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LEGAL PROTECTION FOR COMPUTER PROGRAMS

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by
John R. Manning
Office of Assistant General
Counsel for Patent Matters

National Aeronautics and Space Administration

INTRODUCTION

During this seminar, you have heard a discussion of a number of most interesting topics. One may gaze at an electronic computer with a certain amount of fascination and awe. However, the machine does only what it is told to do, not what you want it to do. The program is the medium for telling it what to do.

This is counter to normal human operations where everything does not have to be spelled out precisely. In speech, for example, proper information is conveyed when sounds and even words are missing. The redundancy of the language permits one to follow the thought anyway. For example, I can appear at the desk of a co-worker at about 12:00 noon and by saying one word -- lunch? -- I can convey the idea to him that I am going to lunch and invite him to accompany me. In fact, if I have my coat on and the time is about 12:00 noon, I probably won't have to say anything at all, yet he knows he is invited to accompany me to lunch.

It has been estimated that English is 60 percent redundant. So, that leaves just 40 percent of my talk that, I hope, is meaningful.

An interesting application of a computer has been proposed

in a British magazine "New Scientist", February 12, 1970. The article is entitled "And the Last Word on Confessions."

> When firemen were recently called to dowse a minor conflagration in Toledo Cathedral, they found that the blaze was started by an electric blanket which had apparently short-circuited in a confessional box. Cathedrals are notoriously chilly places and this introduction, with or without papal blessing, of such modern comfort for the confessor, probably has the approbation of all thoughtful sinners in Toledo. Self-accusers with heavy lists of past delinquency to deliver, certainly don't want the chap giving out the penance to be in any dungeon because his feet are freezing cold. And the scientifically minded among them, now that the confessionals are wired for power, might be pondering the prospect of other technological advances. It has already been found in America that such psychotherapy can be achieved in lay establishments by the patient talking out his troubles with a friendly computer. In fact, some people of humble nature have preferred the interview with the faceless machine to the session with the human psychiatrist whose superiority of intellect and vocabulary makes them ill at ease.

The city of San Francisco presents two applications for possible use of a computer. In the first, firemen, enroute to the scene of a warehouse blaze, are briefed by radio from a dispatcher who has queried - computer stored fire and property records - and learned: That explosives are stored at the scene. This is the third fire at the location in 18 months. There is a small hotel across the street. Fuel is stored in an adjacent garage. And, the structure involved is brick and wood and was constructed in 1912.

The second possibility comes closer to the legal aspect of this talk. Called to a tavern, police are briefed enroute from computer data that a man involved in a shooting is a parolee. This tavern has been the scene of four shootings in the past 18 months. In the past 30 days, a crowd at this site attacked officers responding to a routine call. And, the site is a one-story structure with one front entrance and two rear doors providing access to an alley.

From these examples, it is readily apparent that the computer has grown from its earlier primary role of mathematical computation so that it now performs roles more related to our social needs.

You have heard it estimated that the total value of computers installed by 1972 will be $18 billion. Perhaps the value of the programs and data bases will exceed that value. The Federal Government has taken the lead in advancing this new technology. By purchasing or leasing approximately ten percent of all computers produced in the United States, the Government is the largest single procurer of computers and peripheral equipment.

What Are We Trying to Protect - A Program

Those of us working in the area of the protection and rights surrounding hardware and software, kick a lot of terms around and may not know what they really, and I emphasize

really mean. Lets start with some definitions you have all seen before.

(Figure 1 - Definitions)

Computer Program: List of commands, orders, or instructions specifying the sequence of operations which the computer is to execute.

Machine Language: Is that language under which the computer operates and which can be read by the computer.

Source Program: Is that program expressed in one of the programming languages, such as FORTRAN, ALGOL or COBOL.

Object Program: Is that program that can be used directly by a computer inasmuch as it is in the machine language comprehensive to the particular computer for which it will be used.

Compiler or Assembler: Is that which converts a source program to an object program or converts the programming language to the machine language.

All of these are programs. My experience in the technical and legal end of computers goes back many years. And yet I never really felt comfortable around computers because I did not understand the software, i.e., the computer program. The definitions helped, but little. Programs have been defined for me, I have seen programmers write them, and I have seen computers operate on them. Still, I did not feel

I really had a handle on them. Since learning by doing is the best teacher, I obtained formal training in computer programming. I am still a novice at being a computer programmer, but at last I think I have a feel for it. Knowing a little programming first hand helps me to better understand what it is that I, or someone else, is trying to surround with a legal garb.

I have ten figures in which I have written a simple program to calculate and write the paycheck for an employee on our "Seminar Computer". These ten figures will illustrate the development of programming on the very earliest machines, in machine language, to the latest computers, in the high level language of COBOL.

The Figure 2 sets out the problem. We shall calculate an employee's pay by multiplying the number of hours worked by the hourly rate; subtract the deductions; and, write the pay check.

We start by constructing a flow chart of the problem as shown in the Figure 3. The flow chart provides an organized approach to the solution of the problem. First, we must read a punched card which has been previously prepared and contains the necessary information relating to hours worked, the hourly rate, and the employee's deductions. After the card is read, the information is stored in the memory in

the computer. Next, a multiplication operation takes place which gives the gross pay. After the gross pay is calculated, the deductions are substracted. Finally, the check is prepared by writing the net pay on the employee's pay check.

Before writing the program, a few preliminaries must be taken care of. An instruction, as shown in the Figure 4, includes an operation portion and an address portion. The operation specifies the operation to be performed such as add, substract, transfer, etc. The address portion represents the location of the data (the operand) to be operated on.

The code list of the Figure 5 specifies the operations that are possible with the hypothetical machine with which we are working; an assigned decimal code shown in Column 2; and, a corresponding binary code in Column 3. The binary code is the only thing the machine can understand although later machines can interpret other characters, alphabetical or numerical, which are subsequently translated into a binary code.

The first draft of the program is illustrated in the Figure 6. Here, each operation is set out, the address of the operands, and any remarks relating to that operation. The next step is to code the program which is accomplished by substituting the binary code of the corresponding operations of the Figure 5 for the operation column and address of the operand column in the Figure 6.

The coded program of the Figure 7 is not required in later machines which may recognize assembly languages or higher level languages.

If we consider the amount of effort involved in writing a program for the simple problem proposed, we may readily envision an easier solution which is illustrated in the Figure 8. If we simplify our program but provide a detailed and complicated master program, then a merge of the two programs would provide a machine interpretable program. Thus, the master program, known in present language as a compiler or assembly program, would have the ability to convert our program into a code which the computer could understand.

Accordingly, in the Figure 9 we have taken the program of the Figure 6 and substituted mnemonics for the operations and the addresses. Using this approach, a programmer can be more easily trained to prepare the program and with less errors than before. As a result, our program now appears as shown in the Figure 10. With a little training, one can read and interpret the program of the Figure 10. Contrast this with the machine readable program of the Figure 7.

The program in the Figure 10, after it is punched into cards, can now be run against a master or assembly program to yield the solution to the problem.

Lastly, the program is written in COBOL. In the COBOL language of the Figure 11, after the equipment and the files are described, the program is written in sentences which conform to simple rules. After these sentences are punched into cards and run against a compiler program, the solution to the problem results. Thus, program languages have progressed from the "0" and "1" stage to the higher level languages. It takes little reflection to observe that, although computers may solve many of the complex problems of today, the languages are easier to work with.

POSSIBLE PROTECTION

In this talk, I plan to discuss the approaches taken by the general practicing attorney, to protect computer programs. Next, we will consider the problems which you may encounter as a government employee.

Most experts agree that there is no legal method which is fully adequate to protect a proprietary program. However, these are the possibilities:

(Figure 12 - Possible protection of software to be considered)

1. By trademark registration.
2. By copyright registration.
3. As a trade secret.
4. By patent.
5. By contract.

1. By Trademark

A trademark is a word, symbol, device or combination thereof, adopted by a manufacturer and used on his goods, or in connection with them, in order to identify his product and distinguish it from those of others. Unlike a patent, a trademark is a common law right, acquired through prior use, not by statutory grant. Trademarks are registerable under the Lanham Act of 1946.

