance could be improved just by combining individual judgments.

Tabor addressed the issue of internal control evaluation and subsequent audit program planning decisions, as in Gaumnitz *et al.* study.¹⁵¹ Subjects, 109 auditors from four firms, were presented with twelve cases, representing a 2 x 3 x 2 factorial design of three internal control factors (one factor had three levels). The subjects were required to make the following judgments: (1) judgment about the reliability of controls; (2) decisions for statistically determined sample sizes for compliance test and a preliminary decision for a statistically determined substantive test sample size; (3) another judgment about the degree of reliability of internal accounting controls after given compliance test results; and (4) final decisions on a substantive test sample size after evaluating the compliance test results. Despite collecting four judgments from each subject, the author's analysis and results are based on only two judgments: the reliability judgments about internal control, and the preliminary substantive test sample size. The mean consensus index for the reliability judgment was 0.76, and for the sample size decision, 0.69. These were about equal to those obtained by Ashton and Gaumnitz *et al.* and much higher than that obtained by Joyce. Some variations were noticed among firms, but almost no differences in experience levels resulted.

¹⁵¹ R. H. Tabor, "Internal Control Evaluations and Audit Program Revisions: Some Additional Evidence," *Journal of Accounting Research*, Spring 1983, pp. 348-354.

Nanni investigated the effects of firm affiliation, audit experience, audit responsibility, and internal control evaluation experience of auditors on their internal control evaluations.¹⁵² Thirty auditors, responding by mail, provided reliability assessments to 16 cases dealing with four manipulated control variables. The auditors provided reliability assessments on a ten point scale on three objectives, accounting, authorization, and the safeguarding of assets. Using MANOVA, the author noted that firm affiliation, years of experience, and internal control evaluation experience did provide significant differences in the auditors' assessments. These results, particularly the effect of experience on the assessments, were quite different from what had been obtained by earlier researchers.

Nichols used copies of completed internal control questionnaires and documentation of auditors' preliminary evaluation of control over accounts receivables/sales transactions from seventy-nine actual audits conducted by one office of a large public accounting firm to construct a two-group linear discriminant analysis model of the auditors' judgments.¹⁵³ A 79.75 percent predictive ability was achieved by the model. Though the results were not directly comparable to the results of previous laboratory research, it was still

¹⁵² A. J. Nanni, Jr., "An Exploration of the Mediating Effects of Auditor Experience and Position in Internal Accounting Control Evaluation," *Accounting, Organization and Society*, 1984, Vol 9, No. 2, pp. 149-163.

¹⁵³ D. R. Nichols, "A Model of Auditors' Preliminary Evaluations of Internal Control from Audit Data," *The Accounting Review*, January 1987, pp.183-190.

noticed that the auditors viewed separation of duties as the most important control activity in the cues studied.

In the only published study to involve CASs, Biggs *et al.* investigated the decision processes of CASs in evaluating EDP controls in advanced computer environments, as part of their larger project to construct an expert system in EDP auditing.¹⁸⁴ Three CASs participated in a verbal protocol analysis of one very detailed case, containing over 40 pages of information. The case also was performed by 14 individuals and 20 groups that were not required to think aloud. The results indicated that while a high percentage of all subjects identified a majority of the controls in the case, two of the three protocol subjects identified more controls than the other subjects, suggesting greater expertise of the CASs. There was considerable agreement across all subjects over the controls identified. However, surprisingly, the CASs tended to rely on manual controls as opposed to EDP controls, and suggested procedures that were more of "auditing around the computer" in nature. Protocol analysis suggested that this was due to cost-benefit tradeoffs made by the CASs.

¹⁸⁴ S. F. Biggs, W. F. Messier, Jr., and J. V. Hansen, "A Descriptive Analysis of Computer Audit Specialists' Decision-Making Behavior in Advanced Computer Environments," *Auditing: A Journal of Practice & Theory*, Spring 1987, pp. 1-21.

Appendix B

Research Instrument

The entire research instrument is enclosed as Appendix B.

INTRODUCTION

The purpose of this project is to study auditors' evaluations of control risk. Your participation in this project is especially important because you are a professional familiar with internal controls. The study is divided into four parts (Parts I - IV).

Part I consists of general background information on a hypothetical company, Southern Inc., who is your audit client.

Part II consists of 21 versions of a one-page excerpt of a completed internal control questionnaire on the Accounts Receivable cycle of Southern Inc. For each version you are asked to assess the amount of control risk you perceive in the subsystem. A sample solved version is given first to familiarize you with the task. Please respond to each situation in two ways: by placing a X on a scale of 0 to 100%, and by writing your response in a corresponding box. ***The written response will be considered your answer.*** Both responses should be the same for a particular situation.

Part III of the study will collect additional information about your assessments.

Part IV is a questionnaire about the project and about your background.

As you read through the remainder of the booklet, please keep the following points in mind.

1. Only a limited amount of information is presented in the cases relative to the amount of information normally available in a real-world auditing situation.
2. There are no incorrect answers to the questions you will be asked - the concern is that you accurately represent your beliefs.
3. It is important that you do not discuss this study with anyone in the office until the project is completed.
4. Your responses will remain completely confidential.

Thank you for your participation. If you would like a summary of the results, please fill out and mail separately, the self-addressed postage-paid card provided with the materials.

Part I - Background Information

Assume you are auditing the accounts of Southern Inc., a medium-sized manufacturing company. Southern manufactures and sells machine parts from its only plant in Southwestern Virginia. The company is privately held, professionally managed, and has been your firm's audit client since 1976. Southern has always received an unqualified audit report.

The company's headquarters are located in the factory premises. All of its accounting records are processed using a remote-entry batch-oriented system. A traditional file processing system is used, and the transactions are processed using COBOL application programs. A separate EDP department handles all the data processing activities.

The Accounts Receivable Department has terminals which are used principally for accounting transactions. The customer master files contain all information about customers, including their credit status. Customer master files are stored on tape. The Sales Order Department also has terminals used for order entry. Orders received over the phone are immediately entered into the system and processed later in the day. The Distribution Department has two terminals used for shipping records.

At 3-31-1987, the company's gross accounts receivable totalled \$889,416.

An analysis of the receivable accounts revealed:

Aging

Days	Number of Accounts	% of Total	Amount	% of Total
0 - 30	680	59	\$578,040	65
30 - 60	242	21	222,319	25
60 - 90	127	11	62,260	7
90 -120	80	7	17,788	2
> 120	26	2	9,009	1
Total	<u>1155</u>	<u>100</u>	<u>\$889,416</u>	<u>100</u>

Bad debt allowance

Amount	\$26,675
Percent of Receivables	3%

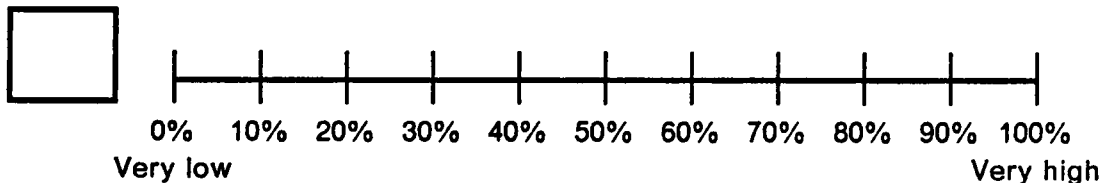
Part II
EXAMPLE

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?		X
2. Is the initiation of transactions performed outside the EDP department?		X
3. Are there formal procedures established to control access to customer master files by authorized personnel only?		X
4. Is the preparation of source documents performed outside the EDP department?		X
5. Are there formal procedures established for changes to customer master files?		X
6. Are error corrections performed outside the EDP department?		X
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?		X
8. Are reasonableness checks performed on all key fields at the time of input?		X
9. Are all customer master files physically protected against damage by fire or other accidental damage?		X

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box.)



If all controls are missing, the control risk would be rated "Very high" (100%); the control risk could be rated below this only if some controls are present.

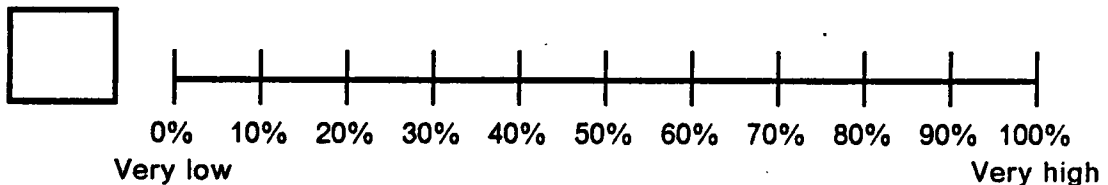
SITUATION 1

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?		X
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?	X	
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?	X	
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?		X
8. Are reasonableness checks performed on all key fields at the time of input?	X	
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



SITUATION 2

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?	X	
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?	X	
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?	X	
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?	X	
8. Are reasonableness checks performed on all key fields at the time of input?	X	
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



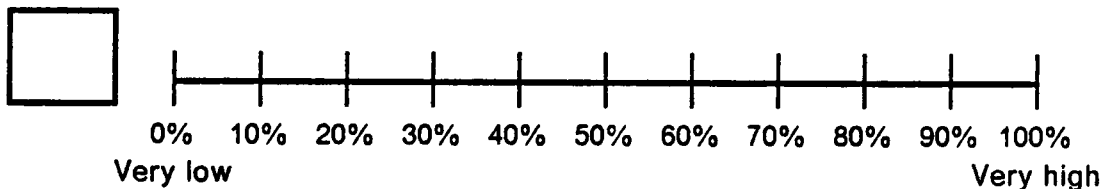
SITUATION 3

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?		X
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?		X
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?		X
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?	X	
8. Are reasonableness checks performed on all key fields at the time of input?		X
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



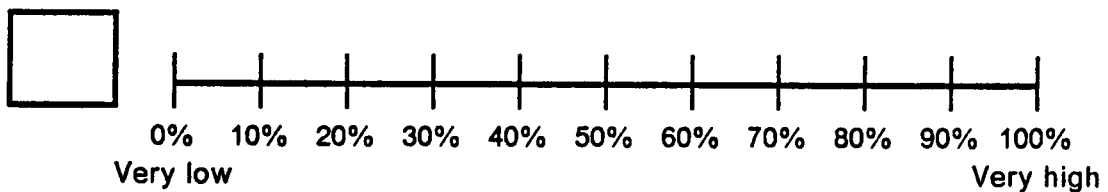
SITUATION 4

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?		X
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?	X	
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?		X
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?	X	
8. Are reasonableness checks performed on all key fields at the time of input?	X	
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



