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A Comparison of Information Systems Coverage in the CPA, CIA and CMA Examinations for the Period 1987-1991

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Abstract

In recent years, three major accounting professional organizations, the American Institute of Certified Public Accountants (AICPA), Institute of Management Accountants (IMA) and Internal Auditors Institute (IIA) have considered and issued statements on the body of knowledge deemed necessary for practice as a Certified Public Accountant, Certified Management Accountant and Certified Internal Auditor. In each instance, knowledge and skills in information systems technology were included. This is not surprising, in view of the fact that changes in technology have dramatically altered the way in which accounting data is gathered, processed, stored, accessed and reported.

Each of these professional organizations also requires or recommends the passing of an organization-sponsored certification examination for entry into or recognition within the various practice areas. While the examinations are not the only means of assessing the knowledge and skills necessary for certification, they are an important tool in evaluating the extent of the qualifications presented by a candidate. In view of the above, one may postulate that the certification examination, in each instance, would include coverage of the areas of knowledge included in the prerequisite body of knowledge. In particular, since each of the professional groups cite information systems (IS) knowledge as an important knowledge component, one would expect to observe test items addressing current IS in each exam.

In separate studies the authors have examined and documented the coverage of IS on the CPA and CIA exams for the period 1987 - 1991 and the CMA exam for the period 1987 - 1992.[1]

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[1] See: Akers, M., Doney, L., & Wick, A.(1993). Analyzing information systems content in the CIA examination. *Internal Auditing*, 9(1), 33-43; Doney, L., & Akers, M. (1993). Information systems content in the CPA examination. *Journal of Computer Information Systems*, XXXIV (1), 81-88.; and Doney, L.& Akers, M. (1995). Information systems content in the CMA examination. *Journal of Education for Business, 70(6), 327-331.*

While there are other professional certification exams for which accountants may sit, Certified Bank Auditor, Certified Data Processor, Certified Fraud Examiner, etc., the CPA, CMA and CIA are the three most widely recognized and attract the most test takers. These studies are intended to inform individuals and professional organizations interested in these exams of the content, extent and relevancy of the IS coverage. Specifically, potential exam takers might benefit by noting the type of exam items and the extent of IS coverage. The findings of these separate studies might also be of interest to systems educators in developing some areas of course content or course projects, although the authors do not suggest that the content of professional examinations should drive curriculum content. The results of the individual exam analysis reveal an observable difference in the relative amount of coverage between the CPA, CMA and CIA exams. The purpose of this study is to formally draw comparisons of the IS coverage on the CPA, CMA and CIA exams for the period 1987 - 1994. This analysis also provides a measure of the importance of IS on each of these three professional examinations.

The importance of IS knowledge as expressed by accounting educators, by committees of the organizations in each of the three professional categories, and the then Big Eight partners is reviewed in the first part of the paper. Second, an analysis, comparing IS coverage in the three exams, is undertaken. Finally, the paper concludes with comments and observations.

The Importance of Information Systems Knowledge

The increasing complexity of economic activity, growth of global competition and rapid advancement of information technology have all contributed to increasing demands on the services of accountants. To meet these demands, accountants must command a wide range of knowledge and skills, not limited to accounting concepts and principles. In particular, requisite knowledge in the area of information systems (IS) recently has been promulgated by each of the major professional organizations of accounting educators and practitioners. In accounting education, the Bedford Committee in 1986 and the Accounting Education Change Commission in 1990 both addressed the importance of information systems in the preparation of future accountants. The AICPA, IMA and IIA and the managing partners of the then Big Eight public accounting firms have also recognized the importance of information systems knowledge to the practice of accountancy in the areas served by these organizations.