The modern trademark performs three basic functions:

1. It serves as an indication of origin;
2. Some assurance of consistency of quality; and,
3. As an aid to advertising and sales.

Some companies have affixed a trademark to a computer program. But, as an indication of origin of the program, the only protection to the owner of the program is the name of the program, i.e., the trademark, of the program. The trademark affords no protection to the goods itself, that is, the program. Thus, the trademark falls far short of protecting the product. It does protect the use of the name of the program, if that is susceptible to protection.

2. By Copyright

Lets look at the protection afforded by copyright registration. The present copyright act was enacted in 1909 when phonograph records and motion pictures were in their infancy. Radio, television, electronic computers, programs, and

satellite communication were completely unknown. To this list, I might add the photocopy machine.

The copyright statute lists the rights of a copyright owner, among others, as the exclusive right to print, reprint, publish, copy, and vend the copyrighted work, and to translate, dramatize, arrange, or adapt it. In 1964, the Register of Copyrights granted, what is proclaimed to be, the first copyright registration for a computer program. I say "proclaimed to be" since Mr. George Cary, Deputy Register of Copyrights, has stated that North American Aviation filed for registration of a program in 1961.

In January 1965, the Register of Copyrights issued Circular No. 31D which stated the conditions under which computer programs would be accepted for registration. As of May 1, 1970, 168 computer programs have been filed for registration of copyright. Perhaps a million programs have been written during this period. In Circular 31D, the Copyright Office itself announced that the registerability of computer programs was doubtful but,

> In accordance with its policy of resolving doubtful issues in favor of registration wherever possible,

the Office will accept programs for registration.

Lets go back to Article 1, Section 8 of the Constitution.

> To promote the Progress of Science and the useful arts, by securing for limited times to authors and inventors, the exclusive right to their respective writings and discoveries.

We know that this clause provides for both our patent and copyright systems. Of interest to copyright registration is AUTHORS and WRITINGS. So, two questions arise: Is the programmer an author? Is the program a writing?

If the program is original with the programmer, then he is the author. Original as used with reference to copyrighted work means only that the work "owes its origin" to an author. In addition to "human written programs", we have computer written programs. Query, can a computer be an author? On this, I refer you to an article in the June 1969 issue of the "Journal of the Patent Office Society" entitled "Can a Computer be an Author or an Inventor?"

The next question is: Is the program a writing? In an 1884 Supreme Court case of Burrow-Giles Lithography and Saxon, the Court defined writings as including all forms of writing by which the ideas in the mind of the author are given visible expression. The criterion of visible expression would seemingly rule out the registrability of a computer program presented on magnetic tape. Further support for this position is gathered from the case of White-Smith Music Publishing Co. v. Apollo Co. (The citation for this case and

all others in this talk are found in the "CITATIONS" at the end.) in which the Supreme Court held that a piano roll, with perforations not unlike those of a punched card, was not a copy of the musical work. Accordingly, no infringement of the copyrighted composition was found.

However, Mr. Cary of the Copyright Office argues that the fact that a punch card, and indeed a magnetic tape, are capable of being "read", prompted the Copyright Office to discount the White-Smith argument.

The formal requirements for registration of a computer program as a copyright are:

1. Original authorship.

2. Publication in fact.

3. That the copies deposited with the registration statement include reproductions in a language intelligible to human beings.

4. That the registration be submitted on Form A as a book.

5. The applicant submit a brief explanation of the way in which the program was first made available to the public.

We know that copies of works to be copyrighted, do not have to be deposited at the Copyright Office to facilitate the registration until it is desired to enforce the copyright.

However, the copyright notice must be marked on the computer program at its beginning or on the tape itself.

If one does not deposit the two copies at the Copyright Office then there are no copies "lying around" and thus available to the prying public. But, this latter point would seemingly somewhat defeat the purpose and function of copyrights. In effect, by this action one would appear to perpetrate a fraud on the Copyright Office since on one hand one alleges the publication of the program while on the other hand, severely restricts its publication and distribution.

The scope of protection afforded by copyrighting a computer program has not been established. However, copyrighting does offer some degree of protection. Whereas a patent prevents others from making, using or selling the patented invention, whether or not the basic or underlying idea was copied, a copyright forbids only the copying of the copyrighted work and not the independent creation of another work no matter how similar. This statement is significant in two respects:

1. A copyright does not protect the idea or central theme of the computer program, and

2. It does not prevent another from independently arriving at the same program.

One of the most difficult problems in effective copyright protection is the requirement that copying be proved. This copying may be established by showing that the alleged infringer had access to the work, and, that "similarities between the two works are such as to raise a reasonable inference of copying."

Mapmakers and publishers of compilations use a trick to prove copying. They insert some small defect or useless character which when copied "shows the infringers hand." In the case of a computer program, a few instructions could be included which have no material effect on the program when run. Even knowing these redundant instructions exist in the program, the cost of detecting and removing them may exceed the cost of independently writing the program.

Recalling that in announcing the acceptance for registration of computer programs, the Copyright Office stated that it <u>did not</u> establish a rule that could be relied on. What they wanted was to make it possible for there to be a judicial determination of copyrightability. To my knowledge, of the 168 copyrighted programs to date, there has been no judicial determination on either the validity or scope of protection of a copyrighted computer program.

There is pending in this congress a bill, S.543, for revision of the copyright law that, if passed, would seem to

me to cover the copyrightability of computer programs. The bill states that literary works are copyrightable and literary works are defined as "works expressed in words, numbers, or other verbal or numerical symbols or indicia". And, copyright protection subsists in any tangible medium of expression . . . . from which they can be perceived . . . . either directly or with the aid of a machine or device.

3. As a Trade Secret

Next, we consider the protection afforded a computer program if the owner wishes to go the trade secret route. Lets go back to the restatement of torts and look at the definition of a trade secret: In Figure 13, a trade secret has been defined as follows:

> A trade secret may consist of any formula, pattern, device or compilation of information which is used in one's business and which gives him an opportunity to obtain an advantage over competitors who do not know or use it. It may be a formula for a chemical compound, a process of manufacture, treating, or preserving materials, a pattern for a machine or other device, or a list of customers.

We have no trouble putting a computer program in the definition. This common law of trade secrets would hold one liable who wrongfully discloses or uses the program.

The tests to bring one's computer program within the legally protectible area of the trade secrets are:

1. Is the program really secret? The ease with which the program can be obtained from its owner is a valid defense

to any trade secret infringement action. The question is, "Has the owner really exerted effort to maintain the secrecy of the program?"

2. Is the program really valuable? In general, the greater the value of the program to its owner, and the greater the extent of injury from its use by a competitor, the more likely that the program will receive protection in an infringement action.

3. Was the program developed and owned by the company?

4. Was it difficult to develop the program in terms of effort and money. Some programs are valuable merely because of their huge volume. Other programs are short, but are of value due to their novelty.

And, the 5th and last test of infringement: The ease or difficulty with which the program could be properly acquired or duplicated by others.

Anyone seeking protection of a computer program by trade secret, must show that at least a substantial part of the alleged infringing program was copied from the owner's trade secret.

One who discloses or uses another's trade secret, without privilege to do so, is liable to the other if:

1. He discovered the secret by improper means, or

2. His disclosure or use constitutes a breach of

confidence reposed in him by the other in disclosing the secret to him, or

3. He learned the secret from a third person with notice of the facts that it was a secret and that the third person discovered it by improper means or, that the third person's disclosure of it was otherwise a breach of his duty to the other, or

4. He learned the secret with notice of the facts that it was a secret and that its disclosure was made to him by mistake.

Now, what happens if your client, the Government, somehow violates a trade secret coupled to a program. Suppose the owner of the program feels the violation is a tort. But, under the Tort Claims Act, torts of an intangible nature such as slander, libel, malicious prosecution, and injuries to business caused by acts of government employees are <u>not</u> actionable. So in the Bofors case, the Plaintiff based his action, in the District Court, of unlawful disclosure of a trade secret for making anti-aircraft guns, on the Federal Tort Claims Act. The District Court dismissed the case and this was affirmed on appeal.