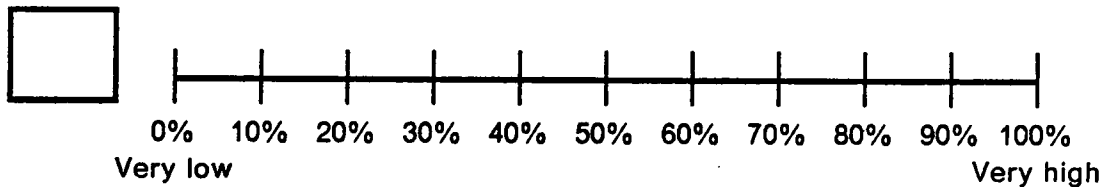
SITUATION 5

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?	X	
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?	X	
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?	X	
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?		X
8. Are reasonableness checks performed on all key fields at the time of input?		X
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



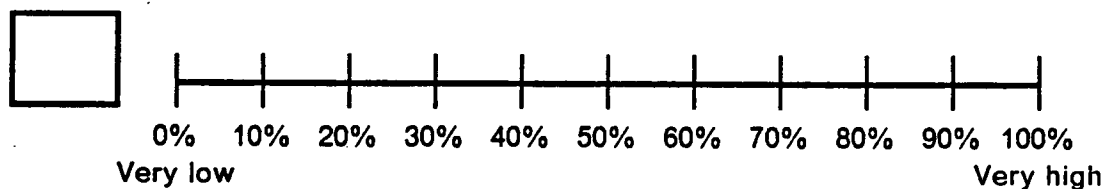
SITUATION 6

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?		X
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?		X
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?	X	
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?	X	
8. Are reasonableness checks performed on all key fields at the time of input?	X	
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



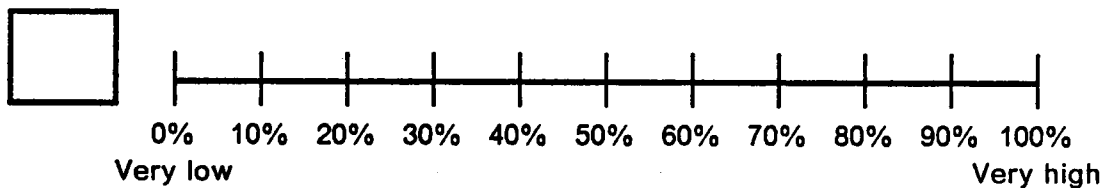
SITUATION 7

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?		X
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?		X
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?		X
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?		X
8. Are reasonableness checks performed on all key fields at the time of input?	X	
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



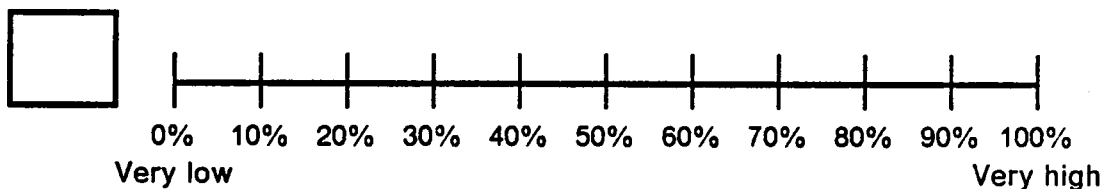
SITUATION 8

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?	X	
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?	X	
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?		X
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?		X
8. Are reasonableness checks performed on all key fields at the time of input?	X	
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



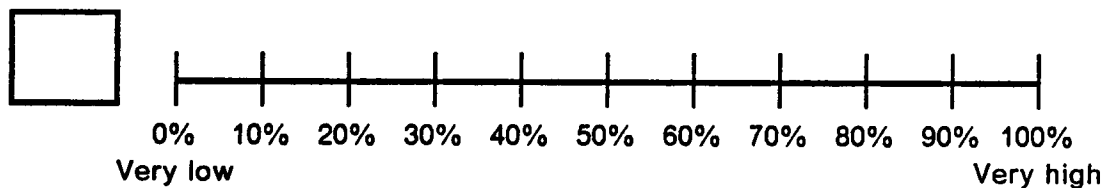
SITUATION 9

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?	X	
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?		X
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?		X
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?		X
8. Are reasonableness checks performed on all key fields at the time of input?		X
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



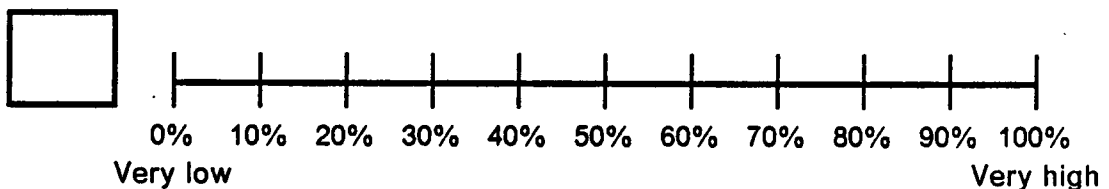
SITUATION 10

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?		X
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?	X	
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?	X	
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?	X	
8. Are reasonableness checks performed on all key fields at the time of input?		X
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



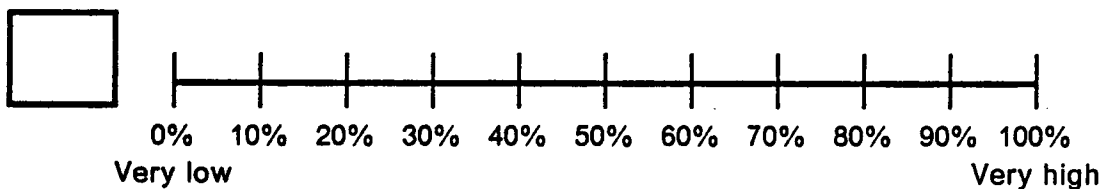
SITUATION 11

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?		X
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?		X
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?		X
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?		X
8. Are reasonableness checks performed on all key fields at the time of input?		X
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



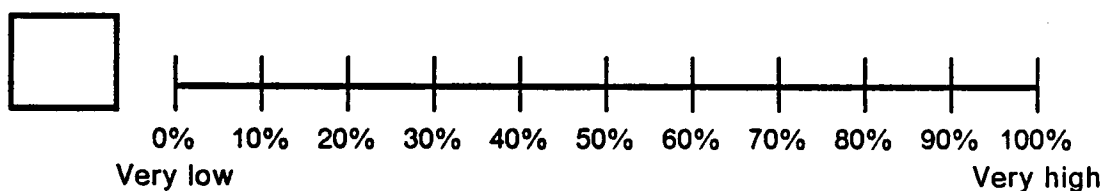
SITUATION 12

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?	X	
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?		X
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?	X	
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?		X
8. Are reasonableness checks performed on all key fields at the time of input?	X	
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



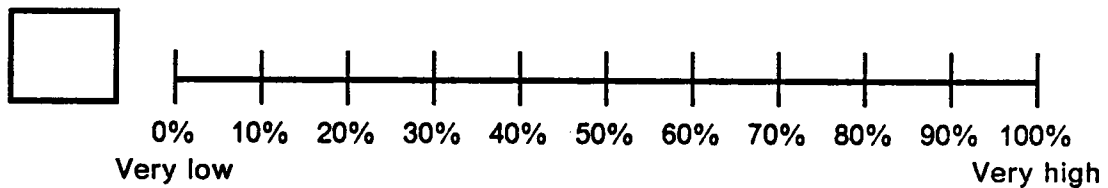
SITUATION 13

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?	X	
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?		X
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?		X
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?	X	
8. Are reasonableness checks performed on all key fields at the time of input?	X	
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



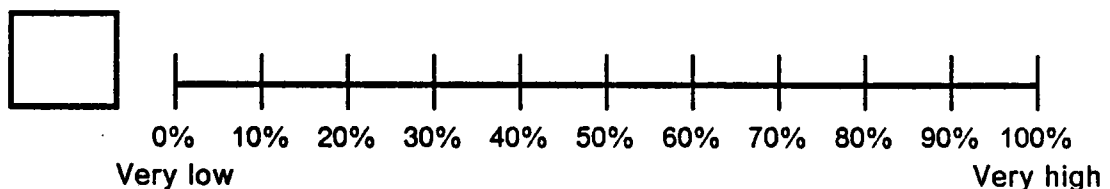
SITUATION 14

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?	X	
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?	X	
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?		X
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?	X	
8. Are reasonableness checks performed on all key fields at the time of input?		X
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



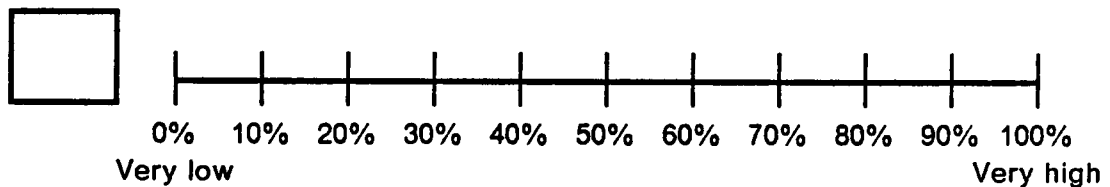
SITUATION 15

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?	X	
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?		X
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?	X	
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?	X	
8. Are reasonableness checks performed on all key fields at the time of input?		X
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



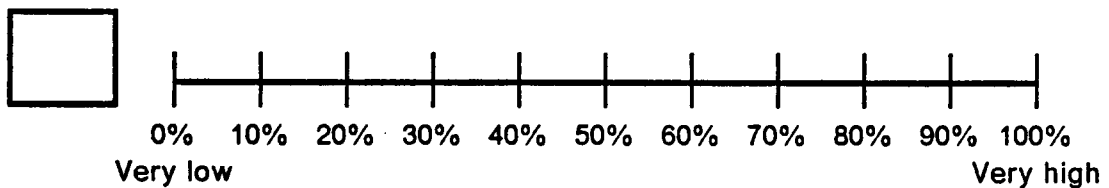
SITUATION 16

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?		X
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?	X	
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?		X
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?		X
8. Are reasonableness checks performed on all key fields at the time of input?		X
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an **X** on the scale and write your response in the box)



