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An Approach
To the Use of EDP
In an Accounting Practice

6

COMPUTER RESEARCH STUDIES

An Approach
To the Use of EDP
In an Accounting Practice

This bulletin is published for the information and assistance of members of the American Institute of Certified Public Accountants and others interested in the subject. It is based on the results of a project undertaken for the Institute by the System Development Corporation. It does not represent the views or an official position of the Institute.

Foreword

The American Institute of Certified Public Accountants engaged the System Development Corporation, Santa Monica, California to undertake a research project on the basic considerations involved in utilization of electronic data processing in an accounting practice.

This booklet is based on the results of that research. It is intended for accounting firms which have had little or no experience, so far, with electronic data processing.

JOHN L. CAREY
Administrative Vice President

May 1968

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I.

Introduction

The growth of electronic data processing since the early 1960's has been phenomenal. It has been estimated that in 1955 there were approximately 250 computer systems installed throughout the world. By 1960, it was estimated that this number had grown to almost 7,000. The advent of less expensive, but more powerful, second and third generation computer systems contributed to a dramatic increase in the number of computers installed—pushing the 1968 estimate to more than 50,000. (In 1960, most industry experts believed that this total would not be reached until the middle or late 1970's.)

This dramatic growth is very likely to continue for the forseeable future, with perhaps only a modest leveling-off of the rate. Many industry sources feel that as the manufacturers place more emphasis on broadening the base of the market by introducing smaller, lower-cost systems, the number of computers installed will reach close to 100,000 in 1970 and may exceed 200,000 by 1975.

This tremendous increase in the number of computers as well as in the number of organizations providing computer services, the number and variety of computer applications and the number of individuals involved in electronic data processing has had a corresponding impact on almost every segment of our economy. The implications of the above demand that the CPA critically evaluate his own position with respect to EDP. Although many firms have been untouched as yet by the effects of EDP, the impact of the aforementioned growth is sure to be felt by even the smallest firm in the very near future.

Although the CPA may conclude that he needn't make any

changes in his present pattern of operation after completing his analysis of the implications of EDP, he can not afford to completely ignore the subject. The expansion of accounting-oriented data processing centers, the increase in the number of audits which must be performed in firms utilizing EDP, and the increased use of computers to perform these and other audits are but a few indications of the need for the CPA to consider the future, evaluate what his role is to be and prepare himself for it.

Electronic data processing should not be viewed as a threat. Rather, it should be viewed as an opportunity for further professional development and better client service. As AICPA President Marvin Stone stated in the April 1968 *CPA:* "The availability of this powerful tool should cause CPAs to take a fresh look at their clients' information systems. CPAs should ask managements what information they need to operate more effectively. In fact, the independent CPA might well discern information needs which managements fail to perceive because they are too intimately involved. Any survey of information needs should ignore cost and time factors at the outset, since modern processing methods might well make practical what once was not.

"Some CPAs have expressed the fear that the computer will prove to be a difficult competitor or that computer owners such as banks will eliminate much of the need for a CPA. Nothing could be further from the truth . . . CPAs with the imagination to make full use of the computer's potential will be the architects of tomorrow's business community."

The preparation process for EDP can be a formidable one and it takes time, particularly if the CPA's ultimate objective is to operate his own computer installation. The evaluation, selection and implementation process for a given computer installation can take several years or even longer. It must also be remembered that the electronic data processing industry is particularly dynamic. New technological developments in both software and hardware occur with amazing rapidity. Competition among manufacturers is intense—resulting in a bewildering array of hardware, software, rental and purchase plans, etc. There is a severe shortage of competent and experienced computer professionals—resulting in spiraling salaries and much job-hopping. In general, the EDP industry is immature and the CPA should recognize this and the other characteristics of the industry cited above.

The reader is cautioned that this document (which is based on work done for the Institute by the System Development Corporation) is not intended to be a comprehensive EDP primer. Rather, it

is designed to provide a basic orientation for the CPA who is considering rendering computer services. Other reference sources (some of which are indicated in this report) and competent experts in EDP should be consulted before making any commitments in the EDP area.

The use of a service bureau or commercial data processing center (CDPC), the use of time on off-premises computers (block time), and the acquisition of an in-house computer are presented as possible sequential steps to be followed by the CPA who intends to provide data processing services to his clients. General guidelines, appropriate caveats and relevant considerations are covered in each area. Several brief case studies are also included, as is a short bibliography.

Although most of this report is in terms of a "service bureau approach" on the part of the CPA, it should be noted that this is only one of a variety of possible uses of EDP in an accounting practice.

EDP can be effectively applied to practice management and auditing, for example. The subject of auditing is covered quite comprehensively in the Institute's publication entitled *Auditing and EDP* (referenced in the bibliography). The reader is urged to consult this volume for further discussion of this important topic.

Research and study of further applications of EDP in all areas of an accounting practice is presently under way at the Institute and in many firms. *The CPA* will contain information about new publications which may be issued as they become available.

II.

Purpose of Report

The purpose of this report is to provide the CPA who is considering providing some form of computer services with a general orientation to this subject as well as with a viable approach towards the achievement of this goal.

A particular effort has been made to present a down-to-earth

discussion, cite appropriate caveats, state relevant considerations and to emphasize the potential pitfalls and problems which the CPA is likely to encounter as he prepares to provide computer services to his clients.

A venture into EDP services is definitely not for every CPA and this area is one which should be approached with appropriate caution and due deliberation. However, as has been stated above, EDP is also an area which cannot and should not be ignored by the CPA. Rather, he should analyze this subject from the standpoint of his own particular position and should proceed accordingly.

The solution to his particular situation with respect to EDP may be to continue his operations as before with no changes; to further increase his professional competence with respect to EDP in order to make a more effective decision subsequently; to utilize the services of a data processing center on an experimental basis; to gradually build his own staff capability in EDP and purchase the necessary computer time from an outside source; to eventually install his own computer system—or some combination of these courses of action.

The Use of a Service Bureau or Commercial Data Processing Center (CDPC)

In this type of application, the service bureau will provide all services required by the CPA and his client—including systems analysis and design, programming, computer and peripheral equipment operation, computer time, and so forth.

The Use of Time on Off-Premises Computers (Block Time)

The use of a "block" of time on an off-premises computer by the CPA. The CPA is responsible for systems analysis, computer programming and delivery of materials to and from the computer. The CPA provides all functions associated with the machine and rents time sufficient to his need. (In some cases, the computer operator may be supplied [for a fee, of course] by the owner of the equipment.)

An In-House Computer

The CPA may elect to rent or purchase his own computer. The price to purchase or rent equipment and the further training and management of personnel are costs which the CPA must undertake

when he elects this option. The potential for financial loss is, of course, greatest when this approach is followed, but so is the opportunity for profit, at least in theory.

A viable approach is for the CPA to consider a gradual involvement which starts with the use of a commercial data processing service, moves through the rental of outside computer time while the CPA builds his staff, and concludes with his ownership of a computer. In this manner, the CPA can minimize potential loss and gradually become familiar with the basic applicability of EDP. He can also elect to stop at any point along the way he deems appropriate to his particular situation.

These courses of action are discussed in greater detail on the following pages, along with related data.

III.

The Computer and the CPA

"Although the purchase price of the smallest digital computer today still greatly exceeds that of a bookkeeping machine, its practical application and justification is no longer limited to the giant corporations. Even when the cost of full-time use of a computer cannot be justified, manufacturers and independent data processing centers and other sources permitting the part-time use of a computer are now quite common. Thus, today the benefits to be derived from a digital computer are available not solely to big business but to medium-sized and even small business as well."[1]

The pervasive influence of EDP in the CPA's work has been sufficiently documented in the American Institute of Certified Public Accountants' earlier publications in the EDP area, to which the reader is referred. Abundant examples exist which demonstrate an inevitable trend in the business world and that this trend is one of increased automation. Thus, the CPA cannot ignore the com-

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[1] Richard K. Puder, CPA (IBM Corporation), "Computer Service for Clients," *Accounting and the Computer,* AICPA (New York, 1966), p. 58.

puter, its effects and implications. To set this movement in proper perspective, one ought to consider the potential benefits of a properly applied EDP system to a typical business organization and therefore a typical client of the CPA. The uses of EDP have generally fallen into two areas where business is concerned: cost reduction and increased operating effectiveness. Among the factors contributing to cost reduction may be listed the following:

1. Reduction in clerical personnel
2. Reduction in floor space needed for clerical personnel
3. Reduction in the cost of forms
4. Reduction in the duplication of records
5. Reduction in the high cost of clerical turnover
6. Reduction in inventory cost as a result of the availability of more precise and timely data.

Along with cost reduction, computers have benefited their users by contributing to increased operating effectiveness. Among these benefits are the following:

1. The ability of management to make better informed decisions in a timely fashion.
2. The reduction in time required to process information.
3. The production of more legible records in a standard format.
4. The creation of new information as a result of the ability to combine data rapidly.
5. The capacity to handle peak work loads.
6. The ability of management to more effectively control operations.
7. The improvement of customer service as a result of faster response to orders and more rapid shipments.
8. The improvement of manufacturing effectiveness through the use of more timely and more accurate production control data.

When one considers all the factors, they present a powerful argument for any businessman to consider the use of EDP. As they affect his clients, these factors confront the CPA with an all-important question—namely, what is his relationship to EDP going to be? Since the CPA's clientele is becoming increasingly involved

in EDP, the CPA himself can consider one of two approaches:

1. The CPA can offer advice, guidance, and assistance to his client in relation to EDP problems.
2. The CPA can offer data processing services to his clients.

This report directs itself toward the second of these alternatives. It is, however, well worth considering the first, briefly.

If the CPA acts as an advisor to his clients on EDP matters he will find himself interacting frequently with other agencies (banks, service bureaus, or computer manufacturers) who have already applied EDP to the financial reporting and advisory fields and are performing a wide variety of additional EDP services. Moreover, such service bureaus can and do hire CPAs. The CPA will be asked to sit in on advisory and steering committees to help evaluate the effect of EDP on his client's business operations. The qualitative aspect of this work can be rewarding, as can the remuneration.

If the CPA elects to provide EDP services to his clients the benefits which can be realized include the following:

1. By providing such EDP services to his client, the CPA will be able to strengthen his continuing relationship, provide more effective service and have a better chance of retaining such a client as the client's data processing system evolves.
2. By participating in the generation of requirements and establishing the problem definition of the EDP system, the CPA will effectively move into EDP-related areas of management services.
3. The CPA can effectively assist in maintaining client confidentiality during the data processing function.
4. Computers and computer services help strengthen the public image of the CPA firm since they indicate that the firm has newer and more powerful resources to aid the client. Further, involvement with computers places the CPA in an advantageous position in the light of new advances in this emerging technology.
5. Staff—especially clerical staff—can often be upgraded through the introduction of EDP.
6. There is a profit/loss potential for the CPA in offering such services.

As should be expected, experience to date does not indicate that

CPAs are one hundred per cent satisfied with their EDP ventures. Certain CPAs have found the use of computers to be unsatisfactory. Clients have complained about services involving computers and some CPAs have suffered financial loss. While other objections have been raised, a significant barrier to the CPA's utilization of EDP has been the difficulty of planning for the break-even point or pay-out period in the offering of these services. General lack of knowledge regarding EDP and its ramifications has been another barrier.

On the other hand, many CPAs have had very successful experiences and they're quite enthusiastic about it. Some of these instances are documented elsewhere in this study (as they have been in earlier reports in this series). Most of the successful experiences have resulted from careful planning coupled with a knowledgeable and professional approach—plus unavoidable hard work.