The most important and frequently used judicial remedy for trade secret violation by the Government is a suit in the Court of Claims under the Tucker Act. By the Tucker Act,

the Government has consented to be sued on any express or implied contract not sounding in Tort. Now Bofors, suing under the contract in the Court of Claims, was successful.

As a final note, in the case of Padbloc Co. v. United States, Padbloc was successful in the Court of Claims on an implied in fact contract which arose as a result of the disclosure of a trade secret by the Government. But, despite the success of Padbloc, it is quite difficult to prove an implied promise by the Government concerning a trade secret. The plaintiff must show an implied promise by a government employee having authority to bind the Government in contract, to keep the owner's trade secret in confidence or to pay for its use by the Government.

Strangely enough, the violation of a trade secret by the Government may also entail a violation of a common law copyright. If the Government discloses an individual's trade secret, say a computer program, acquired in confidence by making copies of a writing containing that secret, available to the public without authority, and if such writing has not been previously published by the owner, the Government not only violates the owner's trade secret, but his common law copyright, the right of first publication. But, there are no statutes permitting the owner to sue nor have any cases been found on this point.

I was asked a question if it were objectionable, for a vendor of a computer program, to negotiate a lease or sale of his program to the Government, and bring the program in and personally load it into the computer. I saw no objection to this, but was curious as to why the owner insisted on loading the program himself. Upon consulting programming experts, some stated that it was possible to have a program, resident in a computer, self destruct if one tried to read it out. This apparently was this owner's means of protection. He had inserted certain instructions in the program that would cause the program to be read out in an unintelligible manner if the computer operator programmed a read out instruction for the program.

I would like to mention a decision that came down in February 1970 concerning trade secrets. In the case of Painton v. Burns, the District Court, S.D. of New York stated,

> This Court holds that federal patent law requires an inventor to submit his ideas to the Patent Office before he can compel consideration for use of his idea."

Continuing,

> Our patent policy of strict regulation of inventions would be undercut if inventors could enforce agreements for compensation for alleged secret ideas without being required to submit those ideas to the Patent Office, and, thereby, eventually have the ideas disclosed to the public.

We just lost our whole body of trade secret law!

4. By Patent

Now we turn to the protection of software by Letters Patent. This area of the law, is without a doubt, the most contraversial and discussed area of computer program protection. Many two and three day seminars and institutes have been directed to this single topic.

The first question we may ask is, "Are computer programs patentable?" My answer is, "It depends on whom you ask." It depends also on one's definition of a computer program.

Is the flow chart of the Figure 3 a program?

Or, is the sequence of instructions of the Figure 6 a program?

Or, is the group of machine language instructions of the Figure 7 a program?

How about the master program known as an assembler or compiler of the Figure 8?

Or, is the assembly language program of the Figure 10 patentable?

Lastly, is the COBOL program of the Figure 11 patentable? These are all computer programs.

The one that may be patentable is the flow chart of the Figure 3.

What does the patent law require of an invention before it rises to the level of patentability? First of all, it

must fit into a class of inventions that the Patent Office considers patentable. (See 35 U.S.C. 101) It requires: novelty or that it be new; utility - that it be useful; and, unobviousness - and that is a tough one. If the computer itself, the hardware, is new, useful, and unobvious, then it is patentable.

The Patent Office applies the same criteria to determine patentability of the software, i.e., the program. What rights does a patent give its owner? It gives him the right to exclude others from making, using, or selling the patented item. The heart of a patent is the claim. We look at the claim for the legal determination as to the scope of coverage of the patent. In patents we have two main types of claims: apparatus or hardware claims, and method or process claims. The computer itself falls in the hardware or apparatus type. The program would usually fall into the method or process category.

The U. S. Patent Office had stated that computer programs are not patentable. In fact, they had issue guidelines in the Official Gazette of the Patent Office which are as follows:

> Special problems of patentability arise in the computer and data processing fields revolving around logical processes and mathematical equations. Mental processes may not be patented although they may be of enormous importance.

> In re Abrams. A process or method is directed to patentable subject matter only if it is performed on physical materials and produces some appreciable change in their character or condition; In re Shao Wen Yuan, Cochrane v. Deener, accordingly, a computer programming process which produces no more than a numerical, statistical or other informational result is not directed to patentable subject matter. Such a process may, however, form a part of a patentable invention if it is combined in an unobvious manner with physical steps of the character above referred to as, for example, in the knitting of a pattern or the shaping of metal.

Fortunately, we have an appeal from decisions of the Patent Office and a number of unsuccessful applicants appealed to the U. S. Court of Customs and Patent Appeals. A certain measure of success was achieved by at least three appellants. As a result of these decisions, a notice appeared in the Official Gazette of the Patent Office on November 11, 1969, as follows:

> In view of the decision by the U.S. Court of Customs and Patent Appeals in "In re Prater et al," the adopted guidelines are hereby rescinded, effective immediately. For the time being, adoption of new guidelines for the examination of patent applications is being deferred pending further judicial interpretation of the law on a case-by-case basis.

Before we briefly look at the three latest decisions from the CCPA (Court of Customs and Patent Appeals), I mention a patent to Goetz which issued in April 1968. Counsel for Goetz announced at great lengths that this patent, to . rting System, had finally broken the ice at the Patent Office and

they had issued a patent to a computer program. When the Patent Office was confronted with this claim of Counsel, an official of the Patent Office indicated that there has been no change in policy. In their opinion, they have not issued any patents on a computer program. This points up the fact that reasonable men differ on the definition of a computer program. My personal opinion is that the Goetz claims are not directed to a program. They are directed to apparatus such as a control loop means which we recognize as an apparatus type claim.

The Prater and Wei case was heard twice, the second decision being in 1969. Rehearing was granted and a somewhat different decision was rendered on the second time around. The Prater and Wei invention related to a method and apparatus for the analysis of spectrographic data to determine the components of a mixture of gases. Through the use of the computer, the inventors were able to analyze the gas in a very short time. The court discussed the doctrine that claims having mental steps are not patentable and they determined that this doctrine was not applicable here. The method claims were rejected on the grounds that the claims did not point out and distinctively claim the invention. The court stated that the method claims were broad enough to encompass pencil and paper markings which a mathematician might make in

documenting or recording his mental calculations. But, one apparatus claim was allowed. This claim called for: means for generating a scalar function; means for generating successive scalar functions; and, means for determining that one of said scalar functions of greatest magnitude.

An interesting footnote appeared in the decision as follows:

> No reason is now apparent to us why, based on the Constitution, statute, or case law, apparatus and process claims broad enough to encompass the operation of a programmed general-purpose digital computer are necessarily unpatentable. In one sense, a general-purpose digital computer may be regarded as but a storeroom of parts and/or electrical components. But once a program has been introduced, the general-purpose digital computer (i.e., a specific electrical circuit with or without electro-mechanical components) which, along with the process by which it operates, may be patented subject, of course, to the requirements of novelty, utility, and non-obviousness. Based on the present law, we see no other reasonable conclusion.

The next case is that of Bernhart and Fetter, decided just five months ago. This invention relates to a computer coupled to a plotter. The court allowed three claims in apparatus format. The broadest claim cited: A system for providing a drawing of an object comprising an <u>electronic digital computer</u>; means programmed to respond to certain signals; and, a plotting means coupled to the computer and responsive to the signals.

The last case, namely In re Mahony, was decided in February 1970. Here, the invention related to a data communication system and methods for synchronizing the bits received by a digital computer. The court allowed the two method claims which recited the steps of: comparing; registering; and, counting. Strangely enough, there was no dispute regarding the statutory nature of the invention. In other words, the case fits into 35 U.S.C. 101 which states the classes of inventions that are patentable.

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions of this title.

The court stated in Mahony that they refrained from deciding whether claims drawn to both mental and nonmental implementation are patentable. I think that this case comes very close in its steps of comparing, registering, and counting, that we have shown in the flow chart of Figure 3.

5. By Contract

We have discussed the protection afforded to computer programs through trademarks, copyrights, trade secrets and patents. We now consider the last, and perhaps the most important, that of protection through contractual arrangements. The contract can be one of sale or can be a leasing arrangement, based upon a fixed price or a variable fee. The

contract route is perhaps the most popular and the most meaningful in government procurement of software since the exact terms of the contract can be spelled out.

