An Examination of the Effect of Memory Support and Advisory Support in a Learner Control Computer Assisted Instruction Program

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ABSTRACT

An Examination of the Effect of Memory Support and Advisory Support in a Learner Control Computer Assisted Instruction Program.

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In this study a Learner Control Computer-Assisted Instruction (CAI) Program was used to instruct students in a subject matter having a complex content structure (the use of string functions in basic programming). Sixty-one students participated in the study. They were assigned to one of four groups which received Memory Support (MS), Advisory Support (AS), Memory Support and Advisory Support (MAS) and neither Memory nor Advisory support (NMAS). The analysis of covariance showed a significant difference effected by the MS treatment, in performance ($f(1,56) = 6.86$, $p < .01$) and cost ($f(1,57) = 4.21$, $p < .05$). No statistically significant effect was found for AS as offered in this experiment and the interaction of AS and MS.

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CHAPTER 1

Context of the Problem

Educators are becoming more and more concerned with the Cost-effectiveness of educational systems for instructional activities.

The accomplishment of Cost-effective systems can only be realized through intensive and extensive research to identify independent variables that are strong correlates of effectiveness and efficiency. It is as a result of such studies that many researchers have identified the computer as a tool which can be used effectively in the learning process.

Computer technology has made it possible to define complex sequences of interactive instructional events, program them for repeated use with individual learners and in essence simulate the interactions between a learner and a sophisticated tutor (Hall, 1977).

An even more detailed analysis of the advantages and applicability of the computer to the instructional process was made by Milner and Wildberger (1974). They point out

that computer simulation of science experiments can provide learning experiences that might not otherwise be available because of such factors as safety, equipment cost or availability, prohibitive set-up time, or other factors of cost, convenience or time.

These advantages are being constantly realized in the use of the computer as a device for computer simulated experimentation. Craig, Sheretz, Carlton and Ackerman (1971) state that computer simulation provides a student with a richer experience in data interpretation and hypothesis making.

The computer can provide a single point of contact through which instruction can be delivered, modified, managed, and most importantly, controlled by the student (National Academy of Science, Note 1; Markuson, Note 2). This procedure of interactive information retrieval certainly enhances the learner's ability to pose questions, recognize valid explanations, and make enquiries (Adair, Note 3).

This ability to interact with the individual is the 'raison d'etre' of computer assisted instruction (Kearsley, 1977). A truly individualized system of instruction incorporates strategies which prescribe the optimal amount of instruction for the student to achieve the instructional

objective (Tennyson and Rothen, 1977). Whatever method is adopted to achieve this end, each student on completing the lesson must have received the optimal amount of instruction. In order to achieve this end, three forms of instruction have become quite common: (1) Program Control, (2) Learner Control and (3) Adaptive Control (Tennyson and Rothen, 1979).

Program Control

Program control implies a learning environment in which the selection or sequence of instructional stimuli are made without strategy inputs from the student (Tennyson and Rothen, 1979). Various propositions have been made for the implementation of Program Control.

Atkinson (1972) proposed a response-sensitive instructional strategy as a means of optimizing instruction. His strategy included a model of the essential features of the learning process needed for the given task and the student's moment to moment response history.

Cronbach (1967) introduced Aptitude Treatment Interaction. His strategy suggested prescribing one type of sequence (even media) for a student of certain characteristics, while another learner of differing characteristics will receive another entirely different form

of instruction.

As an alternative to Cronbach's Aptitude Treatment Interactions, Tobias (1976) proposed the Achievement Treatment Interactions model. While Aptitude Treatment Interaction stresses relatively permanent dispositions for learning as assessed by measures of aptitude, intelligence, personality, and cognitive style, achievement treatment interactions represent a distinctly different orientation, i.e., emphasizing task-specific variables relating to prior achievement and subject-matter familiarity (Tennyson and Rothen, 1979).

Learner Control

Learner control assumes that the student is fully or partially responsible for the learning strategy. Under learner control students are given the opportunity to advance, review, and exit lessons (Caldwell, 1980). Definitions of Learner Control have varied from that of allowing the student to make decisions on just one aspect or one variable to that of almost complete control of instruction (Steinberg, 1977).

Adaptive Control

Hansen, Ross and Rakow (Note 4) defined adaptive

instruction as a corrective instructional process that facilitates a more appropriate interaction between the individual learner and the targeted learning task by systematically adapting the allocation of learning resources to the learner's aptitudes and recent performance.

Landa (1976) has also defined adaptive instruction as a diagnostic process aimed at adjusting the basic learning environment to the unique learning characteristics and needs of each learner.

In adaptive control systems there are few fixed sequences through the material, but rather dynamically adjusted paths based on individual performance.

Cross comparisons of these three strategies have consistently yielded greater effectiveness for the adaptive control strategy and approximately equal effectiveness for the program control and learner control (Tennyson and Rothen, 1977; Tennyson, Tennyson and Rothen, 1980). Though it is believed that the learner is the best judge of his needs, conclusions from studies cited seem to identify two problems that affect the overall effectiveness of the learner control model:

1. The learner's inability to recall previous concepts that are essential to the acquisition of present ones

2.The learner's inability to make correct and completely unassisted decisions.

It is expected that if these two deficiencies are remedied in the Learner Control Model, then performance will be enhanced resulting in greater effectiveness and efficiency.

The Learner Control model lends itself to easy investigation of the effect of independent variables in the learning process in Computer Assisted Instruction. Consequently, it is possible to optimize the Learner Control strategy through identification and manipulation of variables which enhance learning in a given environment.

CHAPTER 2

Review of Related Research

Research on Learner Control

The effectiveness of a Learner Control strategy in CAI is at this present time, questionable (Steinberg,1977;Fry,1972). As one delves deeply into research on Learner Control, it soon becomes quite evident that Learner Control is a very broad and vague term. Learner Control may vary from that of allowing the student to make decisions on just one aspect or one variable to that of almost complete control of instruction (Steinberg, 1977).

In the instructional sequence there are many variables which interact to produce an instructional outcome; e.g. pacing, display rate, feedback, strategy, memory support, advisory support, clarity of presentation, completion time, motivational factors, learner characteristics, learning styles, content sequence, amount of practice, difficulty level, learning task structure (Rosenshine and Furst, 1971; Gordon, Note 5).

Consequently, when one refers to Learner Control, control over any combination of the following may be implied:

1. The number of practice problems received
2. The number of examples shown
3. The number of instances
4. Content sequence
5. Instructional sequence
6. The presence of organizers

(Atkinson,1972).

Steinberg suggests that the main problem hampering the success of Learner Control is the student's unwillingness or inability to make instructional decisions. Tennyson and Rothen (1979) criticized Learner Control for its failure to provide students with early meaningful information upon which to base learning strategy decisions. Even if diagnostic and prescriptive information were provided, Tennyson and Rothen questioned whether students are willing and able to make use of the information in decision making.

It is therefore difficult to assess the effectiveness of Learner Control if specific variables are not specified, defined, and investigated. Only a thorough investigation into the relationship of these variables with performance will reveal which learning decisions should be left to the student and which should be controlled by the computer (Steinberg, 1977).

Clear failure to identify contributing and non-contributing variables has accounted for the conflicting conclusions of various researchers (Tennyson, 1972; McCann, Lahey and Hurlock, Note 6; Judd, Bunderson and Bessent, 1970; Faust, 1974; Oliver, Note 7). A closer look at available research reveals that the performance of students under Learner Control can be improved or enhanced.

Positive Results Research

Hurlock, (1972) and McCann, Lahey and Hurlock (Note 6) found that when students were given control over subject matter they performed just as well as students who did not receive this choice. It was also observed that attitude was improved. Tennyson and Buttrey (Note 8) found that when students were given complete control of the instructional strategy they developed successful instruction orders which were different from their instructor's. These findings have also been supported by Tennyson, Steve, and Boutwell (1975). They found that students who were given complete control of their learning completed their instruction sooner and seem better equipped to implement the terminal behaviors than were students who went through a prescribed course. Other studies in agreement with these findings are those of Flexibrod and O'Leary (1974); Di Vesta (1975); Lahey and Crawford (Note 9); Lahey and Coady (Note 10).

Negative Results Research

In a remedial mathematics CAI program, Judd, Bunderson and Bessent (Note 11) gave students four different treatments:

1. Total computer management
2. Control over the sequence of topics from a table of contents
3. Additional student control of the amount of practice
4. Total learner control.

It was found that students with complete control did not perform as well as those under computer control. Fisher, Blackwell, Garcia and Green (1975) also found that elementary children who were allowed to choose difficulty level in an arithmetic drill, tended to choose problems that were too difficult or too easy. Steinberg (1977) summarizes his investigation thus:

> When students were given control over their learning they sometimes had a better attitude but not always. Better attitude did not necessarily result in higher achievement; performance under learner control was the same as for control groups or worse. (p. 87)

Summary of Research on Learner Control

It is quite noticeable that of the studies cited as having positive results, only one of them (Flexibrod and O'Leary, 1974) yielded a significant result. In this study it was found that the Learner Control group was significantly more productive than the students who had the same externally imposed standards. This study stands out from the others because of the difference in approach used by the researchers. They included in their study, 'contingent reinforcement' (Skinner,1954). However when contingent reinforcement was withdrawn the learner control groups performance decreased, though not significantly.

Performance in other studies were described with phrases such as: "performed at least as well", "seemed better equipped to implement". It is quite evident that the effectiveness of Learner Control CAI programs varies. This variation may vary from worse (Judd, Bunderson and Bessent, Note 11) to significantly better (Flexibrod and O'Leary, 1974).

It should be noted that the studies which found no difference in performance when Learner Control is allowed, have only allowed students control over instructional sequence. This equality in performance can be explained by the findings of Klausmeier, Ghatala and Frayer (1974) that

variations in content sequence does not account for difference in learning. This idea is also supported by Tennyson (1972) and Lahey (1981). The conclusion then, is that content sequence is not crucial in a learner control model. Kaplan and Rothkopf (1974) discovered that a learner is capable of ordering content if given instruction on objectives.

There is obviously some discrepancy in the conclusions drawn by various studies. It is quite probable that this can be accounted for by the findings of Di Vesta (1955). He found that when tasks are large and complex students fail to make adequate decisions. It seems reasonable to suggest that the effectiveness of the learners' decisions varies with the complexity of the material.

It is under these circumstances that the advice of Bunderson (Note 12) that students need advice on management of time and review strategies is worth considering.

Research on Advisory Support

The inability to make wise decisions seems to be one of the main variables that affect students' performance in a learner control CAI program. This observation has prompted many researchers to include an advisory function in their program (Bunderson, Note 12). However, the effectiveness of

the advisory functions has not been examined. Faust (1974) suggests that students must be given a chance to use learning strategies they develop themselves and must be free to accept or reject any strategy advice. Steinberg (1977) questioned the willingness of students to follow a computer generated advising system.

Research dealing with variables of Learner Control (using large or complex learning tasks) has failed to demonstrate that students can make or carry out decisions of content element selection and personal learning assessment. The findings of Oliver (Note 7) agree with this. He gave students instruction in an imaginary science. He found the subjects who had Learner Control did worse than those whose instruction was under program control. Seidel (Note 13) had this to say concerning the apparent ineffectiveness of Learner Control, "learners may need experience and training to make self selection of sequence beneficial".

This study will pay particular attention to the effectiveness of an advisory function which allows students to have freedom of choice, provides them with early meaningful guidance and provides diagnostic prescriptive information.

Memory Support

In experimental learning tasks requiring minimal prior contextual knowledge (prerequisite) and simple content structure (e.g. use of only one or two concepts) the Learner Control strategy usually resulted in less time on task than a similar form of program control and with equivalent performance. However, in tasks having a complex content structure and more demanding prerequisite knowledge, outcomes are contradictory (Tennyson and Rothen, 1977). This observation is explained by the findings of Hunt (1961) and Cahill and Hovland (1960); when subjects cannot adopt a pure wholist strategy because of the nature of the task, and when prior information is no longer physically available, memory plays an important part in concept acquisition.

In the case of CAI, where subjects do not normally have access to prior information, it may be that the learners need memory support. Caldwell and Rizza (1979) suggests that "options should be incorporated into the instructional sequence which allow for review of previous frames". Dennis (1979) investigated the effect of display rate and memory support on correct responses, trials, total instructional time and response latency. Results showed that memory support was a significant factor in students' performances. This finding has also been supported by Leherissey O'Neil and Hansen (Note 14).

Statement of Purpose

The expectations of CAI designers have not been realized. It was anticipated that a Learner Control model would be ideal for CAI since the learner knows best about his needs. On the contrary, experiments on Learner Control in CAI have shown conflicting results. This has occurred not because Learner Control has failed but because research has failed to identify contributing and non-contributing variables in Learner Control.

As a result of the research done in this study, two variables stand out prominently as being crucial to the effectiveness of Learner Control: (1)Advisory Support and (2)Memory Support.

Memory Support was defined as the provision of unlimited access to any previously learned rules, concepts, or discriminations that are necessary to facilitate acquisition of any learned capability (Gagne,1977), and the provision of a map of the instructional path followed by the student (See Student's Reference Manual, Appendix C).

Advisory Support was defined as the providing of advice to the student with respect to (1) what rules, concepts and discriminations are necessary for the acquisition of any

learned capability and (2) the provision of diagnostic and prescriptive information for the student (See Student's Reference Manual, Appendix C).

It is the intention of this study to investigate whether the inclusion of Memory Support and Advisory Support in a Learner Control CAI program would improve learning or decrease the cost at which learning is acquired.

A positive finding from this study should restore confidence in Learner Control and encourage researchers to seek to identify more contributing variables so that output from the Learner Control model can be optimized.

CHAPTER 3

HYPOTHESIS

It was hypothesized that Advisory Support and Memory Support included in a Learner Control CAI program dealing with learning tasks having a complex content structure would result in a

1. difference in performance
2. difference in the cost of producing equivalent performance.

Rationale for Hypothesis 1

According to Gagne (1977), learning outcomes can be classified into 5 distinct categories:

1. Verbal Information
2. Intellectual Skill
3. Cognitive Strategy
4. Motor Skill
5. Attitude.

Intellectual skill has further been broken down into 5 sub-categories:

1. Discriminations
2. Concrete Concept
3. Defined Concept

4. Rule

5. Higher-Order Rule.

These learned capabilities are listed in order of complexity and are prerequisite to the learning of tasks at a higher level of the hierarchy. In order to demonstrate that one has acquired a learned capability at the rule level, one must have already acquired defined concepts, concrete concepts and discriminations.

Consequently when one engages in the learning of a complex rule, the ability to recall simpler rules, concepts and discriminations is vital to the learning process. When this ability is absent, the student will need to be aided in the recall of prior information and to be advised with respect to what prerequisites are necessary to enhance acquisition of competency in carrying out the learning tasks.

Rationale for Hypothesis 2

Studies which have sought to investigate time as a dependent variable have consistently reported the actual time spent by the students in acquiring learning objectives. Comparisons are normally made and conclusions drawn based upon the actual time.

Almost no attempt has been made to relate time or cost to score, which relation is the essence of efficiency.

In the study done by Tennyson et al. (1980) students were assigned to a Learner Control and an Adaptive Control CAI program. Time was one of the dependent variables investigated. It was found that the Learner Control group's time on task was significantly less than the Adaptive Control Group's time on task. It was also found that time on task was drirectly related to number of instances.(See Table 1).

Table 1

(From Tennyson et al., 1980)

Management Strategy	Content Structure: Simultaneous	Content Structure: Collective	Content Structure: Successive
	Post Test Correct Scores		
Adaptive Control	19.7	16.3	15.3
Learner Control	14.5	10.5	12.4
	Time On Task		
Adaptive Control	10.3	13.9	14.3
Learner Control	7.1	7.8	7.6

The conclusion drawn from this study was consistent with previous studies which compared Learner Control with Adaptive Control

1) Students under Learner Control took significantly less time
2) Students under Learner Control

used significantly fewer instances

3) Instructional time was not efficiently utilized by the Learner Control students

4) Students tend to exit from the Learner Control Program regardless of acquisition level.

However, a notable observation can be made from the data in Table 1. The mean score per minute (Score/Time) is higher for all three groups in the Learner Control model than the corresponding score in the Adaptive Control model.

This seems to indicate that even though students exited prematurely from the Learner Control program, their rate of acquisition of the Learning Objectives was faster than that for the Adaptive Control.

In the light of this observation this study was particularly interested in rate of acquisition, or in other words score per unit time as opposed to raw time since the former variable is more indicative of the efficiency of a CAI program.

There were two measures of time in this study (1) Central Processing Unit (CPU) time and (2) On-line time. These two measures were reduced to one common denominator, cost. The efficiency was measured in terms of cost per unit

score.

This cost per unit score is what is referred to as cost of producing equivalent performance.

Variables

There were five variables under consideration in this study, two dependent variables, two independent variables and one control variable.

Dependent Variables	1. Performance
	2. Cost of equivalent performance
Independent Variables	1. Memory Support
	2. Advisory Support
Control Variable	1. Content Structure

Operational Definitions of the Variables

Performance was defined as the score a subject obtained on the posttest (Appendix D) administered by the CAI program.

Cost was defined as the cost of computer time utilized by the student, the cost was measured in dollars and cents. The term 'equivalent performance' is emphasized in this study. It is measured in terms of cost per unit score.

Memory Support was defined as the availability of any previously learned rules, concepts, or discriminations that are necessary to facilitate acquisition of any learned capability. This was made possible through the mechanism stated in Appendix C.

Advisory Support was defined as the providing of advice to the student with respect to (1) what rules, concepts and discriminations he should acquire in order to enhance learning (2) what subject matter he should review in order to acquire concepts and rules which he appears to have problems with (3) what examples are relevant to the acquisition of skills appropriate to each practice incorrectly done by the subject. Advice was available through the mechanism stated in Appendix C.

Complex Content Structure

A learning task with a complex content structure was defined as one which requires as prerequisites (1) Rules (2) Concepts(defined) (3) Concepts(concrete) and (4) Discriminations.

'Learnner Control' was defined as a CAI learning environment in which the student has control over: (1) The sequence in which he receives rules, definitions, examples,

practice, objectives, rationale, advice (2) Lesson duration (3) the number of examples and practice problems received (4) the presentation or recall of prior information, ie. rules, concepts, discrimination, etc.

Anticipated Results

1. It was anticipated that there would be a significant difference in learning performance and cost as a result of the effect of Advisory Support in a Learner Control CAI program.
2. There would be a significant difference in learning performance and cost as a result of the effect of Memory Support in a Learner Control CAI program.
3. There would be a significant interaction between Advisory Support and Memory Support.
4. A lapse of a 1 week time span will not result in a signiificant difference in performance.

All hypotheses were tested at the .05 level of statistical significance.

CHAPTER 4

Methodology

Research Design

The design of this study conformed to that of an Independent Group Comparison 2 x 2 Analysis of Covariance factorial design with one repeated measure. The two factors considered were:

(1)Memory Support

(2)Advisory Support

Each factor had 2 levels:

(1) Memory Support/no Memory Support (MS/NMS)

(2) Advisory Support/no Advisory Support (AS/NAS)

The design yielded 4 distinct independent groups:

No Memory Support and No Advisory Support(NMAS)

No Memory Support and Advisory Support(AS)

Memory Support and No Advisory Support(MS)

Memory Support and Advisory Support(MAS).

Covariate

The covariate for this study was pretest scores.

Repeated Measures

The repeated measure was a delayed posttest (Appendix D) administered to the same students one week after the completion of the experiment.

Sample Selection

There were 65 students who volunteered to participate in the study. There was a specific requirement for qualification as a valid subject. All students must have been either currently or previously enrolled in a computer programming course. This requirement was set in order to ensure their familiarity with the fundamentals of programming.

Recruitment

Participants were recruitted by means of leaflets (Appendix A) and word of mouth. During this recruitment procedure they were made aware of the entry requirements.

Mortality

There were four students who failed to complete the study. Two students excercised their right to END and the data for the other two were lost because of system failure.

Group Assignment

A quasi random assignment to treatment procedure was used. The study lasted for a period of three weeks. Each day of the experiment was divided into 3 time slots on the experiment registration form (Appendix B). Each time slot was sequentially assigned one of the four groups. The students were then asked to select a time and day that was most suitable to them. Consequently they were automatically assigned to groups based upon their arrival and selection of time slots. This procedure accounted for the assignment of 15 students to each of the three groups and 16 in the fourth.