If the CPA wishes to offer EDP services to his clients, an awareness of the available options is essential. Basically these options range from utilization by the CPA of external equipment and services to satisfy his client's needs to ownership by the CPA of completely in-house equipment and services. Within this framework there exist further categories of service. The CPA can utilize external equipment and service to varying degrees. He can, for example, begin with total EDP services provided externally or provide, via his internal operation, all services other than those of the actual machine utilization by renting portions of time on off-premises computers. Finally, he can secure internal equipment which would allow him to have within his firm a more complete capability and greater control.

As the CPA moves through the sequential process of increasing his ability to offer EDP services to his clients, he can consider the following approach. During the period of the CPA's utilization of a service bureau he will find it both necessary and advantageous to gain a mastery of the input preparation process. During the period when he rents off-premises equipment he can expand his knowledge to include the management of programming efforts and computer operations. The acquisition of such skills will make easier the final step that he *may* want to take; that of equipment selection and total in-house operation. Along with the CPA's use of the different options of offering EDP services, this report will suggest to him a gradual growth in his different responsibilities which will enable him to proceed knowledgeably and in an orderly and business-like fashion.

As the CPA's knowledge and confidence increases, he will be able to reduce the element of risk in taking the next sequential step in the process, should he elect to do so. It is also desirable that as the CPA makes his entrance into EDP services in a sequential manner, he provides himself with a position to which he can return should a further step not prove feasible. Each step will have its own challenges, some of which can be formidable.

The remaining chapters depict cost and other considerations for the CPA as he utilizes EDP. Information concerning the CPA's use of service bureaus, the renting of time on an off-premises computer, and the acquisition by the CPA of his own computer is included. A specific EDP application is presented to illustrate the options available to the CPA. By reviewing these factors, the CPA will gain a basic idea of the costs and potential benefits of EDP, become familiar with several guidelines for orderly growth in this area, and become aware of some of the pitfalls that are to be avoided.

IV.

Commercial Data Processing Centers (CDPCs)

A first option for the CPA who intends to provide EDP services to his clients is the employment of a commercial data processing center (CDPC or service bureau). In employing this category of data processing service for his client, the CPA will have a minimum concern with equipment, have no need for computer programming effort, and *may* not require any technical personnel for support of the data processing service. If the CPA is to plan the systematic collection of data and prepare the input for the CDPC, the costs to him will consist of some equipment rental and, of course, payment to the CDPC for data processing services. Most CPAs cur-

rently involved in EDP depend entirely upon CDPCs for data processing.

It is here suggested that a CDPC be considered as the beginning phase of providing data processing services and that it be always held in reserve for overload periods or a fallback should a more ambitious move not work out. It is evident that the proportion of CPAs using commercial data processing centers will further increase with time. This chapter defines commercial data processing services, lists types of services offered, and discusses how a CPA can select and employ a commercial data processing center in his accounting practice. In accomplishing that selection there are certain specific questions that the CPA will need answered. These are as follows:

1. How do I locate service centers?
2. How do I prepare a request for proposal?
3. How do I evaluate them?
4. How much do service bureaus cost?
5. What are the problems I may encounter?
6. What are the advantages of the CPA or his client preparing input rather than the service bureau?
7. What are the advantages and disadvantages of different input preparation approaches?
8. How would the CPA approach the solution of a specific application problem?
9. What jobs are usually best for a service bureau?
10. What should the CPA negotiate with the service bureau?

The balance of this section will explore the following questions

A. *How Does the CPA Locate a Service Center?*

Educated guesses by executives of ADAPSO (the Association of Data Processing Service Organizations) state that there are 1200 or more commercial data processing centers (CDPCs) or service bureaus in the United States. It is quite likely that every city in the 100,000 to 200,000 population range has available service

bureaus and more are being opened—almost daily. Some of the CDPC organizations have become quite large. It has been estimated that the annual volume of the CDPCs has exceeded 700 million dollars for the past two years and that their 1968 volume will approach 800 million.

CDPCs offer a complete range of EDP services. These may be briefly described as services in:

1. Analysis leading to problem definition and a statement of user requirements for the particular system
2. System design establishing a feasible solution to the statement of user requirements
3. System implementation including:
   input preparation
   computer programming
   personnel training
   actual computer processing of the data
4. Methods of evaluating the system's performance.

Naturally, the jobs performed by CDPCs vary as does the size and scope of the service bureau itself. Commercial data processing centers fall into general categories or types. These may be defined as:

Category A. Large, integrated, nationwide service bureaus operating a wide range of small to large EDP and tabulating equipment and providing related systems and programming services for a wide variety of applications. Bureaus in this class are often divisions or subsidiaries of EDP manufacturers.

Category B. Small to medium-sized, local service centers, usually operating in one locality, or at most in a few localities, selling service time primarily on unit record equipment (keypunching of source data, verification of keypunching, sorting, tabulating, and providing printed reports) or small EDP systems. These centers usually concentrate on information of an accounting or a statistical nature. They may also provide extensive clerical, analytical and consulting services as a portion of their product line.

Category C. Specialized information service bureaus which perform functions such as billing for doctors and dentists, bookkeeping ser-

vices for retail stores, automobile dealers, insurance brokers, and so forth.

Category D. Specialists in servicing the needs of accountants and their clients for tax computation and other services who are much more familiar with the needs of the CPA since they are either CPAs themselves or are owned or managed by CPAs.

Commercial data processing centers may be located as follows:

1. A directory of CDPCs may be purchased from the Association of Data Processing Service Organizations, Inc.[2] This directory is published annually and contains the following statement on its inside cover:

   "Membership is limited to those 'for profit' organizations which utilize their own equipment, on their own premises, assume full responsibility for the finished product, and which have completed one full year of successful operation."

2. The classified telephone book (yellow pages) lists such centers under Data Processing Service.

3. The "Roster of Computing, Data Processing, and Consulting Services" is published in *Computers and Automation: The Computer Directory and Buyers' Guide*[3] each June.

4. A reference section called "Manufacturers and Suppliers of Data Processing Equipment and Services" appears in the September issue of *Business Automation*.[3]

B. *How To Prepare a Request for Proposal?*

In order to have a basis for comparing the bids of the various data processing centers approached, it is necessary to develop a request for proposal which can then be submitted to the data processing centers which seem most likely to be suitable—based on a preliminary investigation.

The following material is taken from a special report entitled "The Selection and Use of a Data Processing Service Center" by

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[2] ADAPSO is located at 420 Lexington Avenue, New York, N.Y. 10017. (Directory price is $2 per copy.)

[3] See bibliography.

Gordon B. Davis, Professor of Information Systems and Director of the Management Information Systems Research Center at the University of Minnesota and former Computer Consultant to the AICPA. This report appears in the *Auerbach Computer Notebook for Accountants*,[4] available by subscription to members of the Institute in public practice. The reader is referred to this document for valuable supplementary data in this area.

"The basic idea underlying the request for proposal is that the prospective user of the data processing service should define his own data processing requirements using his own staff or a professional advisor. The completeness and detail of the request will depend, in part, on the capabilities of these individuals. The request should be specific but should allow the proposals submitted by service centers to suggest either alternative means for processing or alternative layouts in order to achieve economies or efficiency in processing. The request document should include the following:

1. Purpose of the processing

2. Handling of exceptions

3. Specifications for frequency of processing

4. Specifications for timeliness

5. Special requirements. For example:
    a. extra copies
    b. special reports required
    c. conversion specifications, including time limits, problems, etc.

"This request for proposal should be sent to those organizations which have passed an initial screening test based on their experience with similar problems, reputation, financial ability, etc. A week to ten days is usually sufficient for a data processing center to respond.

"If the data processing problem is standard and well defined, the request for proposal can be used for obtaining firm proposals from service centers. If the problem is such that considerable systems work is required for the center to make a proposal, the request for proposal may be used to select a suitable organization with which to work. Where the job is a small or medium-sized one, a center can be expected to make a suitable proposal if the job is well-

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[4] See bibliography.

defined in the request, but it may not be willing to invest large amounts of design time to make a competitive proposal."

C. *How Does the CPA Evaluate Service Bureaus?*

After the bidders have responded to the request for proposal, their responses must be carefully evaluated by the CPA based on the factors which he considers critical to his particular situation. Obviously, the decision should not be based on price alone. The following are among the factors which the CPA should consider in making his evaluation:

1. The experience of the data processing center in providing the services desired.
2. The speed and reliability of service as demonstrated by past performance.
3. The quality and capability of the hardware possessed by the center.
4. The capability and experience of the center's staff—including familiarity with accounting problems.
5. The provision for backup services in case of equipment or power failure.
6. Ability to handle possible expanded future requirements.
7. The financial stability of the CDPC (as indicated by the usual reference sources).
8. The ability of the center to adequately safeguard the security of the CPA's data throughout the entire processing procedure.
9. The availability of preprogrammed packages to handle the CPA's particular applications.

To the above list, the CPA will want to add those considerations which are particularly applicable in his own case.

D. *How Much Do Service Bureaus Cost?*

There is no set fee for service bureau costs. The service bureau will base its estimate on a variety of factors. The fact that these

estimates will vary argues for competitive bidding, which is the best way to establish costs. The costs will, of course, be directly proportional to the work that the CDPC is asked to undertake in terms of the potential services discussed earlier. Costs associated with a CDPC therefore have to be based on individual negotiation.

E. *What Are the Problems a CPA May Encounter in Dealing With a CDPC?*

As previously mentioned, many accounting firms do avail themselves of commercial data processing services. Experience with automating accounting applications extends to ten years or more for a number of CPAs. The majority are satisfied with service results and some are enthusiastic about this type of data processing. Other firms encountered problems which were not solved. Statements by CPAs and response comments from an AICPA survey of EDP applications indicate the main problems to be:

— Slow service
— Lack of accuracy in reports and excessive CDPC reruns
— Reports in a format confusing to clients
— Insufficient knowledge of accounting on the part of CDPC
— Insufficient planning and preparation
— Data transmission difficulties
— Additional service charges
— Auditing difficulties
— Overselling by the centers

F. *What Are the Advantages of the CPA or His Client Preparing Input Rather Than the Service Bureau? What Are the Advantages and Disadvantages of Different Input Preparation Approaches?*

These two questions are highly interrelated. The initial and on-going costs associated with input conversion are a significant and costly aspect of an EDP system. Information about the various methods, their advantages and disadvantages, is essential.

There are two fundamental factors to consider with regard to

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input/output equipment. First, that significant advances are continually being made in this type of equipment. Second, that it is imperative that appropriate equipment be obtained for the *individual requirements of a specific system.*

We are currently in a phase of data processing development where more effective, more versatile, and less expensive input devices will permit better utilization of EDP capabilities. This is of particular significance in a business data processing environment where most applications are characterized by a large volume of input and output data and by a relatively small amount of calculations. Because the high speed central processor can process the data more rapidly than the input gear can feed it in, EDP people refer to such applications as being "input/output bound." The development of new higher speed peripherals will help mitigate this problem. Those devices which are all electronic as opposed to most of the present devices which are electro-mechanical will perform most effectively.

1. *General Scope of Input Process*

The general scope of the input process concerns itself with the areas of data collection, source document preparation, editing, verification and error correction.

2. *Advantages and Disadvantages of Input Methods*

The attributes and relative advantages of the many methods of data conversion are extremely important. These advantages and disadvantages will determine the most appropriate application for a given method. Each case must be considered on its own merits.

