

REPORT OF THE TASK FORCE
ON NEW TECHNOLOGY IN AUDITING

Auditing Section
American Accounting Association

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Format

Each Scenario begins with an "Agenda for the Auditing Section" and an "Agenda for the American Accounting Association." These proposed agenda items address the primary charge of the Task Force. However, to provide information on the rationale underlying the various proposals, a summary of key issues considered per scenario is provided. The materials are presented in a question-and-answer format. Appendices are provided with additional background information that address the charges of the Task Force.

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Agenda for the Auditing Section

Scenario I: Microcomputer Use

- Organize an exchange of mini cases which utilize microcomputers. Emphasize substantive problem-solving, rather than mere mechanization.
- Establish an ongoing strategic committee whose job it is to assess technological developments and their implications for auditing.
- Encourage case development with real world application. Consider the possibility of auditing students evaluating the university's EDP center's controls. Also, challenge students to access a data set that you or other students create to demonstrate how difficult it can be to develop effective access controls.

Agenda for the
American Accounting Association

Scenario I: Microcomputer Use

- Encourage a grassroots effort to provide feedback to publishers and other developers of software. Both strengths and weaknesses should be evaluated, alongside ideas for the development of future EDP tools.
- Consider having the national organization serve as a clearing house for micro cases developed by accounting professors, as well as by professors in other disciplines -- particularly finance and business analysis.
- Encourage continuous CE programs on micros, but emphasize a project orientation, i.e., this course is expected to provide sufficient expertise that participants can integrate specific cases into course instruction.
- Establish an ongoing strategic committee whose job it is to assess technological developments and their implications for accounting and auditing.
- Investigate the opportunities for the AAA to negotiate with hardware and software companies for special discounts for university professors and/or accounting students.
- Develop a publicity campaign as to the importance of accounting students' acquisition of micro skills. Possible forms include materials for bulletin boards and pamphlets for Beta Alpha Psi chapters.

SCENARIO I. MICROCOMPUTER USE

In the short run, we wish for students to know the jargon of microcomputers, to feel comfortable with their use, and to have hands-on experience with word-processing, spreadsheet, generalized audit, and statistical software.

KEY ISSUE CONSIDERATION

- What specific suggestions could be offered regarding the use of microcomputers in the curriculum?
 - . Could we create a course on micro use via statistics, operations research, or business analysis departments for all business majors? How do we handle students who are well versed in micros? What sort of placement exam could be offered?
 - . Should we push for mandatory "typed papers" to be submitted, thereby disallowing pen and paper and pushing for adeptness at the keyboard? This could create an incentive to learn about word-processing packages.
 - . Wouldn't a spreadsheet program with software to perform consolidations be an effective tool for Advanced Accounting courses which would ensure both experience with a micro spreadsheet package and appreciation of its value? How might this use be most effectively promoted?
 - . Generalized audit software as well as statistical software are well integrated into many auditing courses, but the breadth of the use of TREAT and similar packages could be increased. How?
 - . Related disciplines such as finance can assign micro applications, including the selection and evaluation of investment portfolios and the performance of simulation analysis on capital budgeting decisions under uncertainty to demonstrate the use of software and access to data bases. How can this use be increased in scope?

Care must be taken to demonstrate substantive applications of computers, rather than mere mechanization. Perhaps a part of freshman orientation could be a short course on the location and use of micros on campus. University-wide standards requiring typed papers would clearly create proper incentives for students to learn word processing skills. A short not-for-credit orientation approach to micros would facilitate full coverage of the student body, without totally boring those skilled in micros. Of course, a follow-up course demonstrating computer applications across various fields would be a key "optional course" in the curriculum.

Encouragement of publishers to develop more effective software is needed. This would involve a grassroots effort by academicians to critique available software. Within each university, the accounting department should prioritize potential uses of software within courses. Advanced accounting would appear to be an appropriate high priority.

Generalized audit software available for course use has resulted in the complaint that micro litigation is too time consuming, given the quantity of auditing material needing coverage within a course. One approach would be an emphasis on mini-micro cases, such as problems in which the use of a micro is necessary to research an audit objective. A regression model to select locations to visit or to highlight unreasonable observations could be one useful case.

Exchanges of syllabi and working papers are common. Why not encourage similar exchange of cases in micro use by finance, business analysis, and accounting professors?

- Assuming some faculty are not comfortable with micros, how can they be effectively trained and encouraged to integrate state-of-the-art technology into coursework?
 - . Consider the problem with some students being very well-versed in micros, potentially intimidating some professors from using micros.
 - . How do we avoid "reinventing" the wheel across universities?

The simpler the micro application is to administer, the more likely it is to be integrated into coursework. An exchange of easy-to-apply micro problems would encourage the wider use of micros. Perhaps the AAA could act as a sort of "clearing house" for such an exchange.

CE for faculty, focused on how to use a particular micro software, with exemplary problems should be a permanent component of annual meeting programs.

- Consider the effect of technology on the necessary "core body" of knowledge on micros by both students and professionals.
 - . Specifically, how will natural languages for auditor interfaces and voice systems affect what auditors will need to know?
 - . How does the proliferation of types of micros influence training? What are the most generic hardware types and software packages for instructional purposes?

Probably IBM compatibility is the appropriate focus for hardware and software instruction. While natural languages are evolving, the rate of application will lag technology. As a result, auditors will need to know common languages underlying popular software packages.

Of interest is an article entitled "ACL: A Language Specific for Auditors," by Hart J. Will, Communications of the ACM (May 1983), pp. 356-361. An ACL/PC software is expected to be available in the near future.

- How are micros likely to affect the audit process itself?

Micros permit the virtual elimination of the pencil in producing working papers. It facilitates the application of quantitative procedures with ease. Down loading from main frames often permits circumvention of compatibility problems. Of course, such down loading increases the risk of unauthorized access, loss, or contamination of data sets.

Control in a micro environment presents unique challenges to an auditor. Concerns relate to access, input, processing, and output distribution. Often companies have no centralized control over software, leading to risk exposure from faulty software and the wide distribution of spreadsheet (LOTUS) programs with errors.

- How are micros likely to affect audit research?

Researchers need to exercise care in assessing the quality of available software. In addition, controls over data entry and editing are needed to ensure the integrity of data sets. Access control over confidential data is also of concern. Yet, overall, micros facilitate empirical work and quantitative analyses.

