

# An Introduction to the Use of Computers In Bovine Practice

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## **Part I. The Computer and The Bovine Practitioner: Past and Present**

Electronic data processors, computers, have been around since World War II. The first computers were used for decoding of German War codes. From the early 1950's to the 1970's there was a slow evolution of development which had little direct effect on bovine practitioners. The closest the profession came to computers was through Dairy Herd Improvement Centers which utilized large computers to help manage the production records. To this date, DHI Centers have concentrated on utilizing a large mainframe computer and maintaining a central data base. During the 1970's came a wave of new technology that led to the introduction of the microcomputer. This new technology has created an entirely new industry involving the microcomputer and the peripherals and services associated with it.

Presently the computer industry has the technology available, at an affordable price, that will enable bovine practitioners and their clients to utilize these products to increase productivity and profitability. However, there is still the question, "How is the technology going to be used to do this?" The profession is now at a stage where only a small handful of veterinarians are using computers. In five to ten years the majority of practices will be utilizing computers.

How will practitioner begin using computers?

There are two major areas:

### *1. Management of Health and Production Records*

This would include all the health, reproduction and production data generated from a farm; Action Lists, Culling Lists, Herd Summaries, Individual Cow Reports and Management Reports would all fall into this category. Basically the computer is being used as a record keeping system, storing data and generating reports. The specific type of reports that can be generated are numerous and were discussed at the 1980 AABP Convention.

The computer can also be used to help formulate rations.

## *2. Office Management*

This would include:

- A. Accounting Systems
  - i) Billing
  - ii) Accounts Receivable
  - iii) Accounts Payable
  - iv) Inventory Control
  - v) Payroll
  - vi) Business Analysis
- B. Office Systems Management
  - i) Appointment Scheduling
  - ii) Calendar Management
  - iii) Word Processing
  - iv) Electronic Mail
    - a) ordering drugs
    - b) laboratory results
  - v) Literature search

One computer in the 5-10 thousand dollar range can manage all these functions, for both health management and office management. However, to perform these tasks, not only is the computer (hardware) required but also programs (software).

## **II. Evaluation of Computer for Bovine Practice**

A. A "Computer System" consists of four items:

- 1. Software
- 2. Software maintenance
- 3. Hardware
- 4. Hardware maintenance

It takes all four to make a complete system.

The most important single item and most difficult to evaluate is the **software**. There are two types of software:

- 1. Operating System
- 2. Application Programs

The operating systems consists of the programs that allow the computer to manage and run the application programs. Typically, an operating system would be responsible for

coordinating all the activities between the hardware components, loading in programs and data, and generally acting as an overall manager. Operating systems are very important to the overall computer system but also very complex and beyond the scope of our ability to evaluate them. The operating system become particularly important in the discussion of software transportability. Some operating systems are hardware dependent; that is, they run on only one type of computer. Some are hardware independent, meaning they run on many different types of computers.

Application programs are what actually instruct the computer to send out bills or construct a list of cows to freshen. They are the programs that the user interacts with and are what are usually referred to as software. Application programs can be written in one of many different languages. What determines which language a program will be written in is largely a function of personal preference by the developers of the program. Many computers only support one type of operating system which may only run one specific language. Other operating systems may support many languages. The more common languages for microcomputers are Basic, Fortran, Pascal, and Cobol. The language is important in that some languages, such as Pascal, are more "structured" than other languages and the more structured a language is the easier it is to modify the program in the future.

To evaluate an application program, start with an overview of what the program does. It doesn't matter how well a program is written, if it doesn't perform the desired tasks, it is unacceptable. Once it is determined that the program performs the functions required then it needs to be examined in more detail.

There are four areas to evaluate:

1. Data collection
2. Data Entry
3. Analysis
4. Reports

#### 1. DATA Collection-

In any record keeping system, collecting accurate data is the single most important step. Particularly in a livestock situation where the data is being collected in the field. If the data is not accurate, it doesn't matter how good the programs are, the reports that will eventually be generated will be worthless.

**The data collection system should be easy to use, promote accurate data collection, and have a permanent paper backup. The best way to evaluate a data collection system is to sit down and go through the actual motions of collecting data.**

When evaluating the data collection system it is possible to get an insight into how comprehensive the total program is. If particular types of data are not collected, the reports that rely on that data cannot be generated. For example, in a record keeping system for dairies, if milk production data is not collected, reports that require milk production data can

not be generated. This is a good time to determine how detailed the program is.