3. *Devices and Media for Input/Output*

A detailed discussion of the various input devices available and their respective pros and cons is beyond the scope of this paper. However, some of the types of input/output devices and the media currently available are listed below along with background data. Sources such as the *Auerbach Computer Notebook for Accountants,* the Adams Associates *Computer Characteristics Quarterly*[5] and the manufacturers' own literature should be consulted for specifications and other details.

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[5] See bibliography.

The following discussion of input-output operations and the table of media and devices (page 18) have been excerpted from *An Introduction to Electronic Computers* by Gordon B. Davis.[6]

Overview of Input-Output Operations

The purpose of an input operation is to cause an input device to read information from the media on which it is stored, translate it, if necessary, to computer code, and store the coded information in computer memory. The purpose of the output operation is the reverse—to take information in computer code from memory and cause it to be written on some media. The media may be in visual form (such as a printed output) or in machine-readable form (such as a record on a magnetic disc file).

The devices for input and output and the storage media involved are summarized in the following table. The storage media may be classified as primary input-output (I/O) media and as secondary media used principally for computer files. Computer files provide storage outside the internal memory of the computer in a form readily and rapidly available when needed for processing. In addition to the primary input-output and file devices, there are special-purpose input-output devices used in computers. These typically are for limited use and are not usually employed for a large volume of input or output.

The input-output instructions provided with a computer system will specify the following, either as an explicit part of the instruction or as an element of the way the instruction is executed.

1. The input-output device to be used
2. The area in main memory to be utilized—area in memory to be read from or area to be written on
3. The action to be taken if an error condition results from the execution or attempted execution of the instruction

In addition to these three basic specifications, the instruction or hardware design must specify how the computer should handle simultaneous, conflicting operations by two or more devices.

Input and output instructions typically read or write one unit record. The unit record can be a Hollerith card, a line of printing, or a length of magnetic tape called a *block*. An instruction for input-output can therefore be summarized as causing a specified input-output device to read or write a record from or into memory.

Although seldom seen except in the electronic card processors or older computer input-output equipment, there are input and output units that are programmed by means of a wired board attached to the unit rather than by programmed instructions.

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[6] G. B. Davis, *An Introduction to Electronic Computers* (New York, McGraw-Hill Book Co., 1965), pp. 164-165.

Table of Media and Devices for Input-Output*

| PRIMARY INPUT-OUTPUT | | USED FOR | |
MEDIA	DEVICE	INPUT	OUTPUT
Punched cards	Card reader	X	
	Card punch		X
Paper tape	Tape reader	X	
	Tape punch		X
Magnetic ink	Reader	X	
Paper	Optical scanner	X	
	Printer		X
Picture	Display	X	X

| FILES | | TYPE OF ACCESS | |
MEDIA	DEVICE	RANDOM	SEQUENTIAL
Magnetic tape	Tape transport		X
Magnetic disc	Disc file	X	
Magnetic cores	Core memory unit	X	
Magnetic drum	Drum storage unit	X	
Magnetic strips	Strip storage unit	X	

| SPECIAL-PURPOSE INPUT-OUTPUT | |
DEVICE	PURPOSE
Console keyboard or switches	To put information into the computer memory
Console register display	To display the contents of the registers
Console typewriter	To introduce information into the computer and to type out low-volume output

*From *An Introduction to Electronic Computers,* page 164.

4. *Variations in Keypunching Rates*

In keypunching rates, almost any figure from 4,000 to 10,000 keystrokes per hour is cited by authorities in the punched card field. The reasons for this wide variation are worth enumerating.

The condition of the source document is extremely important. Handwritten material is normally more difficult to keypunch than printed or typewritten material. If the source document is typewritten, neatness and legibility permit rapid reading and transcribing while eliminating lost time otherwise consumed by correcting of additional errors and questioning of uncertainties. If it is necessary to extract information from the source document rather than follow a layout in the form of the card files, there will be a reduc-

tion of speed corresponding to the degree of difficulty of the selection process. Numerals are keypunched faster than alphabetic characters, and the combination of these characters with special characters is the most difficult form of keypunching. In any production process, quantity of work affects efficiency.

It is practically axiomatic that the larger the volume, the more opportunity there exists for efficient operation. Relatedly, if a given quantity of keypunch work is in the form of one large job or several small jobs, the former will be done more efficiently. This results because less setup time is involved and the tempo of the operator increases with familiarity with the work.

The human element is as important as any. Human abilities and traits differ remarkably. These abilities are not only different between individuals but for the same person at different times. The most obvious example is improvement through experience which demonstrably increases speed and reduces errors. Less apparent factors will also have an effect. Distractions, incentive, motivation, etc., make their contributions to the variation of keypunch rates.

Consequently, the proposed costing of a keypunch activity cannot be deemed valid unless these factors are considered or legitimately ruled out. The costing finally obtained is an approximation but will permit reasonable planning and prevent gross miscalculation.

The previous discussion in terms of keypunching has obvious application to any keyboard activity.

5. *Other Considerations*

General. There are many factors to be considered in achieving a successful input process. For example, in any process, responsibility for accurate, readable inputs should be placed on the data source. This may eliminate redundant processing as well as error detection and correction activities. If control over the source documents is impossible, plan for the accuracy control function in the input process.

It is necessary to consider the need for a means of backup for the input process. Having duplicate machinery, called "duplexing," is a common method of providing backup but it may be expensive. However, if the problem is critical enough, the expense is worth it. It could well be arranged that one or more inexpensive backup input systems could be provided to serve as auxiliaries during normal system operation and then as prime input sources in the event the primary devices are down. The system may have to run on a limited basis, but at least it still will run.

Data Form Considerations. If forms are planned for use in data

collection, it is essential to follow certain precepts of good form design. If forms are to be completed by hand, it is often advantageous to provide places where options may be checked rather than filled in. This multiple choice type of design is especially valuable for electronic reading methods, but has other application as well. If possible, the options (with their code) should be fully shown on the form rather than requiring referencing of the form instructions or manuals.

6. *Input Conclusions and Recommendations*

It may be advantageous to install the system's input process in advance of the system and accomplish the initial conversion of file data on the premises of the client. This will produce savings in reproduction and transportation of records in addition to absorbing the cost of training system operating personnel. If personnel from the existing activity are selected for this work, it will alleviate some of the fears attendant to the installation of an electronic data processing system. Further, this process is an integral part of the current system of the client, and it is here that the CPA has a strong knowledge derived from his continuing relationship. The elimination of service bureau costs for data conversion is a strong argument for doing it on the client's premises. The maintenance of flexibility is preserved in that the client can leave the service bureau should the CPA change to another method of operation (his own computer) much more easily than if tied to the CDPC's input process. The CPA can assure himself that the optimum choice for his client is made by directing the evaluation. He can begin his sequential acquisition of knowledge by controlling the selection of the proper input process. To help him determine that method, the following steps are recommended:

7. *Input Method Selection Process*

Step One. Establish general requirements for functions that will be accomplished in the *input area* as opposed to those functions that will be done by the computer, humans, or other application elements.

Step Two. Define inputs as precisely as possible. This definition must include such data characteristics as data types (numeric, alpha, etc.), input record lengths, volume of data, peak loads, etc.

Step Three. Define special system requirements, such as specific method of conversion.

Step Four. Determine the method or combination of methods best suited to solution of the input problem as a result of findings

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of steps one, two, and three. Determine what functions are to be accomplished off-line.

Step Five. Specify the components involved in the selected methods.

Step Six. Establish specific, evaluative criteria, such as "optical character recognition device must read at least the two most common typewriter fonts (or need not read any typewriter fonts)," or "punched tape preparation device must simultaneously produce 11″ x 14″ proof copy."

Step Seven. Eliminate from further consideration any methods or equipment that do not satisfy the criteria established in Step Six.

Step Eight. Validity-test remaining methods and equipment with representative input samples, if possible.

Step Nine. Determine costs associated with the relevant methods and equipment. Consider any existing data converting facilities as cost gains or losses. Consider associated benefits which may accrue from a given method or piece of equipment.

Step Ten. Consider physical space or cost restrictions and make final decisions.

G. *Approaching the Solution of a Specific Application Problem*

An illustrative example has been selected to provide the CPA with an indication of the relevant economics of his offering data processing services to his clients. The example involves the application of electronic data processing to the record-keeping functions of a medium-sized hospital in the New York metropolitan area, based on 1967 data. The problem of administering hospitals has become quite burdensome, and a primary factor in this burden is the complexity of records which a hospital must keep to allow it to pay its bills, its personnel, and to collect its bills. Hospital administrators are among the executives urgently seeking help from EDP in a variety of ways in order to reduce their work load and improve their efficiency. The specific example will be the application of EDP to process the payroll (1100 checks bi-weekly for part-time and full-time employees) of this medium-sized hospital. The present costs to process this payroll on an annualized basis are set forth in Schedule A, page 22.

In order to apply EDP to the problem, several alternative approaches were undertaken by the hospital administrator. Among them were discussions with his CPA, a local service bureau, and an

Manual Costs to Prepare Payroll for Hospital X

1. Clerical Salaries

   3 clerks at $4800/year $14,400

2. Supervisory Time

   1/10 time at $15,000/year   1,500
                                                                  _____
                                                                  $15,900

3. Burden

   Hospital burden set at 65% $10,335
                                                                  _____

Item	Percentage of Base Pay
Fringe benefits	20
Janitorial supplies	5
Facility rental	7
Equipment rental	5
Duplicating service	2
Telephone	7
Administrative charges	10
Internal moving	2
Postage	7
	65

Total expense to hospital	$26,235

EDP consultant. The average estimates secured by the hospital are contained in Schedule B, page 23. The negotiated agreement for activities to be carried out by both parties is outlined in Schedule C, page 23. It was possible to negotiate further on the development cost in Schedule B ($7,000), since it could easily be shown that there was general applicability of the service to more than one hospital. Regardless of that, a reduced cost to the client (the hospital) for a superior service would be established in about one and a half years.

An illustrative example has been used to cast some light on the comparative costs at a CDPC. In the application reviewed, the CDPC provided the input processing at request of the hospital. (The CPA was unable to provide these services at the time.) An example of the benefits of the use of an EDP system at a service bureau over a manual system might be best reviewed by looking at the same application.

Prior to the use of a CDPC the hospital had little or nothing in the way of management reports or job distribution. Very shortly after the payroll system was satisfactorily implemented by the use of EDP, hospital management decided that they needed a precise job description in order to more effectively run their operation. The

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SCHEDULE B (YEARLY)

Estimate to Prepare Payroll by CDPC

		Rounded
Checks per year	$32,000	$ 9,000
Unit cost	.28	
New employees per year	350	
Unit set-up cost	.25	90
Item changes per year	$12,740	
Unit cost of item	10	1,300
Stationery		
Envelopes		
W-2		170
	Yearly CDPC Cost	$10,560
Development Cost (one time)		7,000
		$17,560

Hospital Costs

1. Clerical		
1 clerk at $5,000	$5,000	
2. Supervisory		
1/20 time at $17,000	850	
	$5,850	
3. Burden at 65%	3,802	9,652
		$27,212

SCHEDULE C

Functional Outline of EDP Payroll System

Hospital

1. Hospital prepares time cards for current employees.
   a. Employee and organization identified.
   b. Types of hours identified and totaled (regular, sick, overtime, etc.).
2. Hospital prepares Payroll Exceptions list (on forms supplied by service bureau).
   a. New employee data.
   b. Change data for current employees.
   c. Correction of errors in previous payroll run.

Service Bureau

1. Service bureau picks up payroll inputs (by truck).
2. Payroll Exceptions and time cards are keypunched and verified by service bureau.
3. Cards are sorted by employee number sequence.
4. Changes and corrections are made to Master Deck, and time-card data is added to deck.
5. Year-to-date information is kept for one calendar year for tax purposes.