Micros do suggest research topics. Man/machine interface, the influence of computerized decision aids on judgment, and similar issues merit investigation.

- What are the expected technological developments in the next five to ten years which may influence micros and their use in audit practice and research?

This is one of those very uncertain projections. Yet, within a decade, very portable, low cost machines should be plentiful. User-friendly languages or voice-driven software will be likely to prevail. This development will permit auditors' time to focus far more on the issues being addressed than the underlying technology facilitating the analysis. The availability of expert systems software will likely grow and facilitate the creation of tailored applications.

- What specific plans can we recommend to the Auditing Section of the American Accounting Association regarding how to react to and anticipate the effects of technology on auditing?

Perhaps an ongoing strategic committee whose job it is to assess technological developments and their implications for auditing (as well as other facets of accounting) would be an appropriate first step.

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| <ul style="list-style-type: none">- What actions can the profession take?<ul style="list-style-type: none">. For example, should training courses for faculty be emphasized in AAA CE activities?. Should the Section encourage programs begun at some universities to require students' acquisition of a micro upon registration? (Note that bulk buys can make such a requirement reasonably economical.) |
|--|

CE for faculty is a must. However, it should focus on specific case use so that participants walk away with sufficient knowledge to integrate the micro application into their courses.

A possibility exists for the AAA to negotiate with hardware and software companies for special discounts for university professors and/or accounting students. However, administratively, the purchase would be most effectively handled at the university level. Publicity concerning the importance of accounting students acquiring micro skills would seem warranted and could be developed at the AAA or Section level, then disseminated for bulletin board use or distribution to Beta Alpha Psi chapters.

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| <ul style="list-style-type: none">- Consider issues in past literature as you explore the types of questions posed here.<ul style="list-style-type: none">. The role of vendors' controls. The ability for employees and others to gain total access to data bases, as well as to alter such data. Problems with both input and output controls. Difficulty in segregating duties in microcomputer environments |
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These points clarify the need for course integration of micro material, particularly in systems and auditing courses. The access problem could be demonstrated purposefully by the instructor through a case problem that motivated students to attempt to access others' data bases. Often, experiencing a problem is the most effective means of learning about the risks involved and retaining a clear notion of real word concerns in EDP environments.

One idea is to critique the controls present at the university's EDP center, with which the students are familiar. Micro lab security issues warrant discussion.

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Agenda for the Auditing Section

Scenario II: Information Systems

Phase I

- . Emphasize to students a "business" perspective in the evaluation of companies, particularly auditees. This may be done through cases or similar teaching tools.
- . Exert pressures on systems developers to be more cognizant of control problems.
- . Emphasize the need to test a mechanized system on a PC. For example, manual footing and limited recomputation should be performed. This point warrants emphasis in future textbooks.

Phase II

- . Develop materials which facilitate the incorporation of decision analysis in auditing courses, preferably using micros.
- . Arrange a CE course to get faculty interested in the use of decision analysis in courses.

Agenda for the
American Accounting Association

Scenario II: Information Systems

Phase I

- . Encourage team teaching approaches to integrate information systems with accounting.
- . Encourage changes in textbooks toward integrating more information on information systems.
- . Request case development by the AICPA and the profession, demonstrating the use of systems and auditing in a systems environment. The realism of cases is important to an effective educational process.
- . Exert pressures on systems developers to be more cognizant of control problems.
- . Attention is needed to the development of more sophisticated control techniques than passwords and locks. To secure interest in this line of inquiry, a sort of competitive contest could be designed.

Phase II

- . Propose curriculum development of a course called Professional Decisions in Accounting. Include human relations aspects of decision making in the course.
- . Integrate the use of services such as NAARS and LEXIS into the classroom.
- . Develop materials which facilitate the incorporation of decision analysis in accounting courses. The materials should include use of micros.
- . Discuss the potential role of a "current events in business" course which focuses on popular media such as the Wall Street Journal and Fortune. Alternatively, how might such material be effectively integrated in existing courses?
- . Mandate the use of word processing spreadsheet and automated workpaper packages throughout coursework.

SCENARIO II. INFORMATION SYSTEMS

While accounting systems are an important facet of education, information systems encompass a far greater breadth of data, including non-financial and qualitative information. The organization of information, its use in decision making, likely needs for retrieval by disparate users, and means of integrating accounting into the overall information system to further enhance decision making are components of that knowledge base which we would like accounting undergraduates to possess.

PHASE I. Data Base Organization/Data Base Management Systems

PHASE II. Decision Analysis--Bayesian/Expected Value/Simulation/
Sampling/Linear Programming/Modeling

KEY ISSUE CONSIDERATIONS

PHASE I: DATA BASE ORGANIZATION/DATA BASE MANAGEMENT SYSTEMS

-	How can the concept of information systems best be integrated with accounting courses?
.	Can separate systems departments be merged with low cost?
.	Are present accounting books sufficiently attune to how accounting interfaces with information systems?
.	Who should teach information system courses and what extent of such courses should relate to accounting information?
.	How can the concepts of data base organization and the operation of DBMS be effectively communicated?
.	Are there means by which either the AAA or the Profession (via firms or the AICPA) can enhance a shifting of education toward a data base orientation?

First, consider some general issues beyond the technical audit issues. Information systems generally allow for easier and faster access to information, both financial and other. For the auditor, company-related information is more easily accessible (i.e., internal systems) in the presence of EDP. Also, industry and economic information may be simpler to obtain (i.e., external systems). Data base systems can give easier access to information outside the accounting system and assist the auditor with gathering information about the client-company beyond the accounting system, as well as information about the industry. One priority of accounting education should be to teach students to broaden their outlook to take an overall "business" perspective of their audit clients. That is, a short-sighted outlook to only technical accounting issues may cause an auditor to miss key points. Knowledge of the company, the industry, and the economy allows the auditor to better assist the client with not only internal controls and accounting problems, but also business problems.

In particular, data base systems are extremely useful in situations where several years of historical information is needed. These would include special projects for clients (e.g., litigation support, special studies and audits, etc.) which generally need access to historical information. Examples of such projects include: (1) Analysis of events in past; (2) Forecasts of sales,

costs, and lost profits; and (3) SEC filings for sale of subsidiaries.