The Bedford Committee of the American Accounting Association (AAA) concluded that an essential component of general professional accounting education is the design and use of information systems, including the following:

- The concepts and principles underlying the general structure, design, and implementation of information systems.
- The methods and processes to be used in designing and implementing particular information systems for

different purposes and users.
- Role of accounting information systems in financial, managerial and entrepreneurial decision making.
- Principles of system review: its design integrity and its effectiveness in operation. (AAA,1986,p.182)

The Accounting Education Change Commission also of the AAA, in developing its views on accounting education, noted that there are three components that form the foundation for life-long learning: skills, knowledge and professional education. The importance of information systems, as a part of the knowledge component, is reflected in the following:

> Because organizations are affected by rapidly increasing dependency on technology, accounting professionals must understand the current and future roles of information technology in organizations. (AECC, 1990, p.308)

More specifically, the Commission believes that accounting graduates need capabilities in identifying, gathering, measuring, summarizing, and analyzing financial data in business organizations, including the:

- Role of information systems.
- Concepts and principles of information systems design and use.
- Methods and processes of information systems design and use.
- Current and future roles of computerized information technology. (AECC,1990,pp.311-312)

In 1988 the Education Executive Committee of the AICPA included the following statements regarding information systems in its final report:

The widespread use of computers and telecommunications technology makes an understanding of the technologies and their applications and limitations essential. Students should be familiar with the functions and interrelationships of hardware components, and with the capabilities and applications of software. File structure, data storage and retrieval, networking, and telecommunications are relevant concepts. The internal controls that ensure accuracy, integrity, and confidentially of information should be examined. Most importantly, the CPA should know how and if the system provides information to management that is relevant, reliable, timely and readily accessible. (AICPA, 1988, p.22)

In 1986, an Ad Hoc Committee of the Institute of Management Accountants (then the National Association of Accountants) recognized the importance of information systems in enabling management accountants to have the knowledge and skills necessary for success in the practice of management accounting. The Committee concluded that:

All segments of the accounting function have been affected by computer technology, so information systems literacy is a significant part of the management accountant's knowledge. A familiarity with the concepts, processes, and security aspects of information and communication systems is important for management accountants. (IMA, 1988, p.60)

In 1991 the Advanced Technology Committee of the IIA rendered its design of a "Model Curriculum for Information Systems Auditing". The importance of

information systems knowledge was recognized in the enumeration of thirteen "building blocks" on which IS knowledge/skill sets were constructed.

Each block is a significant aspect of information systems technology. (Gilhooley, 1991, pp.2-6)

Table 1: Professional Exam IS Knowledge Categories		
AICPA Categories	**IIA Building Blocks**	**IMA Aspects**
Database and File Processing Concepts	Information Systems Organization and Administration	Systems Analysis and Design
Internal Control	Information Systems Security	Database Management
Systems Technology	Systems Development	Software Applications
Applications	System Maintenance and Change Control	Technological Literacy
Systems Analysis, Design and Implementation	Information Systems Problem Management	Systems Evaluation
EDP Auditing	Information Systems Contingency Planning	
	Information Processing Operations	
	Application Systems	
	Systems Software/Environmental Control Programs	
	Data Management	
	Database Management/Data Dictionary	
	Telecommunication Networks	
	Intelligence/Expert Systems/Image Processing	
Note: See individual studies for detailed description of knowledge categories		

The managing partners, in their "white paper" noted that today's business environment is constantly changing due to several factors, including advanced technology. To effectively deal with this change, they suggested that accounting education must produce students who have a large body of knowledge, including organizational knowledge. The importance of IS knowledge is evidenced in a comment that states that, "No understanding of organizations could be complete without attention to the current and future roles of information technology in client organizations and accounting practice." (Perspectives, 1989, p.8) In

addition to recognizing the importance of IS knowledge in general, each of the practitioner organizations formulated a more detailed listing of the composition of IS knowledge appropriate to their practice area. The AICPA listed six categories; the IIA listed thirteen "building blocks" (categories) of IS knowledge; and the IMA listed five aspects of IS. This detailing of IS knowledge is shown in Table 1.