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hospital requested that the CDPC consult with them. The reports shown on the following pages were added to the outputs received by the hospital. (See Schedule D, pages 25-30.)

The significant points to be made follow.

1. An entirely new service to the public can be offered by the CPA in extending management control by means of EDP services.

2. To get started by utilizing a CDPC, a CPA needs only *one* client. He can then move from there.

3. The only limit to the service that the CPA can offer is the willingness of the CDPC to program the CPA's specific needs and to provide competent service to do so.

4. The CPA can provide a mixed service to his clients; he does not have to be either entirely "on or off" EDP to make it pay with the use of a CDPC.

5. The continuing relationship of the CPA with his client eases the client's transition to EDP and strengthens his relationship with the CPA.

6. There is no direct way of quantifying profit in this area, given the variability of rates and services.

H. *What Jobs Are Usually Best for a Service Bureau?*

Service bureaus usually perform best on those applications which are familiar to them. A recent survey showed service bureaus effectively handling work in:

— General ledger and subsidiary ledger
— Financial statements
— Budgetary reports
— Job cost accounting
— Accounts payable
— Accounts receivable
— Sales analysis
— Statistical reports
— Inventory reports
— Job distribution
— Payroll
— Billing

(PROCESSING DATE) _____ (HOSPITAL NAME) _____ (COST CENTER NO.) _____ (COST CENTER NAME) _____ (PAY PERIOD DATE) _____ (PAGE NO.) _____

Emp. No.	Employee Name	Earnings			Adjust to Gross	Gross Earnings	Tax				Tot. Vol. Ded.	Adjust To Net	Net Pay	Check No.
		Reg.	O/T	Other			Fed W/T	FICA	State	City				
		(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	

	Attendance			Base Rate	Hours Worked								Social Security No.
	Tardy	Pd. Abs.	Unpd. Abs.		Shift #1	Shift #2	Shift #3	Overtime	On-Call	Holiday	Sick	Vacation	
					(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	

	Reg./Shift#1	O/T/Shift#2	Other/Shift#3	Adj/OT	Gross/On-Call	FedWT/Holiday	FICA/Sick	State/Vac	City	TotVolDed	AdjNet	Net
Cost Center	1	1	1	1	1	1	1	1	1	1	1	1
Total	2	2	2		2	2	2	2	2	2	2	
Hospital	1	1	1	1	1	1	1	1	1	1	1	1
Total	2	2	2		2	2	2	2	2	2	2	

(1), (2) = Line item to be accumulated
1, 2 = Line item total

SCHEDULE D (continued)

VOLUNTARY DEDUCTION REGISTER

(PROCESSING DATE) (HOSPITAL NAME) (PAY PERIOD DATE) (PAGE NO.)

Employee No.	Employee Name	Ded. #1 Rent	Ded. #2 Chgs.	Ded. #3 Accts. Rec.	Ded. #4 Emp. Adv.	Ded. #5 Emp. Loans	Ded. #6 Ret. Fund	Ded. #7 B/C B/S	Ded. #8 Ins.	Ded. #9 Union Dues	Ded. #10 Tax Annu.	Ded. #11 Bldg. Fund	Ded. #12 United Fund	Ded. #13 Cr. Union	Ded. #14 Bonds	Total Employee Deductions
	Deduction Totals	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )	(( ))

( ) = Ded. total
(( )) = Grand total

SCHEDULE D (continued)

INDIVIDUAL DEDUCTION REGISTER

(HOSPITAL NO.) (HOSPITAL NAME)   (REPORT NAME)   (DATE) (PAGE NO.)

Employee No.	Employee Name	Current Deduction	Deduction Limit	Year-to-date Deduction
Deduction Totals		( )	( )	( )

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(DATE) _____

SCHEDULE D (continued)

BOND DEDUCTION STATUS REPORT

(PAGE NO.)

Cost Center No.	Employee No.	Employee Name	Address	Bond Amount

Page Total ( )

Hospital Total ( )

YEAR-TO-DATE PAYROLL REGISTER

(DATE) (HOSPITAL NO.) (HOSPITAL NAME)   (COST CENTER NO.) (COST CENTER NAME) (PAGE NO.)

Employee No. (1)	Employee Name	Reg. Hrs. (1)	Overtime Hrs. (1)	On-Call Hrs. (1)	Holiday Hrs. (1)	Sick Leave Hrs. Used (1)	Vacation Hrs. Used (1)	Retirement Earnings (1)
		FICA Pay (2)	Gross Earn. (2)	Fed W, T (2)	F.I.C.A. (2)	City W, T (2)	State W, T (2)	Vol. Ded (2)	Net Pay (2)
Cost Center		1	1	1	1	1	1	1
Total		2	2	2	2	2	2	2
Hospital		1	1	1	1	1	1	1
Total		2	2	2	2	2	2	2

(1), (2) = Line item to be accumulated
1, 2 = Line item total

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SCHEDULE D (continued)

LABOR DISTRIBUTION REPORT

(DATE) (HOSPITAL NO.) (HOSPITAL NAME)   (COST CENTER NO.) (COST CENTER NAME) (PAGE NO.)

Employee Number	Employee Name	Hours Sched. or Assgnd. Cost Center	Hours Worked							Earnings					
			Regular	Overtime	On-Call	Sick	Vac.	Hol.		Regular	Overtime	Other	Sick	Vac. Hol.	Gross

Cost Center Total (home)

Cost Center Total (floats)

Grand Total (home & floats)

Master Grand Total

Cost Center

Grand Totals Summary

I. *What Should the CPA Negotiate with the Service Bureau?*

The following are among the subjects which should be discussed with the service bureau and reflected in the written agreement:

1. A clear definition of the job including a precise statement regarding the nature and format of all input and output data. Every aspect of the system should be covered in detail. Nothing should be left to the imagination!

2. There should be a clear statement of all costs involved—including overtime payments (if any), penalties, charges for back-up equipment, transportation, supplies utilized, etc.

3. The conversion procedure should be particularly clearly defined. The time framework, responsibility for input preparation, provision for parallel runs, protection of basic data from destruction, right of return of basic data, etc., should be clearly spelled out.

4. The CPA should retain the right of concurrence on all aspects of the job at defined key junctures.

5. The right to a demonstration and an audit of the production run in a parallel system—prior to acceptance, should be retained by the CPA.

6. Provision for security of the CPA's data should be made and specified in the written agreement.

7. Acceptance procedures for all programs should be clearly defined.

8. The matter of work space for the CPA at the data processing center should be covered.

9. The liability of the data center and the insurance to be carried should be explicitly covered.

10. Billing procedures should be adequately defined.

11. Communication channels between the CPA and the vendor should be specified.

J. *Case Study*

The material used in the case study presented on the following pages first appeared in *The Journal of Accountancy* under the title

"Electronic Data Processing Is for Everyone."[7] At the time of its publication, there was no expectation that this article would be used in one of the Computer Research Studies. However, no case study has been collected that better illustrates the points set forth in this chapter. Also, the enthusiasm and spirit of the writer are representative of the enthusiasm and spirit found among many CPAs in the field. The following excerpts are selected to preserve the special flavor and interest of this study:

"It seems simple for a CPA to get started in EDP. But for a sole practitioner like myself in Waukesha, Wisconsin, becoming an EDP pro was not so easy, though it may seem that way today, after two solid years of EDP operation. . . .

"How do you take the first step in EDP? . . .

"We were not sure of our clients' requirements. We could not come up with a concrete plan for equipping our office, and the questions were many. How far should we go? How much overhead could we afford? How long would it take us to get off the starting block and into the field of EDP? How much money would we lose before the department showed a profit?

"It was at about this time that we met a knowledgeable and disinterested party. He neither sold hardware nor installed it. He had no ax to grind. He had had experience in many aspects of EDP, including sale of hardware, installation of equipment and systems, and a short experience actually operating a data processing center. His approach was simple, elementary and practical. Since you may wish to follow a similar approach, here are a few of the highlights:

"1. We analyzed with the specialist the various types of clients that we felt might benefit from data processing. We then prepared a list of perhaps a dozen 'prospects.' These clients were interviewed and an estimate prepared of the monthly and annual costs of the proposed EDP service.

"2. We did not wish to crash the market and contract for substantial monthly rentals in exchange for 'complete' hardware. We were willing to start operations without a showcase of equipment which might amaze our clients and friends but prove us mighty poor businessmen in the eyes of our banker. We planned to allow a data processing

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[7] Norman E. Schley, *Journal of Accountancy*, April 1966, p. 74.

center to handle all but the original posting media provided by the client. This meant the selection of an inexpensive piece of input equipment for our office. It also meant the selection of a data processing center or two.

"3. It appeared that most of the clients included in our preliminary list needed assistance in the preparation of accurate monthly financial statements to be delivered on a timely basis. It appeared further that many of our clients required statements that would include monthly, year-to-date and budgeted earning reports, together with percentages. Some even required departmental analysis.

"4. While some clients had payroll problems, we determined that for the present we would make no move in this direction. Manual pegboard and various machine methods employed by our clients seemed adequate in most cases.

"5. Accounts receivable procedures in many cases were found to be adequate. In some areas, however, the processing of mounds of detailed sales invoices and the preparation of monthly statements for customers, after recognizing cash received, served as a real challenge, and a requirement of any EDP service we might offer.

"6. A complete audit trail was a requisite of any EDP service we might offer. In other words, the by-products of our input machine must provide a complete set of journals and ledgers, statements, and reports.

"Magic Results with the Right Equipment. Having 'cased' enough of our clients to know the potentials available for our new data processing department, we leased a punched tape adding machine to handle our input. The decision was a good one, and, after two years of constant use, this machine has been found entirely adequate for all our purposes. The manufacturer's representatives have been most effective in upgrading the equipment from time to time. Under terms of the lease, the machine is serviced regularly and the amount of downtime is insignificant.

"We found that EDP equipment (even basic input devices) becomes obsolete rapidly. This prompted us to opt for an annual lease based on a monthly rental of less than $100 per month, rather than outright purchase of a machine valued in the $3,000 area. . . .

"Today, because of the flexibility of the system and the imaginative assistance of a representative of one of the data processing centers selected, we are converting one client after another to data process-

ing. It is our aim to eliminate each and every write-up account by transferring it to electronic data processing.

"Within the past two years we have converted small and large retail and wholesale organizations, hotels, motels, restaurants, contractors, water utilities and city, village and school districts, too. Not one of the clients would return to the former method of bookkeeping. The city, village and school districts' accounts are particularly interesting to convert. In these cases the monthly statements can be prepared in such a manner as to provide not only the month and year-to-date figures, but the budgeted amounts as well.

"A Successful Conversion. One of our larger 'conversions' involves an employer with a payroll of just under $1 million per annum. . . .

"The secret of this successful installation was, of course, in *'preparation.'* We spent more than three months in detailed study and survey and in planning of the various procedures. We conferred with department heads, and with each employee through whose hands any posting data might pass, but more about that later. . . .

"Two of the most interesting conversion features follow:

"General Ledger. One of the most important factors in EDP is the proper coding or classification of all posting media, making a comprehensive chart of general ledger accounts of prime importance. Preparation of a chart of general ledger accounts involved us in various types of efforts for a period of almost three months. While coding of the proprietary accounts involved very little of 'unusual' effort, the organization of the nominal accounts for some 12 departments of activities and almost 200 types of services required study, classification and reclassification. A complete chart of 'sales' general ledger accounts that squared with the company's catalogue of available services was essential. In this area, cooperation between the accountant, the sales department and the various department heads, as well as all individuals handling purchases and sales of merchandise and services, was imperative. A preliminary meeting of all personnel involved, held early in the three months' installation period, was reconvened from time to time. Initially, several hours were devoted to a 'school' of elementary EDP and a discussion of the various plans that might be employed. While the magic of this system and its projected results thrilled some, there were those who were skeptical and some even opposed this change. These, of course, were the ones who had probably heard or read of some bad EDP

experiences. Happily, today some of these people, as is usually the case, are the biggest boosters of the system.