Moving from the general perspective to specific issues concerning an accounting education on information systems, consider the following observations and suggestions.

Current education on mechanical systems is not adequate. Generally EDP is one chapter of audit courses, and both manual systems and auditing "around" the computer are more widely taught than effective EDP auditing. Especially with the significant development of information systems in the past 10 years, more emphasis is needed in education on such systems. Courses need to integrate computer controls and audit impacts into each "cycle" rather than a single chapter. Control problems over mini and micro computers especially need to be addressed.

Some "ramping-up" will be necessary for cost purposes. As an example, a team teaching approach, especially in audit courses, could be used to integrate information systems with accounting. Separate systems courses will need to broaden treatment of systems, but may be slower than integration in the classroom. As classroom integration increases, textbooks will follow (professors will use handout materials at first, and then begin to write textbooks from this material). Actual hands-on experience should be considered, although it may be the final step of the ramp-up efforts. The AICPA and the profession can help fund the development of case studies in order to give students practice on the use of systems and auditing in a systems environment. Like other aspects of accounting, "problems" will have to be the basis for learning.

As is true for many aspects of education, work between the AAA and the profession will enhance the education regarding information systems. The realism of case work in university problems will help reduce the education burden of the firms. The firms, in turn, can be expected to be willing to devote some time and resources to assist in this effort.

"Ramping-up" also includes determination of the extent of technical information that can and should be taught to the accounting students. Auditing through a personal computer (PC) or mini computer environment is generally easier. DBMS are easy to use and access through these types of computers.

Even though internal control problems are more sticky in this type of environment, it should be easier to integrate into the accounting curriculum. Auditing "through" a main frame computer generally requires extensive technical expertise. Separate EDP/computer courses would have to be required as part of the accounting curriculum to achieve this level of knowledge. Programming skills would be necessary leading to the likelihood that in the field, a technical person with a strong accounting background would assume many of the EDP responsibilities. This could very well mean that an emphasis on micros is appropriate.

- How can a data base be effectively controlled and audited?
 - . What unique problems are faced with a DBMS?
 - . How are these problems likely to be affected by future technology?
 - . How might controls and the effectiveness of audits be improved upon?
- What technological advancements affecting data base systems are likely? What do they imply for the
 - . practitioner
 - . researcher
 - . student

Especially in a micro and mini computer environment, controls over data integrity are difficult, from a company perspective, as it offers easy access and ease of operating mini and micros. Control difficulties are likely to increase with future technology. This is due to the fact that the emphasis of technological advancements is on making systems more "user friendly". Easing use of systems can increase control problems, as segregation of duties, access to files, etc. becomes more difficult to control. Especially in the PC or mini environment, the increased possibility of unauthorized use/access to information grows due to: (1) the small time investment required to become proficient on the system and (2) the declining learning time likely to result from advancements.

The profession as a whole (education and industry) will need to devote resources for the development of better safeguards over information as technology advances. Pressures need to be placed on systems developers to be more cognizant of control problems. A need exists for more sophisticated control techniques than passwords and locks. Firms report that several of their professional staff can break into any password in less than 10-15 minutes.

- How can data bases be utilized in the audit process, as well as litigation and claims support work?

In considering how data bases influence the audit process, consider that a lot more information is accessible to the auditor for use in analytical review and control problems change--substantial risks are tied to data integrity, back-up procedures, and the accessibility of data.

Generally, several years of revenue and cost information is needed for long-term analytical review or damage analyses in a litigation setting. When clients have DBMS, the clients can run off a hard copy of information to be used in analyses. Generally, information is then entered onto a PC. PC's tend to be utilized as intelligent terminals. Alternatively, clients may work with or give access to an auditor or consultant to the system in order to do analyses within the system. This may require special programming and often involves the use of PC's as intelligent terminals. When clients do not have DBMS, existing hard copy of financial information is used. PC data bases are often used for

mechanical sorts and analysis. Several types of sorts are often useful and are usually different than what are used for financial reporting. That is, the evaluator may want just overhead accounts by monthly total, by project number, or product line. Generally, in a forecasting or litigation setting, the client's financial information is analyzed using sensitivity analysis and "what if" models. Integrity of data is as important to litigation-related services, however, as it is to auditing. But litigation concerns regarding integrity are somewhat different than an auditor's concern. That is, review of controls is not common, as work is not generally related to the attest function.

Fraud considerations are most likely after-the-fact in litigation support work. That is, fraud has already taken place and analyses are performed to prove fraud took place, how it happened, and quantify the impact. Forensic or reactive analysis rather than proactive analysis is done by an auditor. Testing of a litigation consultant is primarily substantive testing in nature. Totals tie to financial statements, general ledgers, and certified cost reports, to name a few. Various sorts are done on the same data balance to the same totals (i.e., internal consistency is checked.)

Data within the DBMS ties to source documents including invoices, purchase orders (PO's), checks, bank statements, and receivables/billing records.

Litigation work and auditing utilize PC data bases extensively. The analyst takes information from the client system and performs analysis on the PC. Retrieval systems for document control are prevalent, especially in litigation.

One integrity problem is in the input. Corrections of input is critical, and for retrieval systems, consistency in coding key words is necessary. Common programs in use are DBase III and FOCUS.

Education needs for litigation type of work, many of which relate to auditors as well, include:

- . A recognition by students (and relatedly, young staff) that the best "test" is to be aware, gather facts, pay attention, and thoroughly know your area.
- . Investigations are not always exciting, but extensive knowledge of the assigned area will help the person recognize irregularities or errors.
- . Use of the DBMS, where available, can be used to gather facts which will corroborate the numbers, especially reasonableness tests.
- . Students need to be taught to recognize how one area fits into the total picture of the company and its industry.
- . Good awareness of the company, possible external events which affect the company, and internal events which affect several areas is critical.
- . Again, DBMS make access to corroborating evidential matter easier.

- . Non-technical points are best learned through problems, cases, and clear communication by instructors.

It is a common misconception of new staff (and sometimes experienced staff as well) that if the data comes from a mechanized system, it must be right. It must be emphasized that good controls and adequate testing are still necessary. If a PC is involved, good quality control of the formulas is necessary. Furthermore, if a PC is involved, manual footing and some recomputation to check formulas can be useful. This latter point is an important facet of effective systems education.

