A SYSTEMS ANALYSIS
OF COMPUTER ASSISTED INSTRUCTION
FOR THE SYSTEMS TEST EQUIPMENT PROGRAM

A report submitted in partial satisfaction of the requirements for the degree of Master of Science in Engineering

by

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ABSTRACT

A Systems Analysis of Computer Assisted Instruction for the Systems Test Equipment Program

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This paper is a systems analysis employed in the development of a new training program reflective of the state of the art and structured to be compatible with the Systems Test Equipment Program (STEP).

The analysis begins with a "Conceptual Phase", in which the objectives of the program were clarified, issues of concern defined, problems limited, and good criteria for choice sought.

In the "Research Phase" various instruments and programs of instruction were analyzed for their approach, relationships, and effectiveness.
Within the "Analytic Phase", are various Computer Assisted Instruction (CAI) programs which were developed or acquired and compared.

In the "Judgement Phase" the relative effectiveness of the various CAI techniques were evaluated.

Effective CAI programs were then designed within the given limits, to incorporate techniques which previous evaluations have shown to be the most successful. Their relative effectiveness was then validated in the "Testing Phase".
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1.0 Introduction

It is the function of the Systems Test Equipment Program (STEP) to provide Computer-Assisted Instruction (CAI) programs which utilize system equipment to develop related operator and technician skills. Existing CAI programs make poor use of the STEP environment and pedagogical theory. Because of this, the decision was made to produce a totally new training program more reflective of the state of the art and structured to be compatible with the STEP environment.

1.1 Objective

Evaluate various techniques for teaching computer programming language, test equipment operation, and maintenance information to operating and maintenance personnel. More specifically

a. Evaluate existing CAI packages and video tape packages for teaching a computer programming language and use this data to establish a base line for evaluating the effectiveness of various CAI and other training techniques.

b. Redesign CAI programs to include more sophisticated techniques as suggested by training experts. Prepare versions of these programs, each illustrating use of techniques which require evaluation.
c. Evaluate relative effectiveness/ineffectiveness of different CAI techniques.

d. Design a program to incorporate techniques which previous evaluation has shown to be most effective.
2.0 **Instruments of Instruction**

2.1 **Machine Versus Tutor**

The advantage of a machine over a private tutor is:

a. There is a constant interchange between program and student. Unlike lectures, textbooks, and the usual audio-visual aids, the machine induces sustained activity. The student is always alert and busy.\(^1\)

b. Like a good tutor, the machine insists that a given point be thoroughly understood, either frame by frame or set by set, before the student moves on. Lecturers, textbooks, and their mechanized equivalents, on the other hand, proceed without making sure that the student understands, and thus easily leave him behind.\(^2\)

c. Like a good tutor, the machine presents just that material for which the student is ready. It asks him to take only that step which he is at the moment best equipped and most likely to take.\(^3\)

d. Like a skillful tutor, the machine helps to come up with the right answer. It does this in part through the orderly construction of the program and, in part, with techniques of
hinting, prompting, suggesting, etc. derived from an analysis of verbal behavior.\textsuperscript{4}

e. Lastly, of course, the machine, like the private tutor, reinforces the student for every correct response, using this immediate feedback not only to shape his behavior most efficiently but to maintain it in strength in a manner which the layman would describe as "holding the student's interest".\textsuperscript{5}

2.2 \textbf{Machine Versus Texts}

One of the principle advantages of machines is greater control of the student's behavior. Because the program can be locked inside, some machines are relatively "cheat proof". Mechanical controls assure that only one frame is presented at a time. The student must respond before he is shown the answer or allowed to proceed to the next frame.

In addition to controlling the student's behavior, the machine maintains an accurate record of his responses on the tape, which is locked inside. This record is important for two reasons: (1) it can be used later for individual student guidance, and (2) it can also be of great value to the program writer in making revisions in the program. Thus the machine is ideally suited for collecting the objective data needed for research on the learning process.
Neither of these advantages is possessed by textbooks. They make it possible for a student to skip ahead without answering a frame by merely turning a page. He can fail to respond at all or merely copy the correct answer. He can also change his response. For these reasons a reliable record of his responses cannot always be obtained. 6

Another advantage of the machine is the pinball effect. An increase in student interest and motivation, particularly in younger children, is said to result from working with hardware. It is also thought that the pinball effect is important in maintaining the motivation of older students working on long programs. More experimentation comparing student reactions to longer programs written for both machines and texts is needed before these hypotheses can be accepted. 7

A further argument for the superiority of machines over texts is a logistical one. The costs and quantity of paper required for texts are said to be quite high, whereas teaching machines can employ reusable microfilm and store long programs in a small space.

On the other hand, certain disadvantages in using machines should also be considered. The first is the relatively high cost of most teaching machines. These range in price from about twenty dollars to several thousand dollars. 8 However, because the Systems Test Equip-
Program already has machines at its disposal, namely the Hewlett-Packard model 9830A calculator and model 9866A printer, there seems to be no problem in this area.

A more important issue is whether machines, with their greater control of student behavior and their pinball effect, can teach more effectively than textbooks. Fortunately, experiments have been completed that can provide one with some answers. In four studies, involving high school students, college students, and adult electronic technicians, no differences in learning achievement as measured by test scores were found between groups using Skinner-type machines and those using programmed textbooks. These four were conducted at the Collegiate School in New York City, New York University, University of California at Los Angeles, and Bell Laboratories. The greater control of student behavior and the pinball effect provided by machines did not result in greater learning achievement in these situations. It thus appears that programmed instruction can be effectively presented by both textbooks and machines.

In none of these four studies was there any consistent difference in the time it took to present the subject matter by texts and machines. In one instance, however, machine breakdowns in one of the classes actually caused the machine-taught class to take more time on the
material than the programmed-text group. This finding points out one of the hazards of using present-day machines, although future improvements in machine functioning can be anticipated. However, the results of a study at the General Telephone Company of California revealed that an Auto Tutor effected a reduction in learning time of 55 per cent, as compared with a reduction of 40 per cent by means of a text. These reductions took place in a basic electronics course for installer-repairmen. The preponderance of evidence at this time indicates that machines have no advantage in this respect, even when they function satisfactorily.

As a result of these studies, it now seems that the quality of the programmed instruction material is more important, as a variable affecting learning achievement, than the means of presentation. It is therefore more important, initially, to learn to recognize or prepare good programs than to become a connoisseur of teaching-machine hardware.

2.3 Types of Teaching Devices

The term "teaching device" should be reserved more correctly for the stimulus-response type of device which is capable of teaching without the mediation of a human teacher.

Stimulus-response devices are designed to present a sequence of stimuli (content) and provide the setting in
which appropriate responses may be made and rehearsed (process). Thus, stimulus-response devices more nearly reproduce the characteristics of teaching which are required for efficient learning than do other devices.

Stimulus-response devices may be categorized into three major areas: (1) simulators consisting of Add-a-part films and tapes, Dearborn reading films, and Electric flight simulators, (2) immediate reinforcers consisting of Pressey multiple choice, chemical paper, Electric answer board, Punch board, Skinner device, and Trigger squeeze indicator, and (3) pacers consisting of memory drum, Metronome, Metronoscope, Reading accelerators, Reading films, and Tachistoscope.

Student responses to teaching sequences can be analyzed and the materials modified and tried out again as many times as necessary to perfect the lessons. This research function, made possible by teaching devices, provides one of the greatest long-term advantages of such teaching techniques, the possibility of gradual cumulative revision and perfection of lessons based upon factual findings rather than educated guesses.11

If it is anticipated that such research-editing activities will be undertaken, then it is mandatory that the devices used, or at least some of them, be equipped to facilitate the research. Such facilities require the following features:
1. Teaching devices which will accept easily prepared and modified sequences of visual and auditory material. Magnetic recordings are very well suited for the auditory presentations, and the Hewlett-Packard model 9830 would provide the most practical visual materials because of its duplication process.

2. Techniques for the easy analysis of students' spoken and written responses. The analysis of spoken responses in the form of recordings is an arduous and time-consuming task. One feasible way of speeding up such work is to provide some sort of recorded signal on the tape at the point where error responses lie (such signals could be automatically placed on the record every time a student indicates that he has made an incorrect response).

3. Teaching devices that are flexible enough to allow investigation of all possible combinations of visual and auditory presentation, response, and confirmation within the limits of tape recordings and still pictures. To provide insufficient research flexibility would be to invite perpetuation of time-honored techniques of teaching in which there lie some hope of improvement.
3.0 Constructing the Program

Certain general principles have evolved relating to the construction of programs.

3.1 Physical Properties

Length of Program. The length of a program is determined in the first place by the material covered and by the number of hours the student has available. In adapting a program to the user requirements, the programmer will presumably have to accept available time limits. This will not specify number of sets or frames because materials differ enormously in the speed with which students go through them. The following considerations about length of sets therefore bear on the length of programs.

Length of Set. Possibly the most important consideration in the normal length of session is the student's schedule. Presumably more than one set will be covered by a student in one session. The time the student can ordinarily work without fatigue is important and may have no close relationship to normal length of classroom session. A set of approximately thirty frames may nearly constitute the right length. Anything below this means that the student returns to an item very quickly after making an incorrect response and may be getting it right for unimportant reasons. Much longer sets call for more time than the slow student has available in a single
session. Moreover, a greater reinforcement from a-
chievement may follow, even for the good student, from
completing several sets per session. However, all
statements of this type depend upon the kind of material
in a quick vocabulary review of the basic computer lan-
guage required in the STEP program. For example, where
reading and writing time will be short, a set containing
one hundred items might require only a few minutes of
time. "Lead-in" sets can often be done quickly. In the
long run, only an experimental analysis of material in a
natural situation will determine suitable length for a
given kind of material. For the material presented in
the STEP program, a maximum time of forty-five minutes
was determined.

Length of Frame. It is sometimes desirable to
present a considerable amount of text before asking the
student to respond, particularly where every frame must
reinstate a given situation to make it independent of
earlier frames. There is a danger in lengthy material -
the student will skip to the blank and attempt to find
the answer from adjacent material. If material is long,
care must be taken to make sure that terms and material
throughout the program are relevant to the right answers.

Number of Blanks. Sometimes in economizing on
space, two or more items can be printed in a given frame
and separate answers required. When two blanks are asked
for in the same item, however, it must be remembered that this may weaken or conceal the syntactical structure. The same behavior can usually be evoked by two frames with one blank in/each while the student is puzzling out the syntax of an item with more than one blank. Syntax is not involved, however, when a student is asked, for example, to give both of two synonymous forms, one of which is to be technical and the other popular. Summarizing material in a set of multiple-blank items may also permit the student to organize it more coherently. Indeed, when the subject has been well-prepared, it is often desirable to eliminate some of the syntax by use of multiple blanks to further refine the stimuli controlling the response. 

3.2 Composing the Program

Specifications of the Course. The programmer must know what verbal behavior the student is to have in his repertoire after completing the course and how precisely and extensively he is to talk about the field.

Knowledge previously acquired. The student is assumed to possess some verbal behavior in the area before he starts the course. This must be stated, and the programmer must not at any time appeal to material not included in the statement or provided by earlier parts of the program (e.g., a program of a STEP course assumes only the vocabulary and language ability of the operator or technician).
Ordering the Knowledge to Be Acquired. At each step the programmer must ask, "What behavior must the student have before he can take this step?" A sequence of steps forms a progression from the initially assumed knowledge up to the specified final repertoire. No step should be encountered before the student has mastered everything needed to take it.

Listing Terms, Etc. Before writing frames for each set, the programmer should make lists of: (a) the terms to be covered, (b) the processes or principles, and (c) a wide range of illustrative examples. Ideally, examples should differ from each other in all respects with the exception of those which illustrate a term or principle. The programmer should also note various syntactical possibilities including inflected forms and items "saying the same thing" but with different terms asked for. After these lists are made, a fairly mechanical procedure can be followed in writing frames so that each concept and process will be used with each example in as wide a range or syntactical arrangements as possible. 17

At this stage, the programmer should also consider what concepts can be appropriated and reviewed from earlier materials. This can be done by "leading in" with relevant concepts or by contrasting concepts. 18

Writing Frames. With rare exceptions, frames are statements with words missing, the missing word supplied
by the student. Multiple-choice is not used, in order to avoid strengthening alternative wrong answers. (Exceptions are cases where the student has been prepared for a fine distinction which is then required in a multiple-choice item). It is important that each frame be intelligible by itself because it will often be presented without the preceding frames in later cycles. However, a given set may assume a universe of discourse within which frames can be, to some extent, elliptical.