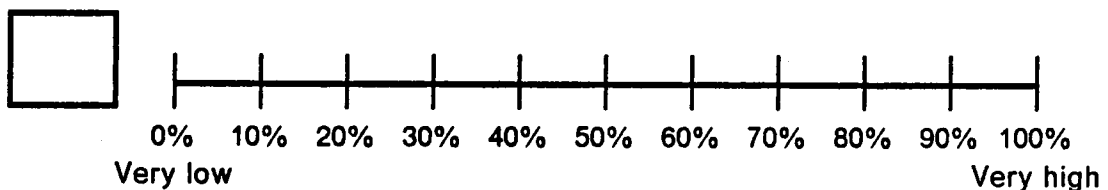
SITUATION 17

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?		X
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?		X
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?	X	
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?		X
8. Are reasonableness checks performed on all key fields at the time of input?		X
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



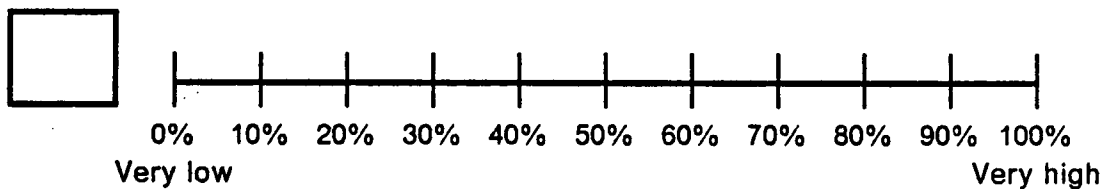
SITUATION 18

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?		X
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?		X
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?		X
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?	X	
8. Are reasonableness checks performed on all key fields at the time of input?		X
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



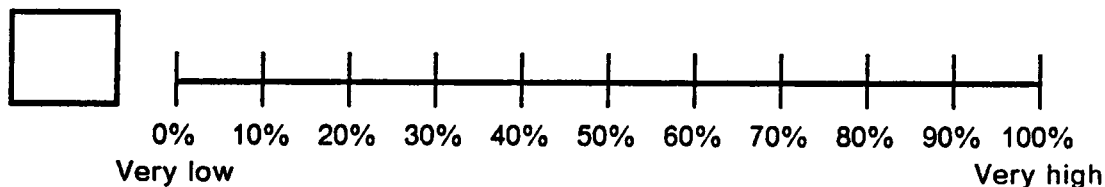
SITUATION 19

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?		X
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?		X
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?	X	
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?	X	
8. Are reasonableness checks performed on all key fields at the time of input?	X	
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



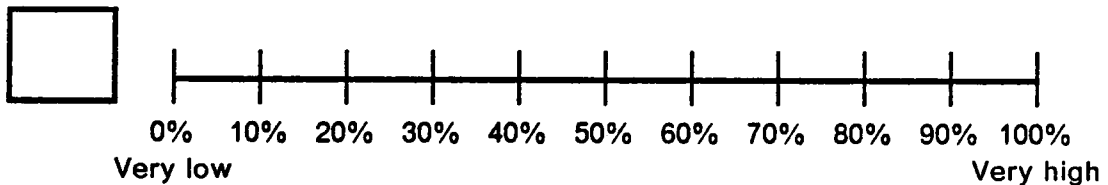
SITUATION 20

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?	X	
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?		X
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?		X
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?		X
8. Are reasonableness checks performed on all key fields at the time of input?		X
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



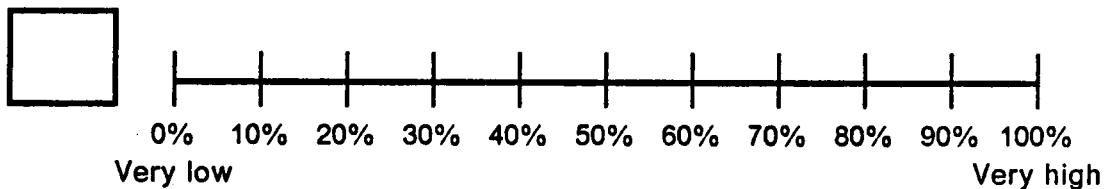
SITUATION 21

As part of the evaluation of internal control over the receivable subsystem, you note the following:

	Yes	No
1. Are batch controls for source documents sent for processing verified by personnel independent of the Accounts Receivable department?	X	
2. Is the initiation of transactions performed outside the EDP department?	X	
3. Are there formal procedures established to control access to customer master files by authorized personnel only?		X
4. Is the preparation of source documents performed outside the EDP department?	X	
5. Are there formal procedures established for changes to customer master files?	X	
6. Are error corrections performed outside the EDP department?	X	
7. Are there programmed procedures for checking the credit status of customers prior to processing orders?		X
8. Are reasonableness checks performed on all key fields at the time of input?	X	
9. Are all customer master files physically protected against damage by fire or other accidental damage?	X	

Based on the above information, the assessment you will make about control risk in the accounts receivable subsystem is: (in percent)

(Please place an X on the scale and write your response in the box)



Part III

We are interested in knowing how important some of the control factors were in the assessments you have just made. Please allocate 100 points across the factors which are listed below. Your basis for allocation is the relative importance that you feel you have placed on the factors in rendering your judgment. If there are factors listed below which were of no importance to you, you should allocate 0 points to those factors.

<i>Factor description</i>	<i>Points</i>
1. Independent verification of batch controls	_____
2. Use of formal procedures to control access to customer master files	_____
3. Use of formal procedures for changes to customer master files	_____
4. Use of programmed procedures to check customer credit status before order processing	_____
5. Performance of reasonableness checks on all fields at the time of input	_____
Total points allocated	<u>100</u>

Part IV - Questionnaire

1. Your designation in the firm? (circle)
 Staff Auditor Senior Computer Auditor Manager Other _____
2. What was your undergraduate major? _____
3. Do you have a graduate degree? (circle) Yes No
 If yes, what degree? _____ major? _____
4. How many computer related courses did you take in school/college?
 _____ number _____ hours
5. Professional Certification? (circle)
 CPA CMA CDP CISA Other _____
6. How long have you worked with the present firm? ____yrs ____mos
7. How much auditing experience do you have? ____yrs ____mos
8. How many audits were you involved in the last year? _____ number
 How many of these audits involved clients with
 computerized accounting applications? _____ number
9. Have you attended any CPE courses or seminars on the topic of
 EDP auditing or Auditing Computer Systems? (circle) Yes No
 If yes, how many? ____courses ____hours when? _____year(s)
10. How realistic was the task you performed?

Extremely Unrealistic		Moderately Realistic				Extremely Realistic	
11. How difficult was it to make the required assessments?

Not Difficult		Moderately Difficult				Extremely Difficult	
12. What are your comments concerning this project?

Thank you, once again, for your cooperation.

Appendix C

Computer Programs

All the programs run on SAS for data analysis are enclosed as Appendix C.

TITLE 'RAW SCORES OF NSs';

DATA RESP;

INPUT N;

DO I=1 TO N;

INPUT RESPONSE @@;

OUTPUT;

END;

CARDS;

1241

90 60 75 60 60 80 15 40 40 50 70 70 10 10 60 40 0
90 90 80 80 100 90 50 80 80 80 80 90 40 40 60 80 10
70 60 50 60 80 70 40 30 50 50 60 60 40 30 40 60 10
70 60 60 70 60 60 30 30 30 40 30 30 30 50 50 10
70 50 70 70 60 70 40 40 20 60 30 30 40 60 60 65 0
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98 94 95 85 98 99 59 78 89 89 90 93 50 51 60 93 10
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80 75 60 70 50 70 20 20 40 10 50 40 30 25 8 20 5
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90 85 75 70 65 90 25 50 60 55 60 80 45 20 50 55 15
80 70 60 60 80 80 30 40 30 40 50 70 30 20 50 30 10
90 80 60 80 80 90 50 60 60 70 70 80 30 50 60 70 10
85 90 80 70 85 90 75 80 75 70 70 90 15 10 75 65 10
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;
PROC UNIVARIATE; VAR RESPONSE;

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//
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TITLE 'RAW SCORES OF CASs';

DATA RESP;

INPUT N;

DO I=1 TO N;

INPUT RESPONSE @@;

OUTPUT;

END;

CARDS;

697

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90 80 70 70 90 80 30 60 70 50 50 60 70 30 70 70 10
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75 75 55 75 75 70 25 45 40 55 60 75 25 30 35 60 10
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;

PROC UNIVARIATE; VAR RESPONSE;

//

/*

TITLE 'COMPARISON OF NSs AND CASs CONSENSUS - PEARSON';

DATA CONS;

INPUT G \$ N;

DO I=1 TO N;

INPUT RESPONSE @ @;

OUTPUT;

END;

CARDS;

NS 2628

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TITLE 'COMPARISION OF NSs AND CASs CONSENSUS - SPEARMAN';

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DO I=1 TO N;

INPUT RESPONSE @ @;

OUTPUT;

END;

CARDS;

NS 2628

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PROC UNIVARIATE; VAR RESPONSE; BY G;  
PROC NPAR1WAY; CLASS G; VAR RESPONSE;  
//  
/*
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TITLE 'COMPARISON OF RELIABILITY - NSs VS CASS- PEARSON';

DATA NSREL;

INPUT G \$ N;

DO I=1 TO N;

INPUT RESPONSE @@;

OUTPUT;

END;

CARDS;

NS 73

.8480001 .901 1 .84 .225 .9770001 .942

.87 0 .198 .997 .8980001 .87 .9770001

.8850001 .993 .851 .9950001 .707 .943 .8020001

.966 .956 1 .9960001 .997 .984 .997

-.8660001 .324 .8940001 .9040001

.9270001 .8160001 1 .34 .8250001 .897 .426

.8290001 .577 .9040001 .9910001 .9270001 -1 .674

.8160001 .845 .577 .8980001 .943 .9500001 .8710001

.9040001 .9670001 .8670001 0 .573 .8520001 .9300001

.548 .7330001 .7510001 .9910001 .952 .205 0

.707 .688 .279 1 .333 .302

CAS 41

.258 .6120001 -.333 .942 -.577 0 .947

.9040001 .8750001 1 .9900001 .9710001 .809 .9830001

.8160001 .966 .9040001

.61 1 .9480001 .993 .14 .9590001 .058

.292 .989 .841 .9820001 .962 .8570001 .9910001

.9760001 .993 .9480001 .738 .9540001 .721 .9530001

.9900001 .924 .943

;