"*Sales Invoices.* Perhaps the most critical area was determined to be that occupied by the computypist who was in charge of writing the customer's final invoice. Inclusion of the proper customer's name, address and account number and ascribing to each sale or service the proper general ledger account classification is a definite responsibility of the computypist. This responsibility, however, can be discharged effectively only if the order department, the sales department and the various department heads responsible for the approval of the final order form cooperate in this invoicing procedure. The manuals of procedure and account numbers were made available to all and have been revised regularly. Today, it is quite rare for us to receive an invoice for a customer whose account number has not been established, or to have an improper code entered on one of the sales items. Of course, we hope the present experienced computypist stays with the company for a long, long time. . . .

"[*Evaluation*] Some time ago, I asked the treasurer of the company for a list of the items which he considered most important in comparing the data processing system with the old mechanical bookkeeping methods. Here is his list:

"1. First and foremost, we have saved money, and this we believe is unusual. Because of the system's attributes, we would have been willing to go along with increased costs. We are paying you, our certified public accountant, a substantial monthly fee, which we assume is profitable to you, but this fee does not equal the previous cost of maintaining mechanical accounting machines, two accounting machine operators and the salary of our controller or head accountant.

"2. The various department heads have been stimulated in their desire to improve profits and reduce costs. The availability of weekly reports on sales activity keeps department heads current. The detailed department financial statements, prepared in great detail—including monthly and year-to-date nominal accounts and percentages, all available within a few days after the close of the account period —'spur' our employees on.

"3. The accounts receivable statements are available for mailing to the customer with a minimum of effort. No longer is there a last-minute rush on the part of the mechanical accounting machine

operators to post in the last few days of the period sales, head up customer's statements, attempt to strike a trial balance and then prepare for the mailing. Often a delay in some department's invoicing procedure or an illness in the bookkeeping staff meant overtime. Often the statements went out later in the month than would be considered good business procedure.

"4. The complete tabulation of sales by departments and by type of service rendered is invaluable. We'd gladly pay an extra fee for this by-product of the posting of accounts receivable ledger, if necessary.

"5. Our credit department saves hours of time and has become more efficient because of the complete trial balance of accounts receivable in 'aged' form. The aged trial balance is available soon after the close of the month and updates the credit department in its collection efforts.

"6. The company personnel manager no longer fights a losing battle with operators, and we are not constantly annoyed by breakdowns not unusual to mechanical accounting machines. It seems there was always some problem with the mechanical accounting machines— new operators had to be trained to replace those who married, or became pregnant. Substitutes were needed during vacations or sick leave.

"7. The actual cost of changing over to the data processing system was negligible. About the only form that required change was the monthly statement prepared for our customers, and we found this no more expensive than our old style. We do have the nominal cost of printing an extra copy of our order invoice sets, which are shipped to you each week.

"8. Although we did not immediately recognize it, we were able to obtain a reduction in the cost of our insurance for accounts receivable and other accounting records. Lodged in our accountant's office and in the data processing center are practically all the facts and figures we would require if our accounting department were destroyed by fire.

"*Conclusion.* Several points to keep in mind during an EDP installation are:

"1. *Research, study and plan each installation carefully.* Spend *twice as much time* as you think necessary meeting with department heads and all individuals who will come in contact with posting data

requiring coding for the data processing system. Employees' meetings are helpful.

"2. *Move slowly.* Do not attempt to transfer the entire system at the close of a particular month. Rather, transfer one department, one ledger or one journal at a time. Be careful and most conservative in promising results. EDP is wonderful and it doesn't have to be oversold.

"3. *Be careful in setting delivery dates* for data processing statements and material.
    a. Make sure that the client knows what you require each month and set a deadline for him.
    b. Be careful to allow enough time to cover transportation between your office, your client's office and the data processing center.
    c. Work out a satisfactory method of transportation of posting media and statements. (Currently, we find that a good package delivery service beats Uncle Sam's pony express.)

"4. *Much of your success will depend on the data processing center chosen* and the availability of well-trained representatives to work with you on programming each particular installation.

"5. During the actual installation, and particularly during the first four or five months, the accountant in charge of the installation should *be constantly on the alert.* Numerous little questions and problems will pop up, and, if the employee or department head is serviced immediately, friction will not develop.

"6. Recognize that, not withstanding the numerous meetings you have held with the employees and the detailed time you have spent in familiarizing them with the processes, errors will develop and misunderstandings will become apparent. Get to each one promptly. . . .

"Our EDP installation is a success. We could not do without it. A couple of girls and an input machine have taken the drudgery out of write-up work, have speeded up the preparation of financial statements and have satisfied very many clients.

"In addition, our staff is happy with the system, too. It upgraded practically every employee's position. It released manpower for more advanced and better paying accounting services making for larger annual fees earned per employee. And the adjustment of an individual employee's salary had its full effect on morale. Because we're in love with EDP, we believe it's for everyone."

K. *Use of a Time-Sharing Service Center*

One of the newest and currently one of the most popular concepts in electronic data processing is that of time-sharing. Although not yet fully developed, this concept holds promise of making available the power of the computer to the broadest possible base of users with a minimum of investment of time, effort, and money on the part of the user. Little or no technical knowledge will be required—a significant advantage.

"Time-sharing makes possible the simultaneous access to a central computer by many users—each of them operating a different computer program, communicating data and requests from remote locations, and receiving on-line responses. Each user has his own input-output device, such as a teletypewriter, which is connected to the computer by a communications line. Each user can make demands at random intervals. This is in sharp contrast to the scheduled, sequential service offered by the standard service arrangement."[8]

In some instances, the users of a time-sharing center are able to write their own programs from their respective terminals. In other cases, the operator of the center may provide a standard set of programs. Sometimes these programs are oriented to a specific application.

Time-sharing systems currently tend to be more expensive than regular data processing center services—due to the provision of such services as instantaneous response and ability to interact with the computer. However, as these systems mature, the prices will undoubtedly go down.

L. *Summary on CDPCs and the CPA*

1. There are many CDPCs available to CPAs.

2. They provide a variety of services and are easily accessible.

3. Cost comparisons for volume work favor CDPC operations over manual systems. Very important is the fact that new informa-

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[8] Gordon B. Davis, "The Selection and Use of a Data Processing Center," *Auerbach Computer Notebook for Accountants* (Philadelphia, Auerbach Info, Inc.). (Article appeared as a Special Report in March 1967.)

tion for management decision making can be secured by the client.

4. The fees charged by CDPCs are subject to individual negotiation.

5. There is a need for the analytic and design services which the CDPC can provide.

6. The CPA who desires to provide EDP services may begin by using a CDPC as soon as he has one or more clients who can benefit. This gradual acquisition of EDP knowledge and experience is usually a more appropriate first step for the CPA than beginning with his own computer.

7. If the CPA wishes to offer EDP services to his clients then a strategy of the most effective way he can provide both continuing services and acquire technical knowledge must be developed. It is particularly suggested that the CPA acquire knowledge of the input preparation area during his use of the CDPC. This will be most useful knowledge should he elect to proceed further in EDP.

8. By using a CDPC the CPA can begin with a good margin of safety to move toward a broader capability provided by his increased knowledge of EDP.

9. There are many caveats to be observed in dealing with a CDPC. Most of these have been outlined on the preceding pages.

V.

Use of an Off-Premises Computer (Block Time)

The use of scheduled portions of time on an off-premises computer is frequently described as the use of "block time." A number of CPAs are "permanently" operating their own computer programs on unowned off-premises equipment. If the CPA wishes to expand the services he desires to offer his clients, then the use of block

time in this context can be seen as a further sequential step in the CPA's experience with EDP.

In the use of this option, the CPA is responsible for writing computer programs by the use of his own professional staff. Such programs will fit the particular requirements of the CPA's own practice and clients. The running of these programs is accomplished on a computer owned by someone other than the CPA. Charges to the CPA are made for the time the equipment is used. This time may be purchased from EDP centers, banks, business firms or other computer owners who have extra operational time.

Under this option, the CPA will accept a fuller responsibility for problem definition, system design, and system implementation. While the rental of this equipment time can be acquired through a commercial data processing service, the other above mentioned organizations who sell such time may afford the CPA a more economical use of the equipment, because of their desire to profitably dispose of surplus time.

The use of block time will enable the CPA to:

1. Take an important step towards eventual acquisition of "on-premises" equipment, should he later elect this course of action.

2. Offer more extensive services to his clients.

3. Continue to acquire knowledge by managing the production of an EDP system and thereby evaluating his and his staff's effectiveness without taking the greater risk of equipment acquisition.

4. Try a variety of machines to aid him in proper selection of his own machine at a later date, should he decide to take this step.

5. Provide flexibility, by contracting only for the amount of computer time actually needed.

When considering the use of block time, the CPA will have certain specific questions, such as:

1. Who sells block time?

2. How much does it cost?

3. What is negotiated during the acquisition of block time?

4. How does the CPA organize for use of block time?

5. What are the economics of block time?

6. What are good applications for block time?

A. *Who Sells Block Time?*

Computer time may be acquired on a block time basis from an array of sources. The chief of these are:

1. Commercial data processing centers
2. Banks
3. Insurance companies
4. Other owners of equipment who advertise in the classified section of the newspaper under "Computer Time Available."
5. Hardware manufacturers' salesmen who are anxious to help new owners during their start-up period and will gladly suggest such opportunities to the CPA.
6. "Time brokers."

B. *How Much Does It Cost?*

The costs for utilization of block time are negotiated with the particular organization offering such time. A typical set of costs is contained in Schedule E, page 42. The rate variation is a function of individual negotiation. Block time is often inexpensively offered by hardware manufacturers to induce machine purchase. Another example is the fact that banks are sometimes more willing to sell daylight hours ("prime shift time") since the bank's own internal processing is best done in the evening hours.

C. *What Is Negotiated During the Acquisition of Block Time?*

During the negotiations with the provider of block time, the CPA must consider the actual block of time that he is to receive. Most vendors of block time will want to keep the daylight hours (commonly called "prime time") for their internal use. The CPA will be able to secure such "prime time" through negotiations and price if it is actually needed in a particular situation. There are other considerations toward which attention is warranted. These are:

1. The provision of an operator of the machine is often included by the vendor. This is an important point. The CPA should strive to secure an operator with whom he can work on a steady

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Costs Per Hour of Computer Time

Machine	Cost/Hr. (Prime Time) ($)	Cost/Hr. (Other) ($)
IBM 1401 Tape (4)	40 - 50	20 - 40
IBM 360/20 Tape (4)	45 - 55	45 - 55
IBM 360/30 Tape (4)	60 - 70	50 - 60
IBM 360/30 Disc (3)/Tape (4)	70 - 80	70 - 80
NCR 315 Tape (4)	50 - 60	50 - 60
NCR 315 Disc (3)/Tape (4)	60 - 70	60 - 70
H-200 Tape (4)	50 - 60	40 - 50
H-200 Disc (4)/Tape (4)	50 - 60	50 - 60

( ) = Number of drives
* Vendors of block time are often unhappy about quoting general costs. The figures above were derived from direct offerings by vendors, but could have easily varied upward. The above prices reflect 1967 data and should be used only for general orientation purposes.

basis. The CPA ought to further insure that he has effective operator backup in the case of absence of an operator, and that these "backup" operators are familiar with the specific work they are to handle for the CPA.