3.3 Getting Out New Responses Without Errors

Panels. An effective way of evoking new terms is to use printed material which remains before the student while he works through the tape. Early frames guide him through careful textual behavior. The distinction between this program and reading a text for memorization is that comprehensive reading is not assumed but rather forced by the frames which carry him through all points on the panel. The panel should include nothing which is not treated by the frames, because it should be as short as possible. The labor of searching the panel should be kept at a minimum. Reference letters or numbers are useful for this purpose in referring the student to particular parts of the panel. Subsequent tapes or disks should cover the same concepts and principles without the panel. These should contain new frames rather than repetitions of previous frames.
Use of New Words in a Series of Frames. Correct responses in a short series can be made to depend on careful observation of a new word. In the last frame in the series the student must write the word.  

Definitions and Examples. These should generate sentences easily completed.

Explicit Formal Prompts. A response of low strength can be made more probable by giving its beginning or ending or selected letters. Indicating the number of letters is not very effective as a prompt, but permits the student to discard wrong responses. Rhyming is sometimes used effectively as a formal prompt. In the STEP training program parentheses were used to highlight an important word or phrase.
4.0 Applications of Principles in the Design of the Instructional Material

Psychological principles appear in the design of the sentences in the instructional material.

4.1 The Amount of Work Per Reinforcement Is Kept Low

The occurrence of reinforcements during the course of the instructional material depends on the amount of work the student does. Reinforcements programmed on the basis of amount of work done have special effects which have been studied extensively in lower organisms. It has been found there that the organism shows a lesserened disposition to return to work as the amount of behavior (work) required to obtain reinforcement is increased. This lessening of motivation continues until at extreme values the behavior will no longer be emitted. The decreased motivation is not caused by physical exhaustion, because under similar circumstances equivalent amounts of work will be done without signs of fatigue. Every time a student translates a line of the instructional material incorrectly, the amount of work he does per reinforcement is increased and his motivation is correspondingly decreased. Any factors which will reduce the number of errors, therefore, will keep the ratio of reinforcement to work high and avoid the lessening of motivation that occurs as a result of too much work per reinforcement.
4.2 Vocabulary

New vocabulary is introduced in a controlled manner. After each new word is introduced, it is included in the subsequent few units in order to provide practice. No attempt is made to match the natural frequency of occurrence of the various words. Words which occur very infrequently in the natural language are used as frequently as those words which occur much more frequently. This prevents overlearning of high-frequency words and underlearning of low-frequency words and minimizes the amount of work required for a given amount of progress in the language. In the construction of the material, a tally was kept of the use of each word so that all of the vocabulary was used as equally often as possible.

4.3 Control of Overlearning

The student continues to work only on those items which he does not yet know. Items which are mastered to the required criterion are omitted.

4.4 Conceptual Terms

All of the conceptual and more complicated parts of the language are taught without any explicit mention of the grammatical principle. This is accomplished by making the student translate sentences which require the application of the principle.
4.5 Graded Level of Difficulty

A graded level of difficulty was attempted so that the progression from item to item is so slight that the student seldom fails. In this way, the student makes constant progress in the mastery of the language. Experiments show that the motivation of the learner is largely determined by the overall frequency and the pattern of success and failure. Ideally, as noted above, a set of materials could be constructed in which the progression from item to item is so gradual that few failures will occur.22

Whenever a new principle, vocabulary item, or usage is being learned, it is the only thing being learned at the time. All the other parts of the material have been mastered previously. The second stage in learning these new materials is to have the student use them in varied contexts. This practice conforms to the basic process of concept formation, in which a crucial element is an opportunity for the organism to behave inappropriately in respect to the concept. For example, if a hungry pigeon pecks at a green disk because the response is reinforced with food, we cannot be sure that he is attending to the green light until other colors are presented and the bird's pecks go unreinforced.

Sufficient practice and training are given so that older material is thoroughly mastered before new material
is introduced. The principle of continuous mastery is particularly important in learning cumulative skills such as the basic computer language. A temporary lapse of effort or attendance in an early stage of a course frequently makes it difficult, if not impossible, for a student to resume his studies with the class as a whole at a later point. This common source of difficulty is less likely to occur with the method discussed here because the rate at which the student is exposed to new material depends on his mastery of the prior material.
5.0 Kinds of Programs

The kind of program where the student composes the entire response by writing the correct responses in the blanks provided in the frames is known as a write-in or constructed-response program. In another kind of program, the student is presented with a number of alternative responses to the question asked in the frame and is required to choose the correct one. This program is known as a multiple-choice response program.

A program where the student works through the same fixed sequence of frames determined by the program writer is called a straight-line, or linear, program. Programs in which each student follows a sequence of frames determined by his own responses are called branching programs.

Generally, programs differ in two respects: the mode of response (constructed-response or multiple-choice) and the sequence of frames (linear or branching). All existing programs can be classified according to these two characteristics. Most of the programs written at present are of the multiple-choice response variety.

5.1 Pressey Program

In 1926 S. L. Pressey, a psychologist at Ohio State University, described his development of a mechanical apparatus for presenting a fixed sequence of multiple-choice questions on a revolving drum similar to
a typewriter platen. This device thus employed a multiple-choice response, linear program. By depressing one of four keys corresponding to the multiple-choice answers, a student could choose an answer and find out immediately whether he was correct. This has been called the first teaching machine, although it was not intended primarily as a testing device. Later, Pressey used a punchboard for the same purpose. 28

5.2 Crowder Programs

N. A. Crowder developed multiple-choice response, branching programs based on what he calls intrinsic programming principles. By intrinsic programming he means that each student determines the sequence of frames by his responses to the multiple-choice questions contained in the frames. In this kind of program, a paragraph or more of information is presented to the student in a frame. At the bottom of the page, the student is tested by a multiple-choice question to see whether the information has been successfully communicated to him. If the student chooses the correct response, he is directed to another page containing new informational material. If he chooses an incorrect response, he is shown why this response is incorrect and referred back to the original material for another try at answering it correctly. When he finally chooses the correct response, he goes on to the next unit of information.
All students do not proceed through the program in the same sequence of frames, because each frame they are given is determined by the accuracy of the response they have made to the preceding frame. A branching program is thus quite different from a linear program, in which all students follow the same sequence of frames. 29

5.3 **Skinner Programs**

The constructed-response, linear program was originally developed by B. F. Skinner and his associates at Harvard University during the 1950's in order to apply to human learning the principles of reinforcement learning theory found successful in animal learning experiments. Student response to this kind of instruction, as measured by questionnaires, was very favorable.

According to Skinnerian reinforcement learning theory, learning is most effective when the student writes in the correct response and is immediately reinforced by a statement of the correct response. 30 An important objective of programs of the Skinner type is therefore to present material in a sequence that makes it possible for most students to respond correctly to each small unit of information presented. This permits the responses to be reinforced so that learning can take place effectively. It is thought undesirable for the student to make many errors in completing a program. (An error eliminates the opportunity for a correct response to be reinforced; in
addition, there is the danger that the wrong response may be learned and repeated in the future.) If students make too many wrong responses — such as more than 5 to 10 percent of the total — the program is considered a poor one and in need of revision. Through repeated tryouts on students and constant revision of frames, the error can be reduced to meet these standards. 31

The material to be programmed is broken down so that one small unit of information is presented in each frame. The frames develop the material step by step in a fixed logical sequence determined by the program writer from his analysis of the information or behavior to be taught and from repeated tryouts on students. By completing a soundly constructed program, the student learns to make the numerous responses which result in his mastery of the material. 32

5.4 **Skinner Versus Crowder**

There are a number of differences between the Skinner approach and the Crowder approach. In addition to the matter of constructed versus multiple-choice responses and linear versus branching sequences, there are also differences in the length of the frames and the frequency of responding. In Crowder programs, the frames generally consist of several paragraphs of information which the student must read before choosing a response. In Skinner programs, the student typically reads only a
few sentences before constructing his responses and therefore spends a greater proportion of his time in active responding. A Crowder program requires relatively more reading and less responding.

At the heart of the differences between the two methods is the fundamental theoretical controversy between Skinner and Crowder. Basically, Skinner maintains that learning takes place most effectively when a correct response is made and immediately reinforced. Crowder, on the other hand, asserts that learning can effectively take place while the student is reading the information presented, and that the multiple-choice testing at the bottom of the page is primarily a confirmation of the learning that has already taken place. If no learning has occurred, that is, if the communication process has failed and the student has chosen the wrong answer, Crowder attempts to improve communications with the student by presenting additional information. Thus, the student's responses determine the next step in the communication process. It is Crowder's belief that no program writer can specify a single sequence of frames that will be best for all students. Skinner, on the other hand, believes that the experienced program writer can construct a satisfactory sequence of frames through the use of repeated tryouts and revisions.
5.5 **Other Kinds of Programs**

In addition to Skinner and Crowder, other program writers have more or less independently begun writing programs of their own. Some use Skinnerian principles; some follow variations of them. For example, there are programs with short frames of the Skinner type that use multiple-choice responses and branching. Some constructed-response programs may provide for branching to an easier level if students have difficulty in responding correctly, or branching to faster-paced material if the going gets too easy. There are many possibilities.

One interesting variation in program writing, introduced by J. A. Barlow at Earlham College in Richmond, Indiana, is called "conversational chaining". In this constructed-response program, there is no separate answer or feedback frame. Instead, the correct response is printed in capital letters in the following presentation frame.33

A number of other variations and novelties have been developed. In an attempt to make program writing more scientific, some writers have set up formal principles for the analysis of behavior and the design of programs. One such system is the Ruleg, or rule-example, method developed by J. L. Evans, R. Glaser, and L. E. Homme, all of the University of Pittsburgh. In this method it is assumed that the subject to be programmed can be
broken down into two classes of statements, called RU's (for rules) and EG's (for examples). A fairly complex and technical procedure has been developed for constructing a program according to this method.34

Another system of program preparation is called Mathetics, a term derived from a Greek word meaning "to have to do with learning". T. F. Gilbert, its originator, describes it as a technology for taking the guesswork out of programming by systematically applying a number of precise behavioral principles.35
DIAGRAM OF INTERACTION BETWEEN SUBJECT AND TEACHING-MACHINE FUNCTIONS

TEACHING MACHINE MAKES TRIALS AND LEARNS

OUTPUT FROM SCORING DEVICE GIVES PERMISSION TO LEARN

ONLY IF SCORE IS HIGH-VALED

TEACHING MACHINE MOVES

INPUT TO SCORE

SCORING DEVICE

SUBJECT

INPUT TO SCORE

SUBJECT RESPONSE MOVES
6.0 Evaluation

An important prerequisite in the design of the new training program is minimizing costs without affecting quality. It was therefore decided that a Hewlett-Packard model 9830A calculator together with a model 9866A printer would be employed as the instrument of instruction because this equipment was already being utilized by STEP and was quite capable of being programmed for CAI. This model calculator employs the "basic" computer language which is the same language that will be used on all STEP testing equipment. Studies have shown that there were no consistent differences in the time it took to present the subject matter either by texts or machine, and therefore it is the quality of the programmed instruction material that is important as a variable affecting learning achievement.

Memory capacity of the Hewlett-Packard model 9830A calculator is quite limited, thus preventing the branching effect recommended by Dr. N. A. Crowder. Dr. B. F. Skinner, however, in his studies, found that the branching effect was no more beneficial than a sequence of frames. Accepting Dr. Skinner's findings, the limited memory capacity would not be a detriment if a satisfactory sequence of frames were presented. Limited memory capacity will therefore only limit the physical properties of the training program.
The STEP department had no inventory of testing equipment and therefore only knowledge of the basic computer language was required at this stage. Each program throughout the STEP course assumed only the vocabulary and language ability of the operator or technician. Careful measure was taken to ensure a proper progression in the sequence of steps from the initially assumed knowledge up to the final repertoire. Examples throughout the program were constructed to differ from each other as much as possible except that in which they illustrate a term or principle.

In writing each frame, short paragraphs were presented, followed by related statements containing missing words. The student was then called upon to type in the missing word. If the student answered incorrectly, he was obliged to review the material and then kindly asked to supply another answer until he answered the question correctly. Progression through steps was restricted to small increments to make it easier and less frustrating for the student to answer the questions.

The write-in or constructed response type program was preferred over the multiple-choice response type program in this particular case because it was feared that the students would have a tendency to play "Russian roulette" with the different choices of the multiple-choice response type. Furthermore, it was felt that the
write-in or constructed response type program forces the student to recall the correct word and spell it out, rather than only recognizing the correct word as in the multiple-choice response type. Therefore, the Skinner type approach of write-in response was decided superior because it required the student to not only recognize, but recall and spell the correct word, steps that reinforce and enhance learning in the application of a new language.
7.0 Validation

From the data thus obtained, two different types of CAI programs were designed, compatible to the STEP environment.

The first CAI program consisted of the constructed response, linear type (Group I). The second program consisted of the multiple-choice type program (Group II).

After each group completed their program, an examination was given.