#### 2. Date Entry-

Once the data is collected it has to be entered into the computer, usually through a cathode ray terminal (CRT). If the data entry program is not designed well it can be a very slow and frustrating experience for the person who is responsible for entering data.

The best way to evaluate the data entry step is to sit down and enter data. Pay particular attention to how fast the data entry program is and how easy it is to catch and correct mistakes. Speed and accuracy are what's most important for this aspect of the program.

#### 3. Analysis-

The program that actually stores and interprets all the data is virtually impossible for a lay person to evaluate. There is no human interaction to this part of the program, the computer does it all. Major error in a program may be fairly easy to detect in a short period of time, but subtle error may take months of using a program before they are detected. So one has to have a certain amount of confidence in the people that write the program.

Certain questions that should be asked in reference to this aspect of the software are:

- i. How large a farm can the system be used for (how many cows)?
- ii. How long is the information kept on each cow (lifetime records, individual lactations).
- iii. How often does the data have to be backed up, and how long does it take?
- iv. How difficult is it to make modifications to the program?

#### 4. Reports

The report program is probably the easiest to evaluate. Sample reports can be examined and readily evaluated. Some programs have the ability to generate new and different reports while sitting at the terminal. Other programs are designed so that new reports can be developed very readily through simple programming changes. Often programs have no provision for change, what you see is what you get.

Time can play a critical role in this aspect of the program. Some reports, depending on the type of searches, may require hours to complete. Determine how much supervision the report generating process requires. If it doesn't require any supervision, then lengthy reports can be generated at night without tying up personnel.

Overall, the program should come within 90% of your requirements. If it doesn't, then don't buy it.

#### Software Maintenance

No matter how well a program is written, it will require changes. Some of these changes may come about because of problems with the program that weren't detected in the testing stage. Other changes might come about because of changes in technology but require the program to change to keep up. Either way, it comes down to the point that

software development is not static, it is a very dynamic process, and there has to be a provision to take this into consideration. Usually the provision would come in the form of paying a yearly service fee to the company that developed the software. The service that the fee would purchase, would include receiving help when problems arise, getting regular updates to the program, and being able to have custom programming done at a reasonable fee.

#### **Evaluation of Hardware**

The basic configuration of a computer dedicated to running a veterinary office and/or livestock operation will consist of:

1. *Terminal* (CRT)—The computer terminal is one part of the total system that has the most contact with people, in a sense it is a window into the computer.

Differences between terminals relate to the quality of the keyboard (important word for processing), how comfortable it is to use, and special functions of the terminal).

Prices range from \$700-\$2500. Failure rates are low because of few mechanical parts.

2. *Printer*—If the CRT is considered a window into the computer, the printer can be thought of as a window looking out of the computer. Its function is to provide written reports, bills, etc.

There are three basic types of printers that can be utilized by a veterinary practice. 1) Dot-Matrix, 2) Letter-Quality, and 3) Thermal. The thermal printers are the cheapest to buy and maintain, but it requires special thermal paper and this limits its use in billing and work processing. The letter quality is the most expensive printer to purchase but has the highest quality print and should be considered if word processing is a main consideration. Finally, the dot-matrix is the most common printer found for the type of applications that a veterinary practice would require.

Printers have the most moving parts of any of the computer hardware, thus they have the highest failure rates. This warrants getting a high quality, dependable, reliable printer. Prices for such a printer, depending on computer type, will range from \$500-\$3000.

#### **Mass Storage**

The majority of information (data) is stored on some sort of mass storage device. It will most likely be either a floppy disc system or a hard disc system. The major difference between floppy disc and hard disc is the amount of data that can be stored, the speed of retrieving that data and the cost of the system. Hard discs can store more data, are faster, and cost more.

The choice of hard disc or floppy disc is based on 1) the application program, 2) the size of the veterinary practice or the livestock operations that will be serviced by the computer.

The real question becomes, "How much mass storage will the total system need presently and in the future?" It's not wise to get too much mass storage because it is costly, both initial purchase price and maintenance and obviously it's not

good to be short of mass storage. This becomes a very difficult question to answer. However, most computers are expandable and a floppy disc system can be upgraded to a hard disc system. So it is possible to start off small and let the system grow as the practice needs grows.

Mass storage devices are one of the more expensive pieces of hardware. A double density, 8 inch disc drive (1 megabyte) will cost between 2-3 thousand dollars. A 10 megabytes hard disc system will cost between 4-6 thousand dollars. Disc systems have higher failure rates than other parts of a computer system because of more mechanical parts. In other words, a high quality mass storage system is important.