PROC UNIVARIATE; VAR RESPONSE; BY G;

PROC NPAR1WAY; CLASS G; VAR RESPONSE;

//

/*

TITLE 'COMPARISION OF RELIABILITY - NSs vs CASs - SPEARMAN';

DATA NSREL;

INPUT G \$ N;

DO I=1 TO N;

INPUT RESPONSE @@;

OUTPUT;

END;

CARDS;

NS 73

.8 .8 1 .9480001 .258 .8160001 .942

.8160001 -.4 .333 1 .9480001 .7370001 .9480001

.8 .9480001 .777 .942 .6 .9480001 .8330001

1 .8 1 1 .8940001 .9480001 1

-8330001 .5 1 .942

.9480001 .942 1 .105 .8 .8 .5

.316 .577 .942 1 .8160001 -1 .4

.8160001 .9480001 .577 .9480001 .9480001 .888 .5

.942 .8 .8 0 .5 .8330001 .6

.7370001 .7370001 .632 .942 1 .2 0

.5 .707 .316 1 .333 .4

CAS 41

.258 .632 -.333 1 -.577 0 1

.942 .8 1 1 .9480001 .8 1

.942 .9480001 .942

.7370001 1 .8940001 .8160001 .5 1 .333

.258 1 .6 .888 .942 .8 1

.9480001 1 .9480001 .5 .9480001 .8 .8

.9480001 .888 .9480001

;

PROC UNIVARIATE; VAR RESPONSE; BY G;

PROC NPAR1WAY; CLASS G; VAR RESPONSE;

//

/*

```

options ls=80;
title 'comparision of insight scores - cas vs ns - pearson';
data ins;
input g $ n;
do i=1 to n;
input response @ @;
output;
end;
cards;
ns 73
0.822 0.919 0.745 0.401 0.837 0.674 0.938 0.917 0.493 0.897
0.877 0.936 0.987 0.245 0.688 0.965 0.923 0.188 0.827 0.925
0.977 0.927 0.866 0.876 0.901 0.790 0.933 0.911 0.969 0.957
0.713 0.873 0.617 0.231 0.792 0.770 0.899 0.454 0.861 0.863
0.879 -.154 0.952 0.872 0.585 0.042 0.725 0.539 0.586 0.662
0.981 0.993 0.931 0.825 0.966 0.929 0.643 0.527 0.900 0.657
0.936 0.636 0.942 0.620 -.026 0.776 0.622 0.971 0.879 0.889
0.906 0.959 0.941
s 40
0.401 0.925 0.840 0.707 0.677 0.994 0.675 0.993 0.914 0.980
0.968 0.111 0.989 -.333 0.713 0.809 0.204 0.607 0.960 0.370
0.726 0.848 0.944 0.844 0.799 0.936 0.976 0.818 0.875 0.672
0.561 0.966 0.999 0.980 0.380 0.920 0.963 0.985 0.710 0.824
;
proc univariate; by g;
proc npar1way; class g; var response;
//
/*

```

```

options ls = 80;
title 'comparision of insight scores - cas vs ns - pearson';
data ins;
input g $ n;
do i = 1 to n;
input response @ @;
output;
end;
cards;
ns 73
0.921 0.916 0.500 0.486 0.917 0.811 0.790 0.820 0.579 0.894
1.000 1.000 0.921 0.344 0.888 0.700 0.894 0.263 0.790 0.763
0.921 0.974 0.974 0.666 0.737 0.892 0.973 0.973 0.948 0.974
0.718 0.974 0.564 0.223 0.600 0.737 1.000 0.500 0.802 0.666
0.432 0.078 0.892 0.730 0.300 -.057 0.811 0.405 0.527 0.917
0.900 0.763 0.648 0.872 1.000 0.763 0.948 0.459 0.974 0.458
0.359 0.270 0.948 0.573 0.000 0.289 0.526 0.974 0.648 0.737
0.540 0.872 0.802
s 40
0.316 0.865 0.916 0.718 0.688 0.917 0.763 0.917 0.648 0.894
0.948 0.316 0.948 -.250 0.666 0.700 0.229 0.583 0.921 0.324
0.763 0.666 0.883 0.900 0.289 0.921 0.948 0.974 0.974 0.815
0.394 0.573 0.894 0.763 0.176 0.917 0.917 0.917 0.630 0.892
;
proc univariate; by g;
proc npar1way; class g; var response;
//
/*

```

TITLE 'COMPARISON OF EXP VS INEXP NSs CONSENSUS - PEARSON';

DATA NS;

INPUT G \$ N;

DO I=1 TO N;

INPUT RESPONSE @ @;

OUTPUT;

END;

CARDS;

IEN 820

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EN 496

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```
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PROC UNIVARIATE; BY G;  
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
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```
//  
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```

TITLE 'COMPARISON OF EXP VS INEXP NSs CONSENSUS - SPEARMAN';

DATA NS;

INPUT G \$ N;

DO I=1 TO N;

INPUT RESPONSE @ @;

OUTPUT;

END;

CARDS;

EN 496

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.6529413 .7713236 .7816176 .6823529 .807353 .6558825 .7257353
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.7242648 .419853 .782353 .4727941 .5455883 .3036765 .519853
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.6764706 .6632353 .7485295 .8727941 .8882352 .7801471 .7139706
.5919118 .5573529 .5161766 .6308824 .6845588 .8448529 .6
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.3139706 .8058823 .9022059 .8529411 .6389706 .7625 .5154412
.7757353 .6676471 .677206 .7816176 .6117648 .8125 .8889706
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.5294118 .6205883 .3816177 .5602941 .7705883 .7794118 .7272059
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.7147059 .4794118 .7294118 .669853 .5654412 .7772059 .6227941
.5676471 .6169118 .7691176 .6375 .6963235 .8830882 .8235295
.9080882 .8360295 .8580882 .7455883 .6779412 .6639706 .7816176
.3830882 .4654412 .642647 .6764706 .4029412 .6860295 .3397059
.3580883 .6852941 .6080883 .6705883 .7183825 .4154412 .3889706
.4360295 .45 .1632353 .7213235 .5080882 .4801471 .625
.2955883 .2352941 .2970588 .5492648 .5220589 .4794118 .6110294
.5683824 .6617648 .6301471 .6808823 .719853 .5566176 .4161765
.4786765 .7764706 .8191178 .7205882 .6161765 .7308824 .5860295
.5875 .55 .6536765 .6985295 .6683824 .8904412 .7764706
.7426471 .7808825 .7375 .4147059 .6595588 .4345588 .5029412
.5213237 .6801471 .6514706 .6029411 .6007353 .5264706 .8676471

.6132353 .775 .7147059 .8294118 .7235294 .5235294 .6808823
.6661765 .8352941 .7514706 .7213235 .5757353 .7882353 .6625
.719853 .769853 .7507353 .7926471 .8455882 .8867647 .8183824
.8286765 .725 .4676471 .7095589 .5102941 .6154412 .6514706
.6838235 .6632353 .8470588 .6183823 .5625 .8154412 .6169118
.8036765 .677206 .8544118 .6264706 .5125 .7169118 .7845588
.7830882 .7647059 .725 .7779413 .7808825 .8352941 .8242647
.8286765 .9169118 .9139706 .8647059 .85 .8830882 .7029412
.5933825 .7367648 .580147 .7610295 .7301471 .7191176 .7558824
.8492648 .7830882 .782353 .9 .7669118 .8779412 .8463236
.9507352 .6933824 .6338235 .7933824 .8632353 .5213237 .6404412
.5970588 .6492647 .7808825 .7389706 .9264706 .7617647 .6955883
.7419118 .7463235 .6816176 .4742648 .7389706 .7536765 .4338236
.5617647 .6235295 .725 .582353 .6404412 .5529412 .6022059
.7955883 .7286765 .7830882 .7647059 .7875 .8279412 .5963235
.6794118 .6875 .4022059 .694853 .575 .6477941 .7779413
.5169118 .7272059 .705147 .8220588 .6036765 .8514706 .5264706
.2492647 .4602942 .4551471 .4080882 .6845588 .6470589 .775
.6617648 .5875 .4779412 .7058824 .4294118 .6345588 .552206
.7551471 .3382353 .1970588 .4742648 .7272059 .3911765 .5441177
.569853 .6507353 .7433823 .6514706 .6926471 .5213237 .552206
.6036765 .3801471 .725 .4279412 .6558825 .6470589 .5029412
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.6786765 .7448529 .4772059 .2845588 .5419118 .2955883 .4588236
.6558825 .632353 .7639706 .732353 .6397059 .5242647 .6779412
.5235294 .6882353 .4602942 .7801471 .4360295 .4066177 .5345588
.6551471 .8066176 .6132353 .7794118 .6522059 .8007353 .8264706
.7058824 .6617648 .5419118 .5485294 .6647059 .694853 .6676471
.9044118 .7382353 .7757353 .732353 .8352941 .8764706 .6617648
.4485294 .6367647 .694853 .7125 .4683824 .6139706 .8904412
.7448529 .8235295 .8102941 .8860294 .694853 .7933824 .7529412
.7477941 .4507354 .5875 .7544118 .4477942 .7411765 .7375
.6264706 .6845588 .7669118 .677206 .7014706 .7838236 .6161765
.8330883 .6507353 .8227941 .5794118 .6985295 .6485295 .7845588
.6919118 .9220588 .7264706 .7941176 .7588235 .919853 .4264706
.5485294 .5139707 .3455882 .6330883 .6808823 .6433824 .7720589
.7875 .5926471 .5154412 .8669118 .6397059 .7875 .5485294
.8779412 .5955882 .3977941 .5433824 .8242647 .7448529 .7404412
.7294118 .6860295 .644853 .457353 .8066176 .7375 .6477941
.5985294 .7544118 .7007353 .6022059 .7257353 .6360295 .8242647
.7963236 .6742648 .7610295 .8897059 .819853 .8529411 .752206
.814706 .6713236 .7882353 .7845588 .7963236 .8639706 .5514706
.5426471 .7154413 .3852942 .7639706 .632353 .5602941 .7330883
.794853 .644853 .6375 .8875 .739706 .8808824 .6683824
.8911764 .6227941 .5610295 .607353 .8404412 .9066176 .8477941
.8375 .8397059 .475 .7389706 .6235295 .7110295 .7514706
.707353 .8051471 .7786765 .7492647 .7477941 .8830882 .6676471
.8117647 .7904411 .8470588 .5963235 .5786765 .8705882 .819853
.8794118 .8772059 .7691176 .419853 .7080883 .5433824 .6544118
.825 .8139706 .8485294 .8102941 .7242648 .6382353 .8352941
.6316178 .8161765 .689706 .830147 .475 .4632353 .7830882
.8705882 .8625 .830147 .5257353 .6808823 .3992647 .8183824
.6602941 .8117647 .6411765 .8485294 .6419118 .5419118 .814706
.8404412 .8404412 .642647 .8014706 .5176471 .5441177 .7419118