Assignment of Manuals

The reference manual (Appendix C) was immediately distributed when the student registered for the study. This resulted in some students having the manual longer than others. To test the effect of this a correlation was done between time spent reading the manual and posttest scores. This was found to be non-important ($r = -.11$, $p = .20$).

Assignment of Terminals

Two Televideo 920 terminals were used in this experiment. The terminals operated at 9600 baud rate and 1200 baud rate. Every time slot accommodated 2 students. As those students arrived the first was assigned to the 9600 baud rate terminal. Since the experiment was conducted over 3 weeks from Monday to Saturday there were 108 time slots. Consequently, approximately 75% of the students from each group was assigned to the 9600 baud rate terminal and 25% to the 1200 baud rate terminal. This equivalence in terminal assignment accounted for any existing terminal variability.

Administration

Pre-treatment

When the subject arrived, before commencing the study the following procedures were taken:

1. Students were asked if they had read the manual.
2. If the manual was not read, approximately 10 minutes were allowed for reading.
3. If the students had any questions concerning the content of the manual these were discussed and further explained.
4. The manual was totally free of lesson content since it was not designed to complement the program. Hence the prediscussion focused on the methodology of the program only. This procedure seemed necessary because of the novelty of the experiment and since the students were not tested on their knowledge of the manual.
5. Subjects were again reminded of the entry requirements and at that time they were free to opt out of the study.
6. Subjects were also briefed on the operation of the terminal.

During Treatment

The study commenced with a pretest (Appendix D) followed by the appropriate treatment for the particular group, then the postest. Students were allowed to keep and use the manuals during the experiment. Since this was a Learner Control program it was necessary at times to answer questions relevant to the operation of the program. If a question was asked pertaining to the lesson content students were told these questions could not be answered.

Post Treatment

After the posttest was completed students were given an attitude questionnaire (Appendix E) to complete. Attitude was not a dependent variable in this study, the questionnaire was administered merely to inventorize students' feelings with respect to the program.

Upon completion of the questionnaire students were told their score on the posttest and were given a sealed envelope which contained the delayed posttest to be completed in one week.

The delayed posttest was completed when the week was over and was delivered by mail, in person or by messenger

service.

Some students were late in delayed posttest completion. As a result it was necessary to examine the correlation between delayed posttest scores and length of time between posttest and delayed posttest completion. The correlation was non-important (r= -.38, p = .001).

Data Collection

All data gathered in this study were stored on a student file. On this file each student had a record with the following statistics:

1. ALCCAIP (Record Identifier)
2. Time Begun
3. Date
4. Student's Name
5. Time at Commencement of pretest
6. Pretest Answers
7. Time at Termination of pretest
8. Practice Answers
9. Time at Commencement of posttest
10. Posttest Answers
11. Time at Termination of posttest
12. Sequence of Instruction
13. CPU Time at pretest Commencement
14. CPU Time at pretest Termination
15. CPU Time at posttest Commencement
16. CPU Time at posttest Termination
17. Score on pretest
18. Score on posttest
19. Number of advice instances received
20. Number of instances received.

CHAPTER 5

CAI Program

Content Description

The CAI program was designed to teach the use of 8 string functions in BASIC programming. The eight string functions taught were:

1. LEN(SE)
2. TRM$(SE)
3. PAD$(SE,NE)
4. LEFT$(SE,NE)
5. RIGHT$(SE,NE)
6. RPT$(SE)
7. POS(SE1,SE2,NE)
8. MID$(SE,NE1,NE2)

This subject matter was chosen because it conformed to the demands of this study, i.e., a complex content structure. Before the student is able to apply the use of functions or solve problems that involve their use, it is necessary to be extremely familiar with the pre-requisite rules, concepts and discrimination that pertain to variables, constants and expressions. A detailed content analysis can be found in Appendix E.

Content Structure

The lesson content for the computer-assisted instruction program formed a rich data base (Appendix H) of all topics that were related or connected to the main topics discussed above. There were 30 topics and each was connected to (1) those topics for which itself was a pre-requisite and (2) those topics which were pre-requisite to it (Mitchell, 1982). In figure 1 this this relational connection for the concept "se" is illustrated.

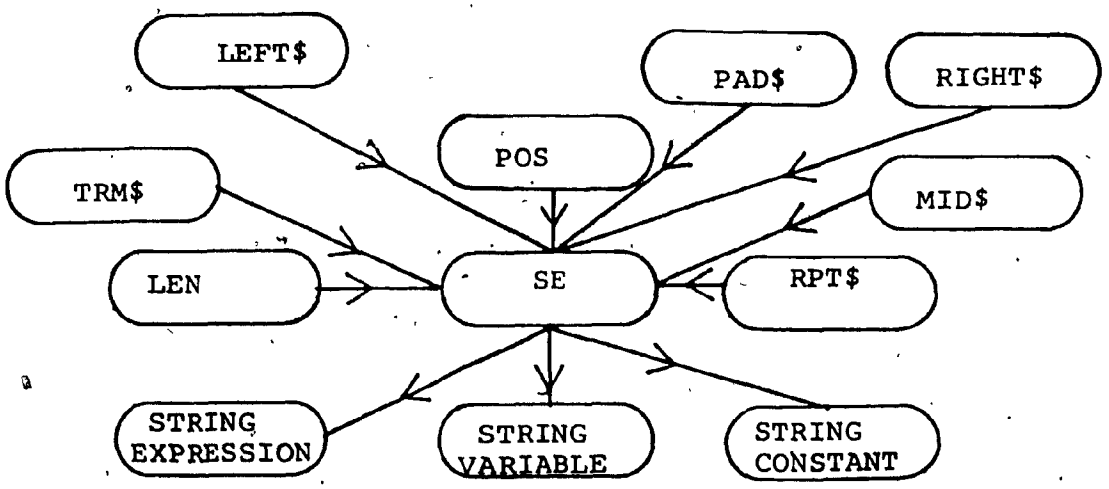

FIGURE 1

Relational Structure of Concept "se"

This relational connection for all 30 topics is stored within the program.

Program Methodology

Instance Presentation

Under the control of the learner there were six different types of instances available for each of the 30 concepts in the study.

1) Rationale
2) Objectives
3) Advice
4) Rules and definitions
5) Practice
6) Examples

These instances could have been requested in any sequence and with unlimited frequency subject to the limitations of the treatment being received.

A detailed explanation of these instances and the relevant commands which activated their presentation are documented in the Learner's Reference Manual (Appendix C).

Program Commencement

The program first presented preliminary introductory information, mainly a reminder or a reinforcer of what was read in the manual.

Secondly the pretest was presented. Students had the option of skipping questions on the pretest. At the end of the pretest they were given the option of redoing the questions skipped or going on to the lesson.

Thirdly, at the commencement of the lesson they were given:

1) The Lesson Objective
2) The Rationale
3) The Advice.

Advice for the lesson applied to the 8 string functions which the student had to learn to use.

From there on the student was on his own to use the available commands in conjunction with concepts and sub-concepts in order to acquire the learning objectives. (See Appendix G for sample session).

Table 2

Description of Group Treatment

Features Available to Group	MAS	AS	MS	NMAS
Ask For Advice	*	*		
Receive Advice on incorrect answer	*	*		
Receive Advice on appropriate examples	*	*		
Ask for reminder of instructional sequence followed	*		*	
Unlimited Information Access	*		*	
Allowed only one viewing per instance		*		*
Receive answer on incorrect response	*	*	*	*
Allowed to see list of available concepts	*	*	*	*
Unlimited Time	*	*	*	*
Attempt Post Test any time	*	*	*	*
Ask for Objectives	*	*	*	*
Ask for Rationale	*	*	*	*
Ask for Examples	*	*	*	*
Ask for Practice	*	*	*	*
Ask for Rules or Definitions	*	*	*	*

Table 2 has summarized the main features of the CAI program which were allowed or disallowed to each group.

There was no fixed instructional path through the lesson. The instruction received was dependent on the student's entry knowledge and his selection strategy. Through experience and practice students learned to select the optimal amount of instruction necessary. (See Appendix F for a detailed content analysis and Conceptual Entailment Structure).

Objectives for the CAI Lesson

It was expected that at the end of the lesson, Ss would have been able to:

1. correctly employ the use of string functions to solve problem situations presented to them
2. correctly evaluate the solution to given pre-written statements in Basic programming.
3. identify any irregularity or invalidity that may be present in statements in Basic which utilize the functions covered in this lesson.

Rationale for Objectives

These objectives could not be realized if the student:

1. did not know the purpose for each function
2. could not correctly apply the rules of evaluation
3. did not acquire all pre-requisite rules, sub-rules, concepts, and discriminations that pertained to the use of the string functions.

CHAPTER 6

Evaluation

Formative

There were 3 areas of this study which were subjected to evaluation and revision:

1. The Reference Manual
2. The Program
3. The Test.

Reference Manual

Eight students participated in a pilot study on the manual. These students were asked to read the manual and offer comments and feedback. As a result of suggestions made, the manual was redesigned in order to produce the final product. Criticisms were concerned with:

1. Grammatical Constructs
2. Difficult technical terminologies
3. Ambiguous statements
4. Redundant statements
5. Positioning and sequencing of content.

Program

Five students particiapted in a pilot study to evaluate the program. Two were placed in the AS group, and one each in the MAS, MS and NMAS groups. As a result of the comments the following steps were taken:

1. Restructuring of the Advice function
2. Improvement of the relevance of the examples and practice to the posttest
3. Enabling the student to do questions skipped on tests
4. Providing answers for examples and practices if done incorrectly
5. Allowing students to see all the topics
6. Provision of 3 examples and 3 practices on the 8 main functions to be learned.

Summative

Test Construct and Analysis

The test for this study comprised 20 items. Twelve were multiple choice and eight were problem solving open ended questions. These latter eight were more difficult (Table 3), hence they were given two points each. The

multiple choice were given one point each. As a result the maximum score possible was 28.

Scoring

The test papers were primarily scored by the computer and subsequently adjusted by the scorer, since the program evaluation system could not make adjustments for transmission errors, the inclusion of blanks which did not nullify an answer, and the exclusion of minor details such as quotes in an open ended question. The paper was subsequently re-marked without knowledge of the student nor the group to which the student belonged.

Test Analysis

Among the factors which enhance the quality of a test three of the most critical are:

1. Test difficulty
2. Test reliability
3. Test discriminability
4. Test relevance

The test for this study was analysed based upon the above four qualities.

Test Item Difficulty

In Table 3 a Test item difficulty chart is shown. The least difficult items had a percentage of 75. The open ended problem solving questions had a higher level of difficulty than the multiple choice questions. In order to appreciate the overall difficulty of the test the reasoning of Ebel becomes applicable (Ebel, 1972).

> In most classroom situations a test in which the average score is somewhat more than half the maximum possible score will be appropriate in difficulty. p. 375

Average Score	17.426
Half Maximum Possible Score	16

Table 3

Item Difficulty Report

Item Nos.	Difficulty Index	Item Nos.	Difficulty Index
1	19%	2	22%
3	28%	4	59%
5	22%	6	22%
7	16%	8	22%
9	28%	10	34%
11	59%	12	31%
13	75%	14	41%
15	49%	16	50%
17	48%	18	53%
19	38%	20	42%

Test Reliability

Richman, Mofrides and Prince (Note 15) pointed out different methods of reliability measurement which tap different aspects of reliability. Two of them are

1. Test-retest reliability which measures the tendency of the instrument to be stable over time
2. Internal consistency reliability which measures the degree of consistency among the different items.

Test-Retest Reliability

The test-retest reliability for this study was measured by correlating posttest scores with delayed posttest scores. This was found to have a correlation of .90, $p < .001$.

Internal Consistency Reliability

Two methods were used to measure internal consistency

1. The split-half procedures
2. The Kuder Richardson Formula (KR21) (Ebel, 1972, pp.419, Appendix J).

Under the split-half procedures after adjustment with

the Spearman-Brown prophecy formula, the reliability was calculated to be .92. Using KR21, r was calculated to be .86 (Appendix J).

Item Discrimination

The ability of a test item to discriminate between high scorers and low scorers is one of the most important qualities of a test. This quality is even more crucial to the effectiveness of the test when the test's principal function is to distinguish different levels of achievement as clearly as possible (Ebel, 1972).

In order to investigate the discriminating power of the test items two analyses were done, one was the calculation of an item discrimination index according to Ebel's formula (Ebel, 1972) and the other was a discriminant analysis.

Table 4 presents the discrimination index for each item. Eightyfive percent of the test items could be classified as high discriminators and 15% as fair discriminators, there were no low discriminators.

The results of the discriminant analysis (Table 5) also agreed with the latter analysis. As shown by the Wilks Lambda statistic (Table 5) items with the largest Wilks Lambda had the least discriminative power. On the entire

test the overall Wilks Lambda was .0033 and the cannonical correlation was .998 (Table 6).

The items that were among the 85% identified as high discriminators using Ebel's formula (Ebel, 1972), were also identified through the discriminant analysis.

Table 4

Item Discrimination Report

Indices	Item Nos.	Indices	Item Nos.
.95		.90	17 18
.85	15	.80	20 16 14
.75		.70	19
.65		.60	12
.55	9 10	.50	13
.45	3	.40	5 6 8
			2 11
.35		.30	4 7
.25	1	.20	

41 - 100	High Discriminators	85%
20 - 40	Fair Discrinators	15%
01 - 19	Low Discriminators	0%
< 0		0%

Table 5

Wilks Lambda (U-Statistic and Univariate F-Ratio with 1 and 30 degress of freedom

Variable	Wilks Lambda	F	Significance
Item 1	.89744	3.429	.0739
Item 2	.72	11.67	.0018
Item 3	.60870	19.29	.0001
Item 4	.89879	3.378	.0760
Item 5	.72	11.67	.0018
Item 6	.72	11.67	.0018
Item 7	.81481	6.818	.0140
Item 8	.72	11.67	.0018
Item 9	.60870	19.29	.0001
Item 10	.64935	16.20	.0004
Item 11	.80162	7.424	.0106
Item 12	.54545	25.00	.0000
Item 13	.66667	15.00	.0005
Item 14	.27584	78.76	.0000
Item 15	.11627	228.0	.0000
Item 16	.14033	183.8	.0000
Item 17	.10817	247.4	.0000
Item 18	.05717	494.7	.0000
Item 19	.30947	66.94	.0000
Item 20	.21951	106.7	.0000

Table 6

Total Test Discriminability

Function	Eigen Value	Percent of Variance	Canonical Correlation
1	303.70541	100	.998
Wilks Lambda	CHI Squared	DF	Significance
.003	114.37	20	.000

Relevance

No statistical analysis was done to determine the relevance of test questions to lesson content. However this aspect of the test quality was covered in the questionnaire. Eighty five percent of the students agreed or strongly agreed that the lesson content was relevant to the posttest.

Test Analysis Summary

The conclusion drawn concerning the test was that its relevance, reliability, discriminability and difficulty was sufficiently acceptable to have enabled the test to be an adequate measuring instrument for the dependent variable in this study.

Table 7

Attitude Analysis

Item	Agree	Neutral	Disagree
1. Motivation	84%	13%	3%
2. Program Familiarity	52%	18%	3%
3. Challenge	69%	28%	3%
4. Instruction Clarity	84%	10%	6%
5. Interest	84%	8%	8%
6. Performance	54%	16%	30%
7. Response Clarity	69%	11%	20%
8. Time Needed	54%	11%	34%
9. Content Relevance	95%	3%	2%
10. Manual Helpfulness	59%	26%	15%
11. Willing to try again	72%	16%	12%

See Appendix E for Actual Items

As pointed out attitude was not a dependent variable in this study. Consequently no attempt was made to do any statistical analyses on items except tabulations of relative percentage frequencies (Table 7).

CHAPTER 7

RESULTS

Data Analysis-Cost Estimate

The cost figure applied in this study are strictly the cost of using the Control Data Corporation System at Concordia University.

These cost figures may not be applicable to other systems since cost varies from installation to installation. The two cost dimensions considered in this study were (1)Cost per unit on-line time $.15/minute (2) Cost per CPU second $.19/per CPU second (These are the commercial rates charged by the University).

Total Cost was computed using the following formula, Total On Line time * .15 + Total CPU time * .19. The dependent variable Cost Per Unit Score was computed using the folowing formula.

Total Cost / (Post Test Score - Pre Test Score)

i.e., Total Cost / Gained Score.

Restatement of Hypotheses in Null Form

1. There is no difference between the effect on cost and performance produced by Advisory Support (AS) at the .05 level of significance.
2. There is no difference between the effect on Cost and performace produced by Memory Support (MS) at the .05 level of significance.
3. There is no interaction between Memory Support and Advisory Support at the .05 level of significance.

Of a secondary interest to this study was the effect of repeated measures on performance.

Hypothesis Testing

To test the Hypotheses an Analysis of Covariance was done with the scores on the 1 week delayed posttest used as repeated measures and pretest scores used as the covariate.

Homogeneity of Regression Slopes

The Analysis of Covariance was employed in this study because it has the ability to test the Null Hypothesis that

two or more adjusted population means are equal. The Analysis of Covariance adjusts the dependent scores for each group to what it would have been if all groups had had exactly the same covariate mean (Huitema,1980, pp.31).

Since the Homogeneity of regression slopes is a necessary requirement for the Analysis of Covariance it was mandatory to test the Null Hypothessis of no difference in Regression Slopes. The Statistical Analysis is reported in Table 8.

Table 8

Homogeneity of Regression slopes

Source	SS	DF	MS	F
Heterogeneity of slopes	52.15	3	17.38	.42
Individual residuals	2189.34	53	41.31	
Within residuals	2241.49	58		

The computed F statistic is .42
The tabulated F statistic is 2.76 ($p<.05$)
Hence the Null hypothesis was accepted and the conclusion drawn that the regression slopes are homogenous.

Table 9

Analysis of Covariance

Dependent Variable- Performance

Source	Sum of Squares	DF	Mean Square	F	Tail Prob.
Mean	22056.42	1	22056.42	262.13	.00
AS	153.55	1	153.55	1.82	.18
MS	577.49	1	577.49	**6.86	.01
MAS	7.98	1	7.98		
Covar	831.73	1	831.73	*9.88	.0027
Error	4712.08	56	84.14		

* P < .05 ** P < .01

Advisory Support

The calclated F value for the effect of AS is 1.82. The tabulated F value was 4.08. The null hypothesis was therefore accepted and the conclusion drawn that there was not sufficient evidence at the .05 level of significance to indicate that AS has an independent effect on performance (Table 9).

Memory Support

The calculated F value for the effect of MS was 6.86.

Since this exceeds the tabulated value of 4.08 the null hypothesis was rejected and the conclusion drawn that there is sufficient evidence at the .05 level of significance to indicate that MS has an independent effect on performance (Table 9).

Interaction Effect

The calculated F value for the interaction effect between MS and AS was non-significant. The Null hypothesis was accepted and the conclusion drawn that there is no significant difference in performance due to the interaction of MS and AS (Table 9).

Table 10

Results of Analysis on 2nd Dependent Variable

Cost

Source	Sum of Squares	DF	Mean Squares	F	Tail Prob.
Mean	139.46	1	139.46	95.24	.00
AS	.00	1	.00	.00	.97
MS	6.16	1	6.16	4.21	.04
MAS	2.01	1	2.01	1.37	.25
Error	83.46	57	1.46		

The Null hypotheses for the 2nd dependent variable were

1. There is no significant difference in cost due to the effect of AS.
2. There is no significant difference in cost due to the effect of MS.
3. There is no significant difference in cost due to the interaction of MS and AS.

Hypothesis 1 was accepted. The computed F was .00. The tabulated F value was 4.13. The conclusion drawn was that AS does not account for a significant difference in cost.

Hypothesis 2 was rejected. The computed F was 4.21. The tabulated F value was 4.13. The conclusion drawn was that there is sufficient evidence at the .05 level of significance that MS does contribute to decrease in cost in a Learner Control CAI program.

Hypothesis 3 was accepted. The computed F value was 1.37 which is less than the tabulated F value of 4.13. Hence, the interaction of MS and AS does not contribute to a decrease in cost.