We know that the protection afforded by a patent is doubtful and if a patent is secured, it may take three or more years to obtain it. The copyright of a program is easy to secure, but is of doubtful protection. Trademarks will protect the source or origin only of the goods, and, trade secrets are always a problem when dealing with the Government. In the contract, the supplier can spell out the price, restrictions as to where the program can be used, an agreement of confidentiality (not to disclose outside the Government), and the like. However, there are two weaknesses in the contract approach: Since computer object decks are easy to produce, it is difficult to police the contract; and, secondly, the contract cannot bind a third party who did not sign the agreement. Thus, the vendor of the program cannot enforce the secrecy requirements against a third party who obtained the program from the purchaser or lessee <u>even though</u> the third party obtained it in breach of the purchaser's contractual requirement.

Perhaps the supplier of a program to the Government can find some solace in 18 U.S.C. 1905 which is a prohibition by government employees from disclosing confidential information.

Some of the problems that you may directly encounter are shown in the Figure 14 and are as follows:

1. A government employee writes a program or modifies a program under which the Government has limited rights.

2. The Government purchases an off-the-shelf program.

3. The Government contracts for a modified off-the-shelf program.

4. The Government contracts for a new program either directly or indirectly.

First of all, a computer program should be more than a deck of cards or a reel of tape. We must also think about instruction manuals, the data base, a flow chart, and the like. Also, for example, a source program in COBOL or FORTRAN is of little value to us if we do not have available an appropriate compiler program to get the source program into some form the computer can understand (an object program).

Suppose a government employee, in the course of his official duties, writes a program and accompanying documentation which has a commercial market. What are the rights of the Government and the employee in this program? Can the Government freely distribute this program and thereby effectively destroy any market the employee may supply? I know of no government regulation, directive, order or the like specifying the rights of a government employee v. the Government in a computer program.

E. O. 10096, as implemented by 37 C.F.R. 300, relates to regulations concerning inventions made by government employees. The definition of what inventions fall into statutory classes according to 35 U.S.C. differs slightly from the definition in 37 C.F.R. relating to government employees. In 37 C.F.R., "art" has been substituted for "process" and, it is "process" under which proponents of the patentability of computer programs want to fit the program. However, since the patent statutes define "process" as "process, art or method," then clearly the program would be assignable to the Government if:

1. The program was written during working hours; or

2. With a contribution by the Government of facilities, equipment, materials, funds, or information, or if time or services of other government employees on official duty; or

3. Which bears a direct relation to or is made in consequence of the official duties of the inventor.

But we are not sure that computer programs are patentable. So where do we go from here? One may rely on the common law concept of "works made for hire." Under the works made for hire doctrine, the copyright statute defines an "author" as including "an employer in the case of works made for hire." Therefore, when a work can be shown to have been made for hire, the employer is given all literary property rights in

the first instance, whether or not the Government had anything to do with the creation of the program. However, "for hire" in this context has been held to mean something broader than "for salary" and narrower than "on commission."

In the recent case of Scherr et al. v. Universal Match, Scherr and Goodman were two G.I.s who constructed a statue of an infantryman at Fort Dix, New Jersey. Scherr and Goodman sued Universal Match Co. for copyright infringement after Universal Match distributed matchbook covers depicting the statue. The Government intervened and interposed an answer denying Scherr and Goodman's copyright. The copyright notice on the statue was defective and, even if it were not defective, the court stated that if any copyright interests exist, it belongs to the U.S. Contrasted to this case is the Rickover case wherein the Government's input to the Admiral's speeches was small. There the court held that the two speeches were not "publications of the U.S. Government. . . ."

Assume a government employee makes a novel modification of a program under which the Government has limited rights. Is the employee free to now sell this program to anyone? Of course, the answer is "no," even though the employee's contribution constitutes a major portion of the work. Can the employee sell it to the owner if the program is leased by the Government? Can he sell it to the former owner if the

Government has purchased the program? Can the Government sell it to the vendor? Can the vendor obtain the modified program under the Freedom of Information Act? It is clear that the employee can neither sell or give it away. I really don't know what the Government can do in these instances. The Government should not enrich one contractor with this software to the exclusion of others. The question is, "How is the public interest best served?" I recommend that the contract provide for this possibility of modification. If nothing else, the Government should be able to modify, by contract, the program.

Whenever a computer program is purchased by or developed for the Government, it is imperative that the Government obtain sufficient rights to permit its use in accordance with the intended purpose.

Rights to use a program may fall into three classes or groups:

1. Use by the Government itself in in-house efforts.
2. Use by government contractors for the Government.
3. Dissemination to the general public and use by anyone.

Whenever a computer program is <u>completely developed</u> by or for the Government, then the Government should negotiate the contract so that unlimited rights are obtained.

Whenever a proprietary program is purchased or modified,

usually something less than unlimited rights are obtained. Oftentimes it is impossible to foresee the use that the Government may make of the program. Many times, there is the financial trade off -- that is, government use only will cost X dollars. Unlimited use may cost X^2 dollars.

If the Government purchases an off-the-shelf program, it may be on the GSA federal supply schedule and then the terms are as described by GSA. If not on the schedule, then you will be required to spell out the terms of the contract to buy. In NASA, we are guided by NPR 9.205-3 as follows:

> 9.205-3 Purchases of Existing Computer Programs or Computer Program Data Bases. When purchasing an existing computer program or computer program data base directly, rather than from a Federal Supply Schedule contract, it is important that the contract adequately describe the computer program or the computer program data base, the form (tape, punch cards, disk packs) of the program to be delivered and all the necessary documentation pertaining thereto. The contract should also specify any limitations on the right of the Government to use or copy of the computer program, data base or documentation, such as the physical location, number of uses and other conditions under which the purchased material may be utilized. The contracting officer should consult with counsel in drafting such rights provisions for these contracts.

In addition, the contract should clearly set forth whether a lease or a sale; if restricted, how is the program marked; if a lease, what is done with the program when the lease is terminated; in what language is the program written; etc. Also, I would advise our people not to purchase a

program as a trade secret. The trade secret route always presents problems. If the program is taken as a trade secret, then the Government would be precluded from having a government contractor with a computer do the computing task. Purchase or lease the program, but let the supplier, if he wishes, copyright his manuals. Then the supplier's rights are determined by well established copyright law.

The Government, in its many roles in research and development, relies on the use of computers, and has been one of the principal stimulants in their development. In spending funds for research, the Government traditionally disseminates the results of this research to the benefit of all citizens. The greater the rights to the computer program, the more effective the Government can be in this area.

Many government agencies do not have regulations and clauses useful for the purchase of data. We in NASA have had considerable experience in this, and perhaps it would be helpful to discuss some of our clauses. First of all, we include computer programs as <u>data</u> by defining <u>data</u> as: "writings, recordings, pictorial representations and works of any similar nature." We include in most contracts a Data Requirements clause and a Rights in Data clause.

We will look at three of the Rights in Data clauses. Normally, we permit a contractor to copyright data first

produced under a contract. An exception to this policy is when the data is a computer program, a computer data base, or documentation thereof. NPR 9.202-3 relates to copyright policy and NPR 9.203-1 sets forth a Rights in Data clause. Your attention is invited to 9.203-1(c)(2) as follows:

> "(2) Subject Data First Produced Under This Contract. The Contractor may copyright subject data first produced under this contract subject to the reservation by the Government for itself and others acting on its behalf a royalty-free, nonexclusive, irrevocable, worldwide license for governmental purposes to publish, translate, copy and perform such copyrighted subject data; except the Contractor agrees not to assert any rights at common law or equity, or establish any claim to statutory copyright in any computer program, computer data base, or documentation thereof first produced in the performance of this contract."

Similarly, where it is the primary object of the contract to first produce a program, a data base, or documentation thereof, then we use NPR 9.204-1, Rights in Data--Special Situations. In clause (b)(2)(A) of the Rights in Data clause of NPR 9.204-1, the contractor is precluded from copyrighting the program.