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.9147059 .6647059 .4566177 .5529412 .3904412 .6625 .6963235
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.5360294 .5933825 .4654412 .7044118 .627206 .819853 .6433824
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.5720588 .6066177 .7007353 .5176471 .4139706 .7029412 .7536765
.6183823 .7132353 .6375 .7816176 .4669118 .6926471 .5477941
.7147059 .3345589 .2617647 .6529413 .739706 .7220588 .675
.7602941 .7154413 .757353 .6941178 .8661765 .569853 .5845589
.7808825 .8492648 .725 .6117648 .4147059 .6191176 .6213235
.7720589 .4977942 .4161765 .7867648 .7095589 .6477941 .4794118
.580147 .85 .6720588 .5691178 .6941178 .8830882 .6301471
.7786765 .9433824 .7794118 .9007353 .6985295 .6176471 .694853
.8279412 .8132353 .7029412 .6955883 .5691178 .5573529 .5816176
.7419118 .7360294 .8639706 .6161765 .6463236 .6352941 .830147
.769853 .7411765 .6992647 .8360295 .6514706 .7742647 .6036765
.7191178 .8058823 .6867647 .6125 .4330883 .6544118 .4294118
.7132353

```

```

;
PROC UNIVARIATE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```

```

TITLE 'COMPARISION OF RELIABILITY BY EXP - NSs - PEARSON';
DATA NSREL;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @ @;
  OUTPUT;
END;
CARDS;
EXP 32
.8480001 .901 1 .84 .225 .9770001 .942
.87 0 .198 .997 .8980001 .87 .9770001
.8850001 .993 .851 .9950001 .707 .943 .8020001
.966 .956 1 .9960001 .997 .984 .997
-.8660001 .324 .8940001 .9040001
INEXP 41
.9270001 .8160001 1 .34 .8250001 .897 .426
.8290001 .577 .9040001 .9910001 .9270001 -1 .674
.8160001 .845 .577 .8980001 .943 .9500001 .8710001
.9040001 .9670001 .8670001 0 .573 .8520001 .9300001
.548 .7330001 .7510001 .9910001 .952 .205 0
.707 .688 .279 1 .333 .302
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```

```

TITLE 'COMPARISION OF RELIABILITY BY EXP - NSs - SPEARMAN';
DATA NSREL;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @@;
  OUTPUT;
END;
CARDS;
EXP 32
.8 .8 1 .9480001 .258 .8160001 .942
.8160001 -.4 .333 1 .9480001 .7370001 .9480001
.8 .9480001 .777 .942 .6 .9480001 .8330001
1 .8 1 1 .8940001 .9480001 1
-.8330001 .5 1 .942
INEXP 41
.9480001 .942 1 .105 .8 .8 .5
.316 .577 .942 1 .8160001 -1 .4
.8160001 .9480001 .577 .9480001 .9480001 .888 .5
.942 .8 .8 0 .5 .8330001 .6
.7370001 .7370001 .632 .942 1 .2 0
.5 .707 .316 1 .333 .4
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```

```

TITLE 'COMPARISION OF SELF-INSIGHTS BY EXP - NSs - PEARSON';
DATA NSSELF;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @ @;
  OUTPUT;
END;
CARDS;
EXP 32
.822 .745 .938 .897 .9360001 .9870001 .245
.9270001 .8760001 .79 .933 .9690001 .873 .7700001
.454 .863 .8790001 .952 .585 4.200001E-02 .539
.6620001 .9810001 .9310001 .8250001 .929 .527 .9
.62 .622 .8890001 .906
INEXP 41
.919 .401 .837 .674 .9170001 .493 .877
.688 .965 .923 .188 .827 .9250001 .9770001
.8660001 .901 .911 .957 .7130001 .6170001 .231
.7920001 .8990001 .8610001 -.154 .872 .725 .586
.993 .966 .643 .657 .9360001 .636 .942
-.026 .776 .9710001 .8790001 .9590001 .9410001
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```



```

TITLE 'COMPARISON OF SELF-INSIGHTS BY EXP - NSs - SPEARMAN';
DATA NSSELF;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @ @;
  OUTPUT;
END;
CARDS;
EXP 32
.9210001 .5 .79 .8940001 1 .9210001 .344
.974 .666 .892 .9730001 .9480001 .974 .7370001
.5 .666 .432 .892 .3 -5.700001E-02 .405
.9170001 .9 .648 .872 .763 .459 .974
.573 .526 .7370001 .54
INEXP 41
.916 .486 .9170001 .8110001 .8200001 .579 1
.888 .7000001 .8940001 .263 .79 .763 .9210001
.974 .7370001 .9730001 .974 .7180001 .564 .223
.6 1 .8020001 .078 .73 .8110001 .527
.763 1 .9480001 .458 .359 .27 .9480001
0 .289 .974 .648 .872 .8020001
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```

TITLE 'COMPARISON OF EXP VS INEXP CASs CONSENSUS - PEARSON';

DATA NS;

INPUT G \$ N;

DO I=1 TO N;

INPUT RESPONSE @ @;

OUTPUT;

END;

CARDS;

IEX 288

.6569943	.7827518	.4357124	.7625588	.7571975	.5618648	.665676	.7296718
.7683228	.5140787	.7596401	.65752	.7382946	.6513231	.6503048	.6192146
.6944538	.787659	.6585111	.5817901	.5138549	.7684963	.6881999	.6970479
.6097651	.5536933	.6070008	.6109012	.5961329	.696124	.5117801	.6169559
.7041529	.4535599	.6696359	.6110948	.634445	.5242612	.5256715	.7099142
.540882	.2827053	.337127	.534881	.3559917	.5418068	.8077108	.6379103
.5606708	.843096	.5230348	.7726704	.5566848	.936707	.8271236	.7466605
.7363365	.5359045	.7828142	.6661628	.8078246	.8396314	.5667893	.6166325
.8377505	.6538035	.435674	.5994087	.7303188	.6812373	.605683	.3346422
.542295	.5540272	.3318926	.3571511	.5934045	.5789645	.4904298	.4865213
.5799218	.4698679	.3203301	.4358226	.4100658	.386801	.7875282	.7161671
.8552154	.4674337	.820351	.7744152	.8433662	.9128022	.675766	.8741838
.7292453	.9498334	.8198275	.8390758	.9203709	.7357843	.8144835	.9234582
.8624139	.777825	.684582	.481052	.7068292	.690048	.6499237	.658495
.6392341	.7392645	.9221858	.7570716	.8615059	.7234206	.7012241	.7148477
.7455973	.787441	.7595106	.7946686	.5878855	.6413026	.8375841	.5468266
.5399406	.6342893	.7679342	.8319547	.7180001	.6493136	.7739013	.7037528
.677914	.7288767	.6337654	.5816746	.5315782	.8203971	.8326928	.8481779
.7565251	.7085166	.8794934	.607326	.8980282	.700348	.8657078	.9388456
.6811402	.7614086	.8441585	.7126296	.3436345	.4742838	.4753899	.2428452
.5317748	.5205937	.5329236	.3135777	.3053843	.5944446	.3825427	.2482478
.1391971	.3213107	.388819	.6851873	.772425	.7782008	.7629026	.7049218
.5750063	.8278755	.7224095	.8675417	.8751821	.7650373	.7929916	.9363262
.6512315	.6684844	.5918258	.6621421	.8357456	.6943265	.8059078	.6336676
.7852726	.7809676	.5899075	.7163502	.7055112	.5886398	.8574161	.6784929
.786814	.5162856	.8330631	.6971556	.8346085	.8302309	.5085443	.655271
.8769189	.6462195	.5584766	.7632046	.5900942	.8718583	.6975176	.7619333
.8438382	.7315093	.8160843	.9204816	.7998708	.682253	.5936919	.631282
.6196886	.7391029	.7172668	.513093	.5862143	.706777	.5317933	.6619406
.8851251	.7421063	.7098533	.8774208	.6292026	.6927929	.7928096	.807516
.6605073	.724457	.7188961	.6138055	.7274205	.7249087	.6593078	.7182201
.8362126	.7988925	.9658659	.7137906	.8464985	.9162764	.8018325	.6535052
.7607059	.5845213	.7075	.813412	.7529545	.8246132	.7116156	.7935016
.8641139	.633204	.7536618	.8111763	.9076832	.7985936	.8583221	.7581845
.8144075	.8572211	.7474203	.7791865				