Relevant articles in evaluating information systems are "A Relational Approach to Decision Support for EDP Auditing," Communications of the ACM by James V. Hansen and William F. Messier (November 1984), pp. 1129-1133 and a working paper entitled "A Relational Approach to Monitoring Controls" by James V. Hansen and William F. Messier (University of Florida, No. 86-4).

**PHASE II: DECISION ANALYSIS—BAYESIAN/EXPECTED VALUE/SIMULATION/SAMPLING
/LINEAR PROGRAMMING/MODELING**

- | | |
|---|---|
| - | How can students be better educated as to how decisions are made? |
| . | Without such knowledge, it is difficult to design an information system for multiple uses; the implication would seem to be coursework in decision theory and related topics. |
| . | Are such courses to be adapted from engineering and other business departments? If not, is it possible to get other faculty outside of accounting to use some accounting information when developing course examples? |

The first key is to educate students that decision making is a major part of an accountant's and auditor's life. Too many people entering public accounting envision a process oriented (almost clerical) profession; they are not prepared for the level of thinking and the decision making skills required in public accounting. This may be because of the type of person who goes into public accounting, or because our education system teaches public accountants not to be thinkers. We need to get thinking into our educational programs. We must avoid cookbook approaches and memorizing of rules; instead, we need to stress the decisions that have to be made and the number of close calls faced in practice.

The best way students can learn how decisions are made is to see real world cases and how real world decision makers consider them. This implies that internships need to be part of most programs; it also implies more practitioners doing the teaching, and review of cases for relevance by practitioners. More needs to be included in courses as to how to make accounting and auditing decisions, how to gather facts, how to research a problem, how to find precedents, how to use a service, how to use NAARS and LEXIS, and how to understand business risks and the business aspects of making a decision.

The human relations aspects of decision making also need to be taught: how to get the client to tell you all the facts, how to explain the decision to a client so that the client understands why your conclusion is in his best interest, how to negotiate effectively, the bounds of professional ethics, etc.

The CPA examination needs to be changed to stress decision making. Short answers should be eliminated since the real world doesn't deal in short answers and since short answers lead to memorizing rules to deal in a black or white situation. Similarly, most examinations (including sections of the CPA examination) need to be "open book" or project oriented to get away from "memorizing rules."

There is a need for a course called Professional Decisions in Accounting. This should be a decision-making course, but it shouldn't be adopted from other departments. It needs to be developed and taught by people who've made accounting and auditing decisions.

Students could be, and should be, exposed to the basics of decision analysis. Such exposure could be achieved either by:

- (a) incorporation of accounting examples in engineering or statistics courses, or
- (b) incorporation of decision analysis in accounting courses.

The latter is preferable. For example, one academician in the last two years has tried to expose students to Bayesian analysis in the auditing course and the experience has been successful. It is important to develop course material, however, to explain these complex issues in simple language without much technical jargon. The purpose is the use by students of these techniques without overwhelming them with complexity. We can do for students what statistical packages such as SAS and SPSS have done for us in our research activities: to use these statistical packages, one does not need to be a statistician. One only needs to know the appropriate test to use; the mathematical complexities are dealt with in the programs written for statistical procedures used.

Of course, before software is developed, we need a good understanding of the types of decisions made in practice and how decisions are actually made. Academics and students both need to recognize that sample size or scope decisions are just one of many types of decisions an auditor makes.

-	Can Bayesian statistics be used on a micro to improve auditors' decision making?
.	Are there other more effective rules for integration (note the results of some of the past behavioral literature)?
.	Are simulation and expected value programs recognized for their use in forecasting reviews, going concern evaluations, and similar CPA judgments? What software is available?

In some contexts, Bayesian statistics might be helpful. Typically this would be for a test of details or scope setting. It would not be useful for disclosure or the accountant's reports. If Bayesian statistics are used, the software has to be extremely user friendly.

Some questions exist as to how useful Bayesian approaches will be. Most decisions are not sample size or even scope decisions. Rather, they are interpretations and communications issues, e.g., How can we get the reader to understand that....

Many auditors are familiar with spreadsheet packages and their use in forecasts and projections. Many are helping clients develop projections. If there is a real going concern problem, many auditors are smart enough to help the client put together a projection using a spreadsheet package. There's also software to value a company, such as ALCAR. Most auditors are not using this type of software because it is too complex.

The Bayesian statistics can be used on a micro. The manuscript, "Decision Support and Expert Systems in Auditing: A Review and Research Directions" by

Mohammad J. Abdolmohammadi (Boston University, 1986)," provides an example of a Bayesian assisted sampling system (BASS) developed for use on a micro computer. BASS could be used for instructional purposes in teaching auditing.

- As the use of micros extends from spreadsheet to sampling and modeling programs, certain aspects of the audit will be affected which merit research and analysis:
 - . Audit risk is likely to decline since sampling risk is controlled and modeling can result in more effective analytical review.
 - . The audit process will likely demand a greater breadth of information concerning the client.

Audit risk may not decline because of the use of modeling software; rather, the risk may be held constant by auditors. Instead, what will decline is the extent of detailed testing. Since SAS 39 was published, we have seen a decline in sampling. While part of this comes from auditors' understanding of what sampling is, a good part comes because we are replacing detailed testing with analytical review. This is especially true in cycles that are not significant.

Whether modeling can result in a more effective analytical review depends on the circumstances. We have told our auditors to use the ratios or statistical measures that the client uses to run his business. For many clients, an effective analytical review can be done with a fairly small number of ratios. The construction of models must be evaluated as to the models' cost effectiveness.

As we get away from detailed testing, a greater breadth of information is needed concerning the client's business and industry. More important, auditors need to understand business in general: what makes a client tick. Too many students entering public accounting haven't the foggiest idea what goes on in business. A current events in business course that included reading current business publications (Wall Street Journal, Business Week, Fortune) might be useful.

- What is the quality of available software?

Bayesian, expected value, simulation, and linear programming software are not easy to learn. Some firms use LOTUS 1-2-3 as a spreadsheet package, JustWrite for word processing, and FAST as an automated workpaper and analytical review package.

- Are certain packages advisable for instructional use?

For instructional use, students should be forced to use a word processing package, a spreadsheet package, and an automated workpaper package. These

should be taught in the freshmen year and used in all courses. All students should be forced to keyboard most of their assignments -- whether it be a ten-page paper, a one-paragraph answer, or a worksheet. Today's accounting students (and their professors) need to understand that by 1990 pencil-prepared workpapers will be obsolete.