So, we have covered three situations:

1. Purchase of off-the-shelf programs.

2. Contracts generating a program for the first time but not the primary purpose of the contract.

3. Contracts primarily for the generation of programs or program materials.

In a contract for the modification of an off-the-shelf program, one will try to obtain the best contract terms that one can. As a minimum, one must obtain a royalty-free, irrevocable, worldwide license for government purposes. If the contribution of the Government is greater than that of the contractor, then the Government should get unlimited rights.

In Comptroller General decision B-167020, August 26, 1969, relating to a contract between the Government and McDonnell for a LITE program, McDonnell had modified one of its own proprietary programs. The Government had contributed substantial funds. Here is what the Comptroller General said:

> In any event, it appears from the administrative report that the Government paid for a substantial part of the computer time used in developing the material. Where there is a mixture of private and Government funds, the developed data cannot be said to have been developed at private expense. The rights will not be allocated on an investment percentage basis and the Government will get unlimited rights to such data.

In a recent negotiation for a modified program, the contractor complained that due to our clauses, he would be precluded from using the modified program, the base of which had been developed under his IR&D. When we say that "the contractor agrees not to asset any rights at common law or equity," we do not intend to preclude the contractor from using the modified program. Therefore, he was given a clause as follows:

> It is the intention of the Government as expressed by the clause entitled "Rights in Data" not to preclude the contractor from using, duplicating, disclosing, in whole or in part, or authorizing others so to do, any computer program, computer data base, or documentation thereof delivered under this contract.

NASA subscribes to a program by Illinois Institute of Technology Research Institute called APT or Automatically Programmed Tools Long Range Program. Computer programs and modifications are supplied under this arrangement. The Rights in Data clause which one of our centers uses is as follows:

> Rights in Data - IITRI agrees that the furnished subscription data (set forth in Item 1) may be used at Ames Research Center by Ames employees and employees of contractors having support-service-type contracts with Ames.
>
> IITRI grants NASA/Ames Research Center the right to reproduce any of the furnished subscription data, whether copyrighted or not, for use at Ames Research Center by Ames employees and employees of contractors having support-service-type contracts with Ames.
>
> IITRI agrees that none of the furnished subscription data shall jointly bear a copyright notice and a restriction use legend. In the event that any data is furnished with a copyright notice and a restrictive use legend, Ames Research Center shall have the right to modify, remove, obliterate or ignore any marking not authorized by the terms of this contract on any piece of subscription data furnished under this contract.

This clause gives us the rights we require and still maintains IITRI in business.

You are all familiar with the Air Force Project LITE, Legal Information Through Electronics. This is a system for computerized storage and retrieval of legal information. The Air Force is to be commended for this outstanding effort. However, there are some lessons to be learned from this undertaking. The following is taken from the Hearings on Project LITE in 1967 and the House Committee on Government Operations Report 1133, February 29, 1968.

The first test contract between the Air Force and the University of Pittsburgh carried only boiler plate clauses for a cost-reimbursement type supply contract. It was not written as an R&D contract. This was one cause for confusion which later developed concerning ownership of the data base. The second contract was written as a nonpersonal service contract. The standard provisions carried no government property clause. However, it was made clear in the contract that the tape data base to be created was of primary object of the contract.

In the third contract, the parties came to grips with the property issue. A government furnished property clause, the existing LITE data bases, was included.

In the hearings, Mr. Herbert Roback, Staff Administrator of the Military Operations Subcommittee, asked:

> There are companies that are interested in selling search services. Will all those companies have <u>equal</u> and <u>free</u> access to government data bases?

Mr. Grant Reynolds, attorney of the Air Force, answered:

> They all have the same opportunity to lease the data base tapes.

The following appeared in the report:

> The question of the proper policy toward the LITE contractor was somewhat more complicated. The University of Pittsburgh already had made copies of data tapes for the Air Force, and had performed well in developing the system. As part of its own plan for developing commercial use of what it calls the University of Pittsburgh system, it had set up a profit-type corporation as a spinoff organization. In return for use of its facilities, including the university data base, the university secured the largest bloc of stock in the new company, called the Aspen Corp., in 1965. This corporation was already performing commercial type searches for law firms and other users at the University of Pittsburgh computer location using the same computer and computer operations. The data base tapes of the Air Force, Pittsburgh, and Aspen were separated only to the extent of being kept in different racks within the university facilities. There was already, then, this parallel operation, in addition to other types and specialty companies being formed in other cities.

In the first contract, the University of Pittsburgh was to update the United States Code tape data base owned by the University. The use of an "existing" United States Code tape data based turned out to be more of a problem than anticipated. What Pittsburgh actually had on tape was not the language of the United States Code as officially revised by Congress, but the Federal Code Annotated, a private publisher's version using the language of the statutes. With the requirement of total text retrieval and analysis, the

language differences were important.

The report on the LITE hearings sets forth the following in italics:

> The lesson is plain that all contracting officers concerned with development of ADP systems should be alerted to the need to provide clearly for the ownership and rights in system concepts, software, and data base, as well as such matters as patents and proprietary data pertaining to the equipment.

At this point, one might ask: "If the Government owns and is in possession of a valuable piece of property, such as programs, documentation, and a data base, why cannot 'any person' obtain a copy under the Freedom of Information Act?" The withholding of this data does not seem to fit under any of the nine exemptions. However, I think the Government owned data could be withheld on the basis of the Attorney General's Memorandum on the Public Information Act, which states:

> An important consideration should be noted as to formulae, designs, drawings, research, data, etc., which, although set forth on pieces of paper, are significant not as records but as items of valuable property. These may have been developed by or for the Government at great expense. There is no indication anywhere in the consideration of this legislation that the Congress intended, by subsection (c), to give away such property to every citizen or alien who is willing to pay the price of making a copy. Where similar property in private hands would be held in confidence, such property in the hands of the United States should be covered under exemption (e)(4).

Lastly, I would like to tell you about COSMIC. COSMIC stands for "Computer Software Management and Information Center." COSMIC is NASA supported and physically located at the University of Georgia. It was established to evaluate computer software developed by government agencies, and then disseminate the evaluated programs to other government agencies, as well as industrial, educational, and research institutions. This "sharing" of programs places additional responsibility on us when negotiating software contracts or contracts that may produce software. To forward software to COSMIC for dissemination, we need unlimited government rights. Also, to be meaningful to someone else, we require, that set forth in Figure 15.

> As a minimum, this documentation, to permit sharing, should include: program identifiers, an abstract, and introduction including intended usage, technical description, program run instructions, special machine requirements, application limitations, diagnostic messages, data formats, running time, accuracy characteristics, flow charts, subroutine documentation, listings, and the magnetic tape, disc, or card deck. Quite a long list.

Lastly, here is an attorney in the Figure 16 that really got caught up in his work.

CITATIONS

John R. Manning

"Legal Protection of Computer Programs"
May 6, 1970

Suggestions for uses of computers, "New Scientist," February 17, 1970 (a British magazine).

Proposed use of San Francisco computers, "Government Executive," April 1970, p. 66.

"Computer Programs in Government Procurement" by Earl Levy, William and Mary Law Review, Volume 10, No. 3, Spring 1969.

Registration of Trademarks, Lanham Act of 1946, Title 15, U.S.C. 1051 et seq.

Registration of Copyright, Title 17 U.S.C.

Registration of computer programs as copyrights, Circular 31D, January 1965 (Copyright Office Announcement SML-47, June 1964).

Constitutional basis for patents and copyrights, Article 1, Section 8, Clause 8.

Patents, 35 U.S.C. See §101, 102 and 103 on class of patentable subject matter, novelty, and unobvious subject matter, respectively

Definition of writing -- Burrow-Giles Lithographic Co. and Saxony -- Supreme Court, 1884, cite unknown.

Punched paper piano roll not a copy of printed musical composition, White Smith Music v. Apollo, 209 U.S. 1 (1908). See also Fortnightly v. United States, 88 S. Ct. 2084 (1968).

Pending Bill, a general revision of the Copyright Law, McClellan S. 543, 91st Cong., 1st Sess.