Repeated Measures

Of a secondary interest to this study was the effect of repeated measures on performance. The Null Hypothesis was

1. There is no difference in performance on test scores taken one week apart by the same students.

Table 11

Analysis of Repeated Measures

Source	Sum of Squares	DF	Mean Squares	F	Tail Prob.
Repeated	17.65	1	17.65	2.81	.10
Rep/AS	.18	1	.18	.03	.86
Rep/MS	.24	1	.24	.04	.84
Rep/MAS	5.02	1	5.02	.80	.37
Error	357.46	57	6.27		

The analysis showed that 'Repeated Measures' was not a significant factor, neither did it interact with any of the treatments to produce changes in performance (Table 11).

CHAPTER 8

Conclusion Suggestions Recommendations

Conclusion

The foundation of this study was based upon the premise that the efficiency of a Learner Control CAI program can be optimized through the manipulation of independent variables and identification of appropriate dependent variables.

Two dependent variables, performance and efficiency, were measured in this study. Performance on test scores was chosen because it is a good measure of the standard of acquisition level of each student. Efficiency was chosen because it measures the rate at which learning objectives are acquired and if this rate could be improved then cost would consequently be decreased.

From a statistical standpoint the results of this study definitely demonstrated that Memory Support significantly contributes to the improvement in performance in a Learner Control CAI program in which a complex subject matter content is dealt with. Memory support also contributed to an increase in the rate of learning thereby effecting a significant decrease in cost.

It was difficult to assess the true effect of Advisory support because of the two categories of students that were in the AS group (1)those who had advice and took it and (2)those who had advice and did not take it. Personal observation revealed that those who took the advice tended to do better than those who refused it.

Advisory support is an expensive function in a CAI program. There was a tendency for AS to improve learning. However, this improvement was greater when MS was present. There were no statictically significant effects for Advisory support.

The personal comments of some students expressing their unwillingnes to be told what they should do or where they should go revealed some reasons why AS was not effective. Probably if the presentation of advice was left totally to the discretion of the students better results would have been realised.

Suggestions and Recommendations

The main concentration for future research in Learner Control should be on Advisory Support. This study revealed that though it can be helpful, it is ignored by many students.

Students preferred to learn by Examples, Definitions, Practice and Errors and consequently in some cases could not adequately grasp a concept because of their lack of understanding of prior rules, concepts and discriminations which they needed to know.

In order to tap the real effect of Advisory Support it may be neccessary to examine the performance of students who actually took the advice as opposed to those who did not take the advice.

Many studies have compared the Learner Control model with the Adaptive Control and have found greater effectiveness for the Adaptive Control. The design of this study incorporated aspects of adaptiveness except that students were responsible for the adaptive decisions. A Learner Control CAI program with this methodology might be worth comparing with an Adaptive control program.

Most students are not familiar with the depth of power and versatility that is available in a Learner Control program. Even the use and function of the advice command is not well explored by new students. It may be interesting to examine whether performance improves as familiarity with Learner Control models improve.

One notable unexpected observation was that students who spent a longer time viewing instance presentations did worse than those who spent a shorter time. This seems to suggest that if the instructional strategy of a Learner Control CAI program is very efficient then better effects would be produced by viewing more instances than viewing instances for a longer period of time.

Finally, Memory is a very important factor in CAI. Many Ss who did not have Memory Support attributed their performance to their ability to store facts and information in various ways.

It is believed that if more ways can be developed by which storage and recall of concepts and rules can be enhanced then even greater effect will be had from any Learner Control CAI program that deals with subject matter having a content structure as complex as was dealt with in this study.

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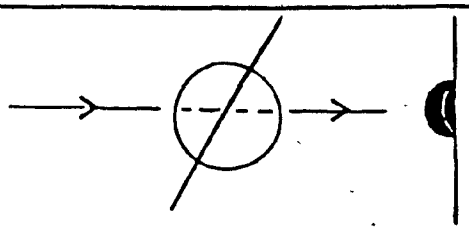
Appendix A

Leaflet



ALCAIP is here!
ALCAIP is here !
ALCAIP is here!
ALCAIP is here !

ALCAIP is a "CAI" program, designed to:

-Enhance the delight of learning.

-Give you hands on experience with tele-video terminals.

-Challenge and intrigue you.

-Allow you to directly participate and interact with the lesson content.

Would you like to be a part of the ALCAIP experience ?

Call any of the following numbers to set an appointment:

879-8476 (Lionel Douglas)

342-5094

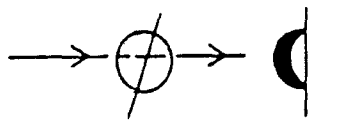
933-4884

Appendix B

Registration Form

AlccaiP

ALCCAIP



22/03 - 03/04

DATE	NAME PHONE		NAME PHONE		NAME PHONE	

Appendix C

Reference Manual

REFERENCE MANUAL TO ALCCAIP

BY

LIONEL L. DOUGLAS

CONCORDIA UNIVERSITY (1982)

INTRODUCTION

Every Computer Assisted Instruction (CAI) Programmer should be skillful in the processing of strings (a collection of characters).

At the elementary level the CAI programmer knows how to work with information represented as VARAIBLES, CONSTANTS or EXPRESSIONS. But how can one process portions of information to increase programming efficiency.

The only simple way to do this is by making use of STRING FUNCTIONS. There are more than 15 string functions that can be used in BASIC programming.

In this course 8 of the most common functions are introduced and explained by means of 'ALCCAIP'; A Learner Controlled Computer Assisted Instruction Program.

Besides these 8 String Functions, lessons are also provided on other COncepts that you may not understand.

This Reference Manual is designed to familiarise you with the way 'ALCCAIP' works.

MANUAL TO ALCCAIP

ALCCAIP (AL-CAPE) IS A Learner Controlled Computer Assisted Instruction Program.

This program is uniquely different from most CAI programs that you may have previously used.

It offers you the Learner the unique privilege of controlling and organizing your own learning process. This means that every bit of information you recieve will be supplied at your command or request.

Hence you have 14 commands at your disposal with which you can guide yourself in any direction at any pace through the lessons.

INDIRECT COMMANDS

There are 7 indirect commands:

1. RA for Rationale
2. OB for Objectives
3. AD for Advice
4. RD for Rule or Definition
5. EX for Examples
6. PR for Practice
7. RV for Revising and Reviewing

DESCRIPTION OF COMMANDS

1. RA This command gives you a reason or rationale for studying the COncept.

2. OB This command tells you what you will be able to do after doing the lesson.

3. AD This command advises you about what rules and COncepts are pre-requisite to the COncept you will be currently studying.

4. RD This command gives you the rules or the definitons that are necessary to acquire understanding of the COncept you are studying.

5. EX This command makes available examples of the COncept or rule in use.

6.PR The PR command enables you to test your acquisition of the COncepts and rules through practice.

7.RV This command enables you to revise or review previously learnt material. It does not give you access to material you have not previously studied.

Rule 1

These are called indirect commands since they may be entered alone or may be followed by a COncept.

eg. OB,VARIABLE
OB VARIABLE
OBVARIABLE
OB

These are all valid examples of the use of the OB command. NOTE: Commands and COncepts may be separated by a comma, space or nothing.

Rule 2

If an indirect command is entered alone (ie. with no COncept) the previous COncept will be assumed

eg. If you had previously entered,
RA,EXPRESSION
and then you enter: RD
It will be assumed you want
RD,EXPRESSION.

Rule 3

As a converse to rule 2, if a COncept is entered alone the previous command will be assumed. (Note, in this sense COncepts can be used as commands).

eg. If you had previously entered,
EX,FUNCTION
and then you enter IDENTIFIER
it will be assumed that you want
EX,IDENTIFIER.

Summary: EVERY COncept or command remains in force until a new COncept or command is entered.

EXCEPTION

If RV is entered without a COncept, you will be shown the COncepts you have already studied and be asked to choose which you wish.

DIRECT COMMANDS

These are called DIRECT commands because they are directly understood by the program. They must not be followed by any COncept. There are 7 direct commands:

1. NExt for Next frame
2. HElp for Help
3. COncepts for a list of COncepts
4. CM to see commands
5. POst for Post Test
6. PAss to pass test questions
7. ENd to end

DESCRIPTIONS

1. The 'NExt' command provides the next block of instructional information based upon the sequence of the lesson content.

2. The 'HElp' command provides assistance and explanations to any difficult procedure.

3. The 'COncepts' command enables you to see a display of the 30 COncepts covered in this lesson. Since the screen cannot accommodate all 30 they will be displayed in groups of 18.

4. The CM command will supply you with a list of all the valid commands recognized by 'ALCCAIP'.

5. The 'POst' command will give you the POST-TEST for this Lesson. NOTE: Please do not ATTEMPT to complete this test until you are sure you have mastered the use of the 8 string functions.

After this test your session will be automatically terminated.

6. The 'ENd' command will automatically and immediately shut down all operations. This is an emergency command and should only be used when it is absolutely necessary.

Rule 4

At least the first 2 characters of all direct commands must be entered in order to be recognized. The following are all valid forms of the COncepts command:-

1. CO
2. CON
3. CONC
4. CONCE
5. CONCEP
6. CONCEPT
7. CONCEPTS

OTHER FINE POINTS

When a COncept is being entered, you need not type the entire COncept. In fact only sufficient letters such that the COncept required can be uniquely identified.

eg. If the instructional sequence has the following COncepts:

STRING

STRING FUNCTION

STRING CONSTANT

STRING VARIABLE

IF YOU WANT TO ACCESS STRING VARIABLE you must

at least enter STRING VAR.

HOW TO BEGIN

FINALLY your greatest worry might be How or WHERE must I begin.

Remember 'ALCCAIP' begins with an explanation on the use of STRING FUNCTIONS. However if this is too difficult for you, you have control over 'ALCCAIP'.
Use the AD command if you want advice on what to study first.

Use the NExt command to go sequentially when you wish.

Use the PRactice command to test your understanding.

Use the EXamples command when you do not understand a rule or a definition.

Use the RV command to revise and review your work.

Use the RD command to see rules or definitions.

If you want to be sure about what is available then use the "COncepts" command.

Manipulate yourself through the study always remember:-

YOU ARE IN CONTROL.

ON THE WHOLE I SHOULD NOT BE TELLING YOU WHAT TO DO. YOU ARE THE LEARNER AND YOU ARE IN CONTROL. REMEMBER:-

THIS IS 'ALCCAIP' A Learner Controlled Computer Assisted Instruction Program.

GOOD LUCK.

Appendix D

Pretest Posttest Delayed Posttest

1. 1. LEN (D6)
   2. LEN ("B6")
   3. LEN (D6$)
   4. LEN (D6$ + "D6")

   WHICH OF THE ABOVE STATEMENTS IS INVALID ?

2. 1. RTRM$(B$)
   2. RTRM$(B$+C$)
   3. LTRM$(" YESTERDAY")
   4. LTRM$(B$ + 10)

   WHICH OF THE ABOVE STATEMENTS IS INVALID ?

3. 1. RPAD$(B$,C$)
   2. LPAD$(B$, 2*6)
   3. RPAD$("MONDAY",A/3)
   4. LPAD$(B$,A6)

   WHICH OF THE ABOVE STATEMENTS IS INVALID ?

4. 1. POS (B$,D$,3)
   2. POS ("MONDAY"+"TUESDAY","DAY",4)
   3. POS (A$,B2$,B12)
   4. POS (A$+"12","12"+"6",A**2)

   WHICH OF THE ABOVE STATEMENTS IS INVALID ?

5.
WHICH OF THE FOLLOWING IS INVALID ?

1. RIGHT$(A$,3)
2. LEFT$(A$+B$+C$,6+7)
3. LEFT$(A$+"MONDAY",6)
4. RIGHT$(B$+BOY$5)

6.
1. MID$ ("ELEPHANT",2,4)
2. MID$ ("ELEPHANT","2",4)
3. MID$ (E$,2*A,B*C)
4. MID$ ("YES"+B$,2+6,2*3)

WHICH OF THE ABOVE STATEMENTS IS INVALID ?

7.
1. RPT$ ("81X",5)
2. RPT$ (A$,5+2)
3. RPT$ (23,2)
4. RPT$ (S$,S1)

WHICH OF THE ABOVE STATEMETS IS INVALID ?

---

8. GIVEN THE BASIC STATEMENTS BELOW:

B$ = "MONDAY"
C$ = "TUESDAY"
D = LEN (B$ + C$)

THE VALUE OF D IS

1. B$ + C$
2. MONDAYTUESDAY
3. 13
4. 5

9.
GIVEN THE BASIC STATEMENTS BELOW :-
A$ = RTRM$("SUNDAY ")
B$ = A$ + "MORN"
THE VALUE OF B$ IS :-
1. SUNDAYMORN
2. SUNDAY MORN
3. "SUNDAY""MORN"
4. A$ + "MORN"

10. GIVEN THE BASIC STATEMENTS BELOW
G$ = "HISTORY"
A = 3
H$ = RPAD$(G$,A*A)
THE VALUE OF LEN(H$) IS :-
1. HISTORY
2. 16
3. 7
4. 13

11. GIVEN THE BASIC STATEMENTS BELOW:
A = 2
A$ = "POSSESSES"
D = POS (A$,"S",A**(5-3))
THE VALUE OF D IS
1. 3
2. 4
3. 6
4. 5

12. GIVEN THE BASIC STATEMENTS BELOW
B = 3
C$ = "MANIPULATION"
E = 4
A = 2
D$ = MID$ (C$,A**B-A,A*B)

WHAT IS THE VALUE OF D$

13. GIVEN THE BASIC STATEMENTS BELOW:

```
B = 4
C$ = "000"
D$ = "1" + RPT$(C$,4)
```

THE VALUE OF D$ IS :-

1. 1000000000000
2. CCCC
3. 1000
4. 1C$,4

14.

IF A$ = "CONCENTRATION"

WRITE ONE BASIC STATEMENT WHICH WILL

DETERMINE THE SIZE OF THE STRING

VARIABLE A$.

15.

IF B$ = "HONEY"

WRITE ONE BASIC STATEMENT WHICH WILL

INCREASE THE SIZE OF THE STRING VARIABLE

TO 15 CHARACTERS, BY ADDING BLANKS TO THE LEFT.

16.

WRITE ONE BASIC STATEMENT THAT WILL

CUT THE THREE BLANKS FROM THE RIGHT OF

THE STRING CONSTANT "MONDAY ".

17.

WRITE ONE BASIC STATEMENT WHICH WILL FIND THE LOCATION IN THE STRING CONSTANT "MATHEMATICS" WHERE THE WORD "THE" BEGINS.

18.

GIVEN THAT : A$ = "TECHNOLOGY"
B$ = "BEAUTICIAN"

USE ANY OF THE FUNCTIONS THAT YOU HAVE STUDIED IN THIS LESSON TO PRODUCE THE SORING "TECHNICIAN" FROM THE 2 STRING VARIABLES.

19.

WRITE 1 BASIC STATEMENT WHICH WILL

CAUSE THE STRING CONSTANT "BIG"

TO BE REPEATED 6 TIMES.

20.

GIVEN A STRING CONSTANT "TREMENDOUS"

WRITE 1 BASIC STATEMENT WHICH WILL

EXTRACT THE STRING "MEN" FROM IT.

Appendix E

Attitude Questionnaire

Name: _____

Attitude Questionnaire

You have just completed the Learner Controlled Computer Assisted Instruction Program. I am sure that you have some feelings to express. Please express your feelings about the CAI program by rating the following statements on a scale of 1 to 5 depending on how much you agree with the statement. Circle your choice.

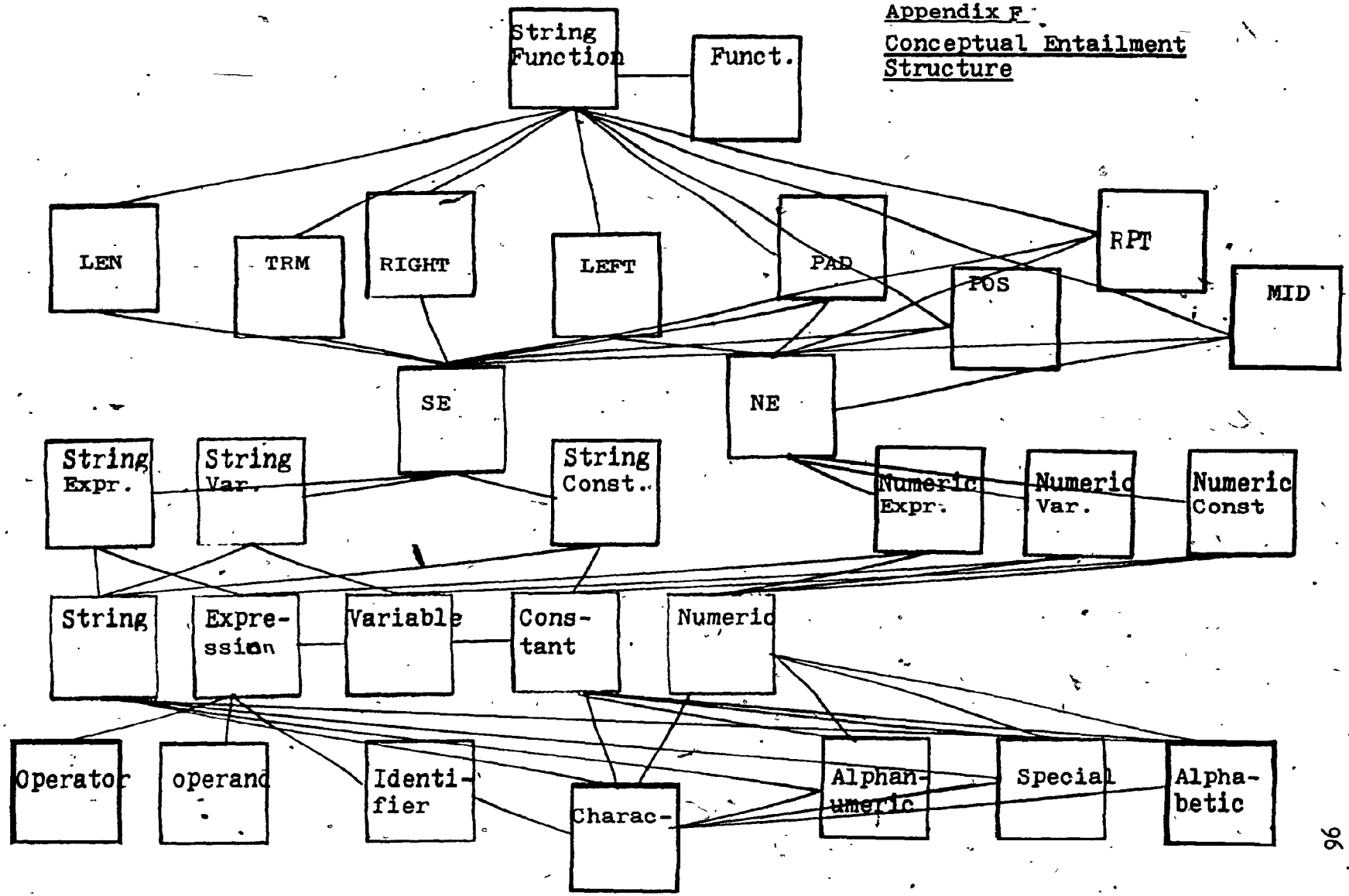
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I was excited by the idea of using a Learner Controlled CAI program.	1	2	3	4	5
2. Very often I did not know what I should do next.	1	2	3	4	5
3. I always felt challenged to learn.	1	2	3	4	5
4. The instructions by the program were understandable.	1	2	3	4	5
5. I was not interested in the lesson content.	1	2	3	4	5
6. My performance would increase if I gain better control of the program.	1	2	3	4	5
7. The response by the program was always very clear.	1	2	3	4	5
8. If I had more time I would have done better.	1	2	3	4	5
9. The lesson content was relevant to the post-test.	1	2	3	4	5
10. The manual was very helpful to me.	1	2	3	4	5
11. I would like to try this program again but not under experimental conditions.	1	2	3	4	5
12. What is the total time you spent reading the manual?	_____				