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| - How do you envision present and future use of decision analysis concepts as audit tools? What research and educational needs are suggested? |
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It is uncertain how decision analysis will be used in the future. Rules of thumb and perhaps a Bayesian approach may help; but, we are a long way from convincing auditors that these things are useful. We need to show auditors how they can be used so that they can buy into the process. Auditors are hesitant to change. Research ideas are detailed in an article entitled "Bayesian Inference Research in Auditing: Some Methodological Suggestions" by Mohammad J. Abdolmohammadi, appearing in Contemporary Accounting Research, vol. 2, no. 1, pp. 76-94.

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|---|
| - What steps can the Auditing Section of the AAA take to encourage the use of decision analysis techniques? |
| . Can it effectively lobby to get hands-on use of simulation software during coursework in statistics, aside from applications in accounting? |
| . Can case examples be generated for instructional purposes on the actual use of such decision tools in the field? |

Every subject that can be taught using a microcomputer should be: whether that's statistics or accounting or anything else. Statistics departments should be using microcomputers.

It is difficult to generate case examples until the tools are actually used. There needs to be a survey of the use of the kinds of software. The researchers can then work with the firms using the software to create case studies. But the field use has to come first. We should also recognize that the problem is not only software. Rather, it is selling the change to auditors.

The development and use of case examples on decision analysis are favored over lobbying for inclusion of accounting cases in statistics courses. The latter may require a great deal of lobbying effort for a likely lack of success, because we would probably need to educate statisticians and engineers in accounting cases.

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| - Can the accounting profession enhance both the development and use of decision analysis? |
| . Are research and development consortia plausible? |
| . Are continuing education joint efforts plausible? |

Research and development consortia and continuing education courses could be effective means of getting faculty interested in the use of decision analysis in courses.

However, some believe that consortia and continuing education joint ventures are not yet possible. We need to have the real field uses, and this will only happen when the software is used.

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Agenda for the Auditing Section

Scenario III: Networking

- Encourage the use of BITNET in Committee and task force activities.
- Form a committee to suggest how the EDP audit course could effectively include the audit impact of local area networks (LANS).
- Encourage faculty to require that students gain experience in accessing a public database. This could also permit a demonstration of the ease of access via modems.
- Consider a role for a task force that identifies networks which are lax in control and auditability for the purpose of motivating the correction of these deficiencies. This same task force should strive to identify research issues related to the control and auditability of networks.

Agenda for the American Accounting Association

Scenario III: Networking

- Encourage the use of BITNET in committee and task force activities.
- Encourage faculty to require that students gain experience in accessing a public database. This could also permit a demonstration of the ease of access via modem.

SCENARIO III. NETWORKING

Professionals need to appreciate the current power from networking and its likely enhancement in the near future. The concepts of electronic mail, dialogue across micros and between micros and mainframes, and access to large data bases through modems should be introduced and experienced to the extent possible.

KEY ISSUE CONSIDERATIONS

| - What do we mean by a network? |

Do we want to consider as a network, any type of telecomputing? In particular, is using a microcomputer as a terminal for a mainframe within the purview of networking as we are defining it? Is the connection of a microcomputer to a public access database within our definition of networking? Does the use of E-mail or any other messaging system define a network? Does a PBX twisted-wire system meet the definition of a network? Or is a network only a specially designed, hardwired system such as a LAN?

The definition of a network is not really all that critical. Rather, the concept and use of the computer as a telecommunication tool is the real issue. The technological basis is not a primary concern.

| - While many organizations have been experimenting with |
| and implementing LANs and other networks, what should |
| be the role of the academic accounting community? |

Within the academic arena, what should the members of the AAA as users of networks, be aware of? Can they enhance the viability of networks?

The members of the AAA should be aware of the technological changes occurring in industry, and the potential benefits (and disadvantages) of both LANs and distributed processing (as a LAN is a small scale distributed processing system). As users, AAA members need to have sufficient expertise to be able to use the systems. For example, BITNET could be viewed as a network that could provide an alternative approach to conducting task force communications and "brainstorming." Improved timeliness and better discussion of issues would most likely result. AAA members must also keep current as to the alternatives available at their university. Due to the rapid change in technology, many academic computing centers are now providing additional networking facilities, ranging from proprietary screen editors for microcomputers to joining networks (e.g., BITNET), to providing LANs for student labs.

What role should members of the AAA play in the education of students as future users of networks?

The role of AAA members as educators of students as future users of networks is somewhat limited. At a minimum, the responsibility should be to

acquaint the students with the concepts driving the technology. Training in the actual use of a network might be appreciated by some employers, but the odds of the same type of system being used in practice as in the classroom are relatively low. Additionally, due to the rapid technological changes occurring in this area, the current systems would probably be technologically obsolete within three years.

Within the realm of auditing and systems education, the emphasis on networks will need to change. At the present, little or no time is devoted to the coverage of networks in traditional auditing courses. In EDP auditing courses, distributed processing systems and databases are covered, but this does not address the problems unique to LANs. At a minimum, the audit impact of the LANs needs to be included in the EDP audit course. The CPA firms could be asked to provide guidance in this area. Support could be in the form of "this is what we do." Alternative reactions of auditors to LANs can range from the "ostrich approach" (let's ignore it and it won't affect us) to actively addressing the control exposures inherent in these multi-user systems. Primary issues include network architecture, encryption, database security, access control, and authentication approaches.

Within the area of accounting systems education, the emphasis on networks will also need to be expanded. In the accounting systems courses, a number of texts provide coverage of the principles of distributed processing. In the past, a number of instructors did not provide a detailed coverage of this material. This will probably change as the increased networking occurs. Additionally, new systems texts generally acknowledge LANs, but only provide a cursory review.

What should be the use of networks in the classroom?

The use of networks in the classroom is generally limited to the resources provided by the university. Consequently, there is likely to be a wide disparity among the "haves" and the "have nots." If networking is provided by a university, then students should be encouraged to use all of the facilities available as a part of normal course assignments, not as special, here's how to use the network assignments. Additionally, it would be advisable to allow the students to gain experience in accessing a public database. This could be accomplished as a required part of the research method used in a term paper/project. If a school does not have access to a public database, but does have a library system that can be accessed via modem or network, the same effect could be achieved.