Pending Bill, a general revision of the Patent Law, McClellan S. 2756, 91st Cong., 1st Sess. Others are McClellans's earlier bill, S. 1246; Dirksen, S. 1569; Wilson, H.R. 12280; and, Halpern, H.R. 7984.

Right to sue the Government in contract action in Court of Claims, The Tucker Act, 28 U.S.C. 1491.

Right to sue the Government for patent or copyright infringement in Court of Claims, 28 U.S.C. 1498.

Right to sue the Government in Tort, District Court and Court of Claims, 28 U.S.C. 1346.

Duty of government employee not to disclose confidential information, 18 U.S.C. 1905.

Violation of trade secrets by the Government, see "Patents and Technical Data," Government Contracts Monograph No. 10, G.W.U., p. 156, et seq.

Suit for violation of a trade secret, Akliebolaget Bofors v. U.S., 194 F.2d 145, 91 U.S.P.Q. 285 (1951).

Suit under implied-in-fact contract, Padbloc Co. v. U.S., 137 U.S.P.Q. 224 (1963).

To receive compensation, patent application must be filed as trade secret, Painton v. Bourns, 164 U.S.P.Q. 595 (1970).

Guidelines to examination of applications for patents on computer programs, Official Gazette of U.S. Patent Office, October 22, 1968 and November 11, 1969.

Mental process not patentable, In re Abrams, 89 U.S.P.Q. 266.

Process or method must be performed on physical materials and produce some change, In re Shao Wen Yuan, 89 U.S.P.Q. 324, Cochrane v. Deener, 94 U.S. 780.

Goetz patent to sorting system, 3,380,029, April 23, 1968.

Latest decisions from CCPA on computer programs: In re Prater and Wei, 162 U.S.P.Q. 541 (1969); In re Bernhart and Fetter, 163 U.S.P.Q. 611 (1969); and, In re Mahony, 164 U.S.P.Q. 572 (1970).

Inventions patentable, 35 U.S.C. 101.

Regulations concerning inventions made by government employees, Executive Order 10096, January 23, 1950; Executive Order 10903, March 24, 1961; 37 C.F.R. 300.

Copyright on "The Ultimate Weapon," Scherr et al. v. Universal Match, 164 U.S.P.Q. 225 (1970).

Rickover case, Public Affairs Associates v. Rickover, 153 U.S.P.Q. 598 (1967).

Mixing contractor programs and government funds for modification, Comptroller General decision B-167020.

Legal Information Through Electronics, Hearing Before a Subcommittee of the Committee on Government Operations, August 1, 1967.

Air Force Project LITE, Seventeenth Report by the Committee on Government Operations, February 29, 1968.

DEFINITIONS

Computer Program: List of commands, orders, or instructions specifying the sequence of operations which the computer is to execute.

Machine Language: Is that language under which the computer operates and which can be read by the computer.

Source Program: Is that program expressed in one of the programming languages, such as FORTRAN, ALGOL or COBOL.

Object Program: Is that program that can be used directly by a computer inasmuch as it is in the machine language comprehensive to the particular computer for which it will be used.

Compiler or Assembler: Is that which converts a source program to an object program or converts the programming language to the machine language

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FIGURE 1

PROBLEM:

FIND EMPLOYEE'S NET PAY AND WRITE HIS CHECK.

HOURS X RATE - DEDUCTION = NET PAY

OR

GROSS PAY - DEDUCTIONS = NET PAY

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FIGURE 2

FLOW CHART OF PROBLEM PROGRAM

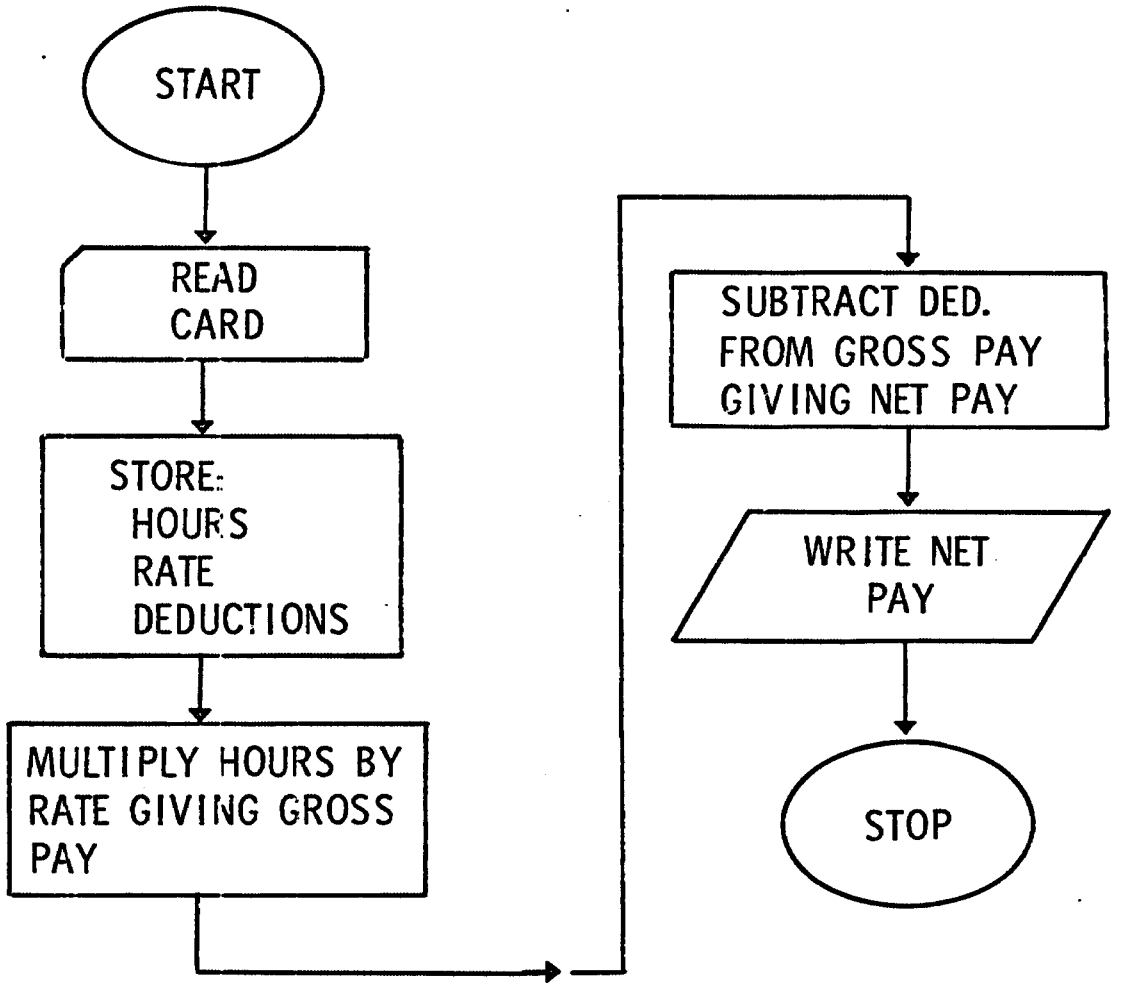

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FIGURE 3

INSTRUCTION

OPERATION OR OP CODE - Specifies the Operation to be Performed Such as Add, Subtract, Multiply, etc.

ADDRESS - Represents the Address or Location of the Data (OPERAND) to be Operated on.