EX 136

.8500291	.5298338	.675201	.7703412	.8524059	.6977701	.8647594	.8402321
.8675428	.571662	.3784475	.7018521	.7597715	.8672251	.8303937	.707161
.5560378	.6151206	.6435975	.7189915	.7872815	.8195996	.7508666	.7508061
.5819198	.2471298	.6373824	.7823765	.795437	.779311	.7118543	.7928716
.7611215	.752942	.6220658	.552525	.5771933	.3779941	.7585666	.4894994
.513947	.5989667	.6445588	.6884121	.5861146	.7894908	.8513267	.7247047
.6794226	.718485	.6340989	.7484523	.5712783	.6918337	.7165279	.7992692
.7595205	.6862155	.8120913	.5150429	.6687486	.8578436	.6781128	.5500191
.4382922	.6052317	.592251	.7539257	.7094835	.5527425	.695958	.7966375
.7625069	.766797	.6940252	.6337653	.8169473	.8360921	.9245593	.8619805
.6270983	.5706646	.5501705	.6638446	.6781107	.4421161	.6680451	.7585048

```
.7745576 .8227285 .7265799 .7318795 .723033 .5583583 .4785694 .6138936  
.7643918 .7378941 .7698411 .6571071 .8242586 .375334 .2921504 .484515  
.5250941 .781167 .6100541 .7191758 .3580288 .4014042 .5156705 .6135617  
.8449108 .6886615 .6376511 .3064874 .676749 .707307 .6576867 .7990547  
.5630225 .5732493 .5867626 .569037 .5593073 .3271357 .8890115 .8042426  
.8280041 .4211915 .8583044 .8491108 .5511696 .827517 .6906941 .6756455
```

```
;  
PROC UNIVARIATE; VAR RESPONSE; BY G;  
PROC NPAR1WAY; CLASS G; VAR RESPONSE;  
//  
/*
```

TITLE 'COMPARISON OF EXP VS INEXP CASs CONSENSUS - SPEARMAN';

DATA NS;

INPUT G \$ N;

DO I=1 TO N;

INPUT RESPONSE @ @;

OUTPUT;

END;

CARDS;

IEX 288

.5544118 .7345588 .4264706 .7455883 .7132353 .5419118 .7102941
 .6264706 .8389706 .6919118 .7213235 .5676471 .7654412 .6911765
 .4772059 .6875 .6911765 .7786765 .7419118 .5294118 .5830883
 .7382353 .5220589 .6308824 .6154412 .4882353 .5433824 .6558825
 .5308825 .7169118 .5029412 .6625 .6132353 .3507353 .6610294
 .5102941 .5860295 .5022059 .4772059 .6154412 .5183824 .1514706
 .3683823 .4375 .1257353 .5926471 .7757353 .6419118 .564706
 .8661765 .4875 .8029412 .694853 .9308822 .7720589 .707353
 .7352941 .4507354 .7647059 .7125 .8080883 .8705882 .4772059
 .7154413 .794853 .5257353 .544853 .6330883 .6757353 .6617648
 .6735294 .3919118 .6566176 .6257353 .4455883 .3705883 .5588235
 .5838236 .5882353 .5772059 .5830883 .45 .2352941 .4345588
 .4169118 .3816177 .8536764 .7617647 .9 .5044118 .8404412
 .9227941 .8455882 .8941176 .6816176 .9 .7007353 .9632353
 .8161765 .8426471 .9007353 .6779412 .8514706 .9007353 .8522059
 .8661765 .7147059 .4904412 .7360294 .892647 .6970588 .7014706
 .6492647 .7639706 .8889706 .8985294 .8264706 .7404412 .7272059
 .6455883 .807353 .7838236 .7066176 .6911765 .6117648 .6220588
 .8705882 .5588235 .6279412 .6794118 .7227941 .9397059 .7867648
 .6926471 .6970588 .6529413 .6257353 .732353 .6183823 .6220588
 .5404411 .8419118 .7904411 .8977941 .8588236 .614706 .8816178
 .5360294 .8772059 .7080883 .8279412 .9205882 .6683824 .7625
 .8661765 .75 .4080882 .582353 .45 .2404412 .5139707
 .4808824 .532353 .3860294 .357353 .5492648 .3647059 .1882353
 .2066177 .2867648 .1963235 .7507353 .7904411 .807353 .775
 .732353 .5669118 .8286765 .6588235 .8845588 .9235294 .7919118
 .8426471 .9301471 .6691177 .7889706 .8066176 .7602941 .832353
 .8389706 .9191176 .8176471 .8264706 .7838236 .594853 .8183824
 .8051471 .7544118 .8330883 .6580882 .8154412 .4580882 .8397059
 .7367648 .8227941 .8713235 .444853 .7367648 .8661765 .5970588
 .582353 .7705883 .5705883 .8757353 .7095589 .8352941 .8617648
 .7367648 .9161764 .8970589 .8352941 .6808823 .6007353 .6595588
 .632353 .7286765 .7433823 .5176471 .7022059 .6808823 .4654412
 .5669118 .8955882 .7661765 .6889706 .8808824 .5713235 .7389706
 .7838236 .7963236 .7308824 .6375 .6404412 .5330882 .6044118
 .7176471 .5808824 .5566176 .8757353 .7992648 .9110294 .6801471
 .8786765 .9102941 .857353 .6544118 .7632353 .4772059 .7095589
 .7588235 .7764706 .8117647 .6205883 .8382353 .8441176 .5852941
 .7022059 .8441176 .9330882 .7617647 .7882353 .7264706 .7691176
 .8816178 .775 .7551471

EX 136

.8963236 .4683824 .7191176 .6301471 .814706 .632353 .8955882
 .832353 .830147 .6529413 .4220588 .7147059 .7808825 .8727941
 .794853 .7955883 .5264706 .6463236 .5338235 .7213235 .7786765
 .8904412 .7786765 .8352941 .6411765 .4183824 .6529413 .8102941
 .8191178 .8352941 .8257353 .794853 .7514706 .7294118 .5727941
 .5 .5617647 .3639706 .7448529 .4926471 .3904412 .5176471

.6316178 .544853 .5632353 .7838236 .8316176 .7022059 .6742648
.7970588 .6154412 .7963236 .5264706 .6205883 .6610294 .7852941
.6985295 .7154413 .7389706 .3779412 .5382353 .7036765 .4772059
.6066177 .5352941 .5713235 .5338235 .6801471 .6095588 .4470588
.6602941 .7654412 .7566178 .7389706 .6919118 .6727941 .7316177
.8154412 .9308822 .8066176 .6544118 .5941176 .5345588 .6720588
.7029412 .3977941 .6110294 .7389706 .7588235 .7588235 .6764706
.8345589 .8257353 .5845589 .5419118 .632353 .8117647 .752206
.757353 .7566178 .8441176 .4933824 .5014707 .5382353 .5852941
.7308824 .6507353 .8058823 .3426471 .5411765 .5117647 .6558825
.7463235 .7080883 .7691176 .3764706 .7272059 .6933824 .7176471
.7742647 .5830883 .5705883 .5867647 .5772059 .5727941 .2661765
.8507353 .807353 .8647059 .4242648 .8830882 .8588236 .5566176
.8463236 .6904412 .6213235

;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```

TITLE 'COMPARISON OF RELIABILITY SCORES BY EXP - CASS - PEARSON';
DATA SPREL;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @@;
  OUTPUT;
END;
CARDS;
EXP 17
.258 .6120001 -.333 .942 -.577 0 .947
.9040001 .8750001 1 .9900001 .9710001 .809 .9830001
.8160001 .966 .9040001
INEX 24
.61 1 .9480001 .993 .14 .9590001 .058
.292 .989 .841 .9820001 .962 .8570001 .9910001
.9760001 .993 .9480001 .738 .9540001 .721 .9530001
.9900001 .924 .943
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```

```

TITLE 'COMPARISION OF RELIABILITY BY EXP - CASs - SPEARMAN';
DATA SPREL;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @@;
  OUTPUT;
END;
CARDS;
EXP 17
.258 .632 -.333 1 -.577 0 1
.942 .8 1 1 .9480001 .8 1
.942 .9480001 .942
INEXP 24
.7370001 1 .8940001 .8160001 .5 1 .333
.258 1 .6 .888 .942 .8 1
.9480001 1 .9480001 .5 .9480001 .8 .8
.9480001 .888 .9480001
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```

```

TITLE 'COMPARISON OF SELF-INSIGHTS BY EXP - CASs - PEARSON';
DATA SPSELF;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @@;
  OUTPUT;
END;
CARDS;
EXP 17
.84 .6770001 .994 .675 .993 .914 .204
.607 .726 .8480001 .9440001 0 .8440001 .9360001
.6720001 .38 .71
INEXP 24
.401 .9250001 .707 .9799999 .9680001 .111 .989
-.333 .7130001 .809 .96 .37 .799 .9760001
.818 .8750001 .561 .966 .9990001 .9799999 .9199999
.9630001 .985 .8240001
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```



```

TITLE 'COMPARISION OF SELF-INSIGHTS BY EXP - CASs - SPEARMAN';
DATA SPSELF;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @ @;
  OUTPUT;
END;
CARDS;
EXP 17
.916 .688 .9170001 .763 .9170001 .648 .229
.583 .763 .666 .883 0 .9 .9210001
.8150001 .176 .63
INEXP 24
.316 .865 .7180001 .8940001 .9480001 .316 .9480001
-.25 .666 .7000001 .9210001 .324 .289 .9480001
.974 .974 .394 .573 .8940001 .763 .9170001
.9170001 .9170001 .892
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```