The AICPA, IMA and IIA each require or strongly recommend the passing of a certification examination for entry into and/or recognition within the professional category represented. In case of the AICPA, passing the CPA examination is a prerequisite to membership and licensing as a Certified Public Accountant by the various states. While the exam is not the only means of assessing knowledge necessary for certification, it is, in each instance, an important tool in evaluating the extent of knowledge presented by a potential member. Since the certification examination in each instance is prepared and graded by the corresponding professional association, there has been a determined effort to bring coincidence between examination coverage and the knowledge deemed to be important to practitioners. In view of the significance of IS knowledge to practicing accountants, it is critical that these professional examinations include coverage of IS knowledge.

Review of Individual Exam Coverage

Table 2 is a frequency distribution of IS items on the three certification exams

under review. The data were extracted from the examinations for the period 1987 through 1994. The table is presented to provide the reader with additional insight, and as a tabulation from which the comparative analysis that follows is derived.

A direct comparison of the extent of IS coverage between exams, using the tabulations in Table 2, is not appropriate for two reasons. First, the mix of multiple choice and essay items differs among the tests. The seemingly higher level of coverage suggested by the apparently greater number of multiple choice items on the CIA exams, as compared to the CPA or CMA exams, may be due largely to a greater reliance on multiple choice items on the CIA exam. Second, the time allocated to essay items differs, not only between exams, but also within exams. The resolution of these differences, which preclude direct item comparisons between exams in Table 2, is presented in the section that follows.

Comparative Exam Analysis

In order to compare the coverage of IS on the three exams, coverage must be measured on a comparable basis. This was accomplished by computing the ratio of total time allocated to IS items to total exam time for each exam. The results, expressed as percentages, are shown in Table 3 and are graphically presented in Figure 1. Two tabulations are included for the CMA examination. The minimum calculation shows the percentage of total exam devoted to IS items, if the test taker does not elect to write any of the IS optional essay items.

Table 2: Frequency Distribution Of Exam Information Systems Items

| | | | | Professional Examination | | | |
| | CPA | | CIA | | CMA | | |
Date	MC	Essay	MC	Essay	MC	Essay (Req)	Essay (Opt)
1987							
1st	14	0	27	1	16	1	1
2nd	6	2	34	2	17	1	0
1988							
1st	10	1	34	1	3	1	2
2nd	12	0	29	3	6	1	1
1989							
1st	9	1	35	1	17	2	1
2nd	8	1	46	1	11	2	1
1990							
1st	8	0	31	3	11	0	1
2nd	7	0	54	1	7	2	1
1991							
1st	7	2	57	2	7	2	0
2nd	9	1	59	0	0	1	2
1992							
1st	5	2	41	3	3	2	0
2nd	10	0	52	2	6	2	0
1993							
1st	12	1	65	3	14	1	1
2nd	9	1	61	1	0	1	0
1994							
1st	7	0	45	1	5	3	0
2nd	8	1	65	1	9	1	0

Note: Essay (Req.) assumes test taker does not elect any optional essay items with IS content

Essay (Opt.) assumes test taker elects all optional essay items with IS content

The maximum calculation shows the percentage of total exam devoted to IS items, if the test taker elects to write all IS optional essay items. Other possibilities between these two extremes are possible depending upon the test takers' choices in combination with the structuring of required and optional items as they may involve IS content.

CIA Exam

With the exception of a tie at 8.8 percent on the first exam in 1987 with the CMA (Maximum) exam, the CIA exam consistently has a higher percentage of IS coverage. Over the period studied, the percentage of coverage ranges from 8.8 percent, first exam, 1987, to 29.1 percent, first exam, 1993. Over the sixteen exams, the mean percentage coverage is 18.3

percent. The individual analysis of the CIA examinations revealed that IS items appeared in Parts I, II and III of the exam.