In order to validate the performance of the constructed response, linear program over the multiple-choice type program, a test was administered for a significant difference between the two groups by assigning a level of significance (α) of 0.05.

Given that the two groups come from two populations having respective means μ₁ and μ₂, one must decide between the hypotheses:

H₀: μ₁ = μ₂, and the difference is due to chance
H₁: μ₁ ≠ μ₂, and there is a significant difference between groups

Given that the arithmetic mean is denoted by \( \bar{X} = \frac{\sum X}{N} \)
then the mean of Group I (\( \bar{X}_1 \)) =

\[
\frac{80 + 92 + 92 + 96 + 96 + 96 + 96 + 100 + 100 + 100}{10}
\]

\( \bar{X}_1 = 0.948 \)
The arithmetic mean of Group II ($\bar{X}_2$) = 
\[ \frac{.68 + .72 + .80 + .80 + .88 + .88 + .88 + .96 + 1.00 + 1.00}{10} \]
\[ \bar{X}_2 = 0.860 \]

Assuming that the two groups are equal in qualification then their standard deviations are equal ($\sigma_1 = \sigma_2$).

The sample standard deviation is denoted by:

\[ S = \sqrt{\frac{\sum_{j=1}^{N} (X_j - \bar{X})^2}{N-1}} = \sqrt{\frac{(X - \bar{X})^2}{N-1}} \]

Therefore:

(Group I) $S_1 = \sqrt{\frac{(X - \bar{X})^2}{N-1}} = \frac{(0.800-.948)^2+2(0.920-.948)^2+4(0.960-.948)^2+3(1.000-.948)^2}{(10-1)}$
\[ S_1 = 0.0598 \]

(Group II) $S_2 = \sqrt{\frac{(X - \bar{X})^2}{N-1}} = \frac{(0.68-.86)^2+(0.72-.86)^2+2(0.80-.86)^2+3(0.88-.86)^2+(0.96-.86)^2}{(10-1)}$
\[ + \frac{2(1.00-.86)^2}{(10-1)} \]
\[ S_2 = 0.1104 \]

Due to the small sample size, the "students" t distribution ($t$) will be employed.

\[ t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{N-1} + \frac{S_2^2}{N-1}}} \]
t = (0.948-.860)/\sqrt{(.0598)^2+(.1104)^2}/(10-1)

t = 2.15

Degrees of freedom = 2N-2 = 18

A two-tailed test with \( \alpha = 0.05 \) will be used because both sides are assumed to be equal. In other words, we will test that at least 97.5% of our hypothesis is true.

For a two-tailed test the result is significant at a 0.05 level if \( t \) lies outside the range -2.10 to 2.10. \( t \) does indeed lie outside this range. Therefore, there is a significant difference between the scores of the two groups.

The result of this experiment is questionable because of the small number of students evaluated. Perhaps a larger group would have provided a more valid validation and a more significant difference in one of the groups.
References


15. Evans, *loc. cit.*


17. Ibid.

18. Evans, *loc. cit.*


27. Crowder, *loc. cit*.


34. Evans, *loc. cit*.

Bibliography


Luce, G. G. "Can Machines Replace Teachers?". Saturday Evening Post, September 24, 1960.


Rothkopf, E. Z. "A Do-It-Yourself Kit for Programmed Instruction". Teacher's College Record, LXII, December, 1960.


1 REM **************************** BASIC PROGRAM LIBRARY *****************************
2 REM
3 REM COMPUTER ASSISTED INSTRUCTION IN BASIC PROGRAMMING LANGUAGE
4 REM
5 REM (PART 1 OF 10)
6 REM
7 REM ADAPTED FOR HEWLETT-PACKARD MODEL 9830A AND 9866A
8 REM
9 REM / BY JEFFREY J. KENRICK
10 REM NAVAL MISSILE CENTER
11 REM CODE 5249
12 REM POINT MUGU, CALIFORNIA 93042
13 REM
14 REM **************************** END BASIC PROGRAMMING LANGUAGE ***************
15 REM
16 PRINT "PLEASE SELECT ONE OF THE FOLLOWING BY TYPING IN THE NUMBER"
17 PRINT "CORRESPONDING TO YOUR SELECTION, THEN PRESS THE 'EXECUTE' BUTTON."
18 PRINT
19 PRINT "1. INTRODUCTION TO COMPUTER ASSISTED INSTRUCTION."
20 PRINT "2. FLOWCHARTS"
21 PRINT "3. ARITHMETIC OPERATORS"
22 PRINT "4. HOW TO TRANSLATE MATHEMATICAL FORMULAS INTO BASIC"
23 PRINT "5. HOW TO PREPARE A PROGRAM."
24 PRINT "6."
25 PRINT "7. BASIC STATEMENTS."
26 PRINT
27 INPUT I
28 IF I=1 THEN 33
29 IF I=2 THEN 34
30 IF I=3 THEN 35
31 IF I=4 THEN 36
32 IF I=5 THEN 37
33 IF I=6 THEN 38
34 IF I=7 THEN 39
35 LOAD 1
36 LOAD 2
37 LOAD 3
38 LOAD 4
39 LOAD 5
40 LOAD 6
41 LOAD 7
42 PRINT "HI! MY NAME IS HEN."
43 PRINT "WELCOME TO THE COMPUTER ASSISTED INSTRUCTION SERIES IN 'BASIC'"
44 PRINT "LANGUAGE PROGRAMMING. I WILL TRY TO TEACH YOU ENOUGH ABOUT BASIC"
45 PRINT "LANGUAGE PROGRAMMING IN THIS SITTING FOR YOU TO BE ABLE TO WRITE"
46 PRINT "YOUR OWN COMPUTER PROGRAMS."
47 PRINT
48 PRINT
49 WAIT 12000
50 DIM A$(50)
51 PRINT "BEFORE WE BEGIN I WOULD LIKE TO KNOW YOUR NAME? PLEASE TYPE IN YOUR NAME, THEN PRESS THE 'EXECUTE' BUTTON."
52 PRINT
53 PRINT
54 INPUT A$
55 WAIT 1000
56 PRINT "I'M PLEASED TO MEET YOU, " A$
"THERE ARE MANY TYPES OF LANGUAGES. ENGLISH IS A NATURAL LANGUAGE.
USED TO COMMunicate WITH PEOPLE."
"FORMAL LANGUAGES ARE USED TO COMMunicate WITH COMPUTERS LIKE ME."
"BASIC (BEGINNERS ALL-PURPOSE SYMBOLIC INSTRUCTION CODE) IS A FORMAL"
"LANGUAGE; IT IS A COMBINATION OF SIMPLE ENGLISH AND ALGEBRA."
LIKE NATURAL LANGUAGES BASIC HAS GRAMMATICAL RULES, BUT THEY ARE MUCH
EASIER TO LEARN. WE WILL NOW LEARN HOW TO INTERPRET THESE RULES."
FOR THE REMAINDER OF THIS LESSON PLEASE COMPLETE THE SENTENCES GIVEN
BY TYPING IN THE CORRESPONDING WORD OR WORDS, THEN PRESS THE "
EXECUTE" BUTTON.

DIM B$[50]
LET R=0
LET Q=0
PRINT "THIS IS A BASIC 'STATEMENT': 10 READ A;B+C"
PRINT "A (     ) CONTAINS A MAXIMUM OF 72 CHARACTERS."
LET Q=Q+1
PRINT
PRINT INPUT B$
IF B$="STATEMENT" THEN 166
PRINT "YOU HAVE ANSWERED '"B$'" WHICH IS WRONG. PLEASE TRY AGAIN "A$
GOTO 176
PRINT "YOU HAVE ANSWERED '"B$'" WHICH IS CORRECT."
LET R=R+1
PRINT "VERY GOOD; "A$
PRINT "A (     ) IS ALSO CALLED A LINE."
LET Q=Q+1
PRINT
PRINT INPUT B$
IF B$="STATEMENT" THEN 222
PRINT "YOU HAVE ANSWERED '"B$'" WHICH IS WRONG. PLEASE TRY AGAIN "A$
GOTO 190
PRINT "YOU HAVE ANSWERED '"B$'" WHICH IS CORRECT."
LET R=R+1
PRINT "EXCELLENT"
PRINT "EACH BASIC STATEMENT BEGINS WITH A 'STATEMENT NUMBER' (IN THIS"
PRINT "EXAMPLE, 20):"
PRINT TAB$25"20 LET S=(A+B+C+D)/5"
PRINT "THE NUMBER IS CALLED A (     ) OR A LINE NUMBER."
LET Q=Q+1
PRINT
PRINT INPUT B$
IF B$="STATEMENT NUMBER" THEN 302
PRINT "YOU HAVE ANSWERED '"B$'" WHICH IS WRONG. PLEASE TRY AGAIN "A$
GOTO 265
PRINT "YOU HAVE ANSWERED '"B$'" WHICH IS CORRECT."
LET R=R+1
PRINT "YOU'RE DOING VERY WELL; "A$
PRINT "THE STATEMENT NUMBER IS CHOSEN BY YOU, THE STUDENT. IT MAY BE ANY"
EXECUTE THE COMPUTER TO KEEP THE STATEMENT IN ORDER.

LET O=O+1

PRINT

INPUT B$

IF B#="STATEMENT NUMBER" THEN 376
PRINT "YOU HAVE ANSWERED "B#" WHICH IS WRONG. PLEASE TRY AGAIN "A#
GOTO 335
PRINT "YOU HAVE ANSWERED "B#" WHICH IS CORRECT.
LET R=R+1

PRINT "MARVEL.

PRINT

STATEMENTS MAY BE ENTERED IN ANY ORDER; THEY ARE USUALLY NUMBERED BY
FIVES OR TENS SO THAT ADDITIONAL STATEMENTS CAN BE EASILY INSERTED.
PRINT "I, THE STATEMENT, KEEP THEM IN NUMERICAL ORDER NO MATTER HOW THEY"
PRINT "ARE INSERTED. FOR EXAMPLE, IF STATEMENTS ARE INPUT IN THE SEQUENCE"
PRINT "30, 10, 10; I WILL ARRANGE THEM IN THE ORDER: 10, 20, 30."
PRINT
PRINT "THE STATEMENT THEN GIVES AN 'INSTRUCTION' TO THE COMPUTER"
PRINT "(IN THIS EXAMPLE, PRINT):"
PRINT
PRINT TAB25"30 PRINT S"
PRINT
PRINT "( , , ) STATEMENT TYPES BECAUSE THEY "
PRINT "IDENTIFY A TYPE OF STATEMENT. FOR EXAMPLE, THE STATEMENT ABOVE"
PRINT "IS A 'PRINT' STATEMENT."
LET Q=Q+1
PRINT
PRINT
INPUT B$

IF B#="INSTRUCTIONS" THEN 514
PRINT "YOU HAVE ANSWERED "B#" WHICH IS WRONG. PLEASE TRY AGAIN "A#
GOTO 460
PRINT "YOU HAVE ANSWERED "B#" WHICH IS CORRECT.
LET R=R+1

PRINT "YOU'RE DOING GREAT "A#
PRINT
PRINT "IF THE INSTRUCTION REQUIRES FURTHER DETAILS, 'OPERANDS'
PRINT "ARE SUPPLIED (IN THIS EXAMPLE, 10, AND"
PRINT "1.1.2.3.4.4.5.5):"
PRINT
PRINT TAB25"40 GO TO 10"
PRINT
PRINT TAB25"50 DATA 1.1.2.2.3.3.4.4.5.5"
PRINT
PRINT "THE ( , , ) SPECIFY WHAT THE INSTRUCTION ACTS UPON; FOR "
PRINT "EXAMPLE, WHAT IS PRINTED, OR WHERE TO GO."
LET Q=Q+1
PRINT
PRINT
PRINT
INPUT B$