What role should members of the AAA play in "selling" of networks to other professional users? Is it the place of the AAA to "sell" networks? Can the AAA encourage improvements in networks?

The AAA should not play the role of advocate for any type of network, primarily because members do not have the appropriate expertise to decide among the alternatives available. Rather, the marketplace (with IBM's help) will determine the appropriate networking structure. The appropriate role for the AAA membership is that of information dissemination in the areas in which expertise is possessed. This generally translates to the areas of auditing and control. If networks are offered which are lax in control and auditability, it

would be beneficial for the AAA membership to join with other professional accounting organizations in attempts to correct those deficiencies.

What, if anything, have other professional accounting organizations done?

The EDP Technology Research Subcommittee of the AICPA is preparing a report to the Board of Directors on computerization and automation of business operations. This report might address some issues.

<p>- Networking problems have been troublesome due to the proliferation of incompatible equipment, software, and auxiliary materials. It is anticipated that this problem is decreasing, as more compatible equipment is being manufactured. Yet, the short-term problems ask</p> <ul style="list-style-type: none">. How can micros and mainframe "talk to each other" presently?. How can micros communicate with one another?. How does such networking influence the audit engagement, and educational process?. What changes are anticipated?

Networking problems are decreasing now that IBM has introduced their token-ring network. Many of the other vendors of LANs are now providing or developing hardware and software consistent with the IBM protocols. In an IBM shop, there would be no question as to the approach taken, simply wait and see what IBM offers, and what compatible equipment is available. While many universities have IBM mainframes, a substantial number do not. Consequently, the wait and follow IBM methodology falls short. In these environments, the strategic plan must first be reviewed in order to determine if a non-IBM environment will continue, and secondly, the importance of networking. If a non-IBM shop is assumed, then the most likely approach is to determine compatibility with the existing equipment. This will generally define the alternatives available.

The "problem" of how micros can talk to each other is really a non-issue given the wealth of software available (e.g., SMARTCOM, CROSSTALK XVI, PC-TALK, etc.). These same packages allow communication with mainframes that allow dial-up access. Perhaps the key is to demonstrate this ease of access to students.

Networking has not really affected the education process as of now. It should be viewed as an aspect of a tool, computerization. Consequently, the students should be aware of its capabilities and deficiencies. The primary concepts should be examined, not a specific methodology.

Members of an audit engagement routinely tie into timesharing for statistical sampling and modeling capabilities. Of course, micro versions for most programs, previously on time sharing, have been developed. Often to tie into a mainframe, different compatibility software is required, but little reason exists for problems in establishing an interface between micro and mainframe.

- Should universities strive to network or wait a short while, due to anticipated declines in cost?
 - . Should electronic mail among students be facilitated and encouraged?
 - . Should students be asked to access large data bases during the course of university work? A variety of data bases could be suggested, including, literary search at the library, stock market activity from the Dow Jones or similar data bases, capital market parameters from CRSP or COMPUSTAT (in finance courses), disclosure prototypes from NAARS, or tax information from LEXIS.

Computing services at universities are not likely to change their strategic plan of action simply because a small group of a college desires some new toys, unless that group is willing to pay for those new resources. Consequently, the best that AAA members could hope to do is lobby for the development of networks and computer labs. Again, whether or not the university operates an IBM shop will most likely define the course of action.

Students should be encouraged to use public and private (library) databases, however, the extent of use will necessarily vary with academic maturity. Undergraduate students would most likely only use a library service and any other features available in a LAN. Graduate students, on the other hand, would probably make use of financial tapes, NAARS/LEXIS, or whatever is appropriate to the course.

- Can the auditing section of the AAA or the profession enhance progress in networking?
 - . Encourage clients who are producing equipment and software to stress compatibility.
 - . Support research on networking (both local area and wide area).

Encouraging compatibility is a two-edged proposition. It allows some consistency to enter into the market, however, if it also forces what may be a deficient design on the market, it reduces innovation. Given all the changes that have taken place in the market during the past 2 years, the time for compatibility may not be now. Granted, IBM's introduction of a LAN had the effect of imposing a standard. It may simply be that the IBM standard will be at a minimum, the protocols used to transfer data between LANs.

The auditing section should encourage research in an area acknowledged to be the strength of both the section and the profession, that of control and auditability of networks. Consequently, research in this area should be encouraged.

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Agenda for the Auditing Section

Scenario IV: Decision Aids

- Periodically, include in the section newsletter an article providing a brief survey of the expert systems literature which is readable by those unfamiliar to the area. Provide references to key literature to which readers with a desire for more in-depth background can turn.
- Establish a committee to
 - determine how ideas can be exchanged while proprietary interests are protected,
 - investigate the field of artificial intelligence and strive to develop publication standards for such research, and
 - develop a recommended syllabus for a course in decision aids.
- Consider means of disseminating a report concerning the effect of decision aids on audit technology which includes: (1) an overview of decision aids; (2) a review of audit support tools and expert systems; and (3) an assessment of the effect of decision aids on audit practice and education.

Agenda for the
American Accounting Association

Scenario IV: Decision Aids

- . Encourage the creation of a column on expert systems in the Journal of Information Systems.

SCENARIO IV. DECISION AIDS

To move forward the effective use of technology, decision makers need to understand what is meant by decision aid/expert system/artificial intelligence, and combinations thereof. In particular, tradeoffs in developing and applying these systems, current capabilities, likely progress in the short-term, and possibilities over the long-term need to be clarified. The complementary vs. substitution role of such aids should be stressed to deter the behavioral problem of purposeful resistance to progress.

KEY ISSUE CONSIDERATION

- How could the current state of decision aids/expert systems/and artificial intelligence be
. demonstrated for educational purposes
. integrated in field applications
. extended via research?

Definition of Terms

Decision aids should be used as a blanket term and expert systems should be treated as a subcategory of decision aids. Expert systems of course are subsumed under the heading artificial intelligence and are that aspect of artificial intelligence of interest to auditors at the present time. Artificial intelligence includes diverse fields such as machine vision natural language processing and robotics. Expert systems would seem to have the greatest short run potential for the accountant and accounting educator. A key concern is that people tend to inappropriately describe decision aids as expert systems. These terms need to be differentiated. Expert systems are a part of decision aids and the term decision aids is much broader than just expert systems. The problem has arisen from many parties treating them as equivalent terms; in particular, some firms have talked about the expert systems they were developing when in fact they were developing other less sophisticated forms of decision aids.