Date	CPA	CIA	CMA (Minimum)	CMA (Maximum)
Table 3: Information Systems Items As a Percentage of Total Exam				
1987				
1st	3.5	8.8	5.9	8.8
2nd	6.5	15.2	6.1	6.1
1988				
1st	5.0	11.7	3.5	9.2
2nd	3.0	16.4	4.0	6.9
1989				
1st	4.8	11.9	8.0	10.9
2nd	4.5	15.7	7.8	10.7
1990				
1st	2.0	18.1	2.1	5.0
2nd	1.8	16.2	6.7	9.8
1991				
1st	6.8	19.5	6.7	6.7
2nd	4.8	14.4	3.1	9.4
1992				
1st	6.3	20.8	6.9	6.9
2nd	2.5	18.8	7.5	7.5
1993				
1st	5.5	29.1	6.1	9.2
2nd	4.8	19.6	3.3	3.3
1994				
1st	1.2	14.3	9.0	9.0
2nd	3.8	20.8	5.1	5.1

The study also revealed that there were some exam items from each of the thirteen knowledge categories enumerated by the CIA. Knowledge categories receiving the most attention, in descending order, were: systems development, application systems, information processing operations, data base management and information systems security. Test items in these categories were considered to have kept abreast of the changing technology.

In May, 1994, the CIA exam was revised. Among the new four, 3-1/2 hour parts is a part titled, "Management Control and Information Technology". This part is largely a carry-over of the previous part III, "Management, Quantitative Methods & Information Systems". The change in title suggested a

over time, the CMA (minimum) coverage is lower than the CIA coverage on all exams studied.

For the same period, the CMA (maximum) coverage is also lower than the CIA coverage for each exam except for the first exam of 1987. Analysis of the individual exams revealed that there was

FIGURE 1
IS Items as a Percentage of Total Exam
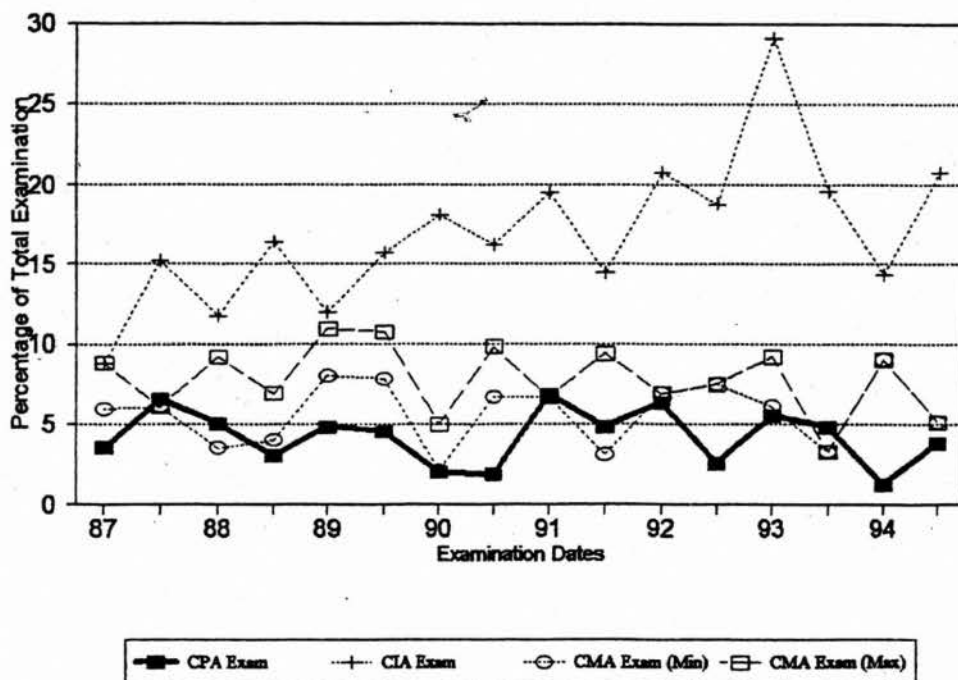
move toward more IS coverage, and this appears to be the case. An exam that was already strong in IS coverage became even stronger.