#### **4. Computer**

The computer itself consists of a central processing unit (cpu) and memory. There are many different types of computers. To be able to evaluate the differences between computers requires fairly expert knowledge. Standard memory size for a computer for veterinary and livestock applications is 64 K bytes.

The computers and memory will cost somewhere between 1-3 thousand dollars. These two components have the fewest moving parts thus having the lowest failure rate.

#### **Hardware Maintenance**

All computer systems break down. Therefore, there should be some provisions for repairs. Fees are either based on hourly charges plus parts or a yearly maintenance contract. Hourly fees will range from 50-100 dollars per hour with the potential of having to replace some very expensive parts. Maintenance contracts usually cost about 10-12% of the purchase price per year. The nice thing about a maintenance contract is that they are all inclusive and the cost can be budgeted.

Some computer manufacturers provide maintenance for their products, or contract with a company to provide maintenance. Other computer manufacturers rely on the local computer store to provide maintenance, which may or may not be adequate.

#### **III. Implementation —How to Get Started**

The first and most important aspect of getting started is to define the needs you have for a computer. If you don't know what they are then consult with someone who can help you in this area that is not selling a product. Start by making a list of the programs that you would use in order of importance, i.e. billing, inventory, word processing, etc. Then for each program make a list of requirements for that program, i.e., reports available and capacity of program.

Software will either be machine dependent or independent. If the software is machine dependent, then there is virtually no choice in hardware, you purchase the hardware that the software was written for. If the software is machine independent then find out which computers are capable of running the software and seek expert advice for which computer to buy. This decision will be based on size of the practice and how many hours a day the computer will be used, price, local dealers, and serviceability, and for future

growth possibility of practice.

**Once it is determined what type of programs are wanted and what the programs should be able to do then start with the most important program and identify difference sources for that program. Included in this paper (Appendix B) is a sample questionnaire that can be used as a guideline to help evaluate a computer system.**

## Appendix A Glossary\*

### Acoustic coupler

A device that can be connected to a telephone handset. It serves as a converter between the analog electronic signals of communications equipment and the digital electronic signals of electronic data processing equipment. Acoustic couplers are generally found as part of portable communications terminals that can communicate with computers over a public telephone network.

### Address

The term is used to define either a specific location in computer memory, a specific location on a direct access storage device, or a relative location. The third address is one which indicates a specific location relative to some reference point, say the beginning of a data set or file. However, since the data set or file itself can be completely relocated from time to time, there is no location or address in an absolute sense.

### A/D

Analog to Digital converter. An interface device that handles conversions of natural parameters (analog), such as temperature displacement and magnetic field strength, to digital form.

### ALGOL

Algorithmic Language or Algebraic Oriented Language. A high-level language whose expressions and statements take the form of algebraic formulas or algorithms.

### ALU

Arithmetic and Logic Unit. The ALU is that part of the processing unit that performs arithmetic (additions, subtractions, multiplications, etc.) and logic (ANDs, ORs, and exclusive ORs) operations.

### Analog

Can be applied as an adjective to nouns such as data, transmission, and computer. Analog means that which is continuously available (often expressed as a wave), as opposed to that which is discretely variable (often expressed as pulses). Analog data are often graphically represented as a sine curve.

### APL

A Programming Language. A high-level programming language. It is used interactively. Its statements use mathematical notation, and the language is a favorite among mathematicians and statisticians.

### ASCII

American Standard Code for Information Interchange. A seven bit, plus an eighth bit for parity, code established in an attempt to standardize data representation.

### Asynchronous

The exact meaning of this term is largely determined by the context in which it is found. When used in the context of communications (teleprocessing), it describes a method of data transmission. In asynchronous transmission, characters are sent one at a time, with each character bounded by start/stop symbols. When used in the context of computer processing, the term describes a method of concurrent task processing by the computer. When two program modules are being executed concurrently in a computer and they do not have impact on one another, they are said to be running a synchronously.

### BASIC

Beginners All-Purpose Symbolic Instruction Code. A high-level programming language, approximating business English, that is used in an interactive computer environment. It is a favorite among financial analysts.

### Baud

For all practical purposes, it is the measure of the speed at which data travels over a communications line. For example, a 1200 baud line is one that commonly supports data transmission at a rate of 1200 bits per second (bps). In reality, baud is not necessarily the same as bits per second, but it is commonly accepted as such.