2. The CPA will want to have access to a "backup" machine commonly used by the vendor for prolonged periods of machine difficulty which are sure to occur. The CPA will want to know the consequent time delay, if any, based on the location of this machine. The CPA will want to be prepared for such delays and to select the proper CDPC accordingly.

3. The CPA will want to be sure that a procedure exists whereby he is only charged for productive machine time. In many instances an apparently successful period of machine utilization is later found to be valueless due to malfunction. To avoid possible argument, a well-defined acceptance procedure for machine time should be established.

4. The provision of storage and work space is generally a problem unless specific arrangements have been made. It will be to the CPA's interest to see that these are taken into account prior to final negotiation.

D. *How Does the CPA Organize for Use of Block Time?*

The problems in utilization of block time faced by the CPA, after he has located a vendor and negotiated costs, will fall into the

general category of organization for utilizing the equipment. These problems will be concerned primarily with the building of an adequate staff to provide proper client services. To provide full EDP services, the CPA will need a staff of people who can accomplish the required functions from analysis through implementation.

It is difficult to say how many of these people will be necessary. This will be determined by the type and volume of work. It is essential that in beginning to undertake the "block time" approach, the CPA provide for a senior systems analyst and/or senior programmer analyst who is capable both of designing a proper application with the CPA, programming it, and possibly operating the machine should the vendor of block time not be able to provide an operator. (This is a minimum requirement.)

The CPA can and should investigate the use of part-time services in these initial stages. It is an economical way of securing the right amount of talent at minimum cost and risk. There are many people in the EDP field who are quite capable and willing to work the evening and weekend hours which will be necessary to accomplish the production job.

As the CPA's utilization of block time increases, he will want to separate these functions. It has been previously suggested that during the use of the CDPC, the CPA would want to have either his client or himself do the input processing. During the use of block time the CPA would consider employing a full time senior systems analyst. The CPA would then expand this staff in direct proportion to the volume of work. A job description of the functions required in this sequence would begin with the keypunch operator. These job listings are as follows:

1. *Keypunch Operator*

The keypunch operator is associated with input preparation. The keypunch operator prepares data for the machine by keypunching source documents (invoices, orders, etc.) into punched cards by operating a key punch machine. The keypunch operator may verify the accuracy of a card previously punched by use of a verifier, a device which is similar to the keypunch. (Data recorders which record data directly on magnetic tape may be used in addition to or instead of keypunches.)

2. *Unit Record Equipment Operator*

This function is also associated with input preparation. The job is often classified as a tab equipment operator. It involves the

operation of standard EAM (electronic accounting machinery) equipment such as the sorter, collator, reproducer and accounting machine.

3. Console Operator

The console operator will actually operate the computer in accordance with standard operating procedures for the machine and for the particular application (computer program) he is running at the time.

4. Programmer

There is a wide range of descriptions associated with this job title. The basic difficulty generally arises from the fact that some descriptions assume that the programmer has systems design responsibilities in addition to developing logical computer flow charts and coding these charts in the language of the particular computer. It is preferable to define the programmer as one who "flowcharts the logic of the computer programs required by the overall system designed by the systems analyst; codes the logic in the computer program language; debugs the resulting program; prepares documentation."[9]

5. System Analyst

Problem definition, the proper assessment of user requirements and design of the appropriate system are the province of the system analyst. In an analysis of the existing system, and the design of a new system to remedy deficiencies, competent and high caliber senior talent is required. An experienced, imaginative person who has the ability to deal with people and has demonstrated this talent is a minimum requirement. The most important function of this person is that his views be as all encompassing as possible, yet that he be aware of the need to develop a system which contains the necessary implementation details and which is appropriate to the client's requirements.

The question of salary for EDP personnel has properly received a good deal of attention. There is a severe shortage of EDP people especially those who are experienced. This has resulted in inflated salaries and much job-hopping.

An annual survey of EDP salaries appears in the June issue of the magazine *Business Automation*.

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[9] Gordon B. Davis, *Auditing and EDP* (New York, AICPA, 1968), p. 10.

There are also guidelines obtainable through personnel systems available to the public. The Personnel Information Communications System[10] (PICS) will serve as an example of this. For a fee, it provides the following services regarding EDP personnel:

— A job-matching system sold to private individuals seeking job change.
— A service for employers at a fee.
— A report to subscribers of salary information allowing for comparisons with others by age, academic degree, and skill classification.

An interesting side-light on systems such as these is that they are themselves computerized and are updated in reasonable time periods. The CPA can get a good line on the going rate in the field for the skills he will need and can make plans accordingly.

Further help can be obtained from the Industrial Relations Counselors Services, Inc. (IRCS).[11] IRCS conducts annually a series of surveys providing participants with thoroughly analyzed salary structure and rate statistics for digital computer programming. The survey, by reflecting current practice in a nationwide cross section of industry, provides aid in arriving at salary decisions in this area.

E. *What Are the Economics of Block Time?*

For an evaluation of the economics of block time, the example used in the previous chapter will suffice. The costs to design and program the application for a given hospital are estimated in Schedule F, page 46. The profit potential of block time may best be seen in the operation of the application on a unit basis as it appears in Schedule G, page 46. A review of these cost factors indicates a much higher cost to the CPA to produce the application but a much lower cost to operate it. Should the CPA be able to apply this work to three separate customers, he will have come close to the break-even point in one year of operation. These figures represent proportional costs. The CPA will want to consider the economic feasibility of block time EDP when he has on the

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[10] PICS is located at 60 Hudson Street, New York, N.Y.
[11] IRCS is a non-profit organization located at 1270 Avenue of the Americas, New York, N.Y.

Estimate to Produce Payroll/Personnel Applications

Time

Function	Analyst Man-Months	Programmer Man-Months	Computer Hours
Analysis	2		
Design	1	2	
Code		4	75
Test		2	50
Installation (training and parallel operation)	1	1	
Totals	4	9	125

Money to Produce

Analyst (4 months at $20,000 per annum)	$6,700
Programmer (9 months at $12,000 per annum)	9,000
	$15,700
Consultant burden set at 90%	14,130

Item	Percentage of Direct Labor
Fringe benefits	27
Travel	7
Equipment expense	2
Stationery supplies	4
Books and periodicals	2
Computing supplies	2
Duplicating	5
Graphic arts	2
Building materials	2
Janitorial supplies	5
Facility rental	15
Equipment rental	2
Telephone	5
Depreciation costs	5
Administration	5
	90

$29,830

SCHEDULE G

Estimate to Run System on an Annual Basis

Computer time 26 runs (15 minutes per run) at $60/hr.		$390
Transportation 26 runs at $10 per run		260
Stationery costs per previous statement		170
	Total	$820
Input preparation costs from previous Schedule B for CPA or hospital		$9,652
	Total to operate system	$10,472

order of three similar applications with the volumes and costs approximating those reviewed in the illustrative example. He should not undertake several different applications which he feels are not general enough to be applied to an extent necessary to break even.

F. *What Are Good Applications for Block Time?*

Block time lends itself best to items which can be processed in volume. The applications relevant to the CDPC and listed in the previous chapter are directly applicable.

To restate, these applications would be of a fairly straightforward nature such as:

— Payroll
— Accounts payable
— Accounts receivable
— Budgetary reports
— Sales analysis
— Inventory reports

In general, what is to be avoided in the use of block time are those applications necessitating close interaction between the user and the computer system. These applications are suitable for time-sharing which was described on page 38.

G. *Summary*

1. The rental by the CPA of block time on an "off-premises" computer is an important sequential step in the preparation for the CPA's internal equipment, should he eventually make this move.

2. Block time is readily available through commercial channels.

3. Negotiated items include the time of day (shift) that the computer is used, the services of an operator, backup in case of prolonged malfunction, and a procedure for the acceptance of productive time.

4. The CPA will be utilizing his own staff and evaluating their reaction to EDP during the period that he uses block time.

5. The economics of block time show a higher cost than CDPCs

to produce an application, but greatly decreased costs to operate it.

6. The successful use of block time by the CPA will have equipped him with several important qualifications necessary for satisfactory ownership of internal equipment. Among these are a mastery of the input processing and the acquisition of a trained and tested staff to service his clients.

VI.

An In-House Computer

The final option to be considered in this study is the acquisition of an in-house computer by the CPA and the provision of even more complete services to his clients. This is seen as a culminating step which began with the CPA's use of the CDPC and moved through his use of block time with an expanded internal capability. It is a major move and should be considered carefully.

The CPA who has followed a path of sequential growth will be familiar with EDP operations as a result of his CDPC experience. He will have gained experience in problem definition, system design, input processing, and his own personnel requirements during the utilization of both the CDPC and the later use of block time. At the time the CPA considers the use of his own equipment, he will have certain questions which must be answered. These are as follows:

1. What are the benefits to the CPA of owning internal equipment?

2. What are some of the difficulties?

3. How much does internal equipment cost?

4. What are the steps by which a CPA may decide on equipment?
5. What are the computer costs?

A. *What Are the Benefits to a CPA of Owning Internal Equipment?*

The benefits to be derived from internal equipment are:

1. There is a larger profit/loss potential for the CPA with internal equipment than in other modes of EDP operation. However, it cannot be emphasized too strongly that while the potential for profit is greater, so is the chance of loss!
2. The CPA will have the power to allocate EDP priorities on a basis most useful to the needs of *his* organization.
3. The CPA will be able to train his force more effectively with an in-house computer. The nearness to the machine will act as a stimulant and diminish a fear of the unknown. Training time can be scheduled for maximum convenience.
4. The CPA will be able to utilize the excess capacity of the machine to develop new tools and techniques advancing the CPA's professional stature in dealing with his clients' problems and requirements.

B. *What Are Some of the Difficulties?*

The following are some of the problems which must be considered in planning for internal equipment:

1. The high cost of entry into EDP—including site preparation, cost of rental or purchase of equipment, recruiting and training of staff, new space requirements, etc.
2. The fixed costs in operating the equipment and maintaining a staff, along with the associated overhead. EDP personnel are scarce, expensive and difficult to recruit and retain.
3. The possibility that one computer system may be inadequate for servicing the CPA's entire practice.
4. The uncertainties surrounding the availability of manufacturer

supplied software (such as utility, assembly, compiler and operating system programs) as to delivery dates, specifications and effectiveness.

5. Delays in hardware and software can be costly in terms of lost revenue while fixed costs continue.

C. *How Much Does Internal Equipment Cost?*

Equipment costs vary directly with the size and specifications of the equipment. This is called the "equipment configuration." Costs are directly related to these configurations. For illustrative purposes costs associated with a small machine, a card-oriented system, and a tape/disc system are illustrated in Schedules H, I and J, page 51.

These ranges are intended to provide an indication of the monies necessary for machine outlay. The costs of specific configurations are thoroughly covered in the *Auerbach Computer Notebook for Accountants.*

D. *What Are the Steps By Which a CPA May Decide on Equipment?*

The principal vendors of computers designed for business data processing are well known and relatively few in number. They include:

— Burroughs
— Control Data
— General Electric
— Honeywell
— International Business Machines
— National Cash Register
— Radio Corporation of America
— UNIVAC

Their local offices may be found in the classified section (yellow pages) of the telephone book under Data Processing Systems, Equipment and Supplies.