IF B#="OPERANDS" THEN 630
PRINT "YOU HAVE ANSWERED "B#" WHICH IS WRONG. PLEASE TRY AGAIN "A#
GOTO 575
PRINT "YOU HAVE ANSWERED "B#" WHICH IS CORRECT.
LET R=R+1
PRINT "VERY GOOD."
PRINT "THE SEQUENCE OF BASIC STATEMENTS DISPLAYED BELOW IS CALLED "
PRINT "A 'PROGRAM'."
PRINT
PRINT "THE LAST STATEMENT IN A PROGRAM IS AN 'END' STATEMENT."
630 PRINT "THE LAST (HIGHEST NUMBERED) STATEMENT IN A PROGRAM MUST BE AN"
635 PRINT "END STATEMENT."
640 PRINT
645 PRINT "THE (  ) STATEMENT INFORMS ME, THE COMPUTER, THAT THE"
650 PRINT "PROGRAM IS FINISHED."
655 LET O=O+1
660 PRINT
665 PRINT "LET R=R+1"
670 PRINT
675 INPUT B:
680 IF B="END" THEN 742
685 PRINT "YOU HAVE ANSWERED ""B""" WHICH IS WRONG. PLEASE TRY AGAIN "A"
690 GOTO 690
695 PRINT "YOU HAVE ANSWERED ""B""" WHICH IS CORRECT.
700 LET R=R+1
705 PRINT
710 PRINT "THATS GREAT "A"
715 PRINT
720 PRINT "'BASIC' IS A 'FREE FORMAT' LANGUAGE-- THE COMPUTER IgNORES"
725 PRINT "EXTRA BLANK SPACES IN A STATEMENT. FOR EXAMPLE, THESE THREE "
730 PRINT "STATEMENTS ARE EQUIVALENT:"
735 PRINT
740 PRINT TAB25"30 PRINT S"
745 PRINT TAB25"30 PRINT S"
750 PRINT
755 PRINT TAB25"30 PRINT S"
760 PRINT
765 PRINT "WHEN POSSIBLE, LEAVE A SPACE BETWEEN WORDS AND NUMBERS IN A "
770 PRINT "STATEMENT. THIS MAKES A PROGRAM EASIER FOR PEOPLE TO READ."
775 PRINT
780 PRINT
785 WAIT 24000
790 LET $(R/O)*100
795 PRINT $(S)
800 PRINT
805 PRINT "YOU HAVE COMPLETED LESSON #1, AND HAVE ANSWERED "R" CORRECTLY"
810 PRINT "OUT OF "O" QUESTIONS, FOR A TOTAL SCORE OF "$(S)%.""
815 IF S>70 THEN 875
820 PRINT
825 PRINT "YOU HAVE NOT PERFORMED WELL ENOUGH TO CONTINUE FURTHER."
830 PRINT "LETS REVIEW LESSON #1 AGAIN."
835 PRINT
840 PRINT "YOU HAVE DONE VERY WELL "A"
845 PRINT "PLEASE GO ON TO LESSON #2."
850 PRINT "A LESSON IN FLOWCHARTS."
855 PRINT
860 PRINT
865 LOAD 2
DIM A$[50]

PRINT "**************************************************************************
0 PRINT
0 PRINT "HELLO! MY NAME IS FLO."
0 PRINT "IN THIS LESSON I WILL PROVIDE YOU WITH AN ELEMENTARY INTRODUCTION"
0 PRINT "TO FLOWCHARTS. BEFORE WE BEGIN, HOWEVER, I WOULD LIKE TO KNOW"
0 PRINT "YOUR NAME? PLEASE TYPE IN YOUR NAME, THEN PRESS THE 'EXECUTE' BUTTON.
0 PRINT
0 PRINT
0 INPUT A$
0 HAIT 1000
0 PRINT "I'M PLEASED TO MEET YOU, "A$
0 PRINT
0 PRINT
0 HAIT 4000
0 PRINT "**************************************************************************
0 PRINT
0 PRINT TAB30"LESSON #2"
0 PRINT
0 PRINT TAB30"FLOWCHARTS"
0 PRINT
0 PRINT
10 PRINT
15 PRINT TAB33"*"
20 PRINT TAB29"*"
25 PRINT
30 PRINT TAB27"*"
35 PRINT TAB32"START"
40 PRINT TAB27"*"
45 PRINT
50 PRINT TAB29"*"
55 PRINT TAB33"*"
60 PRINT TAB33"*"
65 PRINT TAB33"*"
70 PRINT TAB33"*"
75 PRINT TAB32"*"
80 PRINT TAB33"*"
85 PRINT TAB27"***************"
90 PRINT TAB27"*"
95 PRINT TAB27"*"
100 PRINT TAB27"*"
105 PRINT TAB27"* LET R=0 *"
110 PRINT TAB27"*"
115 PRINT TAB27"* ***************"
120 PRINT TAB33"*"
125 PRINT TAB32"***"
130 PRINT TAB33"*"
135 PRINT TAB33"*"
140 PRINT TAB31"* * ***************"
145 PRINT TAB29"* * * * *"
150 PRINT TAB27"* * * * * * *
155 PRINT TAB25"* R=(PI)R *************** R=R+1 *"
160 PRINT TAB27"* * * * * * * * *
165 PRINT TAB29"* * * * * * * * *
170 PRINT TAB31"* * ***************"
175 PRINT TAB33"* * * * * * * * *
180 PRINT TAB33"* * * * * * * * *
185 PRINT TAB32"*** * * * * * * * * *
190 PRINT TAB27"* * * * * * * * *
195 PRINT TAB27"* * * A>100 * * *
200 PRINT TAB1"* * * * * * * * A<100 * * * * * * * * *"
102 PRINT "YOU HAVE ANSWERED ""B$"" WHICH IS CORRECT."
104 LET R=R+1
106 PRINT
108 PRINT "EXCELLENT ""A$"
110 PRINT
112 PRINT "THERE ARE SEVEN MAIN WORDS USED TO DESCRIBE PARTS OF A PROBLEM"
114 PRINT "IN A FLOWCHART:"
116 PRINT
118 PRINT TAB30"START"
120 PRINT TAB30"FLOWLINE"
121 PRINT TAB30"PROCESS"
122 PRINT TAB30"DECISION"
123 PRINT TAB30"CONNECTOR"
124 PRINT TAB30"END OR STOP"
126 PRINT
128 PRINT TAB7"**" * IN THIS PROGRAM THE CIRCLE"
130 PRINT TAB3"**" * INDICATES EITHER THE 'START'"
132 PRINT TAB1"**" * OF A TASK, OR A CONNECTOR, THE"
134 PRINT TAB5"START"! "CONNECTOR" IS USED TO CONNECT"
136 PRINT TAB1"**" * PART OF THE FLOWCHART WHEN R"
138 PRINT TAB23"FLOWCHART FILLS MORE THAN ONE"
140 PRINT TAB3"**" * PAGE."
142 PRINT TAB7"**"
144 PRINT TAB7"**" YOU FOLLOWED A FLOWLINE TO"
146 PRINT TAB7"**" REACH THE RECTANGLE."
148 WAIT 4000
150 PRINT TAB7"**"
152 PRINT TAB7"**"
154 PRINT TAB6"****"
156 PRINT TAB7"**"
158 WAIT 4000
160 PRINT TAB1"*********" THE RECTANGLE REPRESENTS A 'PROCESS';"
162 PRINT TAB1"**" OR ONE STEP IN SOLVING A PROBLEM. THE"
164 PRINT TAB1"**" STATEMENT, LET R=0, IS KNOWN AS A ( ? )."
166 PRINT TAB1"*********"
168 PRINT TAB7"**"
170 PRINT TAB7"**"
172 PRINT TAB7"**"
174 PRINT TAB7"**"
176 PRINT TAB7"**"
178 LET Q=Q+1
180 INPUT B$
182 IF B$="PROCESS" THEN 660 YOU HAVE ANSWERED ""B$"" WHICH IS WRONG."
184 PRINT TAB7"**"
186 PRINT TAB7"*"
188 GOTO 654
190 PRINT TAB7"**"
192 LET R=R+1
194 PRINT TAB7"**"
196 LET R=R+1
198 PRINT TAB7"**"
200 PRINT TAB7"**"
202 PRINT TAB7"**"
204 PRINT TAB6"***"
206 PRINT TAB7"**"
208 PRINT TAB6"**" YOU HAVE ANSWERED ""B$"" WHICH IS CORRECT."
210 PRINT TAB7"**" YOU'RE DOING VERY WELL ""A$"
212 PRINT TAB4"**" * THE DIAMOND SHAPE REPRESENTS "
214 PRINT TAB1"*" A 'DECISION' POINT IN SOLVING" A PROBLEM. THE STATEMENT, R=(PI)R"" REPRESENTS A ( ? )."
YOU HAVE ANSWERED "B$" WHICH IS WRONG.
PLEASE TRY AGAIN "A$"

YOU HAVE ANSWERED "B$" WHICH IS CORRECT.

EXCELLENT "A$"

* 'STOP' OR 'END' STATEMENTS
* HAVE THE SAME SHAPE AS "START OR A CONNECTOR. 'STOP'," "END", "START", AND "CONNECTOR" STATEMENTS ARE REPRESENTED BY A ( ) ."