### Bit

The smallest piece of data recognizable to a computer. The term bit is a contraction for binary digit.

### Bootstrapping

A bootstrap is a small initialization computer program that is used to load another program and to start up an inactive computer.

### Buffer

A term that has more than one meaning. In hardware, it is a component that compensates for the different rates at which data are transmitted from one component to another. Software buffers perform a similar function, but are located in computer memory. One type of hardware buffer is that which is used to compensate between computer memory and a tape drive. Computer memory moves data at electronic speeds while a tape drive moves data at mechanical speeds, which are significantly slower. Rather than tie up the computer as data are moved bit by bit from a tape drive to computer memory, a buffer is put between the two. While the tape drive fills up the buffer, the computer memory does other work. When the buffer becomes full, the computer memory pauses in its work and empties the buffer. Software buffers are like staging areas where pools of data are kept, with individual data records selected when needed. Software

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\**Understanding Computers by Miles E. Walsh, John Wiley and Sons, New York.*

buffers are used to handle blocked records, that is, where one physical record contains more than one logical record. The buffer is used to hold the block of several logical records, and they are selected one at a time from the buffer as needed.

#### Bug

An error in a program, or a malfunctioning piece of hardware. Bugs can manifest themselves in many different ways. Those that manifest themselves most quickly cause the least damage, but they are not necessarily the easiest to find or to fix.

#### Bus

A hardware component to which can be connected several components making up a computer configuration. A bus is like a channel across which data can flow from one component to another.

#### Byte

An electronic data processing term that is used to describe one position or one character of information, made up of eight bits. A character of data or a position of computer storage of the eight-bit variety is called a byte of data or a byte of memory.

#### Console

Usually the main input/output device by which individuals can interact with a computer. The device used for a console is generally a CRT with a keyboard or a typewriter terminal. A console, as the main input/output device, often has some privileged capabilities not available to other terminal devices that can interact with the computer.

#### CPU

Central Processing Unit. The CPU is that part of a computer that contains the arithmetic, logic, and control functions. For practical purposes, it is everything except computer storage (memory) and input/output.

#### Cycle

This term ranks as one of the all-time greats in the "buzz word" category. In the word of EDP, there are several different types of cycles. Basically, a cycle is an interval of time required to complete an even. Examples: an instruction cycle is the interval of time required by a processing unit to execute an instruction; a memory cycle is the amount of time required to fetch a piece of data from memory and get it into the processor; a processing cycle refers to the interval of time between the processings of a job. For instance, a payroll might be processed once a week; that payroll job would be said to be on a weekly cycle.

#### D/A

Digital to Analog converter. An interface device that converts digital impulses into analog or natural parameters such as: magnetic field strength, temperature, or displacement.

#### Data base

A collection of data elements within records within the files that have relationships with other elements within other records within other files. Pointers are used to establish inter-relationships among data elements that transcend file boundaries.

#### Data base management system

A collection of programs that can store, manipulate, and retrieve data elements that make up a data base.

#### Duplex

The name given to simultaneous two-way transmission over a communications line.

#### FAX

Facsimile. An equipment configuration that facilitates the transmission of images over a common carrier network.

#### GIGO

Garbage in, garbage out. A process that has been known to be more efficient when converted to computers.

#### Glich

Same as a bug. An error condition either in hardware or in software that causes a malfunction.

#### Half duplex

The name given to nonsimultaneous two-way data transmission over a communications line.

#### Host

The term host has several uses: Host computer implies a primary or controlling computer in a multiple-computer operation. Host system implies a system to which a communications system is connected and with which the system can communicate. For practical purposes, a host is usually a large-scale computer that is given work by satellite equipment. The large-scale computer usually exercises a degree of control over the satellite equipment.

#### Intelligent terminal

A terminal device that is able to do more than send and receive data. The range of intelligent terminals is very broad. For a terminal device to have intelligence merely means that it is a computer.

#### Interface

A common interconnection between two components or functions that do not normally interact. In the case of hardware, it can be a piece of equipment. In the case of software, it can be a common area of computer storage or some common instructions shared by two or more programs. In the realm of minicomputers, the term interface is used to describe the circuit board that is necessary to attach a particular peripheral device to the minicomputer.

#### I/O

Input/Output. An acronym used to signify the transfer of data between computer storage and peripheral devices.