Appendix F

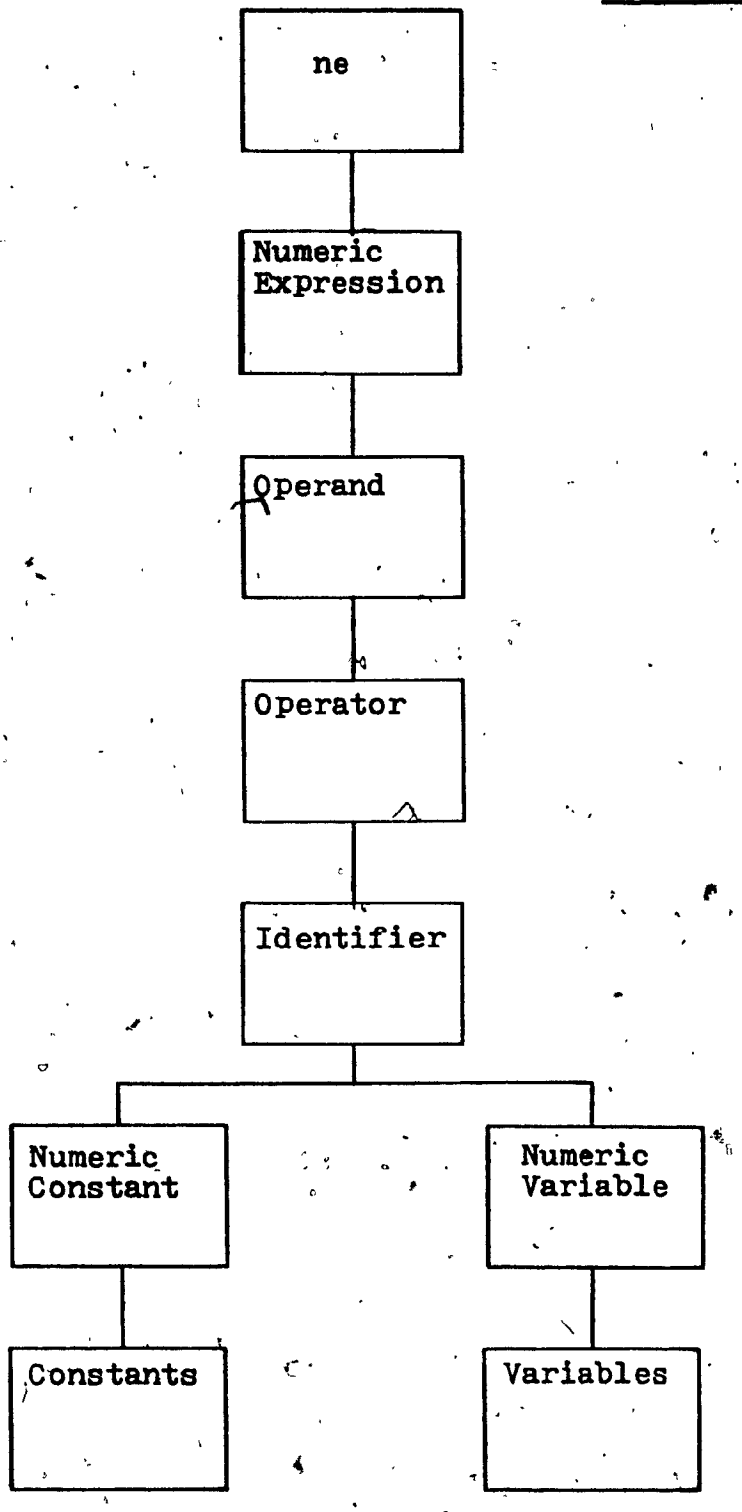
Conceptual Entailment Structure Content Analysis

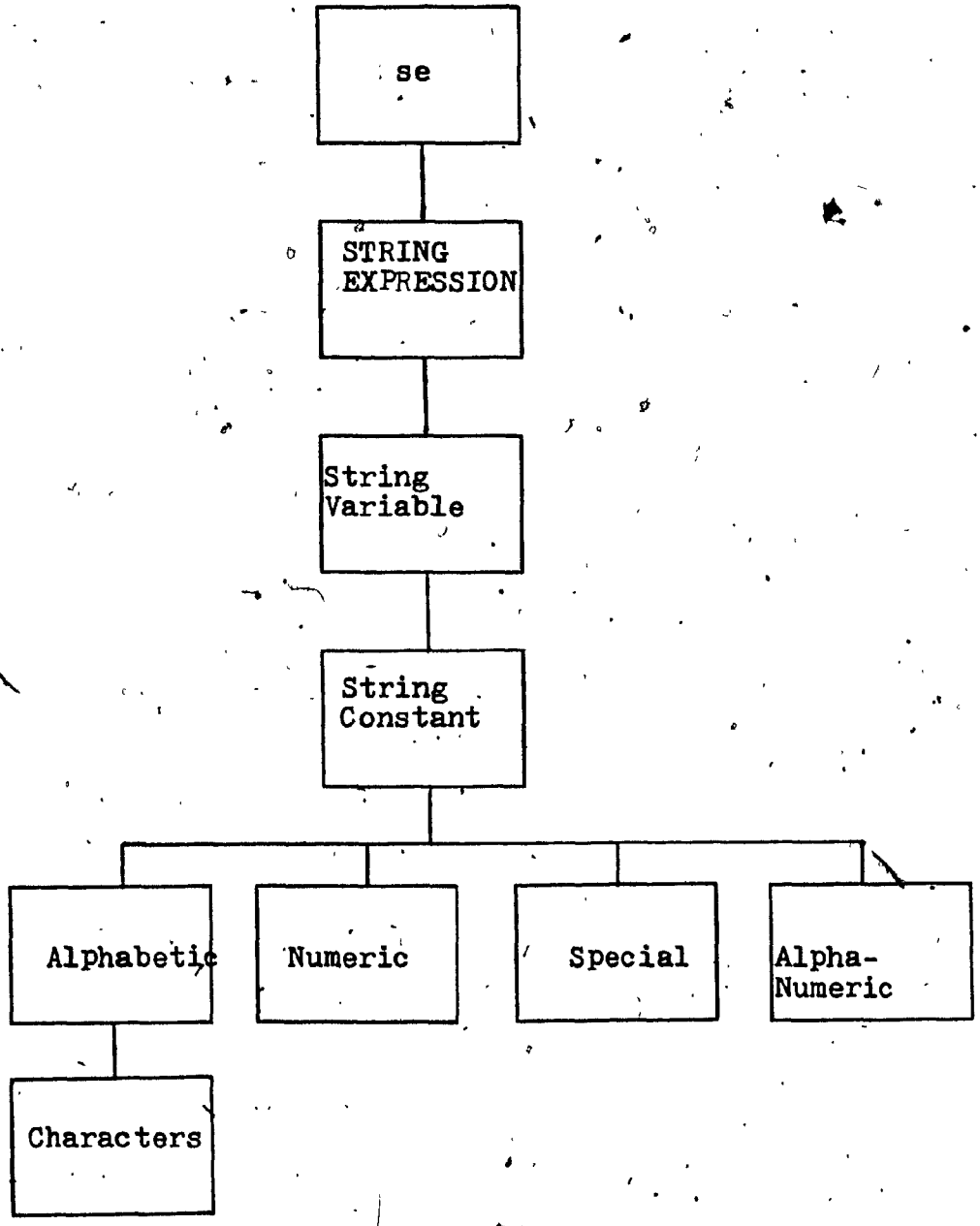
Appendix F

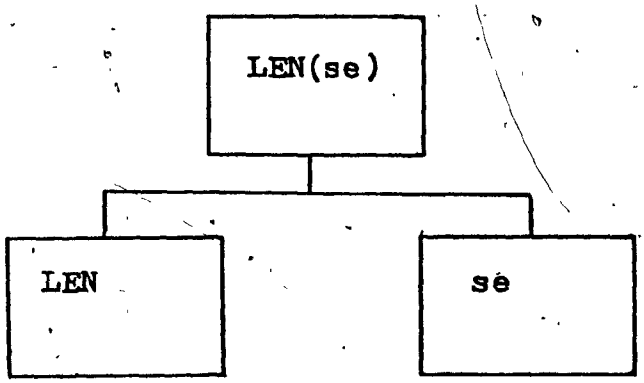
Conceptual Entailment Structure

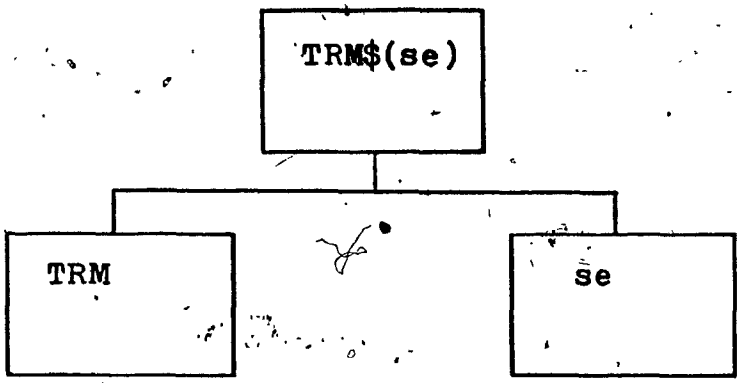


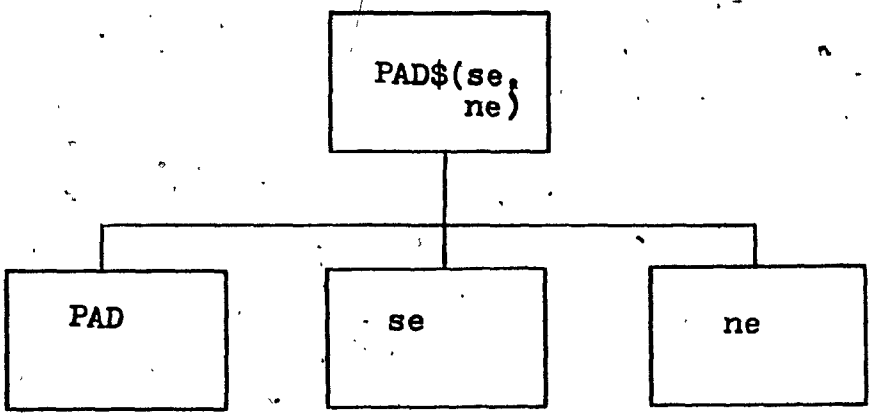
Appendix F
Content Analysis

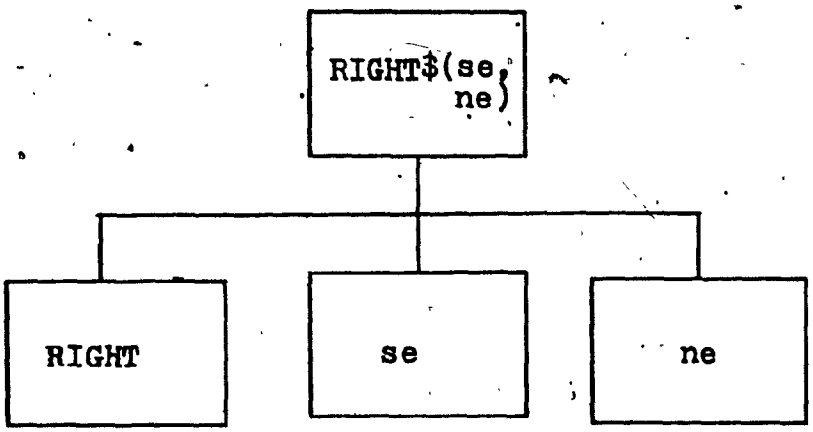


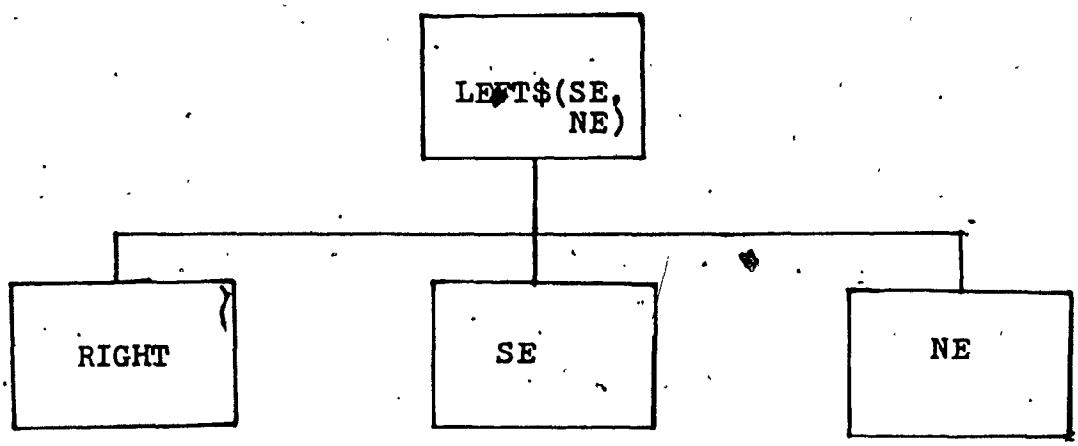

se
STRING EXPRESSION
String Variable
String Constant
Alphabetic
Numeric
Special
Alpha-Numeric
Characters