IF B$="CIRCLE" THEN 726
PRINT TAB23"YOU HAVE ANSWERED "B$" WHICH IS WRONG."
PRINT TAB23"PLEASE TRY AGAIN "A$"
GOTO 714
PRINT TAB23"YOU HAVE ANSWERED "B$" WHICH IS CORRECT."
LET R=R+1
PRINT
PRINT TAB23"WONDERFUL"
WAIT 24000
LET S=(R/Q)*100
PRINT
YOU HAVE ANSWERED "R" CORRECTLY OUT OF "Q" QUESTIONS.
PRINT "OR A SCORE OF "S""
IF S>80 THEN 800
PRINT "YOU HAVE NOT PERFORMED WELL ENOUGH TO GO ON."
PRINT "PLEASE REVIEW THIS LESSON AGAIN."
GOTO 60
PRINT
PRINT "YOU HAVE DONE VERY WELL "A$"
PRINT "PLEASE GO ON TO LESSON #3."
PRINT "A LESSON ON PREPARING A PROGRAM."
LOAD 3
REM ************************************************ BASIC PROGRAM LIBRARY ************************************************
REM TUTOR SERIES IN BASIC PROGRAMMING LANGUAGE
REM (PART 3 OF 10)
REM
REM ADAPTED FOR HEWLETT-PACKARD MODEL 9830A AND 9866A
REM BY JEFFREY J. KERRICK
REM NAVAL MISSILE CENTER
REM CODE 52J
REM POINT MUSK, CALIFORNIA 93042
REM
REM TELEPHONE: (805) 982-7933
REM
REM THIS PROGRAM IS DEDICATED TO DR. B. F. SKINNER, WHOSE WORK IN
REM PROGRAMMED INSTRUCTION SERVED AS A FOUNDATION FOR THIS COURSE.
REM
REM *************************************************
REM
PRINT
DIM A$[50]
DIM B$[50]
LET Q=0
LET R=0
PRINT TAB30"LESSON #3"
PRINT
PRINT TAB24"ARITHMETIC OPERATORS"
PRINT
PRINT "HELLO! IN THIS LESSON WE ARE GOING TO LEARN ABOUT"
PRINT "MATHEMATICAL SIGNS USED IN THE 'BASIC' LANGUAGE."
PRINT
PRINT "BEFORE WE BEGIN OUR LESSON, PLEASE REGISTER YOUR NAME."
PRINT "(SIMPLY TYPE IN YOUR FIRST NAME AND THEN PRESS THE 'EXECUTE' BUTTON.)"
PRINT
PRINT INPUT A$
PRINT "+ - * / ↑ = # << < > <= >= () + - * / ↑ = #"
PRINT
PRINT "MATHEMATICAL SIGNS USED IN THE BASIC LANGUAGE ARE CALLED 'OPERATORS'."
PRINT "'OPERATORS' AND THE STANDARD MATHEMATICAL SYMBOLS USED IN THE BASIC"
PRINT "LANGUAGE, AS DISPLAYED ABOVE, ARE NEARLY THE SAME AS THOSE"
PRINT "USED IN PROBLEM SOLVING 'BY HAND'. WE WILL REFER TO STANDARD"
PRINT "MATHEMATICAL SIGNS USED IN THE BASIC LANGUAGE AS ( , ? ) ."
LET Q=Q+1
PRINT
PRINT
INPUT B$
IF B$="OPERATORS" THEN 84
PRINT "YOU HAVE ANSWERED '"B$"' WHICH IS WRONG. PLEASE TRY AGAIN."
WAIT 3000
GOTO 56
PRINT "YOU HAVE ANSWERED '"B$"' WHICH IS CORRECT."
LET R=R+1
PRINT "VERY GOOD '"A$"
PRINT
WAIT 4000
PRINT "THERE ARE FIVE BASIC ARITHMETIC OPERATORS."
PRINT "THEIR RESPECTIVE SYMBOLS ARE:"
104 PRINT TAB(3), "MULTIPLICATION (X) EXAMPLE: 4*3=12"
106 PRINT TAB(10), "NOTICE: DO NOT CONFUSE THE MULTIPLICATION SYMBOL (*) FOR 'X'"
108 PRINT TAB(7), "DIVISION (/) EXAMPLE: 12/4=3"
110 PRINT TAB(7), "EXPRESSION (↑) EXAMPLE: 12↑2=144"
111 PRINT
112 PRINT "WE EXPRESS THE EQUATION Y=RX5 IN BASIC NOTATION AS:"
114 PRINT
115 PRINT TAB(27), "10 LET Y=R*X"
118 PRINT
120 PRINT "THE OPERATOR FOR MULTIPLICATION IS (    ) ."
122 LET Q=Q+1
124 PRINT
126 PRINT
128 INPUT B$, /
130 IF B$="*" THEN 135
132 PRINT "YOU HAVE ANSWERED "B$" WHICH IS WRONG. PLEASE TRY AGAIN."
133 PRINT
134 WAIT 3000
135 GOTO 94
136 PRINT "YOU HAVE ANSWERED "B$" WHICH IS CORRECT."
138 LET R=R+1
140 PRINT
142 PRINT "EXCELLENT!"
144 PRINT
146 PRINT
147 WAIT 4000
148 PRINT "THE EQUATION 'X EQUALS 144 TO THE 4TH POWER' IS EXPRESSED IN BASIC."
150 PRINT "NOTATION AS:"
152 PRINT TAB(30), "10 LET X=144↑4"
154 PRINT
156 PRINT "THEREFORE, 'TO RAISE TO THE POWER OF' WE EMPLOY THE OPERATOR (    ) ."
158 LET Q=Q+1
160 PRINT
162 PRINT
164 INPUT B$
166 IF B$="↑" THEN 172
168 PRINT "YOU HAVE ANSWERED "B$" WHICH IS WRONG. PLEASE TRY AGAIN."
169 PRINT
170 GOTO 148
171 GOTO 146
172 PRINT "YOU HAVE ANSWERED "B$" WHICH IS CORRECT."
174 LET R=R+1
176 PRINT
178 PRINT "WONDERFUL "A$"
180 PRINT
182 PRINT
184 PRINT "WE INSTRUCT THE COMPUTER TO 'PRINT' THE EQUATION 12 DIVIDED BY 2 AS."
186 PRINT
188 PRINT TAB(30), "10 PRINT 12/2"
190 PRINT
192 PRINT "IN THE EXPRESSION ABOVE, THE 'OPERATOR' FOR DIVISION IS (    ) ."
194 LET Q=Q+1
196 PRINT
198 PRINT
200 INPUT B$
202 IF B$="/" THEN 208
204 PRINT "YOU HAVE ANSWERED "B$" WHICH IS WRONG. PLEASE TRY AGAIN."
205 PRINT
206 WAIT 3000
207 GOTO 182
208 PRINT "YOU HAVE ANSWERED "B$" WHICH IS CORRECT."
210 LET R=R+1
212 PRINT
214 PRINT "YOU'RE DOING VERY WELL "A$"
216 PRINT
218 PRINT
220 PRINT "THE HIERARCHY OF THE ARITHMETIC OPERATORS IS:"
222 END
PRINT "THE INSTRUCTION 'PRINT' IS USED. FOR EXAMPLE, 'AXA' OR 'A SQUARED'"
PRINT "WOULD BE WRITTEN IN BASIC NOTATION AS:
PRINT
PRINT TAB30"10 PRINT A*A"
PRINT TAB35"OR"
PRINT TAB30"10 PRINT A+2"
PRINT
PRINT "SIMILARLY, 'A TO THE NTH POWER' WOULD BE WRITTEN IN BASIC NOTATION AS
PRINT
PRINT TAB30"(? )"
LET Q=Q+1
PRINT
PRINT
INPUT B$
IF B$="10 PRINT A*N" THEN 262
PRINT "YOU HAVE ANSWERED ""B$"" WHICH IS WRONG. PLEASE TRY AGAIN."
GOTO 222
PRINT "YOU HAVE ANSWERED ""B$"" WHICH IS CORRECT."
LET R=R+1
PRINT
PRINT "YOU'RE DOING VERY WELL "A$
PRINT
PRINT
WAIT 4000
PRINT "THE INSTRUCTION FOR 'THE SQUARE ROOT OF A' WOULD BE WRITTEN IN"
PRINT "BASIC NOTATION AS:
PRINT
PRINT TAB29"10 PRINT SQRT(A)"
PRINT TAB35"OR"
PRINT TAB28"10 PRINT A^(1/2)"
PRINT TAB35"OR"
PRINT TAB28"10 PRINT A^.5"
PRINT
PRINT
PRINT "THE INSTRUCTION FOR 'THE NTH ROOT OF A TO THE NTH POWER' WRITTEN"
PRINT "IN BASIC NOTATION IS:
PRINT
PRINT TAB25"10 PRINT A^(N/N)"
PRINT
PRINT "SIMILARLY, THE INSTRUCTION 'THE 3RD ROOT OF 100 TO THE 2ND POWER'"
PRINT "WOULD BE WRITTEN IN BASIC NOTATION AS:
PRINT
PRINT TAB30"(? )"
LET Q=Q+1
PRINT
PRINT
INPUT B$
IF B$="10 PRINT 100^(2/3)" THEN 326
PRINT "YOU HAVE ANSWERED ""B$"" WHICH IS WRONG. PLEASE TRY AGAIN."
PRINT
GOTO 274
PRINT "YOU HAVE ANSWERED ""B$"" WHICH IS CORRECT."
LET R=R+1
PRINT
PRINT "WONDERFUL"
PRINT
PRINT "PART 3."
PRINT
PRINT "LISTED BELOW ARE GENERAL MATHEMATICAL FORMULAS IN STANDARD NOTATION."
PRINT "TYPE IN THE CORRESPONDING 'BASIC STATEMENT', THEN PRESS THE 'EXECUTE'
PRINT "BUTTON. (USE STATEMENT NUMBER 10)"
PRINT
PRINT "STANDARD NOTATION

BASIC NOTATION"
32 PRINT "SIMILARLY, IF A FORMULA FOR SUBTRACTION APPEARS IN 'STANDARD NOTATION',
33 PRINT "AS:"
34 PRINT
35 PRINT TAB30"A=C-B"
36 PRINT
37 PRINT "THIS SAME FORMULA WOULD APPEAR IN 'BASIC NOTATION' AS:"
38 LET Q=Q+1
39 PRINT
40 PRINT TAB30"< ? >"
41 PRINT
42 PRINT
43 PRINT "INPUT B$"
44 IF B$="10 LET D=A-B" THEN 122
45 PRINT "YOU HAVE ANSWERED '"B$"', WHICH IS WRONG. PLEASE TRY AGAIN.
46 GOTO 50
47 PRINT "YOU HAVE ANSWERED '"B$"', WHICH IS CORRECT."  
48 LET R=R+1
49 PRINT
50 PRINT "VERY GOOD 'A$"
51 PRINT
52 PRINT "A MULTIPLICATION STATEMENT IN 'STANDARD NOTATION' IS:"
53 PRINT
54 PRINT TAB30"D=AXB"
55 PRINT
56 PRINT "THIS STATEMENT IN 'BASIC NOTATION' WOULD APPEAR AS:"
57 PRINT
58 PRINT TAB30"< ? >"
59 LET Q=Q+1
60 PRINT
61 PRINT
62 PRINT "INPUT B$"
63 IF B$="10 LET D=A*B" THEN 164
64 IF B$="10 LET D=B*A" THEN 164
65 PRINT "YOU HAVE ANSWERED '"B$"', WHICH IS WRONG. PLEASE TRY AGAIN.
66 PRINT "REMEMBER, THE BASIC NOTATION SIGN FOR MULTIPLICATION IS '*'"
67 GOTO 122
68 PRINT "YOU HAVE ANSWERED '"B$"', WHICH IS CORRECT."  
69 LET R=R+1
70 PRINT
71 PRINT "EXCELLENT 'A$"
72 PRINT
73 PRINT "GIVEN THE 'STANDARD NOTATION' STATEMENT FOR DIVISION:
74 PRINT
75 PRINT TAB30"A=D/B"
76 PRINT
77 PRINT "THIS STATEMENT WOULD APPEAR IN 'BASIC NOTATION' AS:"
78 PRINT
79 PRINT TAB30"< ? >"
80 LET Q=Q+1
81 PRINT
82 PRINT
83 PRINT "INPUT B$"
84 IF B$="10 LET A=D/B" THEN 208
85 PRINT "YOU HAVE ANSWERED '"B$"', WHICH IS WRONG. PLEASE TRY AGAIN.
86 GOTO 172
87 PRINT "YOU HAVE ANSWERED '"B$" , WHICH IS CORRECT."  
88 LET R=R+1
89 PRINT
90 PRINT "WONDERFUL 'A$"
91 PRINT
92 PRINT
93 PRINT "PART 2."
94 PRINT
95 PRINT
96 PRINT
97 PRINT "IN ORDER TO DISPLAY OR 'PRINT' A SPECIFIC VALUE IN BASIC NOTATION,'
10 PRINT "AREA OF A RECTANGLE:"
12 PRINT " S=AXB" *( ? *)
14 PRINT "(WHERE A AND B ARE SIDES)"
16 LET Q=Q+1
18 PRINT
20 PRINT
22 INPUT B$
24 IF B$="10 LET S=AxB" THEN 388
26 IF B$="10 LET S=AxB" THEN 382
28 PRINT "YOU HAVE ANSWERED "B$" WHICH IS WRONG. PLEASE TRY AGAIN."
30 GOTO 358
32 PRINT "YOU HAVE ANSWERED "B$" WHICH IS WRONG. THE MULTIPLICATION SYMBOL"
34 PRINT "FOR BASIC NOTATION IS "*, PLEASE TRY AGAIN."
35 GOTO 358
38 PRINT "YOU HAVE ANSWERED "B$" WHICH IS CORRECT."
40 LET R=R+1
42 PRINT
44 PRINT "GREAT "A$
46 PRINT
48 PRINT
50 WAIT 4000
52 PRINT "AREA OF A PARALLELOGRAM:" *
54 PRINT " S=AXH" *( ? *)
56 PRINT "WHERE 'A' IS ONE PARALLEL SIDE"
58 PRINT "AND 'H' IS THE DISTANCE BETWEEN"
60 PRINT "SIDES"
62 LET Q=Q+1
64 PRINT
66 PRINT
68 INPUT B$
70 IF B$="10 LET S=AxH" THEN 424
72 PRINT "YOU HAVE ANSWERED "B" WHICH IS WRONG. PLEASE TRY AGAIN."
74 GOTO 402
76 PRINT "YOU HAVE ANSWERED "B" WHICH IS CORRECT."
78 LET R=R+1
80 PRINT
82 PRINT "TERRIFIC "A$
84 PRINT
86 PRINT
88 WAIT 4000
90 PRINT "AREA OF A TRIANGLE:" *
92 PRINT " S=(BxH)/2" *( ? *)
94 PRINT "WHERE 'B' IS THE BASE, 'H' IS THE"
96 PRINT "ALTITUDE"
98 LET Q=Q+1
100 PRINT
102 PRINT
104 INPUT B$
106 IF B$="10 LET S=(BxH)/2" THEN 460
108 PRINT "YOU HAVE ANSWERED "B" WHICH IS WRONG. PLEASE TRY AGAIN."
110 GOTO 438
112 PRINT "YOU HAVE ANSWERED "B" WHICH IS CORRECT."
114 LET R=R+1
116 PRINT
118 PRINT "FANTASTIC "A$
120 PRINT
122 PRINT
124 WAIT 24000
126 LET S=(R/Q)*100
128 S=INT(S)
130 LET R=(S+O)/100
132 R=INT(R)
134 PRINT "YOU HAVE COMPLETED LESSON #4, AND HAVE ANSWERED "R" CORRECTLY"
136 PRINT "OUT OF 8 QUESTIONS, FOR A TOTAL SCORE OF "S." 
138 IF S => 90 THEN 500
140 PRINT "YOU HAVE NOT COMPLETED YET, TRY TO CONTINUE FURTHER."
**BASIC PROGRAM LIBRARY**

**TUTOR SERIES IN BASIC PROGRAMMING LANGUAGE**

(PART 5 OF 10)

ADAPTED FOR HEWLETT-PACKARD MODEL 9830A AND 9866A

BY JEFFREY J. KENRICK

NAVAL MISSILE CENTER

CODE 5240

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This program is dedicated to Dr. B. F. Skinner, whose work in programmed instruction served as a foundation for this course.

PRINT

DIM A$(50)
DIM B$(50)
DIM C$(50)
DIM D$(50)
DIM E$(50)
DIM F$(50)

LET Q=0
LET R=0

PRINT TAB30"LESSON #5"
PRINT TAB23"HOW TO PREPARE A PROGRAM"
PRINT

PRINT "BEFORE WE BEGIN OUR LESSON, PLEASE REGISTER YOUR NAME."
PRINT "(SIMPLY TYPE IN YOUR FIRST NAME; AND THEN PRESS THE 'EXECUTE' BUTTON)"

INPUT A$
PRINT "HOW DO YOU DO "A$

WAIT 2000

PRINT "IN THIS LESSON WE ARE GOING TO LEARN THE FUNDAMENTALS OF PREPARING A COMPUTER PROGRAM. EVERYTHING THAT YOU HAVE LEARNED THUS FAR WILL BE SUMMARIZED IN THIS LESSON."