#### K

An expression signifying a unit of memory size. It refers to 1024 positions of computer memory. For example, a 28K memory contains 28,672 positions of memory.

#### LSI

Large Scale Integration. This is component miniaturization technology. LSI usually refers to a piece of semiconductor containing hundreds of transistors.

#### Microcomputer

A very small computer, usually contained on one or a few semiconductor chips.

### Microprocessor

A piece of hardware that houses the computing parts of a computer on one circuit board or in one set of integrated circuits. It is an integral part of a microcomputer, but does not contain the I/O interfaces and memory unit. Microprocessors have been hailed as “computers on a chip”.

### Minicomputer

Difficult to define precisely. The definition seems to evolve. A minicomputer, in general terms, is mini in price and size. Until the late 1970s, minis were also small in terms of word length and memory size. The cost of a mini is difficult to use as a criterion because of the changing nature of minis themselves and the economic climate. The only concrete portion of a definition is that a mini is a general purpose, programmable digital computer.

### Modem

Acronym for modulation/demodulation/demodulation. A modem is a hardware device that interfaces telephone lines and computer equipment. A signal on a telephone line is analog and a signal on computer line is digital.

### Module

Simply described, a module is a part or a component. It can refer to a section of a program, a piece of hardware such as an integrated circuit board, or a peripheral device that is part of a computer system configuration.

### Multiprocessing

Simultaneous processing by two or more processing units that are sharing a common memory and peripheral devices.

### Nanosecond

Billionth of a second.

### Network

An interconnected group of nodes. Nodes can be computers and peripheral devices. The connectors between the nodes can be telephone lines or some of the more exotic links such as satellites or microwaves.

### OS

Operating System. An operating system is a collection of programs that controls the execution of other programs. It handles such tasks as scheduling allocation of resources, input and output, data management, and related services.

### Parity

Parity is a coding mechanism that is used to check data for accuracy as they are moved from device to device. Parity can be odd or even. For example, in EBCDIC, the bit configuration 000100110 is odd. To make it even, the last bit, reserved for parity use is changed to a “1.” It does not change the character but in even parity, the bit configuration is 000100111. In real situations, parity is determined by the type of equipment in use.

### PROM

Programmable Read-Only Memory. Read-only memory has programs “frozen” onto it when it is produced. With programmable ROM, modules of ROM can be replaced. For example, imagine a 16k module of ROM made up of eight 2K modules. A modification could be made to one of

the 2K modules by remanufacturing (reprogramming) it. In this sense ROM becomes PROM.

### Queueing

The process of putting something in a line to wait. A job queue is established for jobs as they await the allocation of computer resources for their execution. Transactions are queued up in a telecommunications environment awaiting the arrival into computer memory of the program modules that are necessary for the processing of individual transactions.

### RAM

Random Access Memory. A computer memory that allows access to any of its locations. It is the most common type of computer memory.

### Register

Register is a word that describes a hardware device where data are held for specific uses. The uses depend on the function of the register. There are several different kinds of registers — address registers, general purpose registers, instruction registers, and accumulators.

### Remote

This term has more than one meaning. One describes a site or a terminal that is located at a place other than where the computer is located. A remote terminal, for example, refers to a terminal that interacts with a computer over communications lines since it is located at a site remote from the computer site. Remote is also used to describe program testing that takes place when the programmer is not present.

### Response time

There is some debate about what actually constitutes response time. Basically, it is the elapsed time from when an entry is made from terminal device until a response is received back on that terminal.

### ROM

Read Only Memory. A memory module that is manufactured with its use predefined and included. This kind of memory can be read from but not written to. It is not programmable in the traditional sense. See PROM for the exception.

### RPG

Report Program Generator. A high-level language, with a compiler that is intended primarily as a vehicle for quickly producing programs that access data from data bases or files and for providing listings or summaries of those data in tabular or formatted reports.

### Source

The term has two meanings. When seen in context of programming, it indicates a computer program in the form that it was originally coded by a programmer. The source program may exist on coding sheets, on a deck of 8-column cards, or may reside on a DASD device. A program in its uncompiled state is called a source program or more simply source. The term is also used to describe input to a computer system as that input exists in its original form. Documents such as time cards or invoices, before they are put into computer-recognizable form, are called source documents

or source.

#### Statement

An expression or an instruction of a computer program. It is analogous to a phrase, clause, or sentence in the English language. Programs written in high-level languages (languages closer to the problem than the machine) often have statements in them that bear close resemblance to English language statements.