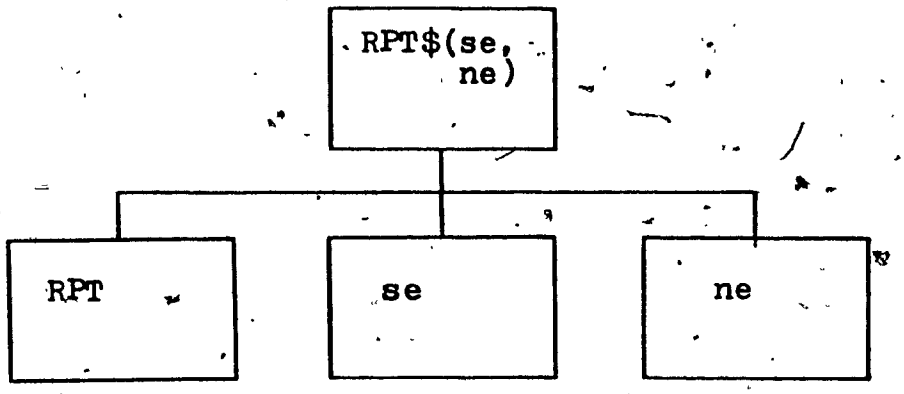

LEN(se)
LEN
se

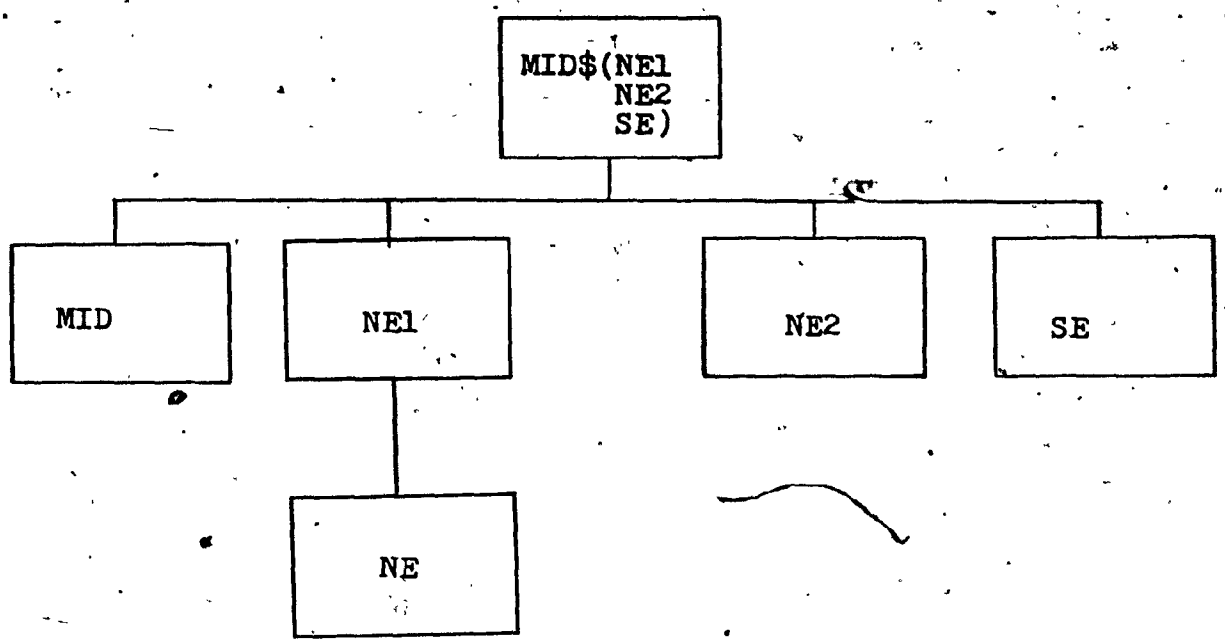

TRM$(se)
TRM
se

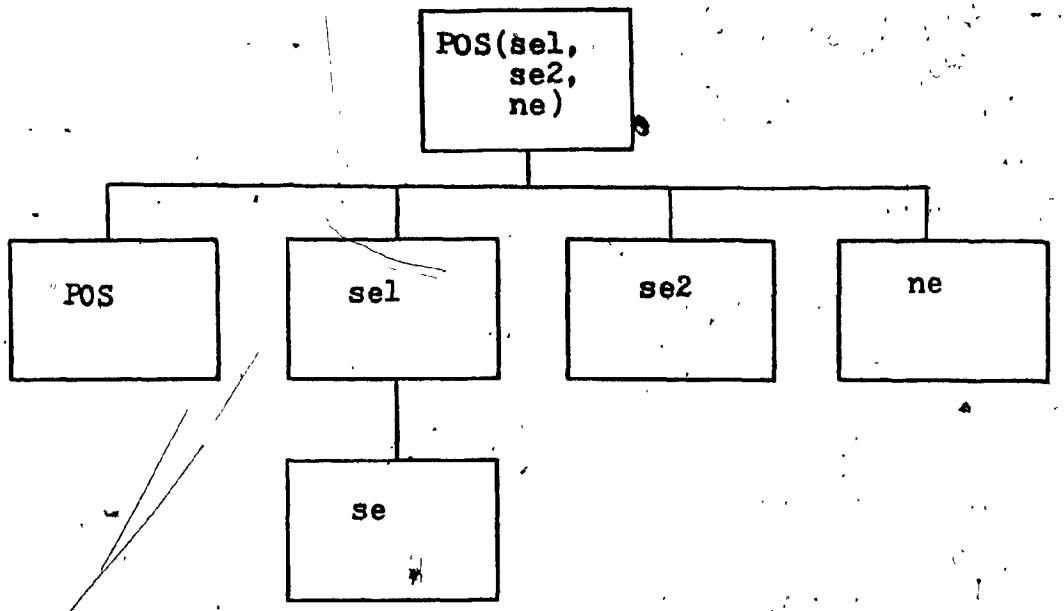

PAD$(se,
ne)
PAD
se
ne


RIGHT$(se,
ne)
RIGHT
se
ne


LEFT$(SE,
NE)
RIGHT
SE
NE


RPT$(se,
ne)
RPT
se
ne


MID$(NE1
NE2
SE)
MID
NE1
NE2
SE
NE

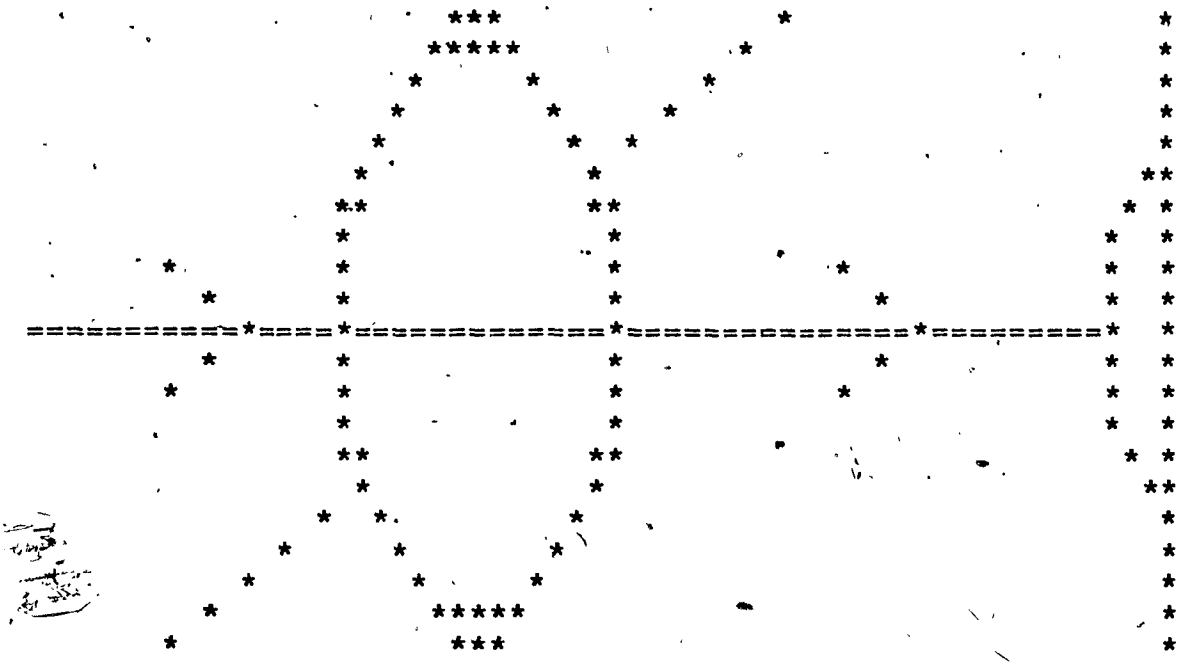

POS(sel,
se2,
ne)
POS
sel
se2
ne
se

APPENDIX G

Sample CAI Session

(See pocket to the back pages 108 to 117)

```
BEGIN,,ALCAIP
+
```



```
   HI! IN A FEW MINUTES ALCAIP WILL BE READY FOR YOU!
   YOU MAY RE-READ YOUR MANUAL WHILE I'M PREPARING.
+
```

```
 ------------------------------------------------------
 !                                                    !
 ! HELLO, WELCOME TO   ALCCAIP, THIS IS              !
 !                     A                              !
 !                     LEARNER                        !
 !                     CONTROLLED                     !
 !                     COMPUTER                       !
 !                     ASSISTED                       !
 !                     INSTRUCTION                    !
 !                     PROGRAM.                       !
 !                                                    !
 ------------------------------------------------------
 HIT THE 'C' KEY THEN 'RETURN'
? C
+
```

```
 ------------------------------------------------------
 ! ALCCAIP (PRONOUNCED  AL-CAPE) GIVES YOU           !
 ! THE LEARNER THE UNIQUE PRIVILEGE  OF              !
 ! CONTROLLING YOUR OWN LEARNING PROCESS.            !
 ! BEFORE ATTEMPTING TO DO THIS PROGRAM, YOU         !
 ! SHOULD READ  THE MANUAL TO ALCCAIP. IF            !
 ! YOU HAVE NOT, YOU SHOULD ASK YOUR                 !
 ! ATTENDANT FOR A MANUAL.                           !
 !                                                   !
 -----------------------------------------------------!
 HIT THE 'C' KEY THEN 'RETURN'
?
```

```
C
+
```

```
!-----------------------------------------------!
! WOULD YOU PLEASE ENTER YOUR  NAME NOW ?       !
!-----------------------------------------------!

WHAT NEXT ? LIONEL SAMPLE RUN
+


 !-----------------------------------------------!
 ! HELLO LIONEL SAMPLE RUN                       !
 ! I WILL NOW GIVE YOU A BRIEF RE-CAP            !
 ! OF HOW ALCCAIP WORKS.                         !
 ! NOTE WELL: I ALCCAIP  WILL OFTEN  PROMPT      !
 ! YOU FOR A RESPONSE WITH THE COMMENT:          !
 !            'WHAT NEXT ?'                      !
 !-----------------------------------------------!
 HIT THE 'C' KEY THEN 'RETURN'
 ?
```

RA	RATIONALE
OB	OBJECTIVES
AD	FOR ADVICE
RD	RULE OR DEF
EX	EXAMPLES
PR	PRACTICE
RV	REVISION
CM	FOR COMMANDS
CO	FOR CONCEPTS
POST	FOR POST TEST
NEXT	
HELP	
PASS	
END	
CL	CLEAR SCREEN

```
!================================================!
! YOU ARE REQUIRED TO USE YOUR OWN STRATEGY TO   !
! LEARN TO USE 8 STRING FUNCTIONS IN BASIC.      !
! RATIONALE, OBJECTIVES, RULES, DEFINITIONS,     !
! EXAMPLES, PRACTICES,    AND  ADVICE ARE ALL    !
! PROVIDED FOR YOU. BY USING THE COMMANDS TO     !
! THE RIGHT, YOU MUST DIRECT YOUR OWN LEARNING.  !
! THE COMMANDS MAY BE ENTERED IN ANY SEQUENCE.   !
!================================================!

 HIT THE 'C' KEY THEN 'RETURN'
? C
!================================================!
! BESIDES THE 8 STRING FUNCTIONS, THERE ARE 22   !
! OTHER CONCEPTS WHICH YOU MAY NEED TO KNOW      !
! BEFORE LEARNING TO USE STRING FUNCTIONS.       !
! YOU CAN USE ALL THE COMMANDS WITH THESE        !
! CONCEPTS ALSO.                                 !
! REMEMBER: THE 'CONCEPTS' COMMAND WILL ALWAYS   !
! SHOW YOU A LIST OF ALL AVAILABLE CONCEPTS      !
! INCLUDING THE 8 STRING FUNCTIONS.              !
! FINALLY: FEEL FREE TO USE THE 'HELP' COMMAND.  !
!================================================!
 HIT THE 'C' KEY THEN 'RETURN'
? C
!________________________________________________!
! BEFORE YOU BEGIN THIS LESSON, I WOULD LIKE TO  !
! GIVE YOU A PRE-TEST. REMEMBER YOU HAVE:        !
!            NOTHING TO FEAR.                    !
! THIS TEST WAS SIMPLY DESIGNED TO SEE HOW MUCH  !
! YOU ALREADY KNOW ABOUT 'STRING FUNCTIONS'.     !
! IF YOU DO NOT KNOW THE ANSWERS, DO NOT GUESS   !
! THEM. SIMPLY TYPE  'PASS'.  AT THE END OF THIS !
! LESSON YOU WILL BE ABLE TO ANSWER ALL THESE    !
! QUESTIONS THAT SEEM SO DIFFICULT NOW.          !
!================================================!
 HIT THE 'C' KEY THEN 'RETURN'
?
```

```
 C
!================================================!
! NOTE WELL: FOR MULTIPLE CHOICE ANSWERS ALWAYS  !
! INDICATE YOUR ANSWER BY THE NUMBER THAT COMES  !
! BEFORE IT. EG. IF THE QUESTION IS: HOW OLD     !
! ARE YOU AND THE ANSWERS ARE:                   !
!            1. 6 YEARS                          !
!            2. 3 YEARS                          !
!            3. 8 YEARS                          !
! IF THE CORRECT ANSWER IS 3 YEARS THEN YOU      !
! SHOULD ENTER THE NUMBER   2  ONLY.             !
!================================================!
 HIT THE 'C' KEY THEN 'RETURN'
? C
!================================================!
! AFTER THIS FRAME THE PRE-TEST WILL BEGIN. DO   !
! NOT WORRY IF YOU DO NOT KNOW THE ANSWERS. IF   !
! YOU   CANNOT   ANSWER A PARTICULAR QUESTION    !
! JUST TYPE 'PASS'.                              !
! READY NOW! OK, HERE WE GO.... GOOD LUCK..      !
!________________________________________________!
 HIT THE 'C' KEY THEN 'RETURN'
? C
!------------------------------------------------!
! 1.          1. LEN (D6)                        !
!             2. LEN ("D6")                      !
!             3. LEN (D6$)                       !
!             4. LEN (D6$ + "D6")                !
!  WHICH OF THE ABOVE STATEMENTS IS INVALID  ?   !
!                                                !
!                                                !
!                                                !
!                                                !
!------------------------------------------------!
WHAT NEXT ? 1
!------------------------------------------------!
! 2.                                             !
!             1. RTRM$(B$)                       !
!             2. RTRM$(B$+C$)                    !
!             3. LTRM$("  YESTERDAY")            !
!             4. LTRM$(B$ + 10)                  !
!                                                !
! WHICH OF THE ABOVE STATEMENTS IS INVALID  ?    !
!                                                !
!                                                !
!------------------------------------------------!
WHAT NEXT ?
          SKIP
 HIT THE 'C' KEY THEN 'RETURN'
?
```

```
C
!-------------------------------------------------!
! HELLO AGAIN. YOU HAD  1  CORRECT.               !
! I ASSURE YOU THAT WHEN YOU FINISH THIS LESSON!
! YOU WILL BE DOING MUCH BETTER.                  !
! LOOK TO THE RIGHT OF THE SCREEN. THESE ARE      !
! THE COMMANDS THAT YOU MUST USE TO GUIDE         !
! YOURSELF THROUGH THE LESSON. DO NOT BE          !
! AFRAID TO USE THEM.                             !
!_________________________________________________!
HIT THE 'C' KEY THEN 'RETURN'
? C
!-------------------------------------------------!
! I WILL BEGIN BY SHOWING YOU                     !
!          THE RATIONALE,                         !
!          THE OBJECTIVE,                         !
! AND THE PRE-REQUISITES FOR STRING FUNCTIONS.    !
! FROM THERE ON, YOU ARE ON YOUR OWN.             !
! PLEASE FEEL FREE TO USE ALL THE COMMANDS.       !
! YOUR GOAL IS TO LEARN TO USE THE 8 STRING       !
! FUNCTIONS.                                      !
! O.K. GOOD LUCK NOW. FEEL FREE.                  !
!_________________________________________________!
HIT THE 'C' KEY THEN 'RETURN'
? C
!-------------------------------------------------!
!      RATIONALE-----STRING FUNCTION              !
! STRING  FUNCTIONS ARE VERY  USEFUL  IN   CAI    !
! PROGRAMMING.   THEY  PROVIDE THE ONLY SIMPLE    !
! METHOD BY WHICH STRINGS CAN BE (1) EXAMINED     !
! (2) ALTERED AND (3) ACCESSED.                   !
!                                                 !
!                                                 !
!                                                 !
!_________________________________________________!
HIT THE 'C' KEY THEN 'RETURN'
? C
!-------------------------------------------------!
!       OBJECTIVE-----STRING FUNCTION             !
! AT THE END OF THIS ENTIRE COURSE YOU WILL BE    !
! ABLE TO :                                       !
!   1. TELL THE DIFFERENCE BETWEEN VALID AND      !
!      INVALID USES OF STRING FUNCTIONS.          !
!   2. EVALUATE THE RESULTS OF STATEMENTS THAT    !
!      USE STRING FUNCTIONS.                      !
!    3. USE STRING FUNCTIONS.                     !
!_________________________________________________!
HIT THE 'C' KEY THEN 'RETURN'
? C
!-------------------------------------------------!
!            ADVICE-----STRING FUNCTION           !
! FOLLOWING ARE THE 8 MAIN STRING FUNCTIONS       !
! THAT YOU SHOULD LEARN TO USE IN ORDER TO        !
! FULFIL THE REQUIREMENTS FOR THIS LESSON.        !
! 1. LEN(SE)              5. RIGHT$(SE,NE)        !
! 2. TRM$(SE)             6. POS(SE1,SE2,NE)      !
! 3. PAD$(SE,NE)          7. RPT$(SE,NE)          !
! 4. LEFT$(SE,NE)         8. MID$(SE,NE1,NE2)     !
!_________________________________________________!
```

```
WHAT NEXT ? RA LEN
!-------------------------------------------------!
!              RATIONALE LEN(SE)                  !
! HOW DOES ONE TELL HOW MANY CHARACTERS  THERE    !
! ARE  IN  A STRING?  SUPPOSE YOU ASK SOME ONE    !
! FOR HIS NAME.  IN BASIC PROGRAMMING THE ONLY    !
! WAY  TO  DISCOVER  THE  NUMBER OF CHARACTERS    !
! THERE ARE IN THE NAME IS TO MAKE USE OF  THE    !
! "LEN" FUNCTION.                                 !
!                                                 !
!-------------------------------------------------!
WHAT NEXT ? RD LEN
!-------------------------------------------------!
!        DEFINITION/RULE-----LEN(SE)              !
! THE LEN (SE) FUNCTION FINDS THE LENGTH  OF A    !
! STRING "SE" BY COUNTING THE TOTAL NUMBER OF     !
! CHARACTERS IN THE STRING.                       !
!  NB. 1. THE STRING MUST BE ENCLOSED IN          !
!         PARENTHESES.                            !
!      2. THE STRING MUST NOT BE MORE THAN        !
!         255 CHARACTERS.                         !
!-------------------------------------------------!
WHAT NEXT ? PR LEN
!-------------------------------------------------!
!   PRACTICE 1.                  LEN(SE)          !
!            1. LEN (C4)                          !
!            2. LEN ("C4")                        !
!            3. LEN (C4$)                         !
!            4. LEN (C4$ + "C4")                  !
!  WHICH OF THE ABOVE STATEMENTS IS INVALID  ?    !
!                                                 !
!-------------------------------------------------!
!***** ENTER YOUR ANSWER WHEN YOU ARE READY *****!
WHAT NEXT ? 3
****************** INCORRECT ! ******************
! THE CORRECT ANSWER IS 1                         !
 HIT THE 'C' KEY THEN 'RETURN'
? C
!-------------------------------------------------!
!              ADVICE-----LEN(SE)                 !
! YOU SHOULD KNOW THE "RULES" AND "DEFINITIONS"   !
! THAT PERTAIN TO THE FOLLOWING CONCEPTS,         !
! BEFORE ATTEMPTING THIS STRING FUNCTION.         !
!      1. SE                                      !
!      2. STRING                                  !
!      3. FUNCTION                                !
!      4. CHARACTERS                              !
!-------------------------------------------------!
! FROM THE LIST OF CONCEPTS ABOVE YOU SHOULD      !
! SELECT AND STUDY THE ONES YOU WISH.             !
!=================================================!
! YOU MAY ALSO WANT TO LOOK AT THE FOLLOWING.     !
!     EXAMPLE 1.           LEN(SE)                !
! THERE ARE 3 PRACTICES ON THIS FUNCTION          !
! IF YOU HAVE NOT DONE THEM ALL YOU MAY           !
! GET ANOTHER BY TYPING 'NEXT'.                   !
WHAT NEXT ?
```

```
NEWXT
!-------------------------------------------------!
!   PRACTICE 2.                  LEN(SE)          !
!                                                 !
!  GIVEN THAT:                                    !
!          B$ = "MONDAY"                          !
!          C$ = "TUESDAY"                         !
! WHAT IS THE VALUE OF LEN (B$+C$)?               !
!                                                 !
!-------------------------------------------------!
!***** ENTER YOUR ANSWER WHEN YOU ARE READY ***!
WHAT NEXT ? 13
****************** KEEP IT UP ! ****************
! THERE ARE 3 PRACTICES ON THIS FUNCTION         !
! IF YOU HAVE NOT DONE THEM ALL YOU MAY          !
! GET ANOTHER BY TYPING 'NEXT'.                  !
WHAT NEXT ? NEXT
!-------------------------------------------------!
!            PRACTICE 3.      LEN(SE)             !
!      IF A$ = "YESTERDAY"                        !
!         B$ = "TODAY"                            !
!      WRITE A STATEMENT WHICH WILL FIND          !
!      THE TOTAL NUMBER OF CHARACTERS IN THE      !
!      TWO STRING VARIABLES.                      !
!                                                 !
!-------------------------------------------------!
!***** ENTER YOUR ANSWER WHEN YOU ARE READY ***!
WHAT NEXT ? LEN A$B$)
****************** WRONG ! ********************
! THE CORRECT ANSWER IS LEN(A$+B$)               !
 HIT THE 'C' KEY THEN 'RETURN'
? C
!-------------------------------------------------!
!                 ADVICE-----LEN(SE)              !
! YOU SHOULD KNOW THE "RULES" AND "DEFINITIONS"!
! THAT PERTAIN TO THE FOLLOWING CONCEPTS,        !
! BEFORE ATTEMPTING THIS STRING FUNCTION.        !
!      1. SE                                      !
!      2. STRING                                  !
!      3. FUNCTION                                !
!      4. CHARACTERS                              !
!-------------------------------------------------!
! FROM THE LIST OF CONCEPTS ABOVE YOU SHOULD     !
! SELECT AND STUDY THE ONES YOU WISH.            !
!=================================================!
! YOU MAY ALSO WANT TO LOOK AT THE FOLLOWING.    !
!        EXAMPLE 3.      LEN(SE)                 !
! THERE ARE 3 PRACTICES ON THIS FUNCTION         !
! IF YOU HAVE NOT DONE THEM ALL YOU MAY          !
! GET ANOTHER BY TYPING 'NEXT'.                  !
WHAT NEXT ? NEXT
!-------------------------------------------------!
!      DEFINITION/RULE-----LEN(SE)                !
! THE LEN (SE) FUNCTION FINDS THE LENGTH  OF A   !
! STRING  "SE" BY COUNTING THE TOTAL NUMBER OF   !
! CHARACTERS IN THE STRING.                      !
!  NB. 1. THE STRING MUST BE ENCLOSED IN         !
!         PARENTHESES.                            !
!      2. THE STRING MUST NOT BE MORE THAN       !
!         255 CHARACTERS.                         !
!-------------------------------------------------!
WHAT NEXT ?
```

```
CON
+
```

```
!--------------------!
!CHARACTERS          !
!ALPHABETIC          !
!NUMERIC             !
!SPECIAL             !
!ALPHANUMERIC        !
!CONSTANTS           !
!VARIABLES           !
!STRING              !
!STRING CONSTANTS    !
!IDENTIFIERS         !
!STRING VARIABLES    !
!NUMERIC VARIABLES   !
!NUMERIC CONSTANT    !
!OPERATORS           !
!OPERAND             !
!EXPRESSIONS         !
!NUMERIC EXPRESSIONS !
!STRING EXPRESSIONS  !
```

```
!--------------------------------!
  DO YOU WANT TO SEE MORE ?
WHAT NEXT ? YES
+
```

```
!--------------------!
!SE,SE1,SE2          !
!NE,NE1,NE2          !
!FUNCTIONS           !
!STRING FUNCTIONS    !
!LEN(SE)             !
!LEFT$(SE,NE)        !
!RIGHT$(SE,NE)       !
!TRM$(SE)            !
!PAD$(SE,NE)         !
!RPT$(SE,NE)         !
!POS(SE1,SE2,NE)     !
!MID$(SE,NE1,NE2)    !
```

```
**** ENTER REQUEST NOW ****
WHAT NEXT ?
```

RD,CHAR

```
!-------------------------------------------------!
!       RULE/DEFINITION-----CHARACTERS            !
!      IN BASIC PROGRAMMING A CHARACTER CAN BE    !
! DEFINED AS ANY OF THE LETTERS OF THE ENGLISH    !
! ALPHABET -                                      !
!              "A"  THRU  "Z"                     !
! THE DIGITS.  "Ø"  THRU  "9" AND CHARACTERS      !
!               SUCH AS:-                         !
!               - $ ! _ & * ( )                   !
!-------------------------------------------------!
WHAT NEXT ? MS
+
```

```
!----!---------------!
! RA ! RATIONALE     !
! OB ! OBJECTIVES    !
! AD ! FOR ADVICE    !
! RD ! RULE OR DEF   !
! EX ! EXAMPLES      !
! PR ! PRACTICE      !
! RV ! REVISION      !
!----+---------------!
! CM ! FOR COMMANDS  !
! CO ! FOR CONCEPTS  !
!----+---------------!
! POST FOR POST TEST !
!--------------------!
! NEXT               !
! HELP               !
! PASS               !
! END                !
! CL ! CLEAR SCREEN  !
!____!_______________!
```