PRINT "PROCEEDING EACH QUESTION IN THIS LESSON, SIMPLY TYPE IN THE ANSWER, THEN PRESS THE 'EXECUTE' BUTTON. I WILL THEN EVALUATE YOUR ANSWER."

WAIT 20000

PRINT TAB17"FUNDAMENTALS IN PREPARING A PROGRAM"

PRINT 100 PRINT
104 PRINT "1. FIRST, 'DEFINE' THE PROBLEM. "
106 PRINT "THINK THROUGH THE PROBLEM AND GET "
108 PRINT "A CLEAR IDEA OF HOW YOU INTEND TO "
110 PRINT "SOLVE IT. ONCE YOU (' ? ) THE "
112 PRINT "PROBLEM, YOU WILL HAVE A CLEAR IDEA "
114 PRINT "OF HOW TO ACHIEVE A SOLUTION. "

116 PRINT TAB51"*
118 PRINT TAB51"
119 LET Q=Q+1
120 INPUT B$
PRINT""
124 PRINT "YOU HAVE ANSWERED ""B#"" WHICH IS WRONG. ""
126 PRINT "PLEASE TRY AGAIN. ""
128 GOTO 116
130 PRINT "YOU HAVE ANSWERED ""B#"" WHICH IS CORRECT. ""
131 LET R=R+1
132 PRINT TAB51"*
134 PRINT "VERY GOOD ""A#"" ""
136 PRINT TAB50"***"
138 PRINT TAB51"*"
140 PRINT "2. WRITE DOWN THE 'STEPS' TO BE USED IN SOLVING THE PROBLEM. PUT THESE IN LOGICAL ORDER. WRITE DOWN STEPS FOR THE SOLUTION"
142 PRINT " " ( ? ) ""
144 PRINT TAB540"***********"
146 PRINT TAB51"*"
148 PRINT TAB51"*"
151 LET Q=Q+1
152 INPUT B#
154 IF B#="STEPS" THEN 162
156 PRINT "YOU HAVE ANSWERED ""B#"" WHICH IS WRONG. ""
158 PRINT "PLEASE TRY AGAIN. ""
160 GOTO 148
162 PRINT "YOU HAVE ANSWERED ""B#"" WHICH IS CORRECT. ""
163 LET R=R+1
164 PRINT TAB51"*"
166 PRINT "EXCELLENT ""A#"" ""
168 PRINT TAB50"***"
170 PRINT TAB51"*"
172 PRINT "3. WRITING THE 'FLOWCHART' OF THE PROGRAM. DRAW FLOWCHART"
174 PRINT " THIS < ( ? ) > WILL EXPRESS THE TYPES AND SEQUENCE OF OPERATIONS NECESSARY TO SOLVE A PROBLEM."
176 PRINT TAB51"*"
178 PRINT TAB51"*"
180 LET Q=Q+1
182 IF B#="FLOWCHART" THEN 193
184 PRINT "YOU HAVE ANSWERED ""B#"" WHICH IS WRONG. ""
186 PRINT "PLEASE TRY AGAIN ""
188 GOTO 182
190 PRINT "YOU HAVE ANSWERED ""B#"" WHICH IS CORRECT. ""
200 LET R=R+1
202 PRINT TAB51"*"
204 PRINT "KEEP UP THE GOOD WORK ""A#"" ""
206 PRINT TAB50"***"
208 PRINT TAB51"*"
210 PRINT "4. WRITE THE PROGRAM. SELECT THE APPROPRIATE BASIC STATEMENTS FOR EACH PORTION OF THE FLOWCHART. ( ? ) ""
212 PRINT TAB51"*"
214 PRINT TAB51"*"
216 PRINT "WRITE THE PROGRAM ""
218 PRINT TAB51"*"
220 PRINT "THESE STATEMENTS ON PAPER."
222 PRINT TAB51"*"
224 LET Q=Q+1
226 INPUT B#
228 IF B#="WRITE" THEN 236
230 PRINT "YOU HAVE ANSWERED ""B#"" WHICH IS WRONG. ""
232 PRINT "PLEASE TRY AGAIN. ""
234 GOTO 220
236 PRINT "YOU HAVE ANSWERED ""B#"" WHICH IS CORRECT. ""
238 LET R=R+1
240 PRINT "TERRIFIC ""A#"" ""
242 PRINT TAB50"***"
244 PRINT TAB51"*"
246 PRINT "5. 'MARK' THE PROGRAM CARDS OR MAGNETIC TAPE. BY ( ? ) ""
248 PRINT TAB51"*"
250 PRINT "MARK IN DATA ""
PRINT "A PERMANENT RECORD."
PRINT TAB(51)"
LET Q=Q+1
INPUT B$
IF B$="MARKING" THEN 258
PRINT "YOU HAVE ANSWERED "B$" WHICH IS WRONG."
PRINT "PLEASE TRY AGAIN."
GOTO 252
PRINT "YOU HAVE ANSWERED "$B$" WHICH IS CORRECT."
LET R=R+1
PRINT "WONDERFUL "A$"! YOU'RE DOING GREAT."
PRINT TAB(50)"
PRINT TAB(51)"
PRINT "6. CHECK YOUR DATA. MAKE SURE EACH STATEMENT IS IN PROPER FORM. ANY COSTLY MISTAKES WILL BE DISCOVERED WHEN WE "
PRINT "( ? ) OUR DATA."
PRINT"
LET Q=Q+1
INPUT B$
IF B$="CHECK" THEN 302
PRINT "YOU HAVE ANSWERED "$B$" WHICH IS NOT CORRECT. PLEASE TRY AGAIN."
GOTO 252
PRINT "YOU HAVE ANSWERED "$B$" WHICH IS CORRECT."
LET R=R+1
PRINT "EXCELLENT "A$"
PRINT
WAIT 2400
LET N=Q-R
LET R=N-N
LET S=(R/6)*100
S=INT(S)
PRINT "YOU HAVE COMPLETED LESSON #5, AND HAVE ANSWERED "R" CORRECTLY"
PRINT "OUT OF 6 QUESTIONS, FOR A TOTAL SCORE OF "S".".
IF S >= 90 THEN 728
PRINT
PRINT "YOU HAVE NOT PERFORMED WELL ENOUGH TO CONTINUE FURTHER."
PRINT "LET'S REVIEW LESSON #5 AGAIN."
GOTO 48
PRINT
PRINT "YOU HAVE DONE VERY WELL "A$"
PRINT "PLEASE GO ON TO LESSON #6."
20 PRINT TAB31"LESSON 7"
22 PRINT
24 PRINT TAB30"STATEMENTS"
26 PRINT
28 PRINT "BEFORE WE BEGIN OUR LESSON, PLEASE REGISTER YOUR NAME."
30 PRINT "(SIMPLY TYPE IN YOUR FIRST NAME, THEN PRESS THE 'EXECUTE' BUTTON)"
32 PRINT
34 PRINT
36 PRINT
38 DIM A$[50]
40 INPUT A$
42 PRINT "HOW DO YOU DO "A$"
44 PRINT
46 PRINT
48 WAIT 2000
50 PRINT "AFTER EACH QUESTION IN THIS LESSON, SIMPLY TYPE IN THE ANSWER;"
52 PRINT "THEN PRESS THE 'EXECUTE' BUTTON."
54 PRINT
56 PRINT
58 WAIT 5000
60 PRINT TAB30"STATEMENTS"
62 PRINT
64 PRINT "STATEMENTS" ARE INSTRUCTIONS TO THE COMPUTER. THEY ARE CONTAINED"
66 PRINT "IN NUMBERED LINES WITHIN A PROGRAM, AND ARE EXECUTED IN THE ORDER OF"
68 PRINT "THEIR LINE NUMBERS. ( ?? ) TELL THE COMPUTER WHAT TO DO WHILE"
70 PRINT "THE PROGRAM IS RUNNING."
72 LET N=0
74 LET W=0
76 DIM B$[50]
78 PRINT
80 PRINT
82 PRINT
84 INPUT B$
86 IF B$="STATEMENTS" THEN 96
88 PRINT "NO! YOU HAVE ANSWERED "B$", WHICH IS WRONG. PLEASE TRY AGAIN."
90 LET W=1
92 LET N=W
94 GOTO 62
96 PRINT "YES. YOU ANSWERED "B$", WHICH IS CORRECT."
98 PRINT
100 PRINT "VERY GOOD "A$"
102 PRINT
104 PRINT
106 WAIT 3000
108 PRINT TAB25"* * THE 'REM' COMMAND * *
110 PRINT
112 PRINT "THE 'REM' (REMARK) STATEMENT IS MERELY A NOTE TO THE PROGRAMMER"
114 PRINT "AND IS NOT EXECUTED BY THE PROGRAM. HOWEVER, THE STATEMENT DOES"
116 PRINT "APPEAR ON A PROGRAM LISTING."
118 PRINT
120 PRINT "EXAMPLES: 10 REM TUTOR SERIES IN BASIC PROGRAMMING LANGUAGE"
122 PRINT TAB14"20 REM ADAPTED FOR HEWLETT-PACKARD MODEL 9830A AND 9866A"
124 PRINT TAB14"30 REM BY JEFFREY J. KENRICK"
126 PRINT TAB14"40 REM THIS PROGRAM IS DEDICATED TO DR. B. F. SKINNER"
128 PRINT TAB15"PROGRAMMED INSTRUCTION SERVED AS A FOUNDATION FOR THIS COURSE."
130 PRINT
132 PRINT
134 PRINT "THE ( ?? ) STATEMENTS PURPOSE IS TO ALLOW INSERTION OF A LINE"
136 PRINT "OF REMARKS OR COMMENTS IN THE LISTING OF A PROGRAM."
138 PRINT
140 PRINT
142 INPUT B$
145 REMARK "THE 'TAB' COMMAND IS MOST OFTEN USED WITH THE PRINT STATEMENT, BUT"
146 PRINT "IT CAN LIKELY BE USED IN DISP AND WRITE STATEMENTS. WITH THE 'TAB'
147 PRINT "COMMAND, OUTPUTS CAN BE LOCATED AT A SPECIFIED CHARACTER POSITION."
148 PRINT "CHARACTER POSITIONS 0 THROUGH 71 CAN BE DESIGNATED."
149 PRINT "THE 'TAB' COMMAND CAN ALSO SPECIFY A VARIABLE POSITION."
150 PRINT "IF 'TAB' IS USED IN A DISP (DISPLAY) STATEMENT, ANYTHING PAST TAB31
151 PRINT "WILL NOT BE VISIBLE ON THE DISPLAY."
152 PRINT "EXAMPLES: 10 PRINTTAB25"'THE 'TAB' COMMAND"
153 PRINT TAB14"20 WRITE(15,*)2;TAB 30.4"
154 PRINT TAB14"30 DISPTAB(10)' 'STATEMENTS''
155 PRINT "THE ( ? ) COMMAND CAUSES THE TERMINAL TYPEFACE TO MOVE TO THE
156 PRINT "SPACE NUMBER SPECIFIED BY THE EXPRESSION."
157 PRINT
158 INPUT B$= "TAB" THEN 234
159 PRINT "NO! YOU ANSWERED "'B$" WHICH IS WRONG. PLEASE TRY AGAIN "'A$"
160 IF W >= (N+1) THEN 220
161 LET W=W+1
162 LET N=N
163 GOTO 220
164 PRINT "YES. YOU ANSWERED "'B$" WHICH IS CORRECT."
165 PRINT
166 PRINT TAB25"* * THE 'WAIT' STATEMENT * *
167 PRINT
168 PRINT "THE 'WAIT' STATEMENT INTRODUCES DELAYS INTO A PROGRAM. THE COMMAND"
169 PRINT "WAIT' CAUSES THE PROGRAM TO WAIT THE SPECIFIED NUMBER OF"
170 PRINT "MILLISECONDS (1/1000 OF A SECOND) BEFORE CONTINUING FURTHER."
171 PRINT "THE DELAY CAN BE SET TO VARY BETWEEN 0 AND 32767 MILLISECONDS."
172 PRINT
173 PRINT "EXAMPLE: 10 DISP'DON'T TOUCH ME!"
174 PRINT TAB12"20 WAIT 32000"
175 PRINT TAB12"30 DISP* OUCH!!!!"
176 PRINT TAB12"40 WAIT 4000"
177 PRINT TAB12"50 GOTO 10"
PRINT PRINTOUTS OR PROLONGING DISPLAYS.

INPUT B$

IF B$="WAIT" THEN 300
PRINT "NO! YOU HAVE ANSWERED "B$" WHICH IS WRONG. PLEASE TRY AGAIN."

IF W >= (N+1) THEN 282
LET W=W+1
LET N=W
GOTO 282
PRINT "YES! YOU ANSWERED "B$" WHICH IS CORRECT."