Other vendors of equipment may be found in *Computers and Automation: The Computer Directory and Buyers Guide.* This

SCHEDULE H

Costs Associated With General Configuration

(Small Scale Machine: Paper Tape Input)

Configuration	Monthly Rental ($)	Purchase & Maintenance ($)
Paper tape punch	100	3,000
Central processor (4K)	1,200	44,000
Card reader	110 to 250	5,000 to 18,000
Card punch	120 to 250	5,000 to 10,000
Printer	250 to 800	29,000 to 54,000

SCHEDULE I

Costs Associated With General Configuration

(Medium Scale Machine: Card Input)

Configuration	Monthly Rental ($)	Purchase & Maintenance ($)
Keypunch	60 to 90	4,200 to 4,600
Sorter	100 to 120	7,000 to 8,000
Central processor (16K)	1,850	100,000
Card reader*	130 to 650	13,000 to 33,000
Card punch*	120 to 450	12,000 to 23,000
Printer*	500 to 800	23,000 to 54,000

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* These items escalate in costs due to the increased capacity of the device. While
  they perform the same function as in the prior configuration, they do it more
  rapidly.

SCHEDULE J

Costs Associated With General Configuration

(Medium Scale Machine: Tape/Disc Storage)

Configuration	Monthly Rental ($)	Purchase & Maintenance ($)
Keypunch	60 to 90	4,200 to 4,600
Storage (64K)	1,850	93,000
Card reader/punch	300 to 600	19,000 to 33,000
Tape drive unit	500 to 900	22,000 to 43,000
Disc unit	400 to 1,000	17,000 to 36,000
Printer	500 to 800	23,000 to 54,000

Directory includes the many manufacturers of peripheral and other computer related equipment and furnishings. To secure the equipment he desires, the CPA should draw up a set of specifications and submit them to the hardware manufacturer for bid. These specifications should include:

1. A complete description of the equipment desired.

2. A costing of the equipment by shift, (and it is to be assumed that the initial uses by the CPA will be on a one shift basis). Costs should include information on:
   — discounts, (if any)
   — minimum rental periods and notifications necessary to terminate the lease, (many manufacturers now offer three- and five-year lease plans which offer substantial reductions over the traditional one-year lease)
   — information on leasing plans which contain purchase options and provide rental credits when these options are exercised
   — cost of a maintenance contract, (if maintenance is not included in rental cost)
   — cost of shipping and installation.

3. The provisions included for system backup and recovery in the event of failure.

4. Software considerations
   — availability of software
   — characteristics of software
   — general applicability of software.

5. Service engineering
   — policy on parts supply
   — proposed schedule for preventive maintenance
   — emergency plans for backup in the event of a protracted breakdown.

6. Tape compatibility
   The CPA may receive, as input, tapes prepared on other systems. He must have assurance as to compatibility or convertibility of tapes.

7. Computer operating personnel
   Training of the CPA's computer operations personnel should be specified.

8. Training programs offered to the CPA's programmers in the compiler, utility, and monitor systems which will be provided.

9. Systems design and programming assistance which will be provided. (This should be in terms of man years, if possible, otherwise the number of personnel to be furnished should be specified.)

10. Site planning
    — floor layout
    — power supply
    — temperature and humidity
    — fire protection
    — auxiliary facilities.

11. Date and method of installation.

12. Availability of computer time prior to installation and cost of such time, if any.

13. Users in nearby areas so that some sharing agreement can be worked out to handle emergencies or overload situations.

14. Full and complete documentation of all hardware equipment and software systems.

E. Computer Costs

Until a few years ago, a minimum computer configuration involved a monthly rental of $4,000-$5,000, or more. Today, such equipment can be obtained in the neighborhood of $1,000 per month.

To the cost of the hardware itself must be added the cost of actually writing the programs for the particular equipment involved. Although manufacturer supplied software tends to lessen this burden, there are still many programs which must be specifically prepared for the particular installation. And, since programmers are expensive, the cost factor must be reckoned with.

Of course, the cost of a computer system should not be considered in a vacuum. The benefits which can be obtained must also be considered. The relationship between the cost of the computer and the results which it can produce is frequently called the price/performance relationship or sometimes the cost/benefit relationship. The implications here are that although one computer system may be more expensive to rent or purchase than another, it may be cap-

able of producing information at a lower rate per unit of data and/or at a faster rate per unit of data.

F. *The Computer Selection Process*

Although a detailed discussion of this vital procedure is beyond the scope of this paper, it is nevertheless appropriate to mention several of the considerations:

1. The CPA should consider his basic objectives in providing computer services. The type of service he expects to provide, the number of clients he intends to serve, and the extent to which he intends to use the computer in his practice will all materially influence the computer configuration which it will be appropriate for him to select. The computer is a costly and complex electronic tool. The proper "tool" must be selected to effectively accomplish the desired objective.

2. Once the general objectives have been defined and the general class of computer system has been decided, it becomes necessary to make a detailed evaluation of those computers currently available which are capable of meeting the CPA's requirements. This process involves a consideration not only of the hardware (which is often unduly emphasized) but also of the software, the systems, educational, maintenance and other support which the manufacturer is prepared to provide, and the type and caliber of personnel which the system requires and which the CPA will have to make available.

3. Although reference sources such as the previously mentioned *Auerbach Computer Notebook for Accountants* and the manufacturer's own descriptive literature and manuals can be utilized in the hardware/software evaluation process, it is strongly suggested that the CPA considering the acquisition of his first computer engage a competent EDP consultant to provide at least some support in this process. Appropriate conversations with other CPAs who have already had the experience of choosing one or more computer systems, can also be of material assistance.

4. It cannot be emphasized too strongly that the selection and evaluation process is a complex one—requiring extensive time, technical knowledge and the ability to relate the available equip-

ment and software specifications to the requirements of the CPA.

5. This process, like all other aspects of the CPA's venture into EDP should not be rushed. Adequate time should be allowed for all phases of the study and then at least a 25 per cent "safety factor" should be added—just to make sure!

There exist few primers that outline considerations for computer evaluation and selection. One source of data in this area, which is particularly recommended, is a special report entitled "The Computer and the Small Company" by Robert Nadel, CPA, and partner in Hertz, Herson and Company. This special report appears in the *Auerbach Computer Notebook for Accountants*.

It is strongly recommended that the CPA employ a competent and experienced EDP consultant to assist him in preparing and evaluating the bids. The evaluation and selection process is at once a most critical and complex process calling for the highest order of judgment, technical knowledge and experience. It is no job for an amateur. The CPA is also advised to consult with other CPAs who have gone through this process one or more times, in order to benefit from their experience.

To properly evaluate hardware manufacturers' responses, the CPA should go beyond a paper evaluation if at all possible. An actual demonstration of the equipment he intends to purchase in a series of tests to validate characteristics of the hardware and software should be undertaken. These tests should be executed on programs (or "benchmark" problems) which have been written by the CPA's staff and/or his consultant to evaluate compliance with the requirements stated in the bid. Most manufacturers will readily comply with this procedure. Sometimes, however, the equipment is announced long before it is actually available. In fact, it is customary for computer systems to be announced one to two years before their actual first delivery date. In such cases, it is necessary to obtain firm specifications commitments from the manufacturer and to enlist his assistance in simulating the running of a program for his newly announced computer on one of his available older models. Manufacturers frequently make such programs available—especially since they find it necessary to develop them for their own purposes.

There is also a commercially available comparison program known as SCERT, which is marketed by COMRESS, Inc., of Washington, D.C. This program which may either be rented on an annual basis or used in connection with a particular project is designed to

quickly furnish comparisons between the relative performance of a wide variety of currently available and announced computer systems—for a variety of hardware and software characteristics and on a variety of applications.

G. *What Are the Operating Costs of Owning a Computer?*

Operating costs may be broken into two general areas. The first set of costs are those associated with the acquisition of the machine and may be considered "one time" costs. They are:

1. Preparation of the site
    a. Special wiring to meet power requirements—necessary in most cases
    b. Air-conditioning installation—usually greater capacity is required
    c. A raised floor to contain connection cables—almost always needed
    d. Construction of a special or additional room to house the computer—frequently needed
    e. Construction or erection of partitioning—frequently needed
    f. Storage racks—almost always needed
    g. Furniture—additional items frequently needed
2. Recruitment and hiring of personnel
    a. Computer operator(s)
    b. Programming personnel
    c. Systems analysts

The second set of costs are those of an ongoing nature that necessitate full consideration by the CPA if he is going to offer this service. They are:

— Monthly rental of the computer and associated equipment
— Salaries of EDP personnel
— Power charges to run machines and air-conditioning system
— Space charges apportioned to the equipment and the associated personnel
— Supplies charges for cards, tape, paper, ribbons, etc.
— Transportation charges to bring the work from the client to the computer and back

The addition of all these charges establishes the target that must

be reached if a break-even point is to be determined. There exists no exact formulation of the proper "hourly" charge that an owner of equipment should set. A rough rule of thumb is to take the entire cost of the configuration and amortize it over a five-year period, operating the computer on a one-shift basis. To this figure one then adds burden and a profit, thus establishing the "charge." In many instances, the owner of the equipment would rent unused time and this calculation would be a guideline. Of course, this figure varies, yet it is also a good indicator of the charge per hour that the CPA could apply to his total operation in order to arrive at a break-even point.

H. *Software Evaluation Considerations*

Software (the programming packages and languages used to actually operate the computer) is perhaps the second most critical element in the computer evaluation, selection and implementation process (the most important factor is, of course, *people*).

1. Since manufacturers frequently fail to live up to their promises regarding the availability and operational capability of their software, claims should not be accepted at face value. They should be carefully checked with the manufacturer's representatives and with as many of his users as possible. Availability dates should be stated in writing and should be included in the actual contract, whenever possible.

2. Many programming languages and software packages are extremely complex. A comparison of the packages offered by competitive manufacturers should be made in order to ascertain those which are both effective and easy to use. Application packages which permit the CPA to "plug-in" his data are highly desirable, since they materially assist in reducing programming costs.

3. The available documentation for the software packages being considered is also important. Technical personnel will need adequate reference documents in order to effectively utilize the system.

4. It should be mentioned that a particular problem in evaluating software arises from the fact that many software systems are far from operational at the time that they and their associated computers are announced. Therefore, particular care must be taken to obtain firm commitments from the manufacturer relating to these packages and to investigate the manufacturer's previous record in

this area. Also, the manufacturer's progress must continue to be monitored, not only throughout the evaluation and selection process but even after an order is placed! Sometimes software specifications are so drastically changed that it may be necessary to reevaluate a contemplated or actual computer selection decision.

I. *Cooperative Computer Installations*

Another alternative which the CPA may consider is the formation of a computer center cooperative, together with other nearby CPAs.

This course of action can provide many of the benefits of having one's own computer installation while at the same time reducing both the risk and the resources required.

Naturally, all pertinent details of the agreement among the CPAs should be carefully spelled out and reduced to writing.

The uses to which different configurations have been put is well outlined in the case histories that follow. (These case studies reflect 1967 data.)

J. *Case Study: Firm A*

1. *Description of Firm*

Firm A is located outside of any large metropolitan area but in a city with manufacturing and light industry. There are three partners and seven staff accountants with clerical and secretarial personnel in the organization. Two partners have been participating in EDP activities. One partner is now in charge of EDP operations. One staff accountant has been trained as a programmer and is now responsible for all EDP functions including programming, operation, and some client relations with regard to payroll services. The firm provides public accounting, auditing, tax, and management services in its practice. The total number of clients is in the neighborhood of 200. Thirty clients are currently using EDP services which include these applications: small client accounting; general ledger and financial statements; and payroll.