MS

```
! ILLEGAL COMMAND OR WRONG CONCEPT  ENTERED !
!-------------------------------------------!
! SEE  TABLE TO THE RIGHT FOR COMMANDS OR   !
! TYPE 'CONCEPTS' FOR A LIST OF CONCEPTS.   !
---------------------------------------------
WHAT NEXT ? RV
+
```

```
!--------------------!
!STRING FUNCTIONS    !
!LEN(SE)             !
!CHARACTERS          !
```

```
+-----------------------------------+
! WHICH CONCEPT DO YOU WANT TO REVISE? !
WHAT NEXT ?
```

```
STRING
!- - - - - - - - - - - - - - - - - - - - - - -!
! PLEASE CHOOSE CONCEPT FROM THOSE SHOWN !
! THE ONE CHOSEN IS NOT VALID !!          !
!- - - - - - - - - - - - - - - - - - - - - - -!
WHAT NEXT ? HELP
!--------------------------------------------!
! YOU REQUESTED REVISION .   YOU WERE  SHOWN  !
! ONLY THOSE CONCEPTS THAT YOU HAVE ALREADY   !
! SEEN, SINCE YOU CANNOT REVISE THAT WHICH    !
! YOU HAVE NOT SEEN. YOU MUST NOW DECIDE      !
! WHICH OF THESE CONCEPTS YOU NEED TO REVISE.!
!____________________________________________!
WHAT NEXT ? STRING F

+
                                              COMMANDS
                                              ________
                                                 RA
                                                 OB
                                                 AD

________________________________________
THESE ARE THE COMMANDS YOU HAVE USED.
WHICH DO YOU WANT TO REVIEW ?
----------------------------------------
WHAT NEXT ? RA
!----------------------------------------------!
!        RATIONALE-----STRING FUNCTION         !
! STRING  FUNCTIONS ARE VERY  USEFUL  IN   CAI !
! PROGRAMMING.   THEY  PROVIDE THE ONLY SIMPLE !
! METHOD BY WHICH STRINGS CAN BE (1) EXAMINED  !
! (2) ALTERED AND (3) ACCESSED.                !
!                                              !
!                                              !
!                                              !
!______________________________________________!
WHAT NEXT ? POST
+

!==============================================!
! WELCOME TO THIS POST-TEST. I AM SURE YOU HAVE  !
! TRIED YOUR BEST WITH THE LESSONS AND NOW YOU   !
! BELIEVE YOU ARE READY TO DO THIS POST-TEST.  !
! THE QUESTIONS ARE SIMILAR TO THOSE YOU HAD ON !
! ON THE PRACTICE, EXAMPLES AND PRE-TEST. IF YOU !
! UNDERSTOOD THE EXAMPLES AND DID WELL WITH THE !
! PRACTICE, YOU SHOULD  HAVE  ABSOLUTELY  NO    !
! PROBLEMS AT ALL WITH THIS POST-TEST.          !
!==============================================!
HIT THE 'C' KEY THEN 'RETURN'
?
```

Appendix H

Sample Lesson Content

RATIONALE LEN(SE)

HOW DOES ONE TELL HOW MANY CHARACTERS THERE ARE IN A STRING? SUPPOSE YOU ASK SOME ONE FOR HIS NAME. IN BASIC PROGRAMMING THE ONLY WAY TO DISCOVER THE NUMBER OF CHARACTERS THERE ARE IN THE NAME IS TO MAKE USE OF THE "LEN" FUNCTION.

OBJECTIVE------LEN(SE)

TO BE ABLE TO WRITE STATEMENTS TO FIND THE NUMBER OF CHARACTERS IN A STRING, EVALUATE A STATEMENT WHICH USES THE "LEN" FUNCTION AND DIFFERENTIATE VALID USES FROM INVALID USES OF THE LEN (SE) FUNCTION.

ADVICE-----LEN(SE)

YOU SHOULD KNOW THE "RULES" AND "DEFINITIONS" THAT PERTAIN TO THE FOLLOWING CONCEPTS, BEFORE ATTEMPTING THIS STRING FUNCTION.

1. SE
2. STRING
3. FUNCTION
4. CHARACTERS

DEFINITION/RULE-----LEN(SE)

THE LEN (SE) FUNCTION FINDS THE LENGTH OF A STRING "SE" BY COUNTING THE TOTAL NUMBER OF CHARACTERS IN THE STRING.

NB. 1. THE STRING MUST BE ENCLOSED IN PARENTHESES.
2. THE STRING MUST NOT BE MORE THAN 255 CHARACTERS.

EXAMPLE 1. LEN(SE)

INVALID	REASON
1. LEN (B6)	B6 IS NOT A STRING
2. LEN$(B$)	LEN DOES NOT TAKE A $ SIGN
3. LEN "MONDAY"	MISSING PARENTHESIS
4. LEN (C$+6)	EXPRESSION IS INVALID

EXAMPLE 2. LEN(SE)

GIVEN THE FOLLOWING;
A$ = "MATHEMATICS"
B$ = "SPANISH"
THE VALUE OF LEN(A$+B$) IS 18.
IE. THE TOTAL NUMBERS OF CHARACTERS IN A$ AND B$.

EXAMPLE 3. LEN(SE)

GIVEN THE FOLLOWING;
A$ = "JACK"
B$ = "JILL"
TO FIND THE TOTAL LENGTH OF THE 2 STRING VARIABLES YOU SHOULD WRITE;
LEN(A$+B$).

PRACTICE 1. LEN(SE)

1. LEN (C4)
2. LEN ("C4")
3. LEN (C4$)
4. LEN (C4$ + "C4")

WHICH OF THE ABOVE STATEMENTS IS INVALID ?

PRACTICE 2. LEN(SE)

GIVEN THAT;
B$ = "MONDAY"
C$ = "TUESDAY"
WHAT IS THE VALUE OF LEN (B$+C$)?

13

PRACTICE 3. LEN(SE)

IF A$ = "YESTERDAY"
B$ = "TODAY"
WRITE A STATEMENT WHICH WILL FIND THE TOTAL NUMBER OF CHARACTERS IN THE TWO STRING VARIABLES.

LEN(A$+B$)

RATIONALE-----LEFT$(SE,NE)

SOMETIMES IN THE PROCESSING OF STRINGS IT IS NECESSARY TO REMOVE CHARACTERS FROM THE BEGINNING OF THE STRING. THE LEFT$ FUNCTION CAN BE USED IN SUCH CIRCUMSTANCES.

OBJECTIVE-----LEFT$(SE,NE)

TO BE ABLE TO ;

1. IDENTIFY VALID AND INVALID USES OF THE THE LEFT$ FUNCTION.
2. EVALUATE STATEMENTS WHICH USE LEFT$
3. USE THE LEFT$ FUNCTION CORRECTLY.

ADVICE-----LEFT$(SE,NE)

YOU SHOULD KNOW THE "RULES" AND "DEFINITIONS" THAT PERTAIN TO THE FOLLOWING CONCEPTS, BEFORE ATTEMPTING THIS STRING FUNCTION.

1. SE
2. STRING
3. FUNCTION
4. CHARACTERS
5. NE

RULES/DEFINITIONS-----LEFT$(SE,NE)

THE LEFT$ FUNCTION EXTRACTS FROM THE BEGINNING OF THE STRING SE AS MANY CHARACTERS AS REPRESENTED BY THE VALUE OF NE.

EXAMPLE 1. LEFT$(SE,NE)

	INVALID	REASON
1.	LEFT$(A$)	MISSING NE
2.	LEFT$("HOUSE",A$)	NE NOT NUMERIC
3.	LEFT$(A$+B$,3	NO CLOSING BRACKET

EXAMPLE 2. LEFT$$ (SE,NE)

GIVEN THAT G$ = "GOOD MORNING"
H$ = "NIGHT TIME "
LEFT$ (G$,5) = "GOOD " .
LEFT$ (H$,5) = "NIGHT" .
THE VALUE OF LEFT$ (G$,5) + LEFT$ (H$,5)
IS, "GOOD NIGHT".

EXAMPLE 3. LEFT$ (SE,NE)

GIVEN THAT I$ = "MONDAY"
J$ = "KEY RING"
IN ORDER TO OBTAIN THE WORD "MONKEY"
YOU WOULD WRITE;
LEFT$(I$,3)+LEFT$(J$,3)

PRACTICE 1. LEFT$ (SE,NE)
WHICH OF THE FOLLOWING IS INVALID?

1. LEFT$ ("MONDAY",5)
2. LEFT$ (A$,"6")
3. LEFT$("7$",1)
4. LEFT$("YESTERDAY",3)

2

PRACTICE 2. LEFT$(SE,NE)
GIVEN THAT ;
G$ = "MONOTONY"
H$ = "EYE"

WHAT IS THE VALUE OF ;
LEFT$(G$,3)+LEFT$(H$,2)

MONEY

PRACTICE 3. LEFT$(SE,NE)

GIVEN THAT ; K$ = "YESTERDAY"

WRITE A STATEMENT THAT WILL EXTRACT THE
STRING "YES" FROM THE STRING VARIABLE K$.

LEFT$(K$,3)

RATIONALE-----RIGHT$(SE,NE)

SOMETIMES IN THE PROCESSING OF STRINGS IT IS NECESSARY TO REMOVE CHARACTERS FROM THE END OF THE STRING. THE RIGHT$ FUNCTION CAN BE USED IN SUCH CIRCUMSTANCES.

OBJECTIVE-----RIGHT$(SE,NE)

TO BE ABLE TO ;

1. IDENTIFY VALID AND INVALID USES OF THE THE RIGHT$ FUNCTION.
2. EVALUATE STATEMENTS WHICH USE RIGHT$
3. USE THE RIGHT$ FUNCTION CORRECTLY.

ADVICE-----RIGHT$(SE,NE)

YOU SHOULD KNOW THE "RULES" AND "DEFINITIONS" THAT PERTAIN TO THE FOLLOWING CONCEPTS, BEFORE ATTEMPTING THIS STRING FUNCTION.

1. SE
2. STRING
3. FUNCTION
4. CHARACTERS
5. LEFT$
6. NE

RULES/DEFINITIONS---RIGHT$(SE,NE)

THE RIGHT$ FUNCTION EXTRACTS FROM THE END OF THE STRING SE AS MANY CHARACTERS AS REPRESENTED BY THE VALUE OF NE.

EXAMPLE 1. RIGHT$(SE,NE)

INVALID	REASON
1. RIGHT$(A$,7	MISSING PARENTHESIS
2. RIGHT$("HOUSE,A)	MISSING QUOTES
3. RIGHT$(A$+B$,3/*4)	INVALID NUM.EXPRESSION

EXAMPLE 2. RIGHT$ (SE,NE)

GIVEN THAT G$ = "GOOD MORNING"
H$ = "NIGHT TIME"
RIGHT$ (G$,7) = "MORNING" .
RIGHT$ (H$,5) = " TIME" .
THE VALUE OF RIGHT$ (G$,7) + RIGHT$ (H$,5)
IS, "MORNING TIME"

EXAMPLE 3. RIGHT$ (SE,NE)

GIVEN THAT I$ = "MONDAY"
J$ = "KEY RING"
IN ORDER TO OBTAIN THE WORD "DAYRING"
YOU WOULD WRITE;
RIGHT$(I$,3)+RIGHT$(J$,4)

PRACTICE 1. RIGHT$ (SE,NE)
WHICH OF THE FOLLOWING IS INVALID?

1. RIGHT$ ("MONDAY",5)
2. RIGHT$ (A$,"6")
3. RIGHT$("7$",1)
4. RIGHT$("YESTERDAY",3)

2

PRACTICE 2. RIGHT$(SE,NE)
GIVEN THAT ;
G$ = "MONCTON"
H$ = "KEY RING"
WHAT IS THE VALUE OF ;
RIGHT$(G$,3)+RIGHT$(H$,3)

TONING

PRACTICE 3. RIGHT$(SE,NE)

GIVEN THAT ; K$ = "YESTERDAY"

WRITE A STATEMENT THAT WILL EXTRACT THE STRING "DAY" FROM THE STRING VARIABLE K$.

RIGHT$(K$,3)

RATIONALE------TRM$(SE)

HOW CAN YOU GET RID OF BLANKS THAT ARE ON THE LEFT OR THE RIGHT OF A STRING? SIMPLE! JUST MAKE USE OF THE TRM$ FUNCTION.

OBJECTIVE-----TRM$(SE)

TO BE ABLE TO;
1. IDENTIFY IVALID USAGE OF TRM$
2. TO EVALUATE STATEMENTS THAT USES TRM$.
3. CORRECTLY USE THE TRM$ FUNCTION.

ADVICE------TRM$(SE)

FOLLOWING ARE THE CONCEPTS AND RULES THAT YOU SHOULD ACQUIRE BEFORE DOING THIS LESSON.

1. SE
2. STRING
3. FUNCTION

DEFINITION/RULE------TRM$(SE)

1. THE TRM$ FUNCTION WHEN PREFIXED BY AN 'L' TRIMS THE STRING SE OF ALL LEFTMOST BLANKS WHEN PREFIXED BY AN 'R' IT TRIMS THE STRING OF ALL RIGHTMOST BLANKS.
2. WHEN IN USE IT MUST BE IN THE FORM LTRM$(SE) OR RTRM$(SE).

EXAMPLE 1. TRM$(SE)

INVALID STMT	REASON
1. LTRM$(B$,6)	LTRM$ DOES NOT TAKE NE
2. TRM$(" BOY ")	MISSING PREFIX L OR R
3. RTRM$("HOT"+DOG)	INVALID SE

EXAMPLE 2. TRM$(SE)

```
    IF A$ = LTRM$("     HUNDRED")
    THEN A$ = "HUNDRED".
```

THE LTRM$ FUNCTION SIMPLY REMOVES ALL THE BLANKS ON THE LEFT OF THE STRING.

EXAMPLE 3. TRM$(SE)

GIVEN THAT;

```
        E$ = "ANIMAL   "
```

A STATEMENT TO REMOVE THE BLANKS FROM E$ IS RTRM$(E$).

PRACTICE 1. TRM$(SE)

WHICH OF THE FOLLOWING IS INVALID?

1. LTRM$(B$)
2. RTRM$(B$+C$)
3. LTRM$(" YESTERDAY")
4. RTRM$(B$ + 1Ø)

4

PRACTICE 2. TRM$(SE)

GIVEN THAT;

```
        A$ = RTRM$("FRIDAY ")
```

THE VALUE OF A$ + "MORN" IS ;

1. FRIDAYMORN
2. FRIDAY MORN
3. "FRIDAY""MORN"

1

PRACTICE 3. USAGE TRM$(SE)

WRITE ONE BASIC STATEMENT THAT WILL

CUT THE THREE BLANKS FROM THE RIGHT OF

THE STRING CONSTANT "MONDAY   ".

RTRM$("MONDAY   ")

RATIONALE-----PAD$(SE,NE)

SOMETIMES YOU MAY NOT WANT TO REMOVE BLANKS FROM THE LEFT OR RIGHT OF A STRING, YOU MAY WANT TO ADD BLANKS. YOU CAN DO THIS BY MAKING USE OF THE PAD$(SE,NE) FUNCTION.

OBJECTIVE-----PAD$(SE,NE)

1. TO BE ABLE TO ;
   1. IDENTIFY VALID AND INVALID USES OF THE PAD$ FUNCTION.
   2. EVALUATE STATEMENTS IN WHICH PAD$ IS USED.
   3. USE THE PAD$ FUNCTION CORRECTLY.

ADVICE----------PAD$(SE,NE)

YOU SHOULD FIRST ACQUIRE THE CONCEPTS AND AND RULES THAT PERTAIN TO THE FOLLOWING, BEFORE ATTEMPTING TO STUDY THE PAD$ FUNCTION.

1. SE
2. NE
3. STRING
4. FUNCTION
5. LEFT$
6. LEN

DEFINITION/RULE-----PAD$(SE,NE)

1. THE PAD$ FUNCTION WHEN PREFIXED BY AN 'L' PADS THE STRING SE WITH BLANKS ON THE LEFT WHEN PREFIXED BY AN 'R' IT PADS THE STRING WITH BLANKS ON THE RIGHT.
2. THE NUMBER OF BLANKS PADDED IS EQUAL TO NE
3. WHEN IN USE THE FUNCTION MUST TAKE THE FORM LPAD$(SE,NE) OR RPAD$(SE,NE).

EXAMPLE 1. PAD$(SE,NE)

INVAID STMT	REASON
PAD$(A$,6)	MISSING PREFIX "L" OR "R"
LPAD$(HISTORY,12)	MISSING QUOTES ON SE
RPAD$(A$+B$,"12")	INVALID NE

EXAMPLE 2. PAD$(SE,NE)
GIVEN THAT ; G$ = "HISTORY"

A = 3
H$ = RPAD$(G$,A*2)
THEN A*2 = 6, AND H$ WOULD BE = RPAD$(G$,6
H$ = "HISTORY ".

EXAMPLE 3. PAD$(SE,NE)
GIVEN THAT ; B$ = "MONKEY"
TO INCREASE THE SIZE OF B$ BY 6 CHARACTERS
ON THE LEFT YOU SHOULD WRITE;
LPAD$(B$,6)

PRACTICE 1. PAD$(SE,NE)
WHICH OF THE STATEMENTS BELOW IS INVALID

1. RPAD$(B$,C$)
2. RPAD$(B$, 2*6)
3. RPAD$("MONDAY",A/3)
4. RPAD$(B$,A6)

1

PRACTICE 2. PAD$(SE,NE)
GIVEN THAT ; A = 3 AND C = 2
F$ = "LITTLE"
HOW MANY CHARACTERS WILL BE IN G$
IF G$ = LPAD$(F$,A**C)

15

PRACTICE 3. PAD$(SE,NE)
GIVEN THAT ; D HAVE UNKNOWN VALUES
F$ = "SCIENCE"
WRITE A STATEMENT THAT WILL PAD D BLANKS
TO THE LEFT OF THE STRING VARIABLE.

LPAD$(F$,D)

RATIONALE-----RPT$(SE,NE)

THE RPT$ FUNCTION ENABLES YOU TO MAKE COPIES OF THE SAME STRING.

OBJECTIVE-----RPT$(SE,NE)

TO BE ABLE TO ;

1. TELL VALID USES FROM INVALID ONES

2. EVALUATE STATEMENTS WHICH USE RPT$

3. CORRECTLY USE THE RPT$ FUNCTION.

ADVICE-----RPT$(SE,NE)

FOLLOWING IS A LIST OF CONCEPTS AND RULES YOU SHOULD ACQUIRE BEFORE ATTEMPTING TO STUDY THE RPT$ FUNCTION.

1.SE.
2.NE
3.STRING

RULE/DEFINITION-----RPT$(SE,NE)

THE RPT$ FUNCTION GENERATES MANY COPIES OF THE STRING SE.

THE NUMBER OF COPIES GENERATED IS EQUAL TO THE VALUE OF NE.

EXAMPLE 1. RPT$(SE,NE)

INVALID STMTS	REASON
1. RPT(SE,NE)	MISSING $ SIGN ON RPT
2. RPT$"BOY",6	MISSING BRACKETS
3. RPT$(A$*B$,3)	INVALID STRING EXPRESSION

EXAMPLE 2. RPT$(SE,NE)
GIVEN THAT ; B=2
C$="000"
D$="1" + RPT$(C$,B)
THE VALUE OF D$ IS "1000000".
IE. REPEAT "000" TWICE AND JOIN THE RESULT TO 1.

EXAMPLE 3. RPT$(SE,NE)
GIVEN THAT B$ = "BAA"
C$ = "COO"

TO PRODUCE "BAACOOBAACOO"
YOU SHOULD WRITE ; RPT$(B$+C$,2).

PRACTICE 1. RPT$(SE,NE)
WHICH OF THE STATEMENTS BELOW IS INVALID ?

1. RPT$ ("81X",5)
2. RPT$ (A$,5+2)
3. RPT$ (23,2)
4. RPT$ (S$,S1)

3

PRACTICE 2. RPT$(SE,NE)
1. IF S$= "A"
IF T$ ="Z"
IF U$ = RPT$(S$+T$,3)
WHAT IS U$?

AZAZAZ

PRACTICE 3. RPT$(SE,NE)

GIVEN THAT B AND C HAVE UNKNOWN VALUES, WRITE A STATEMENT WHICH WILL REPEAT THE STRING "JOY" AS MANY TIMES AS B DIVIDED BY C.