#### Structured programming

A programming technique. Although the technique has been known for some time, its current applications are being presented as a standardization and simplification tool. The technique embraces the concept of writing completely self-contained program modules. Each module is written and subsequently executed without branching to another module. Unfortunately, although structured programming is the best way to write programs from a program simplicity and program maintenance perspective, the technique is already suffocating under a mountain of technical jargon which belies its simplicity.

#### Subroutine

A program module that handles a specific task or group of tasks within the framework of a larger program or group of programs.

#### Synchronous

A term that indicates that two systems are in step with one another. The word is often seen in the context of synchronous transmission, which describes a method of transmitting data at a fixed rate with sending and receiving stations synchronized with one another.

#### System

This term can refer to either a combination of hardware, a combination of software, or a combination of both. A computer equipment configuration of processing unit, memory, and peripherals is referred to as a system. A collection of related computer programs that work in tandem with one another or in sequence one after another for the purpose of doing a specific job is called a system. A complex computer configuration consisting of many pieces of equipment and a number of computer programs for executing several jobs is also known as a system.

#### Time-sharing

An interactive or conversational method of working on a computer. In a time-sharing environment, a number of typewriter or CRT terminals are given access to a centrally located computer. The software (an operating system option) allocates intervals of time to each of the terminals on a regular basis. The terminals may or may not be located in the same location as the computer. Time-sharing can exist in a communications or in a noncommunications environment. In a hypothetical time-sharing facility, there might be six terminals attached to a computer. Out of each minute (60 seconds), each user might be given a time slice of 10 seconds of CPU time. Since the CPU is significantly faster than the terminal, it appears to the user that he has the whole CPU. In reality, time-sharing facilities support many more

than six devices. Installations supporting hundreds of terminals are not unheard of. Some corporations have as their sole purpose the providing of time-sharing services. These enterprises house a computer at a central site and have customers at various sites to whom they sell time.

#### Utilities

These are programs that are often used in a computer environment. They include programs such as sorts, merges, copiers, reorganizers, restart and recovery programs, and formatters. They are often provided by hardware and software vendors as enhancements of their products. They can also be produced (written) by software vendors and by in-house programmers. Utilities are generalized programs that can be made to perform particular functions by specifying parameters. For example, specifying parameters to a generalized sort program, indicates to the sort the keys on which the file is to be sorted.

#### Virtual storage

A technique in which auxiliary storage is used to provide a depth of memory that is not actually present in the computer. For example, a computer may have 2 million bytes of memory, but it is possible through operating-system technology for users to treat it as an 8 million byte machine. In a virtual storage environment, the computer operating system contains a paging algorithm. Within a virtual storage computer, modules are a specific size. The algorithm keeps track of the most frequently used modules. The operating system, together with the algorithm, keeps the most frequently used modules in main memory; the rest reside on peripheral storage till needed. The modules of fixed size are called pages. The process of bringing the needed modules into main memory as they are needed is called paging.

## Appendix B

### Software Evaluation Questionnaire

1. What are the functions of the program (detailed)?
2. What operating system does it run under?
3. What language is the program written in?
4. What different types of computers *will* (and are) the program running on?
5. How is data collected (specific forms)?
6. How is the data entered into the computer?
7. How is the data backed-up (time required)?
8. What specific type of reports are available?
9. Do modifications have to be made in the program to meet your specific practice needs? If so, can they be made?
10. How much training and work is involved in starting up the program?
11. Are detailed manuals provided?
12. What are the limitations of the program, i.e., how many cows, how many accounts, how many years of data?
13. What type of personnel will have to be hired to run the

- computer and how much of their time will be needed?
14. How much will current practice procedures (billing, etc.) have to change to incorporate the computer into the existing business routine?
  15. How much does the software cost?
  16. What kind of software maintenance is provided?
  17. How much does the software maintenance cost?
  18. Are there people that can be contacted who have used the software?

#### Hardware Evaluation Questionnaire

1. What specific hardware configuration is required to run the software?
  - a) Terminal?

- b) Printer?
  - c) CPU and Memory?
  - d) Mass Storage
2. What operating systems will run on the hardware?
  3. Can the hardware be upgraded? If so, to what?
  4. What environmental limitations are there on the hardware?
  5. How much does the hardware cost?
  6. Is a hardware maintenance contract available? If so, how much does it cost?
  7. If a service contract is not available, who will fix the computer when it breaks down?
  8. Are there people that can be contacted who have used this computer for similar purposes?