Classroom Use

Decision aids are presently in limited use in classrooms, other than the use of various proprietary kinds of software. It may be that if decision aids are better defined, more information could be gathered. Because the various firms have such a plethora of decision aids that they use, care must be taken to ensure that the students are not inundated with every possible variation on a theme. It may be that showing students some of the kinds of software that are available as decision aids may be the best route to follow.

There are currently numerous expert systems projects under development within many of the major accounting firms. There are probably similar expert system projects under development within private firms. While there will be short-term proprietary concerns about releasing or loaning these products after they have been initially developed, some of these will eventually become available for educational demonstration purposes. Also, with the growing availability of microcomputer based expert system shells, there should be

increasing opportunities to develop and demonstrate such tools.

Decision Context for Successful Application in Field and Implications for Education

To date, successful applications of decision aids and expert systems have been in areas where there are finite, even fairly limited bounds on the amount of information relevant to the decision context. There may be many possible decision outcomes that have to be evaluated, but the decision context is relatively confined. The kind of decision context that lends itself to successful application are those that are similar to chess (i.e., chess has limits on the types of information but many possible outcomes are associated with any particular decision). Successful "expert systems" that come to mind are ones like the R1 expert system that configures computers for Digital Equipment Corporation (McDermott, 1981), and the Dendral system that analyzes chemical data (Lindsay, et al., 1980). While expert systems are rapidly becoming more advanced, the possibility of developing an expert system that practicing auditors could rely on seems remote, except for decision contexts that are similar to those addressed by R1 and Dendral.

With respect to education and training, there may be more opportunities to fruitfully apply current technology. These applications carry little in the way of immediate and costly errors that are possible if current technology is applied in an audit situation. Moreover, the objective of educational applications would be to acquaint students with the strengths and weaknesses of current expert systems. Clearly though, educational applications of expert systems are not yet at the point where a system could be used to train students to become experts.

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Research Needs

In terms of expert systems, the most important aspect of current technology is the promise it holds for future applications. Therefore, research aimed at achieving this promise should be the highest priority. The research should address three dimensions of the issue:

1. Basic Research - The field of expert systems/artificial intelligence is moving at a very fast pace. Accountants need to be a part of the frontiers of this developing science. Only by working at the frontiers of the underlying discipline will accountants be able to develop their own high quality applications and understand applications that are taking place in the enterprises they audit. There is a need for scientific knowledge about decision

processes of expert auditors. This knowledge will be based on experimental and descriptive research that can ultimately be verified with computational models.

2. Application Research - While there is little hope for applying current technology to complex auditing situations, research should proceed on applications that are feasible. Some of these applications may not even involve computer technology. However, observing the problems and accomplishments of simple applications will allow accountants to learn important bits of information for more complex applications in the future.

3. Evaluation Research - Research needs to be directed at effects of decision aids on auditors and audits. Expert systems decision aids are relatively new territory for auditors (for society in general), and it will be important to systematically monitor applications and to conduct scientific investigations of the effects of this technology.

Insofar as research into expert systems is concerned, public accounting firms will all become involved in expert systems development at enormous costs and there is a fairly high probability that a number of them will "re-invent the wheel". There is not, for obvious reasons, much sharing of technology between the public accounting firms, and it seems unlikely that the sharing will increase in the near term. That is why large sums will be spent on developing expert systems by the individual firms. One solution would be for academics to work on the research into expert systems; the problem with such a plan is that such research would either be consulting, where the benefits would flow to one firm, or more pure research available to all firms. In the latter case it may be unlikely that an individual firm will fund research that will benefit all firms. Perhaps a consortia approach to supporting such work would be appropriate.

A discussion of research directions is provided in a working paper by Mohammad J. Abdolmohammadi entitled "Decision Support and Expert Systems in Auditing: A Review and Research Directions" (Boston University, 1986).

- How much programming (such as LISP) do students need to know about expert systems?
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The answer to this question depends on future developments. Will the future involve auditors working every day with their own computer-based expert consultant and conducting audits of firms where corporate decisions are made with the aid of expert systems? It is not difficult to imagine such a future. If this is the future, then students (future auditors) must know enough about these systems to understand their strengths and limitations. It is important to note that even the newer "canned" expert systems have the facility to add decision logic via direct programming in LISP. Thus, there may be many situations where auditors will be able to understand the strengths and limitations of systems only by being able to read the decision logic embedded in the program. Auditing students who have been exposed to artificial intelligence methods (this would include learning LISP and/or other AI languages) will be best prepared to operate in the future.

In order to demonstrate how an expert system might be developed, students should probably be exposed to one of the programming languages that can be used for expert systems development. One would think that this material could be combined with the conventional, COBOL or FORTRAN programming types of courses. Based on very limited experiences with each, one member of the subcommittee feels that students might find PROLOG to be easier to grasp than they would find LISP. Other members have expressed the view that students do not need any programming skills unless they are going to become expert system developers.

| - What is the time horizon for new developments likely to affect education and practice? |

The most important thing to keep in mind about the time horizon for new developments is that NO ONE knows what it is. There is a tremendous amount of work going on in accounting firms, in corporations, and in universities throughout the world. Trying to predict how long educators and practitioners have to get ready for this technology is a waste of time. The best thing for education and practice is to get involved in this fast moving field and try to understand and influence its direction.

With the mass of recently published literature about expert systems, the time horizon for these developments should be quite short. We will probably see practically or commercially viable types of expert systems for the accounting and auditing community within the next two or three years.

Teaching students about expert systems and the development of expert systems for use in public accounting are distinct issues. There is a big difference between the two because the latter take quite a bit of time to develop; it is unlikely that students will have the time to develop a fully operating expert system albeit a small one. Yet, the likely speed of technological developments suggests educational attention to expert systems is imperative today.

| - Which decisions are most likely, in the short run, to be effectively addressed via expert systems? |

The answer to this question needs to be addressed at two levels, the application level and the research level. At the application level, an expert system that auditors would rely on during an audit would have to address a fairly limited decision or a limited part of a larger more complex decision. It is difficult to specify particular decisions. In addition, the cost of developing an expert system is such that the decision domain should be fairly constant across clients. One could conceive of some analytical review applications. The most successful applications will probably be ones that operate in very deterministic domains. For example, the first good examples may well relate to solving tax problems.