```

options ls = 80;
title 'comparison between firms consensus - NSs - pearson';
data frm;
input g $ n;
do i = 1 to n;
input response @@;
output;
end;

```

cards;

B 78

0.697 0.711 0.732 0.616 0.592 0.574 0.590 0.472 0.479 0.657
0.762 0.693 0.812 0.773 0.633 0.695 0.766 0.612 0.718 0.823
0.492 0.887 0.600 0.931 0.816 0.639 0.698 0.610 0.726 0.467
0.639 0.854 0.853 0.685 0.682 0.618 0.676 0.733 0.496 0.690
0.809 0.729 0.405 0.588 0.440 0.520 0.318 0.562 0.701 0.852
0.625 0.707 0.751 0.644 0.582 0.572 0.402 0.623 0.697 0.721
0.556 0.772 0.625 0.813 0.590 0.834 0.731 0.480 0.707 0.612
0.717 0.390 0.665 0.614 0.416 0.242 0.669 0.664

C 66

0.760 0.766 0.728 0.644 0.681 0.387 0.875 0.814 0.713 0.748
0.644 0.837 0.694 0.829 0.853 0.654 0.646 0.894 0.888 0.582
0.723 0.790 0.836 0.785 0.526 0.543 0.816 0.732 0.558 0.652
0.585 0.674 0.609 0.551 0.784 0.700 0.642 0.546 0.841 0.623
0.547 0.784 0.701 0.564 0.710 0.707 0.713 0.837 0.871 0.690
0.803 0.501 0.752 0.691 0.618 0.586 0.743 0.695 0.834 0.713
0.922 0.796 0.824 0.714 0.861 0.744

D 28

0.793 0.378 0.443 0.540 0.634 0.304 0.343 0.371 0.479 0.589
0.604 0.529 0.514 0.598 0.501 0.642 0.576 0.378 0.510 0.787
0.809 0.567 0.516 0.606 0.460 0.569 0.476 0.748

E 3

0.827 0.831 0.748

F 45

0.818 0.696 0.829 0.725 0.713 0.464 0.851 0.796 0.695 0.865
0.800 0.856 0.669 0.847 0.615 0.905 0.862 0.875 0.824 0.711
0.776 0.763 0.868 0.805 0.819 0.684 0.782 0.756 0.891 0.845
0.761 0.741 0.817 0.822 0.866 0.574 0.695 0.687 0.646 0.595
0.829 0.731 0.591 0.673 0.876

G 136

0.796 0.704 0.789 0.808 0.862 0.515 0.647 0.653 0.617 0.702
0.702 0.913 0.778 0.475 0.761 0.734 0.585 0.496 0.659 0.753
0.621 0.694 0.516 0.521 0.606 0.444 0.697 0.764 0.363 0.576
0.718 0.646 0.847 0.756 0.431 0.699 0.776 0.505 0.782 0.536
0.858 0.654 0.396 0.744 0.795 0.667 0.725 0.598 0.584 0.738
0.743 0.467 0.834 0.780 0.491 0.685 0.582 0.680 0.864 0.477
0.707 0.688 0.463 0.871 0.598 0.918 0.778 0.333 0.792 0.717
0.549 0.567 0.757 0.613 0.715 0.689 0.885 0.858 0.495 0.794
0.795 0.734 0.658 0.606 0.289 0.333 0.446 0.559 0.665 0.456
0.536 0.568 0.330 0.567 0.363 0.713 0.573 0.354 0.590 0.577
0.846 0.522 0.604 0.701 0.628 0.835 0.597 0.629 0.316 0.682
0.505 0.476 0.904 0.354 0.583 0.434 0.786 0.670 0.115 0.809
0.673 0.698 0.552 0.567 0.539 0.719 0.774 0.393 0.781 0.763
0.442 0.795 0.720 0.307 0.386 0.695

H 45

0.757 0.837 0.726 0.906 0.810 0.852 0.606 0.792 0.889 0.673
0.482 0.787 0.622 0.609 0.551 0.653 0.417 0.595 0.663 0.738

```
0.695 0.680 0.621 0.407 0.802 0.839 0.718 0.516 0.808 0.776
0.792 0.774 0.528 0.804 0.782 0.756 0.457 0.852 0.637 0.431
0.826 0.704 0.596 0.430 0.698
;
proc univariate; by g;
proc npar1way; class g; var response;
//
/*
```

```

options ls = 80;
title 'comparison between firms - non-specialists - pearson';
data frm;
input g $ n;
do i = 1 to n;
input response @ @;
output;
end;

```

cards;

B 78

```

0.718 0.700 0.766 0.567 0.594 0.519 0.488 0.402 0.547 0.598
0.782 0.697 0.669 0.666 0.545 0.654 0.654 0.563 0.688 0.847
0.434 0.881 0.617 0.875 0.861 0.600 0.710 0.574 0.560 0.396
0.770 0.783 0.941 0.663 0.711 0.593 0.771 0.724 0.703 0.596
0.467 0.872 0.714 0.799 0.425 0.523 0.256 0.404 0.277 0.494
0.622 0.869 0.602 0.732 0.759 0.652 0.482 0.534 0.515 0.539
0.726 0.656 0.547 0.743 0.614 0.682 0.504 0.614 0.607 0.415
0.747 0.426 0.648 0.234 0.666 0.552 0.408 0.337

```

C 66

```

0.734 0.801 0.683 0.608 0.645 0.442 0.866 0.723 0.629 0.686
0.532 0.873 0.697 0.843 0.879 0.650 0.595 0.836 0.891 0.519
0.716 0.806 0.818 0.769 0.606 0.591 0.830 0.827 0.635 0.603
0.550 0.621 0.648 0.514 0.723 0.750 0.592 0.467 0.860 0.699
0.635 0.509 0.808 0.783 0.535 0.685 0.767 0.698 0.862 0.940
0.763 0.854 0.571 0.820 0.809 0.694 0.648 0.694 0.617 0.842
0.655 0.918 0.722 0.759 0.726 0.827

```

D 28

```

0.774 0.299 0.445 0.482 0.610 0.285 0.405 0.346 0.526 0.643
0.552 0.559 0.549 0.616 0.327 0.603 0.481 0.454 0.607 0.753
0.805 0.569 0.501 0.688 0.431 0.515 0.455 0.777

```

E 3

```

0.775 0.810 0.827

```

F 45

```

0.863 0.726 0.662 0.864 0.680 0.692 0.356 0.817 0.816 0.858
0.868 0.903 0.733 0.790 0.624 0.949 0.882 0.877 0.874 0.795
0.724 0.766 0.845 0.794 0.858 0.693 0.800 0.826 0.873 0.847
0.709 0.675 0.654 0.862 0.947 0.515 0.672 0.671 0.640 0.508
0.801 0.727 0.572 0.555 0.885

```

G 136

```

0.895 0.692 0.758 0.912 0.878 0.609 0.669 0.699 0.650 0.745
0.547 0.903 0.820 0.511 0.760 0.761 0.532 0.482 0.759 0.791
0.662 0.566 0.495 0.611 0.614 0.383 0.713 0.796 0.386 0.520
0.723 0.695 0.745 0.727 0.414 0.616 0.756 0.497 0.646 0.436
0.819 0.627 0.438 0.591 0.815 0.773 0.644 0.574 0.672 0.782
0.649 0.497 0.683 0.793 0.488 0.794 0.650 0.669 0.860 0.462
0.595 0.615 0.471 0.746 0.485 0.944 0.764 0.343 0.733 0.775
0.462 0.431 0.742 0.571 0.738 0.547 0.886 0.827 0.440 0.718
0.817 0.833 0.503 0.574 0.299 0.288 0.450 0.487 0.569 0.414
0.561 0.500 0.383 0.467 0.225 0.615 0.521 0.401 0.602 0.564
0.809 0.503 0.628 0.683 0.587 0.813 0.576 0.633 0.364 0.712
0.479 0.486 0.892 0.326 0.572 0.381 0.751 0.687 0.161 0.768
0.654 0.515 0.378 0.653 0.508 0.661 0.744 0.373 0.751 0.803
0.386 0.760 0.730 0.359 0.418 0.613

```

H 45

```

0.805 0.843 0.737 0.856 0.789 0.851 0.588 0.851 0.671 0.738
0.591 0.841 0.637 0.695 0.566 0.685 0.498 0.629 0.659 0.783

```

```
0.662 0.567 0.697 0.379 0.772 0.826 0.702 0.568 0.809 0.810
0.754 0.736 0.407 0.724 0.723 0.699 0.388 0.754 0.603 0.414
0.910 0.666 0.559 0.372 0.764
;
proc univariate; by g;
proc npar1way; class g; var response;
//
/*
```

```

TITLE 'COMPARISON OF NS FIRMS RELIABILITY - PEARSON';
DATA NSFRREL;
INPUT G $ N;
DO I=1 TO N;
INPUT RESPONSE @ @;
OUTPUT;
END;
CARDS;
B 13
1 .8250001 .577 .8980001 .8980001 .943 .8670001
.993 .851 .9960001 -.8660001 .707 .688
C 12
.9910001 .9500001 .573 .707 .984 .997 .9910001
.952 1 .8940001 .9040001 .333
D 8
.9270001 -1 .8710001 .943 .8520001 .8020001 .205
.302
E 3
.674 .9040001 .9300001
F 10
.8480001 .9270001 .87 .8160001 0 .9770001 .9670001
.966 .956 .548
G 17
.897 .84 .426 .225 .9770001 .942 .8290001
.577 .9040001 .87 0 .9950001 .7330001 .997
.7510001 .324 .279
H 10
.901 .8160001 1 .34 .845 .198 .997
.8850001 1 0
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```

```

TITLE 'COMPARISON OF NS FIRM RELIABILITY - SPEARMAN';
DATA RESP;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @@;
  OUTPUT;
END;
CARDS;
B 13
1 .8 .577 .9480001 .9480001 .9480001 .8
.9480001 .777 1 -.8330001 .5 .707
C 12
1 .888 .5 .6 .9480001 1 .942
1 1 1 .942 .333
D 8
.8160001 -1 .5 .9480001 .8330001 .8330001 .2
.4
E 3
.4 .942 .6
F 10
.8 .9480001 .8160001 .8160001 -.4 .9480001 .8
1 .8 .7370001
G 17
.8 .9480001 .5 .258 .8160001 .942 .316
.577 .942 .7370001 0 .942 .7370001 .8940001
.632 .5 .316
H 10
.8 .942 1 .105 .9480001 .333 1
.8 1 0
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```

```

TITLE 'COMPARISON OF NS FIRM SELF-INSIGHTS - PEARSON';
DATA RESP;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @@;
  OUTPUT;
END;
CARDS;
B 13
.938 .9170001 .911 .9690001 .957 .7130001 .8610001
.863 .8790001 .8250001 .62 -.026 .776
C 12
.188 .6170001 .872 .585 .527 .9 .657
.9360001 .8790001 .8890001 .906 .9590001
D 8
.827 .9250001 .231 4.200001E-02 .725 .539 .636
.9410001
E 3
.9770001 .7920001 .586
F 10
.822 .919 .9270001 .8660001 .8760001 .7700001 .8990001
.6620001 .9810001 .993
G 17
.493 .897 .877 .9360001 .9870001 .245 .688
.965 .923 .873 -.154 .952 .966 .929
.643 .622 .9710001
H 10
.745 .401 .837 .674 .901 .79 .933
.454 .9310001 .942
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```


TITLE 'COMPARISON OF NS FIRM SELF-INSIGHTS - SPEARMAN';

DATA RESP;

INPUT G \$ N;

DO I=1 TO N;

INPUT RESPONSE @@;

OUTPUT;

END;

CARDS;