CMA Exam

Overall, the CMA exam had the second highest percentage of IS coverage. At the minimum, the average percentage coverage was 5.7 percent, and, at the maximum, the percentage coverage was 7.8 percent. Comparing individual exams

IS coverage in each of the five knowledge aspects identified by the CMA, although most of the items were in the systems evaluation and systems analysis and design categories. The CMA exams for the period December, 1990 through December, 1994 consist of the new four-part format. For this period, all IS items appeared in Part IV (Decision Analysis and Information Systems). Test items were deemed to be timely in view of the changing IS technology.

CPA Exam

For the period studied, the CPA exam had the least amount of IS knowledge coverage. The range of coverage extends from a low of 1.2 percent on the first exam in 1994 to a high of 6.8 percent on the first exam of 1991. Overall, the average coverage is 4.2 percent. Coverage on the CPA exam is lower than the CIA exam on each of the sixteen individual exams studied. CPA coverage is also lower than CMA (maximum) coverage on all exams except for the second exam of 1987, first exam of 1991, and second exam of 1993. In five instances IS coverage on the CPA exam exceeds coverage on the CMA (minimum) exam; and in the other eleven instances, CMA exam coverage is higher. Analysis of individual CPA exams revealed that all IS items appeared in the auditing section of the exam. IS coverage as a percentage of the auditing section was the highest, 27 percent, on the first exam of 1991. During the period studied, test items appeared in all knowledge categories except for the database and file processing and the applications categories. Knowledge categories receiving the most attention were internal control and EDP auditing. It is notable that there were no essay items on six of the CPA exams, including both exams in 1990. Many of the test items were considered to be dated in view of the changing IS technology, and the extent of IS coverage was thought to be limited in view of the importance that has been attributed to IS knowledge by leaders in the profession, both in academia and practice.

The AICPA implemented some exam changes, beginning in May, 1994. For example, the time allowed for the Auditing section increased from three and one-half to four and one-half hours. This change afforded the AICPA an opportunity to increase the scope and to improve the timeliness of exam IS coverage, bringing it more closely into coincidence with its expressed importance. The 1994 exams, however, do not reveal increased IS coverage.

Concluding Comments

The purpose of this study was to compare IS knowledge coverage in the CPA, CMA and CIA exams for the period 1987-1994. Through comparison the relative importance of IS knowledge and skills in each of these practice areas can be ascertained.

The results of the study show that the American Institute of Certified Public Accountants, Institute of Management Accountants and Institute of Internal Auditors, while serving different constituencies of accounting professionals, have all acknowledged the importance of IS knowledge and skills in their respective practice areas. However, there are differences in the extent of IS exam coverage. There are also differences in the content and relevancy of IS test items.

For the period examined, 1987-1994, the extent of coverage of IS knowledge was highest in the CIA exam, followed by the CMA and CPA exams. The CIA exam focused on systems development, application systems, information processing operations, data base management and information systems security while the CMA exam focused on systems evaluation and systems analysis and design. The CPA exam focused on the

important topics of internal control and EDP auditing, but other important knowledge areas such as file and database processing, accounting applications and processing technology received little or no attention. The authors noted that IS test items in the CIA and CMA exams tended to address current technology while many of the items in the CPA exam were dated in view of rapidly changing technology.

Three inferences can be drawn from these findings:

1. Coverage of IS knowledge in the CIA exam and CMA exam appears to be adequate while coverage on the CPA exam is limited.

2. Content of IS knowledge is different as the CIA and CMA exams focus primarily on systems analysis, design, development and evaluation, while the CPA exam focuses primarily on internal control and EDP auditing.

3. IS knowledge addressed in the CIA and CMA exams, in the opinion of the authors, involves current technology, while items in the CPA exam tend to be dated.

The authors recognize that the appropriate extent of coverage of IS knowledge in each of the exams studied has been and will continue to be debated. The extent and content of IS knowledge tested will and should vary in view of the fact that the AICPA, IMA and IIA serve different constituencies. While some variation in the level of coverage and content is expected, the accounting profession has clearly documented the importance of addressing current information technology. Ultimately, the responsibility for determining the appropriate extent, content and relevancy of coverage rests with professional accountants who comprise the memberships of the AICPA, IMA and IIA.

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