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FIGURE 4

CODE LIST

OPERATION	DECIMAL CODE	BINARY CODE
ADD	01	0001
CLEAR	07	0111
MULTIPLY	03	0011
READ CARD	08	1000
STOP	04	0100
STORE	05	0101
SUBTRACT	02	0010
WRITE	06	0110

ADDRESSES AVAILABLE – 00 THRU 15

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FIGURE 5

SEQUENTIAL ADDRESSES	OPERATION	ADDRESS OF OPERAND	REMARKS
00	CLEAR	-	RESETS ACCUMULATOR TO 0.
01	READ CARD	-	READS HRS., RATE, DED., INTO MACHINE.
02	STORE - F1	12	STORES HRS. AT ADDRESS 12.
03	STORE - F2	13	STORES RATE AT ADDRESS 13.
04	STORE - F3	14	STORES DEDUCTIONS AT ADDRESS 14.
05	ADD	12	TRANSFERS HRS. IN ADDRESS 12 TO ACCUMULATOR.
06	MULTIPLY	13	TRANSFERS RATE AT ADDRESS 13 TO ACC. AND MULTIPLIES HOURS BY RATE GIVING GROSS PAY.
07	SUBTRACT	14	SUBTRACTS DEDUCTIONS AT ADDRESS 14 FROM NET PAY GIVING GROSS PAY.
08	STORE	15	STORES NET PAY AT ADDRESS 15.
09	WRITE	15	PRINTS CHECK FROM AMOUNT (NET PAY) AT ADDRESS 15.
10	STOP	-	COMPUTER STOPS.
11	SPARE		
12	(HOURS STORED HERE EARLIER)		
13	(RATE STORED HERE EARLIER)		
14	(DEDUCTIONS STORED HERE EARLIER)		
15	NET PAY STORED HERE		

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FIGURE 6

NOW WE CODE THE PROGRAM

SEQUENTIAL ADDRESS	OP CODE	OPERAND ADDRESS
0000	0111	
0001	1000	
0010	0101-01	1100
0011	0101-10	1101
0100	0101-11	1110
0101	0001	1100
0110	0011	1101
0111	0010	1110
1000	0101	1111
1001	0110	1111
1010		
1011		
1100		
1101		
1110		
1110		

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FIGURE 7

AN EASIER SOLUTION

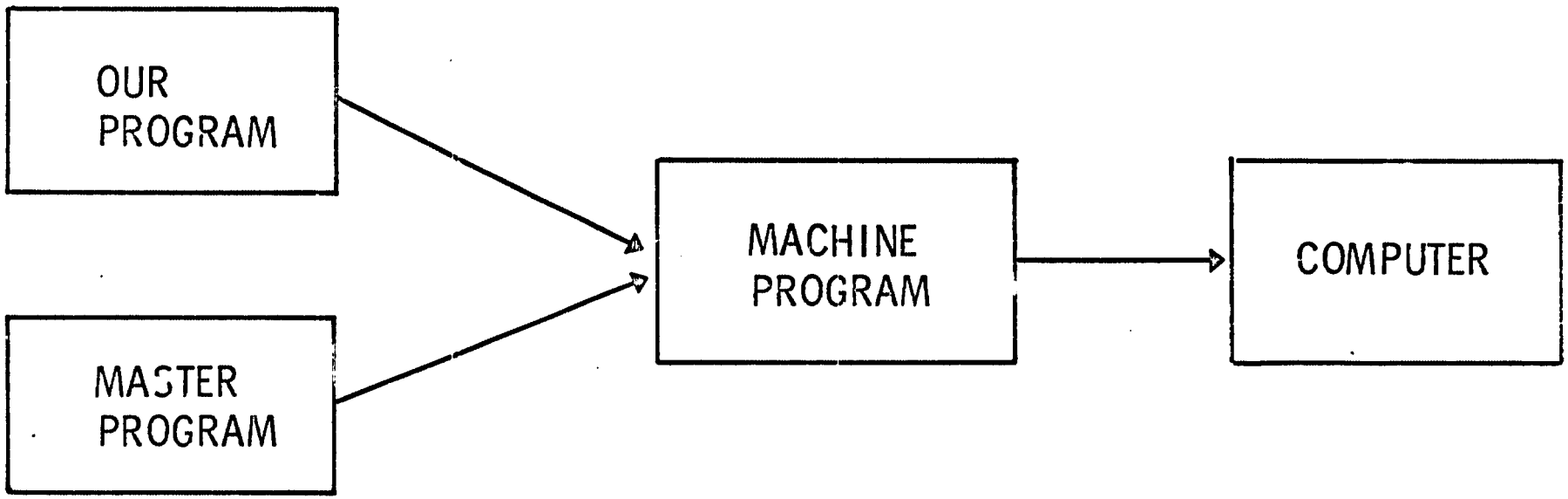

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FIGURE 8

SEQUENTIAL ADDRESSES	OPERATION	ADDRESS OF OPERAND	REMARKS
00	~~CLEAR~~ CL	-	RESETS ACCUMULATOR TO 0.
01	~~READ CARD~~ RCD	-	READS HRS., RATE, DED., INTO MACHINE.
02	~~STORE F1~~ STR	~~12~~ HOURS	STORES HRS. AT ADDRESS 12.
03	~~STORE F2~~ STR	~~13~~ RATE	STORES RATE AT ADDRESS 13.
04	~~STORE F3~~ STR	~~14~~ DED.	STORES DEDUCTIONS AT ADDRESS 14.
05	~~ADD~~ A	~~12~~ HOURS	TRANSFERS HRS. IN ADDRESS 12 TO ACCUMULATOR.
06	~~MULTIPLY~~ M	~~13~~ RATE	TRANSFERS RATE AT ADDRESS 13 TO ACC. AND MULTIPLIES HOURS BY RATE GIVING GROSS PAY.
07	~~SUBTRACT~~ S	~~14~~ DED.	SUBTRACTS DEDUCTIONS AT ADDRESS 14 FROM NET PAY GIVING GROSS PAY.
08	~~STORE~~ STR	~~15~~ NET	STCRES NET PAY AT ADDRESS 15.
09	~~WRITE~~ W	~~15~~ NET	PRINTS CHECK FROM AMOUNT (NET PAY) AT ADDRESS 15.
10	~~STOP~~ STP	-	COMPUTER STOPS.
11	SPARE		
12	(HOURS STORED HERE EARLIER)		
13	(RATE STORED HERE EARLIER)		
14	(DEDUCTIONS STORED HERE EARLIER)		
15	NET PAY STORED HERE		

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FIGURE 9

NOW OUR PROGRAM LOOKS LIKE THIS

00	CL	
01	RCD	
02	STR	HOURS
03	STR	RATE
04	STR	DED.
05	A	HOURS
06	M	RATE
07	S	DED.
08	STR	NET
09	W	NET
10	STP	
11		
12		
13		
14		
15		

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FIGURE 10

NOW A HIGHER LEVEL PROGRAMMING LANGUAGE

- (DESCRIBE EQUIPMENT).

- (DESCRIBE FILES).

- READ CARD. STORE HOURS, RATE, DEDUCTIONS.
  MULTIPLY HOURS BY RATE GIVING GROSS PAY.
  SUBTRACT DEDUCTIONS FROM GROSS PAY GIVING
  NET PAY. WRITE NET PAY.

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FIGURE 11

POSSIBLE PROTECTION OF SOFTWARE TO BE CONSIDERED

1. BY TRADEMARK REGISTRATION.
2. BY COPYRIGHT REGISTRATION.
3. AS A TRADE SECRET.
4. BY PATENT.
5. BY CONTRACT.

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FIGURE 12

TRADE SECRET

A trade secret has been defined as follows:
A trade secret may consist of any formula, pattern, device, or compilation of information which is used in one's business and which gives him an opportunity to obtain an advantage over competitors who do not know or use it. It may be a formula for a chemical compound, a process of manufacture, treating, or preserving materials, a pattern for a machine or other device, or a list of customers. RESTATEMENT OF TORTS § 757 (b) (1939).

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FIGURE 13

PROBLEMS ENCOUNTERED BY GOVERNMENT ATTORNEY RELATING TO SOFTWARE

1. GOV'T. EMPLOYEE
    a. Writes a Program.
    b. Modifies a Program Under Which Gov't Has Limited Rights.
2. BUYING AN OFF-THE-SHELF PROGRAM.
3. CONTRACTING FOR A MODIFIED OFF-THE-SHELF PROGRAM.
4. CONTRACTING FOR A NEW PROGRAM.

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FIGURE 14

MINIMUM DOCUMENTATION REQUIRED TO ENABLE USE OF PROGRAM BY OTHERS

As a minimum, this documentation, to permit sharing, should include: program identifiers, an abstract, an introduction including intended usage, technical description, program run instructions, special machine requirements, application limitations, diagnostic messages, data formats, running time, accuracy characteristics, flow charts, subroutine documentation, listings, and the magnetic tape, disc, or card deck.