B 13

.79 .820001 .973 .9480001 .974 .7180001 .8020001
.666 .432 .872 .573 0 .289

C 12

.263 .564 .730 .300 .459 .974 .458
.359 .648 .737 .540 .872

D 8

.790 .763 .223 -5.700001E-02 .811 .405 .270
.802

E 3

.9210001 .6 .527

F 10

.921 .916 .974 .974 .666 .7370001 1
.9170001 .9 .763

G 17

.579 .894 1 1 .9210001 .244 .888
.700 .894 .974 .078 .892 1 .763
.948 .526 .974

H 10

.5 .486 .917 .811 .737 .892 .973
.5 .648 .948

;

PROC UNIVARIATE; VAR RESPONSE; BY G;

PROC NPAR1WAY; CLASS G; VAR RESPONSE;

//

/*

```

OPTIONS LS = 80;
TITLE 'COMPARISON BETWEEN FIRMS - SPECIALISTS - PEARSON';
DATA FRM;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @ @;
  OUTPUT;
END;
CARDS;

```

A 210

```

.6684844 .5918258 .6621421 .8357456 .6943265 .7215721 .7130828
.8059078 .6336676 .7852726 .6875913 .7497811 .7809676 .5899075
.7163502 .7055112 .7397443 .7482595 .5886398 .4870083 .8574161
.6784929 .786814 .5162856 .6804855 .4815285 .8330631 .6971556
.8346085 .7762938 .8408731 .8302309 .5085443 .655271 .8769189
.9193261 .8539112 .6462195 .7071193 .5584766 .7632046 .5900942
.5578369 .3141407 .8718583 .6975176 .7619333 .7249271 .760779
.8438382 .7315093 .8160843 .9204816 .870393 .7948341 .7998708
.6365188 .682253 .5936919 .7902946 .6027721 .631282 .6196886
.7391029 .6870467 .7418691 .7172668 .513093 .5862143 .706777
.7338345 .7601303 .5317933 .6853253 .6619406 .6730434 .648607
.8851251 .7421063 .7098533 .7935123 .8389927 .8774208 .6292026
.6927929 .7928096 .877679 .7850081 .807516 .5065245 .6357048
.4741912 .6605073 .724457 .7188961 .6402375 .5735058 .6138055
.7274205 .7249087 .6593078 .6552396 .788191 .7182201 .5480908
.3064874 .5594842 .4123965 .7941589 .676749 .707307 .5912806
.4611373 .5952273 .620783 .6576867 .7990547 .3693665 .5630225
.6263345 .6272173 .5287648 .5732493 .5867626 .6569667 .4093166
.3953741 .4925528 .569037 .5593073 .5833447 .3271357 .8362126
.7988925 .7619157 .8057131 .9658659 .7137906 .8464985 .9162764
.9335867 .7719231 .8018325 .6540338 .6535052 .681432 .6844946
.7607059 .5845213 .7075 .813412 .8861812 .7028116 .7529545
.6024153 .7684558 .80196 .8246132 .7116156 .7935016 .8641139
.7950834 .9243189 .633204 .7212595 .8890115 .7937813 .7250581
.7689286 .7509313 .8042426 .8280041 .739948 .4211915 .8557129
.724121 .7032155 .8310502 .8583044 .8491108 .6768273 .5511696
.7536618 .8111763 .9076832 .8955814 .784144 .7985936 .69484
.8583221 .7581845 .6005501 .7243887 .8144075 .440409 .8572211
.7613458 .7427143 .7474203 .5308698 .9138145 .8682136 .7791865
.7867538 .827517 .7407574 .6906941 .7395203 .6756455 .4371751

```

B 21

```

.8350601 .593998 .7894908 .8513267 .73417 .7247047 .7875282
.8334428 .9215758 .7161671 .6949904 .7081235 .8818755 .777825
.5809653 .8120913 .7200528 .5150429 .834932 .695958 .4761153

```

E 10

```

.6569943 .7827518 .685843 .665676 .6970479 .5103282 .5961329
.6464696 .843096 .7328438

```

F 6

```

.605683 .3346422 .4154189 .3436345 .2477089 .6622491

```

G 6

```

.8500291 .5298338 .8675428 .5560378 .7508061 .3779941

```

```

;
PROC UNIVARIATE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;

```

```

//
/*

```

```

OPTIONS LS=80;
TITLE 'COMPARISON BETWEEN FIRMS - SPECIALISTS - SPEARMAN';
DATA FRM;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @ @;
  OUTPUT;
END;

```

CARDS;

A 210

```

.7889706 .8066176 .7602941 .832353 .8389706 .7352941 .757353
.9191176 .8176471 .8264706 .7889706 .7404412 .7838236 .594853
.8183824 .8051471 .8676471 .8375 .7544118 .5580883 .8330883
.6580882 .8154412 .4580882 .719853 .4742648 .8397059 .7367648
.8227941 .7639706 .819853 .8713235 .444853 .7367648 .8661765
.9301471 .8544118 .5970588 .7176471 .582353 .7705883 .5705883
.594853 .4477942 .8757353 .7095589 .8352941 .8176471 .7661765
.8617648 .7367648 .9161764 .8970589 .8507353 .8080883 .8352941
.6051471 .6808823 .6007353 .8264706 .6029411 .6595588 .632353
.7286765 .7257353 .7191176 .7433823 .5176471 .7022059 .6808823
.7647059 .7264706 .4654412 .6294118 .5669118 .6529413 .6779412
.8955882 .7661765 .6889706 .7316177 .8095588 .8808824 .5713235
.7389706 .7838236 .8911764 .7345588 .7963236 .519853 .6463236
.5470588 .7308824 .6375 .6404412 .5992648 .4779412 .5330882
.6044118 .7176471 .5808824 .6058824 .677206 .5566176 .4595589
.3764706 .614706 .4352942 .8117647 .7272059 .6933824 .6808823
.4522059 .6830883 .6139706 .7176471 .7742647 .3044118 .5830883
.6911765 .6933824 .4742648 .5705883 .5867647 .5632353 .4477942
.4669118 .5316176 .5772059 .5727941 .6985295 .2661765 .8757353
.7992648 .7602941 .8044118 .9110294 .6801471 .8786765 .9102941
.9227941 .8308824 .857353 .6595588 .6544118 .6625 .6632353
.7632353 .4772059 .7095589 .7588235 .8639706 .6757353 .7764706
.5963235 .8191178 .7904411 .8117647 .6205883 .8382353 .8441176
.8213235 .9154411 .5852941 .6125 .8507353 .7463235 .7301471
.8117647 .7345588 .807353 .8647059 .7161765 .4242648 .8727941
.7213235 .7433823 .8125 .8830882 .8588236 .6808823 .5566176
.7022059 .8441176 .9330882 .919853 .8169118 .7617647 .7867648
.7882353 .7264706 .5713235 .6977941 .7691176 .4602942 .8816178
.8257353 .8095588 .775 .6404412 .8786765 .8794118 .7551471
.7955883 .8463236 .7220588 .6904412 .627206 .6213235 .3786765

```

B 21

```

.8257353 .6257353 .7838236 .8316176 .6823529 .7022059 .8536764
.8088235 .9183824 .7617647 .6205883 .6970588 .8977941 .8661765
.5294118 .7389706 .8360295 .3779412 .802206 .6602941 .4051471

```

E 10

```

.5544118 .7345588 .7220588 .7102941 .6308824 .4345588 .5308825
.6551471 .8661765 .7654412

```

F 6

```

.6735294 .3919118 .5007353 .4080882 .307353 .7720589

```

G 6

```

.8963236 .4683824 .830147 .5264706 .8352941 .3639706

```

```

PROC UNIVARIATE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;

```

```

//
/*

```

```

TITLE 'COMPARISON OF CAS FIRM RELIABILITY - PEARSON';
DATA RESP;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @ @;
  OUTPUT;
END;
CARDS;
A 21
.258 .9480001 .14
.9590001 .058 .841 .947 .9040001 .9820001 .962
.9710001 .809 .8570001 .9830001 .9910001 .9760001 .9540001
.721 .966 .9530001 .9900001
B 7
.6120001 .8750001 .993 .8160001 .924 .9040001 .943
E 5
.61 0 .993 .9480001 .738
F 4
1 .292 .989 .9900001
G 4
-.333 .942 -.577 1
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```

```

TITLE 'COMPARISON OF CAS FIRM RELIABILITY - SPEARMAN';
DATA RESP;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @@;
  OUTPUT;
END;
CARDS;
A 21
.258 .8940001 .5 1 .333 .6 1
.942 .888 .942 .9480001 .8 .8 1
1 .9480001 .9480001 .8 .9480001 .8 .9480001
B 7
.632 .8 1 .942 .888 .942 .9480001
E 5
.7370001 0 .8160001 .9480001 .5
F 4
1 .258 1 1
G 4
-.333 1 -.577 1
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```

```

TITLE 'COMPARISON OF CAS FIRM SELF-INSIGHT - PEARSON';
DATA RESP;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @ @;
  OUTPUT;
END;
CARDS;
A 21
.84 .707 .9680001
.111 .989 .809 .204 .607 .96 .37
0 .8440001 .799 .9360001 .9760001 .818 .9990001
.9799999 .38 .9199999 .9630001
B 7
.6770001 .726 .8750001 .6720001 .985 .71 .8240001
E 5
.401 .914 .9799999 .561 .966
F 4
.9250001 -.333 .7130001 .9440001
G 4
.994 .675 .993 .8480001
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```

```

TITLE 'COMPARISON OF CAS FIRM SELF-INSIGHT - SPEARMAN';
DATA RESP;
INPUT G $ N;
DO I=1 TO N;
  INPUT RESPONSE @@;
  OUTPUT;
END;
CARDS;
A 21
.916 .7180001 .9480001 .316 .9480001 .7000001 .229
.583 .9210001 .324 0 .9 .289 .9210001
.9480001 .974 .8940001 .763 .176 .9170001 .9170001
B 7
.688 .763 .974 .8150001 .9170001 .63 .892
E 5
.316 .648 .8940001 .394 .573
F 4
.865 -.25 .666 .883
G 4
.9170001 .763 .9170001 .666
;
PROC UNIVARIATE; VAR RESPONSE; BY G;
PROC NPAR1WAY; CLASS G; VAR RESPONSE;
//
/*

```

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the scanned document**