PRINT "WONDERFUL "A$
PRINT
PRINT "IF...THEN STATEMENTS"
PRINT "THE 'IF...THEN' STATEMENT TRANSFERS CONTROL TO A SPECIFIED STATEMENT IF THE SPECIFIED RELATION IS TRUE."
PRINT
PRINT "EXAMPLE: 10 LET R=0"
PRINT TAB12"20 LET R=R+1"
PRINT TAB12"30 LET A=PI*(R^2)"
PRINT TAB12"40 IF A<100 THEN 60"
PRINT TAB12"50 STOP"
PRINT TAB12"60 PRINT "RADIUS="R " AREA="A"
PRINT TAB12"70 GOTO 20"
PRINT
WAIT 3000
PRINT "THE PROGRAM ABOVE PROVIDES US WITH RADIUS OF PIPE FOR AN AREA OF LESS THAN 100 SQUARE INCHES. "IF" THE AREA IS LESS THAN 100 SQUARE INCHES "THEN" CONTROL IS TRANSFERRED TO STATEMENT #60 BY WAY OF THE "GOTO" STATEMENT, WHERE THE RADIUS AND AREA ARE PRINTED OUT. CONTROL IS "THEN" TRANSFERRED BY THE "GOTO" STATEMENT TO STATEMENT 20 WHERE N IS INCREASED BY 1 INCH. WHEN THE VALUE OF THE AREA IS EQUAL TO OR GREATER THAN 100 THEN THE PROGRAM STOPS."
PRINT
PRINT INPUT B$
PRINT "NO! YOU ANSWERED "B$" WHICH IS WRONG. PLEASE TRY AGAIN."

IF W >= (N+1) THEN 356
LET W=W+1
LET N=W
GOTO 356
PRINT "YES! YOU ANSWERED "B$" WHICH IS CORRECT."
PRINT "THAT'S TERRIFIC "A$
PRINT
LET T=(8-N)
LET S=(T/8)*100
S=INT(S)
PRINT "YOU HAVE COMPLETED LESSON #7, AND HAVE ANSWERED "T" QUESTIONS"
PRINT "CORRECTLY OUT OF 8, FOR A TOTAL SCORE OF "S%.
PRINT
IF S >= 90 THEN 750
PRINT "YOU HAVE NOT PERFORMED WELL ENOUGH TO CONTINUE FURTHER."
PRINT "YOU SHOULD HAVE A TOTAL SCORE OF AT LEAST 90%. LET'S REVIEW LESSON #7 AGAIN."
PRINT
GOTO 60
PRINT "YOU HAVE PERFORMED VERY WELL "A$" I'M VERY PROUD OF YOU. LET'S"
REM ********************************************************************** BASIC PROGRAM LIBRARY **********************************************************************
REM TUTOR SERIES IN BASIC PROGRAMMING LANGUAGE
REM (PART 8 OF 10)
REM ADAPTED FOR HEWLETT-PACKARD MODEL 9830A AND 9866A
REM BY JEFFREY J. KENNICK
REM NAVAL MISSILE CENTER
REM CODE 5240
REM POINT MUGU, CALIFORNIA 93042
REM
REM THIS PROGRAM IS DEDICATED TO DR. B. F. SKINNER, WHOSE WORK IN
REM PROGRAMMED INSTRUCTION SERVED AS A FOUNDATION FOR THIS COURSE.
REM
PRINT "*********************************************************************************
PRINT "PLEASE SELECT ONE OF THE FOLLOWING BY TYPING IN THE NUMBER"
PRINT "CORRESPONDING TO YOUR SELECTION, THEN PRESS THE 'EXECUTE' BUTTON."
PRINT
PRINT TAB5"8. LESSON ON BASIC STATEMENTS."
PRINT TAB5"9. STATEMENTS (CONTINUED)"
PRINT TAB4"10. STATEMENTS (CONTINUED)"
PRINT
INPUT I
IF I=8 THEN 30
IF I=9 THEN 28
IF I=10 THEN 29
LOAD 2
LOAD 3
PRINT "*********************************************************************************
PRINT TAB30"LESSON #8"
PRINT
PRINT TAB30"STATEMENTS"
PRINT "BEFORE WE BEGIN OUR LESSON, PLEASE REGISTER YOUR NAME."
PRINT "(SIMPLY TYPE IN YOUR FIRST NAME, THEN PRESS THE 'EXECUTE' BUTTON."
PRINT "BEFORE WE BEGIN OUR LESSON, PLEASE REGISTER YOUR NAME."
PRINT "(SIMPLY TYPE IN YOUR FIRST NAME, THEN PRESS THE 'EXECUTE' BUTTON."
PRINT
DIM A$(50)
INPUT A$"IT'S A PLEASURE TO MEET YOU "A$"."
PRINT
PRINT
WAIT 2000
PRINT "AFTER EACH QUESTION IN THIS LESSON, SIMPLY TYPE IN THE ANSWER;"
PRINT "THEN PRESS THE 'EXECUTE' BUTTON."
PRINT
PRINT
WAIT 5000
PRINT "******************************************************************************** THE 'FOR...NEXT' STATEMENTS ********************************************************************************
PRINT
PRINT "THE 'FOR AND NEXT' STATEMENTS FORM A LOOP WITH THE STATEMENTS BETWEEN"
PRINT "THEM IN A PROGRAM."
PRINT "THE 'FOR' STATEMENT DEFINES THE NUMBER OF TIMES THE LOOP IS TO BE"
PRINT "PERFORMED."
PRINT "EXAMPLE: * 10 FOR N=1 TO 100"
PRINT TAB10"* 20 PRINT "N=S"N, "N SQUARED ="N²"
PRINT TAB11"* 30 NEXT N"
PRINT "IN THE PROGRAM ABOVE, THE ( ? ? ) STATEMENT INSTRUCTS THE COMPUTER."
PRINT "TO EXECUTE THE LOOP 100 TIMES: WHEN I=1, 2, 3, ... 100."
LET W = 0
LET N = 0
DIM B$[150]
PRINT
PRINT INPUT B$
IF B$ = "FOR" THEN 110
PRINT "NO! YOU ANSWERED ""B$$" WHICH IS WRONG. PLEASE TRY AGAIN."
IF W >= (N+1) THEN 92
LET N = N + 1
LET W = W + 1
GOTO 92
PRINT "YES! YOU ANSWERED ""B$$" WHICH IS CORRECT."
PRINT "THAT'S VERY GOOD ""A$$"."
PRINT
PRINT WAIT 3000
PRINT "THE 'NEXT' STATEMENT RETURNS THE PROGRAM BACK TO THE 'FOR' STATEMENT"
PRINT "IN THE EXAMPLE ABOVE, EACH TIME THE 'NEXT' STATEMENT IS EXECUTED;"
PRINT "THE VALUE OF I IS INCREMENTED BY ONE, AS LONG AS I IS LESS THAN"
PRINT "OR EQUAL TO 100, THE LOOP IS EXECUTED AGAIN. BUT WHEN THE VALUE"
PRINT "OF I PASSES THE FINAL VALUE, THAT IS, WHEN I=101, THE STATEMENT"
PRINT "FOLLOWING THE 'NEXT' STATEMENT IS ACCESSED. IN THE ABOVE CASE;"
PRINT "WHEN I=101, THE ( ? ? ) STATEMENT IS ACCESSED."
PRINT
PRINT INPUT B$
IF B$ = "END" THEN 258
PRINT "NO! YOU ANSWERED ""B$$" WHICH IS WRONG. PLEASE TRY AGAIN."
IF W >= (N+1) THEN 168
LET N = N + 1
LET W = W + 1
GOTO 168
PRINT "YES! YOU ANSWERED ""B$$" WHICH IS CORRECT."
PRINT "VERY GOOD ""A$$"!"
PRINT
PRINT WAIT 3000
PRINT "THE ADVANTAGES OF USING 'FOR...NEXT' RATHER THAN 'IF...THEN' CAN BE"
PRINT "SHOWN IN THE FOLLOWING EXAMPLE WHERE NUMBERS 1 THROUGH 100 ARE TO"
PRINT "BE SQUARED AND THEIR PRODUCT LISTED."
PRINT TAB$"USING 'IF'""TAB34""USING 'FOR'"
PRINT "1 N=1""TAB30""1 FOR N=1 TO 100"
PRINT "2 IF N>100 THEN 5""TAB30""2 PRINT 'N SQUARED = '""(N+2)
PRINT "3 PRINT 'N SQUARED = '""(N+2)""TAB30""3 NEXT N"
PRINT "4 N=N+1""TAB30""4 END"
PRINT "5 GOTO 2"
PRINT "6 END"
PRINT
PRINT "IN THE EXAMPLE ABOVE, THE PROGRAM IS EASIER TO KEY IN, TAKES UP"
PRINT "CONSIDERABLY LESS CALCULATOR MEMORY, AND EXECUTES MUCH FASTER IF"
PRINT "THE 'IF' OR 'FOR' LOOP IS USED?"
INPUT B$
IF B$ = "FOR" THEN 360
PRINT "NO! YOU ANSWERED ""B$$" WHICH IS WRONG. PLEASE TRY AGAIN."
IF W >= (N+1) THEN 342
LET N=W
GOTO 342
PRINT "YES! YOU ANSWERED "B$" WHICH IS CORRECT."
 PRINT
PRINT "THAT'S GREAT "A$"!"
PRINT
WAIT 3000
PRINT "******************************************************************** FOR...NEXT WITH 'STEP' ************"
REM ******************************** BASIC PROGRAM LIBRARY ********************************
REM TUTOR SERIES IN BASIC PROGRAMMING LANGUAGE
REM ( PART 9 OF 10 )
REM
REM ADAPTED FOR HEWLETT-PACKARD MODEL 9830A AND 9866A
REM BY JEFFREY J. KENNICK
REM NAVAL MISSILE CENTER
REM CODE 5240
REM POINT MUGU, CALIFORNIA 93042

0 REM
1 REM
2 REM THIS PROGRAM IS DEDICATED TO DR. B. F. SKINNER, WHOSE WORK IN
3 REM PROGRAMMED INSTRUCTION SERVED AS A FOUNDATION FOR THIS COURSE.
4 REM
5 REM ************************************************************
9 PRINT TAB30"LESSON #9"
12 PRINT
14 PRINT TAB30"STATEMENTS"
16 PRINT
18 PRINT
20 PRINT "BEFORE WE BEGIN OUR LESSON, PLEASE REGISTER YOUR NAME."
22 PRINT "SIMPLY TYPE IN YOUR FIRST NAME, THEN PRESS THE 'EXECUTE' BUTTON."
24 PRINT
26 PRINT
28 DIM A$(50)
30 INPUT A$
32 PRINT "IT'S A PLEASURE TO MEET YOU "A$",".
34 PRINT
36 PRINT
38 WAIT 2000
40 PRINT "AFTER EACH QUESTION IN THIS LESSON, SIMPLY TYPE IN THE ANSWER;"
42 PRINT "THEN PRESS THE 'EXECUTE' BUTTON."
44 PRINT
46 PRINT
48 WAIT 5000
50 PRINT "*************** FOR...NEXT LOOP USING 'ARRAYS' ***************"
52 PRINT
54 PRINT
56 PRINT
58 WAIT 5000
60 PRINT "THE EXAMPLE PROGRAM BELOW SHOWS HOW THE 'FOR...NEXT' LOOP CAN BE"
62 PRINT "USED TO ASSIGN VALUES TO ARRAYS. IN THIS EXAMPLE, THE ARRAY"
64 PRINT "VARIABLES, A(1) THROUGH A(4) ARE ASSIGNED VALUES."
66 PRINT
70 PRINT
72 PRINT TAB10"10 FOR I=1 TO 4"
74 PRINT TAB10"20 A(I)=I+2"
76 PRINT TAB10"30 PRINT A(I);"
78 PRINT TAB10"40 NEXT I"
80 PRINT TAB10"50 PRINT"
82 PRINT TAB10"60 PRINT A(1);A(2);A(3);A(4)"
84 PRINT TAB10"70 END"
86 PRINT
88 PRINT
90 PRINT
91 LET N=0
92 WAIT 3000
93 DIM B$(50)
94 PRINT "THE PRINTOUT IS:"
DATA WITHIN A PROGRAM. A ONE-DIMENSIONAL ARRAY AS SHOWN ABOVE
CAN HAVE SEVERAL ROWS BUT ONLY ONE COLUMN. THE SEMICOLON IN
STATEMENT #50 HOLDS THE LOOP UNTIL I=5, WHEREUPON ALL VALUES
OF THE ( ) ARE PRINTED, THEN THEY ARE PRINTED AGAIN THROUGH
THE EXECUTION OF STATEMENT #60.