At the research level, where expert system work is primarily aimed at developing computational models of expert auditors, the decision contexts can should be more complex. Here the objective is primarily the development of knowledge with application as a distant goal. The importance of the decision context for research is that it should: (1) require expertise to solve the problem, (2) be of manageable size, thus one might select one aspect of a larger problem, and (3) if completed, provide some needed scientific knowledge about expert decision processes or auditing and solve a significant auditing problem.

How can the profession and, in particular, the audit section of the AAA enhance

- . knowledge of decision aids,
- . their application,
- . their improvements, and
- . future research?

It will probably take a strong selling job to convince the profession and audit section of the AAA of the growing importance and significance of expert systems. This might be accomplished through a strong encouragement of expert systems research through the AAA's journals. A column or section on expert systems could also be included within the Journal of Information Systems. However, since some faculty are uncomfortable with microcomputers, it may be more difficult to increase the expert systems comfort level.

It might be useful to have an article in the section newsletter pulling together material from a variety of journals in addition to accounting and auditing journals. Such an article would simply be a brief survey of the literature and would point interested parties in the appropriate directions for their own research. It should be readable by an individual who doesn't have a background in this area who might want to plug into the expert systems literature and doesn't know where to begin. John Chandler's article on expert systems several issues back in the newsletter was a useful step in this direction.

There are two major problems on the horizon that could retard the development of decision aids, particularly expert systems, in accounting. First, the proprietary interests of developers of expert systems are such that there may be a reluctance to share important knowledge about expert systems. These systems are costly and time consuming to develop, and there will be a natural tendency to protect this investment. Second, a recent panel discussion of editors of journals (1986, USC Symposium on Audit Judgment) suggests that there will be considerable difficulty in publishing expert systems research. This is a new area that is developing in a different way than traditional lines of research in accounting. Thus, editors are unsure of the appropriate standards for expert systems research. In addition, a high level of uncertainty about publication possibilities will discourage new researchers from engaging in this research.

There are no clear cut answers to these two problems, but there is a need to find ways to allow a vigorous exchange of knowledge in the area. It has been

suggested that the audit section establish a committee to investigate these two problems. The committee would have two charges: (1) determine how the audit section can protect proprietary interests and yet encourage an exchange of ideas, and (2) investigate the field, broadly defined as artificial intelligence, and provide some insight about appropriate publications standards for this type of research.

- How is the audit process likely to be affected by wide use of decision aids?
. behavioral implications
. legal implications

The audit process will certainly be affected by the growth of expert systems to support auditing. We will probably find them being used, initially, in very limited, deterministic domains. These first applications will probably be used as training devices as the true experts, who helped to define the rules for given expert systems, may feel it beneath them to use the expert systems where they contributed the rules. However, as more and more rules are added to these expert system shells, and as they become more widely accepted, they should exercise a significant effect on the overall audit decision process.

At this stage, it appears that expert systems are more than a fad. There are no industries that are not currently or planning to allocate considerable resources for the development of expert systems. This means that future auditors are likely to be using expert systems and auditing companies that use them. The first behavioral implication of this is that all auditors are going to need at least a basic knowledge of these systems, and audit firms are going to need some specialists who are expert in developing and understanding these systems. Auditing quite often involves assessing management decision processes related to some financial statement disclosures (e.g., FASB 5). If management uses an expert system to make these judgments, then auditors will have to understand the decision logic of that system in order to evaluate compliance with GAAP.

An additional thought is that the students who graduate from accounting programs are going to have to be more highly skilled than at present if they are going to be able to fully utilize the decision aids, including expert systems, that are available. So while the need for lower level staff might be reduced, the level of knowledge of those that are hired concerning decision aids will have to be greater than at present.

An additional behavioral issue involves the effect of expert systems on the development of human expertise. Will expert systems enhance or retard this development? The answer is not clear at this time, but it is clear that auditing will always need human experts and must ensure their continued development. The effect of expert systems on human expertise needs to be investigated.

In terms of legal implications, a recent paper by Willick (1985, p. 44) provides some important insight about legal liability of professionals:

"... machines will begin to figure more prominently in malpractice litigation as computers slowly make the transition from experimental innovations to required tools. The threat of malpractice liability will force professionals to use available computer systems, and to be competent in doing so."

Willick maintains that plaintiffs will be able to prevail if they can show relevant expert systems were available that a professional did not use to consult) or if the professional makes inappropriate use of an expert system. Again, there appears to be strong evidence that auditors are going to know what expert systems are generally available, and to know their strengths and limitations if they decide to use them. There appears to be a need of uncertainty ahead, as Willick (1985, p. 45, emphasis in original) states:

"Since practitioners might commit malpractice by failing to use computer systems, they will face dilemmas whenever their best judgment leads to recommendations different from those of their systems. Such professionals appear, in the near term, to face potential liability whether or not they follow the system's recommendations. Eventually, however, the traditional standard of reasonable care will probably be applied so as to free professionals from liability when they rely on systems of established reliability."

Nor will system developers escape potential liability. Willick concludes there will be some shared liability between the system user and developer.

While there are some obvious legal liability problems, it does not appear auditors will be able to avoid developing expert systems and knowing what is happening in the field.

What are the emerging hardware and software issues that affect decision aids? What are the implications of these issues and your recommendations for teaching and research?

Hardware is getting smaller, more powerful, and cheaper. Software is getting more user friendly and more flexible. It is not difficult to imagine a future auditor having expert system software available that will allow a practitioner to develop an individualized system for some aspect of a decision. The consulting firms are likely to keep up with such developments. It seems that the biggest problem is in education. There are very few universities that offer courses that can prepare students for this future. Moreover, even if courses are available, too few advisors will recommend that students take the courses. This probably will not change until more courses are developed and probably, importantly, the CPA exam has some questions related to this technology.

The audit section might consider establishing a committee to develop a recommended syllabus for a course in decision aids.

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Appendix to Scenario IV

Report Concerning the Effect of Decision Aids on Audit Technology

- An Overview of Decision Aids
- A Review of Audit Support Tools and Expert Systems
- An Assessment of the Effect of Decision Aids on Audit Practice and Education