RPT$("JOY",B/C)

RATIONALE-----POS(SE1,SE2,NE)

LET US SAY THAT YOU WANT TO FIND OUT AT WHAT POSITION IN THE STRING "MONDAY" THE STRING "DAY" BEGINS. THIS IS A TOUGH JOB BUT THE POS FUNCTION MAKES IT SIMPLE.

OBJECTIVE-----POS(SE1,SE2,NE)

TO BE ABLE TO LOCATE ONE STRING IN ANOTHER STRING.

ADVICE-----POS(SE1,SE2,NE)

FOLLOWING ARE THE CONCEPTS WHICH YOU MUST KNOW IN ORDER TO MASTER THE POS FUNCTION.

1. SE,SE1,SE2
2. NE,NE1,NE2
3. STRING

RULE/DEFINITION-----POS(SE1,SE2,NE)

THE "POS" FUNCTION LOOKS IN THE STRING SE1 FOR THE STRING SE2 BEGINNING THE SEARCH FROM POSTION NE.
IT RETURNS THE LOCATION OF SE2.

EXAMPLE 1. INVALID STMTS	POS(SE1,SE2,NE) REASON
POS(A$,23,22)	SE2 IS INVALID.
POS("23","2","1")	NE SHOULD BE NUMERIC
POS$("BA","B",1)	POS TAKES NO $ SIGN

EXAMPLE 2. POS(SE1,SE2,NE)

GIVEN THAT ; A = 2
A$ = "POSSESSES"
D = POS(A$,"SS",A**(5-3))

IE. A**(5-3) = A**2 = 4.
THEN LOOK IN A$ FOR AN "SS" BEGINNING THE
THE SEARCH AT POSITION 4.
SS WILL BE FOUND AT POSITION 6.

EXAMPLE 3. POS(SE1,SE2,NE)

GIVEN THAT; A$ = "ANT"
TO FIND THE LOCATION OF A$ IN THE
STRING CONSTANT "ELEPHANT"
YOU SHOULD WRITE; POS("ELEPHANT",A$,1)

PRACTICE 1. POS(SE1,SE2,NE)

WHICH OF THE STATEMENTS BELOW IS INVALID ?

1. POS(A$,"23",2)
2. POS("23","3",1)
3. POS$("A$,"C",2)

3

PRACTICE 2. POS(SE1,SE2,NE)

IF G$ = "ELECTRICITY"
IF D$ = "T"
IF A = POS(G$,D$,6)
WHAT IS THE VALUE OF A ?

10

PRACTICE 3. POS(SE1,SE2,NE)

IF E$="ELEPHANT"
F$="HA"

TO FIND THE LOCATION IN E$ WHERE F$ BEGINS
WHAT WOULD YOU WRITE ?

POS(E$,F$,1)

RATIONALE-------MID$(SE,NE1,NE2)

THIS IS ALMOST THE OPPOSITE OF THE POS FUNCTIGN.
THE POS FUNCTION FINDS WHERE A STRING BEGINS IN ANOTHER STRING.
THE MID$ FUNCTION EXTRACTS A STRING FROM ANOTHER STRING.

OBJECTIVE-------MID$(SE,NE1,NE2)

TO BE ABLE TO EXTRACT FROM A STRING ANOTHER STRING FOR A SPECIFIC LENGTH.

ADVICE-------MID$(SE,NE1,NE2)

FOLLOWING IS A LIST OF RULES AND CONCEPTS THAT YOU SHOULD ACQUIRE BEFORE DOING THIS LESSON ;-

1.SE
2. NE,NE1,NE2
3.POS

RULE/DEFINITION-------MID$(SE,NE1,NE2)

THE MID$ FUNCTION EXTRACTS FROM THE STRING SE ANOTHER STRING WHICH BEGINS AT LOCATION NE1 FOR A LENGTH OF NE2.

EXAMPLE 1. MID$(SE,NE1,NE2)

INVALID STMTS	REASON
MID$(A$,B$,2)	INVALID NE1
MID (A$,2,3)	MID TAKES A $SIGN
MID$(A$,B$,A*C$)	NE2 IS INVALID

EXAMPLE 2. MID$(SE,NE1,NE2)

GIVEN THAT; A = 2
B = 4
C$="AUTONOMOUS"

THE VALUE OF MID$(C$,A**A+1,B)
WOULD BE; "NOMO"

EXAMPLE 3. MID$(SE,NE1.NE2)

GIVEN THAT L$ = "ALABAMA"
N$ = "AMANDA"

TO CONSTRUCT THE STRING "LABMAN"
YOU SHOULD WRITE;
MID$(L$,2,3)+MID$(N$,2,3)

PRACTICE 1. MID$(SE,NE1,NE2)

IDENTIFY THE INVALID STATEMENTS BELOW;
1. MID$("HOUSING",2,4)
2. MID$("LODGING","2",4)
3. MID$(A$,2*A,C*4)
4. MID$("YES"+B$,2+6,2*3)

2

PRACTICE 2. MID$(SE,NE1,NE2)

GIVEN THAT ; B = 3
C$ = "EVALUATION"
E = 4
A = 2

WHAT IS THE VALUE OF MID$(C$,E*A-6,B**A)

VALUATION

PRACTICE 3. MID$(SE,NE1,NE2)

GIVEN THAT B$ = "DEGENERATE"
C$ = "EXHILARATING"
USE THE MID$ FUNCTION TO CONSTRUCT THE STRING "GENERAL"
FROM THE TWO STRING VARIABLES.

MID$(B$,3,6)+MID$(C$,5,1)