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FIGURE 15

MINIMUM DOCUMENTATION REQUIRED TO ENABLE USE OF PROGRAM BY OTHERS

As a minimum, this documentation, to permit sharing, should include: program identifiers, an abstract, an introduction including intended usage, technical description, program run instructions, special machine requirements, application limitations, diagnostic messages, data formats, running time, accuracy characteristics, flow charts, subroutine documentation, listings, and the magnetic tape, disc, or card deck.

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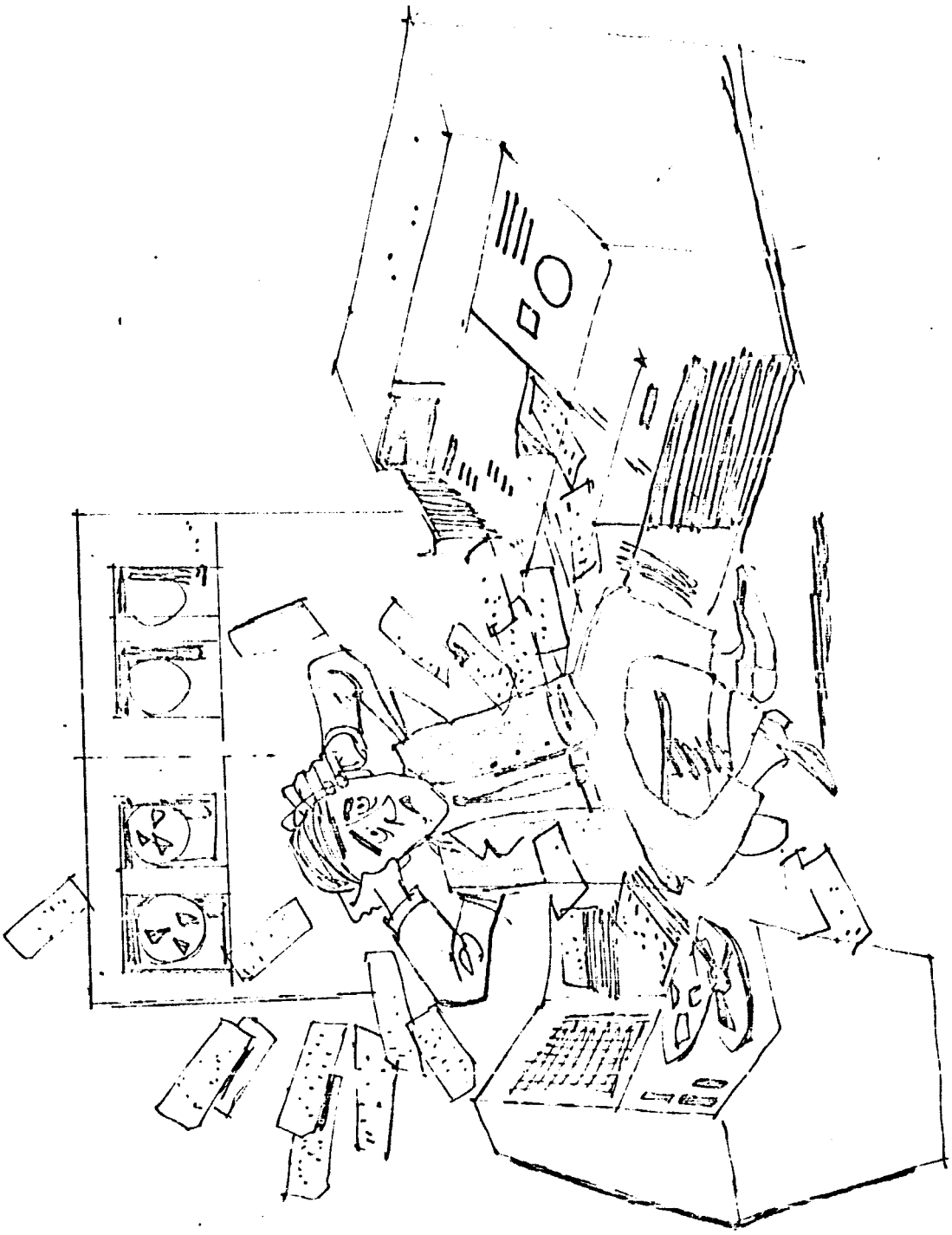
FIGURE 15

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.



END

FIGURE 15

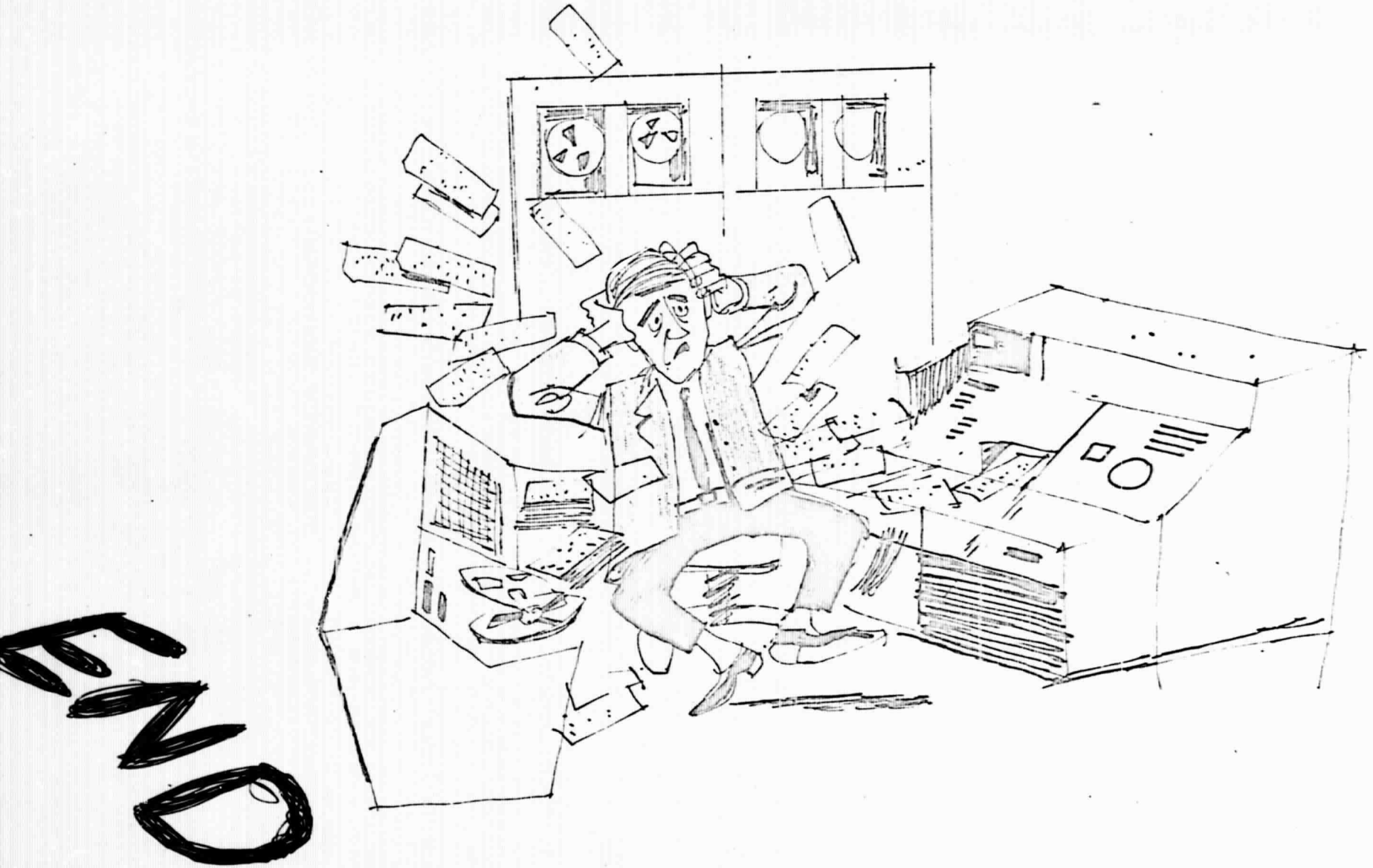


FIGURE 16

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.