INPUT B$
IF B$="ARRAY" THEN 138
PRINT "NO! YOU'RE ANSWER WAS ""B$"" WHICH IS WRONG. PLEASE TRY AGAIN."
IF W >= (N+1) THEN 128
LET W=W+1
LET N=W
GOTO 128
PRINT "YES! YOU ANSWERED ""B$"" WHICH IS CORRECT."
PRINT "THAT'S VERY GOOD ""A$""!
PRINT

WAIT 3000
PRINT "********** READ, DATA, AND RESTORE STATEMENTS **********
PRINT
PRINT "THE 'READ' AND 'DATA' STATEMENTS COMBINE TO ASSIGN VALUES TO"
PRINT "VARIABLES."
PRINT "THE 'READ' STATEMENT INSTRUCTS BASIC TO READ AN ITEM FROM A DATA"
PRINT "STATEMENT. THE 'READ' STATEMENT DETERMINES THE VARIABLE."
PRINT "EXAMPLE: 10 READ Y"
PRINT "THE INFORMATION CONTAINED IN THE DATA STATEMENT IS READ BY EXECUTING
OF THE ( ) STATEMENT."

INPUT B$
IF B$="READ" THEN 192
PRINT "NO! YOU'RE ANSWER WAS ""B$"" WHICH IS WRONG. PLEASE TRY AGAIN."
IF W >= (N+1) THEN 174
LET W=W+1
LET N=W
GOTO 174
PRINT "YES! YOU ANSWERED ""B$"" WHICH IS CORRECT."
PRINT "THAT'S TERRIFIC ""A$""!
PRINT
PRINT
WAIT 3000
PRINT "THE 'DATA' STATEMENT (EXAMPLE: 90 DATA 12.4) IS USED FOR"
PRINT "SPECIFYING DATA IN A PROGRAM. THE DATA IS READ IN SEQUENCE FROM"
PRINT "THE FIRST TO THE LAST 'DATA' STATEMENTS, AND FROM LEFT TO RIGHT"
PRINT "WITHIN THE 'DATA' STATEMENT."
PRINT "THE ( ) STATEMENT DETERMINES THE VALUE TO BE ASSIGNED TO THE"
PRINT "VARIABLE IN THE READ STATEMENT."

INPUT B$
IF B$="DATA" THEN 236
PRINT "NO! YOU'RE ANSWER WAS ""B$"" WHICH IS WRONG. PLEASE TRY AGAIN."
IF W >= (N+1) THEN 218
LET W=W+1.
LET N=W
GOTO 218
PRINT "YES! YOU ANSWERED ""B$"" WHICH IS CORRECT."
PRINT "YOU'RE DOING VERY WELL ""A$"". "
PRINT "THE CALCULATOR USES AN INTERNAL MECHANISM, CALLED A POINTER, TO"
PRINT "LOCATE THE DATA ELEMENT THAT IS TO BE READ. THE 'RESTORE' STATEMENT"
PRINT "RESETS THE POINTER TO THE FIRST DATA ITEM, ALLOWING DATA TO BE"
PRINT "REREAD."
PRINT "DATA ELEMENTS CAN BE READ MORE THAN ONCE IF THE ( ? ) STATEMENT"
PRINT "IS USED."
PRINT INPUT B$.
IF B$ = "RESTORE" THEN 290
PRINT "NO! YOU'RE ANSWER WAS ", B$, WHICH IS WRONG. PLEASE TRY AGAIN."
IF W >= (N+1) THEN 262
LET W=W+1
LET N=W
GOTO 262
PRINT "YES! YOU ANSWERED ", B$, WHICH IS CORRECT."
PRINT "GREAT "A"!
PRINT
LET T=(4-N)
LET S=(T/4)*100
LET S=INT(S)
PRINT "YOU HAVE ANSWERED "T" QUESTIONS CORRECTLY OUT OF 4, FOR A OVERALL"
PRINT "SCORE OF "S",%.
PRINT
IF S >= 90 THEN 630
PRINT "YOU HAVE NOT PERFORMED WELL ENOUGH TO CONTINUE FURTHER."
PRINT "YOU SHOULD HAVE A TOTAL SCORE OF AT LEAST 90%, LET'S REVIEW"
GOTO 60
PRINT "YOU HAVE PERFORMED VERY WELL IN THIS LESSON "A". I'M VERY PROUD"
PRINT "OF YOU. LET'S CONTINUE ON WITH THIS LESSON. THE MACHINE WILL"
PRINT "NOW AUTOMATICALLY 'LOAD IN' TO THE NEXT SECTION."
LOAD 3
REM ******************** BASIC PROGRAM LIBRARY ********************
REM TUTOR SERIES IN BASIC PROGRAMMING LANGUAGE
REM (PART 10 OF 10)
REM
REM ADAPTED FOR HEWLETT-PACKARD MODEL 9830A AND 9866A
REM BY JEFFREY J. KERSHICK
REM NAVAL MISSILE CENTER
REM CODE 5249
REM POINT MUGU, CALIFORNIA 93042
REM
REM THIS PROGRAM IS DEDICATED TO DR. B. F. SKINNER, WHOSE WORK IN
REM PROGRAMMED INSTRUCTION SERVED AS A FOUNDATION FOR THIS COURSE.
REM
REM ********************

20 PRINT TAB30"LESSON #10"
22 PRINT
24 PRINT TAB30"STATEMENTS"
26 PRINT
28 PRINT
30 PRINT "BEFORE WE BEGIN OUR LESSON, PLEASE REGISTER YOUR NAME."
32 PRINT "(SIMPLY TYPE IN YOUR FIRST NAME, THEN PRESS THE 'EXECUTE' BUTTON.)"
34 PRINT
36 PRINT
38 D IN A$[50]
40 INPUT A$
42 PRINT "IT'S A PLEASURE TO MEET YOU " A$
44 PRINT
46 PRINT
48 WAIT 2000
50 PRINT "AFTER EACH QUESTION IN THIS LESSON, SIMPLY TYPE IN THE ANSWER."
52 PRINT "THEN PRESS THE 'EXECUTE' BUTTON."
54 PRINT
56 PRINT
58 WAIT 5000
60 PRINT "TO EXEMPLIFY WHAT WE HAVE COVERED SO FAR IN LESSON #9:" 
62 PRINT
64 PRINT TAB10"*************** EXAMPLE ***********************"
66 PRINT
68 PRINT
70 PRINT TAB20"10 FOR I=1 TO 5"
72 PRINT TAB20"20 READ A"
74 PRINT TAB20"30 PRINT A " 'SQUARED= ' A\^2"
76 PRINT TAB20"40 NEXT I"
78 PRINT TAB20"50 PRINT"
80 PRINT TAB20"60 RESTORE"
82 PRINT TAB20"70 FOR J=1 TO 3"
84 PRINT TAB20"80 READ B"
86 PRINT TAB20"90 PRINT B " 'CUBED= ' B\^3"
88 PRINT TAB20"100 NEXT J"
90 PRINT TAB20"110 DATA 4,9,12,8,27"
92 PRINT TAB20"120 END"
93 PRINT
94 PRINT
95 WAIT 10000
96 PRINT TAB10"*************** FLOWCHART ***********************"
97 PRINT
98 PRINT
100 PRINT TAB20", ***************"
102 PRINT TAB10"................ FOR I=1 TO 5 *
104 PRINT TAB10"................ FOR J=1 TO 3 *"
PRINT TAB10": "TAB29": "
110 PRINT TAB10": "TAB29": "
112 PRINT TAB10": "TAB29": "
114 PRINT TAB10": "TAB17": "TAB25"**********
116 PRINT TAB10": "TAB15": ............ * READ A *
118 PRINT TAB10": "TAB15": "TAB25"**********
120 PRINT TAB10": "TAB15": "
122 PRINT TAB10": "TAB15": "
124 PRINT TAB10": "TAB15": "
126 PRINT TAB10": "TAB15": "
128 PRINT TAB10": "TAB15": * PRINT A " SQUARED=", A+2 *=
130 PRINT TAB10": "TAB15": "
132 PRINT TAB10": "TAB15": "TAB30": "
134 PRINT TAB10": "TAB29": "
136 PRINT TAB10": "TAB30": "
138 PRINT TAB10": "TAB26"**********
140 PRINT TAB10": "TAB14": ................................ # NEXT I *
142 PRINT TAB15": "TAB26"**********
144 PRINT TAB15": "TAB29": "
146 PRINT TAB15": "TAB30": "
148 PRINT TAB15": "TAB26"**********
150 PRINT TAB15": "TAB26"* PRINT *=
152 PRINT TAB15": "TAB26"**********
154 PRINT TAB15": "TAB30": "
156 PRINT TAB15": "TAB29": "
158 PRINT TAB15": "TAB30": "
160 PRINT TAB15": "TAB25"**********
162 PRINT TAB15": "TAB25"* KEUIRE *=
164 PRINT TAB15": "TAB25"**********
166 PRINT TAB15": "TAB30": "
168 PRINT TAB15": "TAB29": "
170 PRINT TAB15": "TAB30": "
172 PRINT TAB15": "TAB22"**********
174 PRINT TAB15": "TAB22"* FOR J=1 TO 3 *=
176 PRINT TAB15": "TAB22"**********
178 PRINT TAB15": "TAB30": "
180 PRINT TAB14": ................................ # READ B *
182 PRINT TAB15": ............ * READ B *
184 PRINT TAB15": "TAB25"**********
186 PRINT TAB15": "
188 PRINT TAB15": "
190 PRINT TAB15": "
192 PRINT TAB15": .................................. "
194 PRINT TAB15": * PRINT B ", "CUBED=", S+3 *, *
196 PRINT TAB15": "
198 PRINT TAB15": "TAB30": "TAB49": "
200 PRINT TAB15": "TAB30": "TAB49": "
202 PRINT TAB15": "TAB29": "TAB49": "
204 PRINT TAB15": "TAB30": "TAB49": "
206 PRINT TAB15": "TAB26"**********"TAB49": "
208 PRINT TAB11": ................................ # NEXT J "TAB49": "
210 PRINT TAB11": .................... * NEXT J "TAB49": "
212 PRINT TAB11": .................... * NEXT J "TAB49": "
214 PRINT TAB11": .................... * NEXT J "TAB49": "
216 PRINT TAB11": .................... * NEXT J "TAB49": "
218 PRINT TAB11": .................... * NEXT J "TAB49": "
220 PRINT TAB11": .................... * NEXT J "TAB49": "
222 PRINT TAB11": .................... * NEXT J "TAB49": "
224 PRINT TAB11": .................... * NEXT J "TAB49": "
226 PRINT TAB11": "
228 PRINT TAB11": "
230 PRINT TAB11": "
232 PRINT TAB11": .................... * END *=
234 PRINT TAB25": "
236 PRINT TAB25": "
238 PRINT TAB25": "
...
FOR THE EXAMPLE PROGRAM ABOVE, THE PRINTOUT IS:

PRINT TAB10"4  SQUARED = 16"
PRINT TAB10"9  SQUARED = 81"
PRINT TAB10"12 SQUARED = 144"
PRINT TAB10"8  SQUARED = 64"
PRINT TAB10"27 SQUARED = 729"
PRINT
PRINT TAB10"4  CUBED = 64"
PRINT TAB10"9  CUBED = 729"
PRINT TAB10"12 CUBED = 1728"
PRINT
WAIT 10000
PRINT "IN THIS PROGRAM, IMMEDIATELY BEFORE THE 'RESTORE' STATEMENT IS"
PRINT "ACCESSLED, THE DATA POINTER IS LOCATED AFTER THE LAST DATA ELEMENT"
PRINT "IN LINE 110, THE (   ) STATEMENT RESETS THE DATA POINTER"
PRINT "TO THE FIRST ELEMENT IN LINE 110 SO THAT THE DATA CAN BE REREAD"
PRINT
DIM B$[501]
INPUT B$
IF B$="RESTORE" THEN 304
PRINT "NO! YOU ANSWERED '"B$" WHICH IS WRONG. PLEASE TRY AGAIN."
IF W >= (N+1) THEN 280
LET W=W+1
LET N=N
GOTO 280
PRINT
PRINT "YES! YOU ANSWERED '"B$" WHICH IS CORRECT."
PRINT
PRINT "THAT'S REALLY GREAT '"B$"!"
PRINT
WAIT 5000
PRINT "CONGRATULATIONS '"B$"! YOU HAVE COMPLETED THE COURSE IN COMPUTER"
PRINT "ASSISTED INSTRUCTION. YOU SHOULD NOW HAVE THE FOUNDATION WITH"
PRINT "WHICH TO WRITE YOUR OWN COMPUTER PROGRAMS."
PRINT
PRINT "SO LONG; AND GOOD LUCK. DON'T FORGET TO USE ME FOR 'REFRESHER'"
PRINT "COURSES."
PRINT
WAIT 3000
END