2. *History of EDP Experience*

Firm A has been using electronic data processing for two years. The firm started the use of EDP by employing the services of a

commercial data processing center in the fall of 1964. This operation required the preparation of input data on an add-punch and the forwarding of paper tapes to the data processing center. The processed reports were returned to Firm A where any necessary adjustments were made prior to final typing. Some reports could be and were sent directly to the client. In mid-fall of 1965, the firm placed an order for a paper-tape-oriented computer system. After the equipment order, one of the staff accountants was trained to program and operate the computer on order. This accountant was then authorized to operate a computer located in the manufacturer's district sales office. During the time that the latter computer was used, it served the purpose of providing on-the-job training and converting client data to EDP operation. Early in March, 1966, the computer was installed on the premises of Firm A.

3. *Computer Costs*

The equipment was purchased by Firm A. (This computer rents in the neighborhood of $1,000 per month and an additional $100 is required for maintenance. This rental covers all devices in the system including the central processor, a magnetic card input and output device and the add-punch.) The accounting applications operated as part of the firm's EDP system were provided by the manufacturer as packaged program systems. These three packaged systems were identified previously. The testing and checkout of these application systems required an estimated 13 man hours and from two to three computer hours.

It has been explained above that the personnel required for operation and implementation of this system consists of one EDP professional. However, this person was appointed from the accounting staff and was trained by the manufacturer for EDP responsibilities. The only additional requirement generated by acquisition of the computer was one clerical person who is currently on a part-time basis and whose responsibilities are concerned with the preparation of input data and the operation of the add-punch. Computer operation is accomplished as a part of the EDP-trained accountant's responsibilities.

Firm A has established a separate corporation for the electronic data processing after a few months of operation. This was done because of ethical, operational, and billing considerations. The EDP organization bills some clients directly. The services for the remaining clients are billed to the accounting firm and, then, in turn by the accounting firm to the clients. Charges are made by the com-

puter-hour, which has a rate set at approximately twice the rental rate for the computer, and by the transaction item, for the services which are similar to those offered by commercial data processing companies.

The EDP system is operated approximately seven and a half hours each day in a five day week. It has been estimated that the breakeven point is four hours of billable operation time per day. Currently, about 55 per cent of the computer operation time is billable and the productive time is distributed by application as follows:

General ledger and financial statement	82 per cent
Payroll	7 per cent
Sales analysis	5 per cent
Other applications	6 per cent

4. Benefits

Firm A reports the realization of tangible and definite benefits. These include:

— increased billings
— an upgrading of staff activities
— additional capability to provide services for other CPAs
— increased client satisfaction
— the raising of its professional standing in the community
— protection of the firm's practice from threats by non-accounting enterprises.

5. Major Problems

The major EDP problem for Firm A has been one of acquiring computer program packages so that additional services and applications could be provided to clients. Firm A has learned about applications developed by others but has been unable to obtain specific information as to the nature and availability of these programs.[12] The firm looks to the manufacturer and to possible users' groups for solution of this problem, but it remains a problem at this point in time. Addition of personnel with EDP capabilities is also a tentative solution.

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[12] Computer user organizations are often a good source for this type of information.

6. *Future Prospects*

Firm A sees no question as to the success of the EDP system and looks forward to further increases in gross billing, continued improvements in client satisfaction, a continued raising of professional standing in the community and a strengthened position for the professional and competitive aspects of the practice. Plans for the future involve the acquisition of both more accounting application capability and EDP personnel capability.

K. *Case Study: Firm B*

1. *Description of Firm*

Firm B is located in a large metropolitan area. One of the technical people has system analysis responsibilities; the other is a programmer and operator. The firm provides accounting, auditing, tax, and management services to its clients. Electronic data processing services are part of the services provided. The total number of clients served by Firm B is in the neighborhood of 160. The firm has very recently started a computer operation and the number of clients receiving EDP services is increasing rapidly at the present time. EDP applications are provided in six accounting areas. These include: general ledger and financial statement, accounts receivable, inventory processing, payroll, sales analysis, and billing.

2. *History of EDP Experience*

The firm now has a card-oriented EDP system on premises. The major equipment components include a multi-function card machine, a central processor, and a printer. Also, some tabulating equipment has been retained. All data storage is on cards. The historical data processing experience of the firm includes electronic accounting machine operations extending over a period of more than seven years, the use of tabulating equipment via a commercial data processing center, the rental of unit record equipment, the rental of computer time for a period of six months, and the recent installation of the EDP system described above.

3. *Computer Costs*

The equipment rental for Firm B's on-premises system runs in the neighborhood of $2200 per month which covers all equipment

devices. The site preparation costs were in the neighborhood of $700. Shipping costs amounted to an estimated $500. The partner in charge of EDP considers professional EDP training as an on-going process. He continues his own training by spending approximately six hours every week on professional reading and development.

The firm has produced the computer programming for its accounting applications. Recurring expenses are the salaries for two full time programming professionals and the two keypunch operators. Other expenses include cards, rent and electricity along with the normal overhead items. The equipment is housed within five city blocks of the firm's offices.

EDP revenue comes from an increasing number of clients and from the six types of EDP applications described above. The EDP operation is still in the stage wherein billing procedures have not been permanently established. Presently, EDP billing procedures include the charging of a fee, charges per transaction, and the EDP operational cost for some clients is being absorbed by the firm. However, the firm expects to reach the breakeven point within one year of EDP operation.

4. Benefits

The immediate benefits realized by Firm B include a greater amount of professional activity from a staff that has not been enlarged, increases in billing, the provision of new services for clients, and increased opportunity to offer total management services.

5. Major Problems

Firm B considers that there are two major EDP problems. Client understanding of and education for EDP is one of these. The firm constantly strives to educate the clients and expects awareness to be increased from other sources such as manufacturer and university courses. It is expected that this problem will diminish with time.

A second problem concerns data input to the computer. Input now requires extensive time, attention and money. The firm looks forward to the employment of newer devices such as optical scanners when these devices become more effective and economical.

6. Future Prospects

Firm B expects to increase gross billings, to increase the size of EDP operation, and to provide more and better information re-

trieval. Firm B has a definite objective to eventually have the capability to provide complete management services using all available scientific approaches.

L. Case Study: Firm C

1. Description of Firm

Firm C is located in a medium-sized city which is a center of manufacturing and trade. The organization includes seven partners, a professional staff of 29, and six clerical people. The data processing department takes ten of the 29 staff members. This department includes a manager, four programmers, two computer operators, and three other peripheral equipment operators.

The firm offers client service in the areas of audit, tax, estate planning, and management services as well as systems and data processing. The number of clients served by the firm is in the neighborhood of 1500, of which 200 are receiving EDP services. The data processing department provides eleven types of accounting applications, with client distribution as follows:

General ledger and financial statements	40 per cent
Payroll	17 per cent
Specialized accounting system	12 per cent
Management and control	10 per cent
Inventory	5 per cent
Sales analysis	5 per cent
Billing	4 per cent
Bankruptcy court reporting	3 per cent
Accounts receivable	2 per cent
Accounts payable	1 per cent
Budget	1 per cent

2. EDP Experience

Firm C began the operation of unit record equipment in April, 1960. A card oriented computer was installed in September, 1964 and a larger computer was installed in April, 1967. Development and debugging of the computer programs for the new equipment has been completed. Since the beginning of data processing operations, the EDP staff has increased from two persons to ten, the firm's organization has expanded from five to forty-two, the number

of data processing applications has increased from two to eleven. Obviously, these changes are not due entirely to the computer. Management, personnel capabilities and other factors have contributed. However, the capability for electronic data processing has been a key factor.

3. Computer Costs

Normally, Firm C's data processing department operates 40 hours per week. However, one computer operator works a second shift of four hours one or two nights each week. Actual metered time for the central processing unit runs approximately 70 to 100 hours per month.

For the EDP system, one-time cost factors have been these:

Site preparation	Approximately $3,000
Shipping	$300
Storage cabinets	$300

The recurring costs for EDP operations include:

Computer rental   Approximately $2,300 per month
Other rentals—punches, $450
   sorters, etc.
Salaries for: data processing manager, four programmers,
   two computer operators, three other operators.

The firm designs and produces its own computer program packages and systems. One of the larger accounting application systems required approximately 395 man hours and fifteen computer hours for development. A typical application requires approximately 100 man hours and ten computer hours for program design, production, testing, and debugging. While the firm considers the manufacturer-supplied software to be satisfactory, the firm does not depend solely upon any outside sources for computer programs. The capabilities and skill levels of Firm C's staff are such as to enable the firm to proceed with any necessary program development. In any case, technical personnel skill level and capability influences actual costs in EDP operation.

The revenue from EDP can be considered to come from the following sources and types of clients: the eleven EDP accounting applications (mentioned on page 63); three types of EDP service

which include: program development, data processing operation and consulting; and these six major types of clients:

retail trade	50
service industries	50
restaurants	30
construction and real estate	20
wholesale industries	15
others	35

4. *Benefits*

The benefits realized by the firm from EDP operation include the upgrading of CPA activities, the upgrading of client types, an increase in management service engagements, an increase in the number of specialists employed, the opening of new fields of practice, the growth of the firm in ways not possible without computer support, improved billing procedures, time records and budgets.

5. *Major Problems*

The EDP experience of Firm C is now sufficiently extensive so that fundamental problems of using EDP in an accounting practice have emerged for recognition. The following list contains the areas that represent the major problems as far as this firm is concerned:

1. The difficulty of scheduling production as volume increases.
2. Training of personnel in the firm in the requisite EDP skills.
3. Programming expense turning out to be greater than anticipated. (The greater economy and benefits come from generalized applications, i.e., those that can be used for all clients; however, these systems are expensive to develop.)
4. The education of clients for data processing, especially small clients.

6. *Future Prospects*

Firm C is looking forward to both technical and application developments in the future. The plans for the utilization of the newly installed system provide for greater control over data handling and storage (both external and internal to the computer). Input and output flexibility will improve EDP efficiency, and the computer

programming will become more generalized. The firm expects to benefit from the increased capability of the new system.

From the standpoint of applications, Firm C expects to expand its own management reporting and to develop client budget services which involve simulation and projection.

VII.

Bibliography

Accounting and the Computer, AICPA, New York, 1966. (Currently out-of-print.)

Auerbach Computer Notebook for Accountants, Auerbach Info, Inc., 121 North Broad Street, Philadelphia, Pennsylvania. ($80.00 per year to members of the Institute in public practice; by subscription.)

Brandon, Dick H., *Management Standards for Data Processing,* D. Van Nostrand Co., New York, 1963. ($12.75)

Business Automation: Annual Reference Guide published each September, Business Publications International, Inc, 288 Park Avenue West, Elmhurst, Illinois 60126. (Annual subscription to magazine, $15.00; reference issue, $5.00)

Computer Characteristics Quarterly, Charles W. Adams Associates, Inc., 575 Technology Square, Cambridge, Massachusetts. (Annual subscription, $25.00)

Computers and Automation: The Computer Directory and Buyers' Guide published each June, Berkeley Enterprises Inc., 815 Washington Street, Newtonville, Massachusetts, 02160. (Annual subscription to magazine including directory, $15.00)

Davis, Gordon B., *Auditing and EDP,* AICPA, New York, 1968. ($12.00)

Davis, Gordon B., *An Introduction to Electronic Computers,* Mc-Graw-Hill Book Co., New York, 1965.   ($10.50)

Lecht, Charles P., *The Management of Computer Programming Projects,* American Management Association, Inc., 135 West 50th Street, New York, New York 10020, 1968.   ($16.50)

Service Center Organization and Control, Burroughs Corporation, Detroit, Michigan, 1964.   ($10.00)