Appendix I

CAI Program Source Code

```
00001 REM ***************************************************!
00004 REM ! VARIABLES USED IN THIS PROGRAM                    !
00006 REM ! A$ A A1$ A3 A3$ A1 A2 A6 A5 A7                    !
00007 REM ! H I J J1 J2                                       !
00008 REM ! N0 N1 N2 N3 N4 N5 N6 N7 N8 N9 M0 M1 M2            !
00009 REM ! M3 M4 M5 M6 M7 M8 M9                              !
00010 REM ! T T1 T6 R$ R1$ R3$ R2$ P$ C$ Z1 Z   T2            !
00011 REM ! C$ W$ L1 R1 D D$ D2 P1$                           !
00012 REM ---------------------------------------------------
00014 DIM A$ (36)          'FOR STORING CONCEPTS
00015 DIM A (37,8)         'FOR STRING SUB CONCEPTS LOCATION
00020 DIM A1$(12)          'FOR STORING LEGAL COMMANDS
00023 DIM Z4(600)
00024 DIM P6 (20)          'FOR STORING PASSED TEST LOCATIONS
00025 DIM A3 (1200)        'FOR STORING STUDENTS CHOICES
00030 DIM A3$(2370)        'FOR STORING INSTRUCTION DATA
00032 DIM C$(5), W$(5)
00035 DIM H(25), D$(400)
00038 DIM A7(37,7)         'FOR STORING CONCEPTS AND COMMAND CHOSEN
00039 GOSUB 1750           'SET VALUES TO COUNTER
00040 GOSUB 1200           'INITIAL RECORD SET UP'
00042 GOSUB 4000           'INTRODUCTION
00045 GOSUB 1900           'STORE FEEDBACK COMMENTS'
00050 GOSUB 450            'STORE COMMANDS
00060 GOSUB 660            'STORE CONCEPTS
00080 GOSUB 5270           'MAIN CONTROL
00090 GOSUB 4660           'TERMINATION ROUTINE
00100 GOTO 12500
00120 REM
00130 REM
00140 REM
00230 REM ---------------------------------------------------
00240 REM     END OF ROUTINE TO FILL CONCEPT CHOSEN TABLE    !
00250 REM ---------------------------------------------------
00260 RETURN
00430 REM *******************************************************
00440 REM * SUBROUTINE  FOR FILLING ARRAY A1$ WITH COMMANDS     *
00450 REM *******************************************************
00470 A1$ (N1) = "RA"   'RATIONAL
00480 A1$ (N2) = "OB"   'OBJECTIVES
00490 A1$ (N3) = "AD"   'ADVISORY SUPPORT
00500 A1$ (N4) = "RD"   'RULES OR DEFINITIONS
00510 A1$ (N5) = "EX"   'EXAMPLES
00520 A1$ (N6) = "PR"   'PRACTICE
00525 A1$ (N7) = "RV"   'MEMORY SUPPORT
00530 A1$ (N8) = "NEXT"   'NEXT CONCEPT
00540 A1$ (N9) = "HELP"   'HELP
00555 A1$ (M0) = "CONCEPTS"  'CONCEPTS
00557 A1$ (M1) = "END"   'END
00558 A1$ (M2) = "POST"      'POST TEST
00560 RETURN
00580 REM *******************************************************
00590 REM * END OF ROUTINE FOR FILLING ARRAY A1$                 *
00600 REM *******************************************************
```

```
00620 REM ************************************************************
00630 REM * ROUTINE FOR FILLING ARRAY A$ WITH CONCEPTS                 *
00640 REM ************************************************************
00660 FOR A1 = N1 TO 30
00670 READ A$ (A1)
00680 NEXT A1
00685 B1 = TIM(1)
00690 RETURN
00710 REM ************************************************************
00720 REM * END OF ROUTINE FOR FILLING ARRAY A$                        *
00730 REM ************************************************************
00860 REM ************************************************************
00870 REM * DATA FOR CONCEPTS TO BE COVERED                            *
00880 REM ************************************************************
00900 DATA "CHARACTERS"
00910 DATA "ALPHABETIC"
00920 DATA "NUMERIC"
00930 DATA "SPECIAL"
00940 DATA "ALPHANUMERIC"
00950 DATA "CONSTANTS"
00960 DATA "VARIABLES"
00970 DATA "STRING"
00980 DATA "STRING CONSTANTS"
00990 DATA "IDENTIFIERS"
01000 DATA "STRING VARIABLES"
01010 DATA "NUMERIC VARIABLES"
01020 DATA "NUMERIC CONSTANT"
01030 DATA "OPERATORS"
01040 DATA "OPERAND"
01045 DATA "EXPRESSIONS"
01048 DATA "NUMERIC EXPRESSIONS"
01050 DATA "STRING EXPRESSIONS"
01060 DATA "SE,SE1,SE2"
01070 DATA "NE,NE1,NE2"
01080 DATA "FUNCTIONS"
01090 DATA "STRING FUNCTIONS"
01100 DATA "LEN(SE)"
01110 DATA "LEFT$(SE,NE)"
01120 DATA "RIGHT$(SE,NE)"
01130 DATA "TRM$(SE)"
01140 DATA "PAD$(SE,NE)"
01150 DATA "RPT$(SE,NE)"
01160 DATA "POS(SE1,SE2,NE)"
01165 DATA "MID$(SE,NE1,NE2)"
01170 REM ============================================================
01180 REM ! END OF DATA FOR CONCEPTS TO BE COVERED                    !
01190 REM ============================================================
01200 REM
01210 REM ============================================================
01220 REM ! ROUTINE FOR STORING INITIAL INFORMATION FOR RECORD        !
01225 REM ============================================================
01230 D = D + N1
01240 D$ (D) = "ALCCAIP"
01245 D = D + 1
```

```
01248 D$(D) = "AR"
01250 D = D + N1
01260 D$ (D) = CLK$
01270 D = D + N1
01280 D$ (D) = DAT$
01290 FILE  2 = "STATDAT"
01292 RESTORE  2
01295 RETURN
01300 REM ============================================================
01310 REM ! END OF INITIAL SET UP RECORD PROCEDURES                    !
01340 REM ============================================================
01345 REM ============================================================
01346 REM  SUB ROUTINE FOR CHECKING DOUBLE ENTRIES                     !
01347 REM ============================================================
01350 L$ = "N"
01352 GOTO 1400
01353 FOR I = 1 TO 250
01354 IF Z4(I) = Z1 THEN L$ = "Y" ELSE L$ = "N"
01356 IF Z4(I) = Z1 THEN 1400
01358 IF Z4(I) = N0 THEN Z4(I) = Z1
01360 IF Z4(I) = Z1 THEN 1400
01390 NEXT I
01400 RETURN
01410 REM ********  END OF SEARCH FOR DOUBLE ENTRY ************
01500 REM ============================================================
01510 REM ! ROUTINE FOR CAUTION ABOUT END OF LESSONS.      !
01520 REM ============================================================
01530 GOSUB 2150
01540 PRINT "!================================================!"
01550 PRINT "!  THE LESSON YOU JUST DID IS AT THE END OF THE  "
01560 PRINT "!  LIST. SINCE 'NEXT' CARRIES THE LESSON FORWARD "
01570 PRINT "!  SEQUENTIALLY, YOU CANNOT USE THE 'NEXT'       "
01580 PRINT "!  COMMAND.   MAKE SOME OTHER SELECTION OR TYPE  "
01590 PRINT "! 'POST' FOR THE POST TEST IF YOU ARE READY.     "
01600 PRINT "!================================================!"
01610 REM ============================================================
01620 REM   END  OF ROUTINE FOR PRINTING CAUTION.
01630 REM ============================================================
01635 T1 = T1 +N9
01640 RETURN
01730 REM ============================================================
01740 REM ! SUBROUTINE  FOR INITIALIZING VARIABLES                     !
01745 REM ============================================================
01750 REM
01752 N0 =0
01755 N1 = 1
01758 Z1 = 9999
01760 N2 = 2
01765 N3 = 3
01770 N4 = 4
01775 N5 = 5
01780 N6 = 6
01785 N7 = 7
01790 N8 = 8
```

```
01795 N9 = 9
01800 M0 = 10
01805 M1 = 11
01810 M2 = 12
01815 M3 = 13
01820 M4 = 14
01825 M5 = 15
01830 M6 = 16
01835 M7 = 17
01840 M8 = 18
01845 M9 = 19
01850 A1 = N1
01855 A2 = N1
01860 T  = N3
01863 T6 = 36
01865 A5 = N0
01870 A6 = N0
01872 H$ = "HELP"
01874 S$ = "
"
01880 RETURN
01890 REM
01900 REM _____________________________________________
01910 REM ! SUBROUTINE  FOR STORING FEEDBACK MESSAGES      !
01920 REM =============================================
01930 C$(N1) = "***************** BRAVO !
************************"
01940 C$(N2) = "***************** GOOD WORK !
********************"
01950 C$(N3) = "******************* KEEP IT UP !
******************"
01960 C$(N4) = "******************** THAT'S FINE !
****************"
01970 C$(N5) = "********************* YOU'RE DOING WELL
************"
01980 W$(N1) = "******************** WRONG !
**********************"
01990 W$(N2) = "******************** INCORRECT !
******************"
02000 W$(N3) = "******************** BE CAREFUL NOW !
**************"
02010 W$(N4) = "******************** TRY A LITTLE HARDER !.
********"
02020 W$(N5) = "******************** NO, THAT'S NOT THE ANSWER
***"
02030 REM ==============================================
02040 REM ! END OF SUBROUTINE FOR STORING FEEDBACK COMMENTS!
02050 REM ==============================================
02060 RETURN
02150 REM _____________________________________________!
02160 REM ! SUBROUTINE  FOR CLEARING PART OF SCREEN      !
02170 REM ---------------------------------------------!
02172 GOTO 2200
02175 T = T + T1
```

```
02180 GOSUB 2320
02185 T = N0
02188 T1 = N0
02190 GOSUB 2320
02200 RETURN
02215 REM ____________________________________________________!
02220 REM ! END OF SUBROUTINE  FOR CLEARING PART OF SCREEN  !
02230 REM ----------------------------------------------------!
02250 REM ____________________________________________________!
02260 REM ! SUBROUTINE  TO CLEAR ENTIRE SCREEN               !
02270 REM ----------------------------------------------------!
02280 T2 = N0                    'SET OFF WHEN DISPLAY IS OFF
02290 PRINT ":I+"
02295 PRINT S$
02300 RETURN
02305 REM ____________________________________________________
02310 REM ! END OF SUBROUTINE FOR CLEARING SCREEN             !
02315 REM ----------------------------------------------------
02320 REM ____________________________________________________
02322 REM!  SUBROUTINE  FOR TABBING AND CLEARING             !
02324 REM ----------------------------------------------------
02326 PRINT ":I"
02330 FOR I = N1 TO T
02340 PRINT S$                   'PRINT BLANK LINES TO CLEAR
02350 NEXT I
02360 RETURN
02362 REM ----------------------------------------------------
02364 REM ! END OF TABBING ROUTINE AND CLEARING              !
02366 REM ----------------------------------------------------
02410 REM ----------------------------------------------------
02420 REM ! SUBROUTINE  FOR DISPLAYING COMMANDS              !
02430 REM ----------------------------------------------------
02435 IF T2 = N1 THEN 2580
02440 PRINT S$
02450 PRINT TAB (54);"!----!---------------!"
02465 PRINT TAB (54);"! RA ! RATIONALE     "
02470 PRINT TAB (54);"! OB ! OBJECTIVES    "
02480 PRINT TAB (54);"! AD ! FOR ADVICE    "
02490 PRINT TAB (54);"! RD ! RULE OR DEF   "
02495 PRINT TAB (54);"! EX ! EXAMPLES      "
02500 PRINT TAB (54);"! PR ! PRACTICE      "
02502 PRINT TAB (54);"! RV ! REVISION      "
02506 PRINT TAB (54);"!----+---------------!"
02508 PRINT TAB (54);"! CM ! FOR COMMANDS  "
02510 PRINT TAB (54);"! CO ! FOR CONCEPTS  "
02512 PRINT TAB (54);"!----+---------------!"
02513 PRINT TAB (54);"! POST FOR POST TEST "
02514 PRINT TAB (54);"!--------------------!"
02515 PRINT TAB (54);"! NEXT               "
02520 PRINT TAB (54);"! HELP               "
02530 PRINT TAB (54);"! PASS               "
02540 PRINT TAB (54);"! END                "
02542 PRINT TAB (54);"! CL ! CLEAR SCREEN  "
02550 PRINT TAB (54);"!____!_______________!"
```

```
02572 T2 = N1                    'SET ON IF DISPLAY IS ON
02575 GOSUB 2320
02580 RETURN
02590 REM ************************************************************
02600 REM * END OF SUBROUTINE FOR DISPLAYING COMMANDS                 *
02610 REM ************************************************************
02630 REM ************************************************************
02640 REM * SUBROUTINE  FOR STORING INSTRUCTIONAL DATA                 *
02650 REM ************************************************************
02670 FILE  N1 = "LESSONS"
02675 DELIMIT  N1,(%)
02680 RESTORE  N1
02700 FOR I = N1 TO 2360
02710 INPUT  N1, A3$ (I)
02720 NEXT I
02730 RETURN
02750 REM ************************************************************
02760 REM * END OF SUBROUTINE FOR STORING INSTRUCTIONAL DATA           *
02770 REM ************************************************************
02790 REM ************************************************************
02800 REM * SUBROTUTINE 2800 FOR RINGING OF THE BELL                   *
02810 REM ************************************************************
02830 FOR I = N1 TO N3
02840 PRINT CHR$ (N7);CHR$(M3)
02850 NEXT I
02860 RETURN
02880 REM ************************************************************
02890 REM * END OF SUBROUTINE FOR RINGING BELL                         *
02900 REM ************************************************************
02920 REM ************************************************************
02930 REM * SUBROUTINE  FOR STORING CHOICES                            *
02940 REM ************************************************************
02960 Z=Z+N1
02970 A3 (Z) = (A2 * 100 ) + A1
02980 IF Z > 500 THEN Z = N1
02990 RETURN
03010 REM ************************************************************
03020 REM * END OF SUBROUTINE FOR STORING CHOICES                      *
03030 REM ************************************************************
03050 REM ************************************************************
03060 REM * SUBROUTINE  FOR GOING TO TOP OF SCREEN                     *
03070 REM ************************************************************
03075 PRINT ":I"
03080 REM ************************************************************
03085 REM * END OF SUB ROUTINE FOR GOING TO TOP OS SCREEN          ***
03090 REM ************************************************************
03094 REM ============================================================
03096 REM ! SUB ROUTINE FOR FINDING Z1.....    !
03098 REM ============================================================
03100 A5 =A1
03102 A6 = A2
03103 GOSUB 2930
03104 GOSUB 3300
03105 IF A2 > 22 THEN 3120
```

```
03110 Z1 = 60 * (A2 - N1) + M0 * (A1 - N1) + N1
03115 GO TO 3130
03120 Z2 = 1320 + (A2 - 23)*100
03125 IF A1 = 6 THEN Z1 = Z2 + 71 ELSE Z1 = Z2+M0*(A1-N1)+N1
03130 IF A1 = N6 THEN L2 = N8 ELSE L2 = N9
03140 RETURN
03142 REM ================================================!
03144 REM ! START OF SUB ROUTINE FOR PRINTING INFORMATION    !
03145 REM ================================================!
03146 REM ************* ROUTINE FOR PRINTING
**********************
03148 GOSUB 2150
03150 FOR A4 = Z1 TO Z1 + L2
03155 PRINT A3$ (A4)
03160 NEXT A4
03170 T1 = T1 +A4 - Z1 + N1
03175 RETURN
03180 REM ================================================!
03182 REM ! END OF SUB ROUTINE FOR PRINTING INFORMATION     !
03184 REM ================================================!
03190 REM
03195 REM
03200 REM ================================================!
03202 REM ! ROUTINE FOR DECISION MAKING .                   !
03204 REM ================================================!
03210 IF A2 > 22 THEN IF A1 = N5 THEN 6500 ELSE IF A1 = N6 THEN
6800
03212 GOSUB 2150
03215 GOSUB 3100          'FIND Z1
03220 GOSUB 1350          'FIND L$
03225 IF L$<> "Y" THEN 3255
03228 GOSUB 2150
03230 PRINT "!============================================!"
03235 PRINT "! PLEASE NOTE THAT ALCAIP PROVIDES YOU WITH A  "
03240 PRINT "! BASED ON YOUR SEQUENCE OF REQUEST. IT DOES   "
03245 PRINT "! EXPECT YOU TO GIVE A REQUEST MORE THAN ONCE. "
03246 PRINT "! YOUR LAST REQUEST YOU HAVE ENTERED BEFORE.   "
03247 PRINT "!============================================!"
03248 H1 = N7
03249 T1 = T1 + N7
03250 GOTO 3280
03255 GOSUB 3145
03260 IF A1 = N6 THEN GOSUB 3450
03280 RETURN
03290 REM ****** END OF DECISION ROUTINE
03300 REM ------------------------------------------------
03310 REM ! SUBROUTINE  FOR STORING CONCEPTS CHOSEN        !
03320 REM ------------------------------------------------
03330 REM
03340 FOR I = N1 TO 30
03350 IF A7 (I,N1) = A2 THEN 3380
03360 IF A7 (I,N1) <> N0 THEN 3400
03370 A7 (I,N1) = A2
03380 A7 (I,A1+ N1) = A1
```

```
03390 GOTO 3410
03400 NEXT I
03410 RETURN
03420 REM _____________________________________________________
03430 REM ! END OF SUBROUTINE  FOR STORING CONCEPTS             !
03440 REM -----------------------------------------------------
03450 REM =====================================================
03460 REM! SUBROUTINE  FOR ACCEPTING PRACTICE ANSWERS          !
03470 REM =====================================================
03480 PRINT "** PLEASE ENTER YOUR ANSWER WHEN YOU'RE READY   "
03485 T1 = T1 + N2
03490 GOSUB 5160
03495 D = D + N1
03497 D$ (D) = R1$
03498 REM ******** GENERATE RANDOM NUMBER FOR RANDOM
03499 REM ******** SELECTION OF POS AND NEG. FEEDBACK.
03500 R1 = INT(((RND(-N1)*M0)+N2)/N2)
03560 IF R1$ <> A3$(A4) THEN 3610
03565 PRINT C$ (R1)
03570 T1=T1 + N2
03580 GOTO 3700
03610 PRINT W$(R1)
03611 PRINT "! THE CORRECT ANSWER IS ";A3$(A4);TAB(48);"!"
03612 GOSUB 3720
03613 T1 = T1 + N3
03614 GOSUB 2150
03620 A1 = N3
03622 GOSUB 3100
03624 REM GOSUB 1350
03626 IF L$ ="Y" THEN 3653
03630 GOSUB 3150
03632 H1 = N8
03640 PRINT "! FROM THE LIST OF CONCEPTS ABOVE YOU SHOULD    "
03646 PRINT "! SELECT AND STUDY THOSE   YOU WISH TO REVIEW.  "
03648 PRINT "!_____________________________________________!"
03649 T1 = T1 + N5
03653 IF L$ = "Y" THEN Z1 = Z1 + 20 ELSE Z1 = A4 + 10
03654 REM GOSUB 1350
03655 IF L$ = "Y" THEN 3669
03656 PRINT "! YOU MAY ALSO WANT TO LOOK AT THE FOLLOWING.   "
03657 PRINT  A3$(Z1+N1)
03658 PRINT "!=============================================!"
03660 H1 = 20
03661 T1 = T1 + N5
03662 H1 = N8
03669 REM
03670 T1 = T1 + N1
03671 REM =====================================================
03680 REM ! END OF ROUTINE FOR GIVING FEEDBACK TO PRACTICE   !
03690 REM =====================================================
03700 RETURN
03710 REM -----------------------------------------------------
03715 REM ! SUBROUTINE  FOR PAUSING FOR A WHILE               !
03718 REM -----------------------------------------------------
```

```
03720 REM
03722 PRINT " HIT THE 'C' KEY THEN 'RETURN'"
03744 INPUT P$
03745 T1 = T1 + N3
03748 RETURN
03770 REM _____
04000 REM _____
04010 REM ! THIS IS WHERE THE PROGRAM REALLY BEGINS !
04020 REM -----------------------------------------------
04030 REM
04040 REM
04045 DELIMIT (CR)
04048 GOSUB 2640                'STORE INSTRUCTIONS
04050 GOSUB 2250                'CLEAR SCREEN
04060 T = N3
04065 GOSUB 2320
04070 PRINT " _____"
04080 PRINT "  !                                          "
04090 PRINT "  ! HELLO, WELCOME TO   ALCCAIP, THIS IS     "
04095 PRINT "  !                     A                    "
04100 PRINT "  !                     LEARNER              "
04110 PRINT "  !                     CONTROLLED           "
04120 PRINT "  !                     COMPUTER             "
04130 PRINT "  !                     ASSISTED             "
04140 PRINT "  !                     INSTRUCTION          "
04150 PRINT "  !                     PROGRAM.             "
04160 PRINT "  !                                          "
04180 PRINT "  ------------------------------------------"
04185 T1 = M3
04190 GOSUB 3710              'PAUSE
04200 GOSUB 2250              'CLEAR SCREEN
04210 GOSUB 2320              'VERTICAL TAB
04220 PRINT " _____"
04230 PRINT "  ! ALCCAIP (PRONOUNCED AL-CAPE) GIVES YOU   "
04240 PRINT "  ! THE LEARNER THE UNIQUE PRIVILEGE OF      "
04250 PRINT "  ! CONTROLLING YOUR OWN LEARNING PROCESS.   "
04260 PRINT "  ! BEFORE ATTEMPTING TO DO THIS PROGRAM, YOU "
04270 PRINT "  ! SHOULD READ  THE MANUAL TO ALCCAIP. IF   "
04280 PRINT "  ! YOU HAVE NOT, YOU SHOULD ASK YOUR        "
04290 PRINT "  ! ATTENDANT FOR A MANUAL.                  "
04300 PRINT "  !                                          "
04310 PRINT "  ------------------------------------------!"
04315 T1 = M2
04320 GOSUB 3720              'PAUSE
04330 GOSUB 2250              'CLEAR
04340 GOSUB 2320              'VERT TAB
04355 PRINT "!-------------------------------------------!"
04360 PRINT "! WOULD YOU PLEASE ENTER YOUR  NAME NOW ?    "
04370 PRINT "!-------------------------------------------!"
04375 PRINT S$
04380 GOSUB 5160
04382 T1 = N5
04384 H1 = N1
04386 IF R1$ <> H$ THEN 4410
```

```
04388 GOSUB 8000
04389 GOTO 4380
04410 GOSUB 2250
04412 D = D + N1
04414 D$ (D) = R1$
04415 GOSUB 2320
04419 PRINT " ------------------------------------------------!"
04420 PRINT " ! HELLO ";R1$;TAB(48);"!"
04430 PRINT " ! I WILL NOW GIVE YOU A BRIEF RE-CAP              "
04440 PRINT " ! OF HOW ALCCAIP WORKS.                           "
04441 PRINT " ! NOTE WELL: I ALCCAIP  WILL OFTEN  PROMPT        "
04442 PRINT " ! YOU FOR A RESPONSE WITH THE COMMENT:            "
04443 PRINT " !              'WHAT NEXT ?'                      "
04445 PRINT " ________________________________________________!"
04450 GOSUB 3720              'PAUSE
04460 GOSUB 2250              'CLEAR
04480 GOSUB 2410              'DISPLAY COMMANDS
04485 PRINT "!================================================!"
04490 PRINT "! YOU ARE REQUIRED TO USE YOUR OWN STRATEGY TO    "
04495 PRINT "! LEARN TO USE 8 STRING FUNCTIONS IN BASIC.       "
04500 PRINT "! RATIONALE, OBJECTIVES, RULES, DEFINITIONS,      "
04505 PRINT "! EXAMPLES, PRACTICES,    AND   ADVICE ARE ALL    "
04510 PRINT "! PROVIDED FOR YOU. BY USING THE COMMANDS TO      "
04515 PRINT "! THE RIGHT, YOU MUST DIRECT YOUR OWN LEARNING.!"
04520 PRINT "! THE COMMANDS MAY BE ENTERED IN ANY SEQUENCE.    "
04525 PRINT "!================================================!"
04526 PRINT " "
04530 GOSUB 3720
04535 T1 =  M4
04540 GOSUB 2150
04545 PRINT "!================================================!"
04550 PRINT "! BESIDES THE 8 STRING FUNCTIONS, THERE ARE 22    "
04555 PRINT "! OTHER CONCEPTS WHICH YOU MAY NEED TO KNOW        "
04560 PRINT "! BEFORE LEARNING TO USE STRING FUNCTIONS.         "
04565 PRINT "! YOU CAN USE ALL THE COMMANDS WITH THESE          "
04570 PRINT "! CONCEPTS ALSO.                                   "
04575 PRINT "! REMEMBER: THE 'CONCEPTS' COMMAND WILL ALWAYS     "
04580 PRINT "! SHOW YOU A LIST OF ALL AVAILABLE CONCEPTS        "
04584 PRINT "! INCLUDING THE 8 STRING FUNCTIONS.                "
04585 PRINT "! FINALLY: FEEL FREE TO USE THE 'HELP' COMMAND.!"
04590 PRINT "!================================================!"
04595 T1 = T1 + M3
04600 GOSUB 3722
04602 H1 = N6
04603 IF P$(N1:N2) <> "HE" THEN GOTO 4608
04604 GOSUB 8000
04605 GOSUB 3720
04608 GOSUB 11600
04610 H1 = M7
04615 T1 = M8
04620 RETURN
04625 REM ------------------------------------------------------
04630 REM ! END OF MAIN SUBROUTINE FOR STARTING PROGRAM        !
04640 REM ------------------------------------------------------
```

```
04645 REM _____________________________________________________
04648 REM ! SUBROUTINE  FOR PRINTING CHOICES D$, A3, H         !
04650 REM -----------------------------------------------------
04660 PRINT  2,"-----------------------------------------------"
04662 FOR K = N1 TO D
04670 PRINT  2,D$(K);"  ";
04675 IF K/MØ = INT (K/MØ) THEN PRINT  2, " "
04680 NEXT K
04700 FOR J = N1 TO 1200
04710 IF A3 (J) =Ø THEN 4800
04720 PRINT  2,A3(J);
04730 IF J/MØ = INT (J/MØ)  THEN PRINT  2, " "
04740 NEXT J
04800 PRINT  2,B1;D1;D2;D3;D4;W1;W2;R2;R3
04810 PRINT  2,B2;B3;B4;B5
04820 PRINT  2,"-----------------------------------------------"
04900 RETURN
04910 REM ===================================================!
04920 REM! END OF SUBROUTINE FOR PRINTING FINAL STATISTICS  !
04930 REM!===================================================!
05000 REM -----------------------------------------------------
05020 REM ! ALL THE LESSONS FOR NEXT COMMAND                  !
05030 REM -----------------------------------------------------
05035 B2 = B2 + N1
05040 IF A6 = NØ THEN A6 = N1
05045 IF A5 = NØ THEN A5 = N1 ELSE A5 = A5 + N1
05050 IF A5 < N7 THEN 5085
05051 A6 = A6 + N1
05055 A5 = N1
05085 A2 = A6
05087 A1 = A5
05090 GOSUB 3200
05140 RETURN
05160 REM _____________________________________________________
05170 REM !              SUBROUTINE  FOR ACCEPTING  INPUT       !
05180 REM -----------------------------------------------------
05190 REM
05200 PRINT "WHAT NEXT ";          'INPUT REQUEST
05201 INPUT C$
05210 L1 = LEN (C$)        'FIND LENGTH
05214 IF C$(L1:L1) = " " THEN L1 = L1 - N1    'VERIFY LENGTH
05230 R3$ = C$ (N3:N3)     'SEPARATOR CHARACTER
05240 R1$ = C$ (N1:L1)     'THE ENTIRE ENTRY
05250 R$ = C$ (N1:N2)      'EXTRACT FIRST 2 CHARACTERS
05252 IF R$ = "CL" THEN GOSUB 2250
05253 IF R$ = "CL" THEN 5200
05254 RETURN
05256 REM _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _!
05258 REM ! END OF SUBROUTINE  FOR ACCEPTING INPUT            !
05259 REM _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _!
05260 REM
05262 REM _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _!
05264 REM ! SUBROUTINE  FOR VERIFYING INPUT                    !
05266 REM !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
05268 REM
05270 GOSUB 5160
05275 FOR A1 = N1 TO N6
05280 IF A1$ (A1) = R1$ THEN 6000
05285 NEXT A1
05305 FOR A1 = N7 TO M1
05310 IF A1$ (A1)(N1:L1) = R1$ THEN 5800
05315 NEXT A1
05320 FOR A2 = N1 TO 30
05330 IF A$ (A2) (N1:L1) = R1$ THEN 5900
05340 NEXT A2
05342 IF R1$ = "POST" THEN 11100
05380 IF L1 <= N2 THEN 5600  'INCORRECT COMMAND
05390IFL1=N3THENIFR3$<>","AND R3$ <> " " THEN 5440 ELSE
        5400 ELSE 5430
05400 R1$ = R$
05405 L1 = L1- N1
05410 GOTO 5275
05420 REM
05430 REM
05440 FOR A1 = N1 TO N7
05450 IF A1$ (A1) = R$ THEN 5480
05460 NEXT A1
05470 GOTO 5600
05480 REM
05490 IF R3$ = "," OR R3$ = " " THEN R2$=R1$(N4:L1) ELSE
      R2$=R1$(N3:L1)
05500 FOR A2 = N1 TO 30
05510 IF A$ (A2)(N1:LEN(R2$)) = R2$ THEN 5540 'CONTINUE
05520 NEXT A2
05530 GOTO 5720
05540 IF A1 <> N7 THEN 5555
05550 GOTO 7362              'VERIFY CONCEPT
05555 GOSUB 3200            'PRINT CHOICE
05560 H1 = N2
05565 IF P3$ = "Y" THEN 5270 ELSE 5270
05570 REM
05580 REM
05590 REM
05600 REM ------------------------------------------------
05602 REM ! TO PRINT ERROR ON BAD COMMAND                 !
05604 REM ------------------------------------------------
05610 IF T2 = N1 THEN GOSUB 2150 ELSE GOSUB 2250
05620 GOSUB 2410            'RULES
05625 IF R$ = "CM" THEN 5665
05645 PRINT R1$
05650 PRINT "_____"
05660 PRINT "! ILLEGAL COMMAND OR WRONG CONCEPT  ENTERED "
05665 PRINT "!-----------------------------------------!"
05670 PRINT "! SEE  TABLE TO THE RIGHT FOR COMMANDS OR  "
05672 PRINT "! TYPE 'CONCEPTS' FOR A LIST OF CONCEPTS.  "
05690 PRINT "-----------------------------------------"
05695  T1 = N8
05700 H1 = N3
```

```
05705 GOTO 5270
05720 GOSUB 2150
05735 PRINT "       ";R1$
05740 PRINT "-------------------------------------------------!"
05745 PRINT "! YOU HAVE ENTERED AN INCORRECT CONCEPT, TYPE  "
05760 PRINT "! 'CONCEPTS' FOR  AVAILABLE LIST IF YOU  WISH. "
05780 PRINT "-------------------------------------------------!"
05785 T1 = N7
05790 H1 = N4
05795 GOTO 5270
05800 REM - - - - - - - - - - - - - - - - - - - - - - - - - - -
05810 REM HELP OR NEXT OR POST TEST OR END OR MEM.SUP
05820 REM - - - - - - - - - - - - - - - - - - - - - - - - - - -
05830 IF R$ = "RV" THEN GOTO 7100
05840 IF R$ = "HE" THEN GOSUB 8000
05850 IF R$ = "NE" THEN GOSUB 5020
05855 IF A6 = 30 AND A5 = N6 THEN GOSUB 1500  'END OF LESSONS
05860 IF P1$ = "YES" THEN 6095   ' AFTER POST TEST SKIP OUT
05865 IF R$ = "EN" THEN 6095
05867 IF R$ = "CO" THEN GOTO 7700
05870 H1 = N5
05875 GOTO 5270
05880 REM - - - - - - - - - - - - - - - - - - - - - - - - - - -
05884 REM
05886 REM
05900 REM -------------------------------------------------
05910 REM ! SUBROUTINE  FOR CAUTION ABOUT NO COMMAND     !
05920 REM -------------------------------------------------
05930 REM
05940 A1 = A5
05945 GOSUB 3200
05980 IF P3$ = "Y" THEN 5270 ELSE 5270
05990 REM -------------------------------------------------
05992 REM ! END OF ROUTINE FOR CAUTION ABOUT INPUT       !
06000 REM
06005 REM -----------------------------------------------------
06010 REM ! ROUTINE FOR CAUTION ABOUT COMMAND WITH NO CONCEPT !
06015 REM -----------------------------------------------------
06020 A2 = A6
06025 GOSUB 3200
06055 IF P3$ = "Y" THEN 5270 ELSE 5270
06095 RETURN
06096 REM -------------------------------------------------
06097 REM ! END OF SUBROUTINE FOR VERIFYING CONCEPTS    !
06098 REM -------------------------------------------------
06100 REM - - - - - - - - - - - - - - - - - - - - - - - - - - -
06110 REM ! SUBROUTINE  FOR VERIFYING CONCEPT FOR MEM.SUPP.  !
06120 REM - - - - - - - - - - - - - - - - - - - - - - - - - - -
06130 H1 = M0
06132 GOSUB 5160
06134 IF R1$ = "RV" THEN 5275
06135 IF R1$ <> H$ THEN 6140
06137 GOSUB 8000
06138 GOTO 6130
```

```
06140 FOR A2 = N1 TO 30
06150 IF A$ (A2)(N1:L1) = R1$ THEN 6240
06160 NEXT A2
06175 GOSUB 7500
06230 H1 = M1
06235 GOTO 6132
06240 GOTO 7362            'RETURNING TO CONTROL
06250 REM _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
06260 REM ! END OF SUBROUTINE FOR VERIFYING CONCEPT FOR M.S!
06270 REM _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
06280 REM
06290 REM
06300 REM _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
06310 REM ! SUBROUTINE FOR VERIFYING COMMAND CHOSEN          !
06320 REM _____________________________________________________
06330 REM
06340 H1 = M2
06345 GOSUB 5160
06346 IF R1$ = "RV" THEN 5275
06347 IF R1$ <> H$ THEN 6350
06348 GOSUB 8000
06349 GOTO 6340
06350 FOR A1 = N1 TO N6
06360 IF A1$ (A1)(N1:L1) = R1$ THEN 6450
06370 NEXT A1
06375 GOSUB 7600
06440 H1 = M3
06445 GOTO 6345
06450 GOTO 7466      'RETURNING TO CONTROL
06460 REM _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
06470 REM ! END OF SUBROUTINE FOR VERIFYING COMMAND          !
06480 REM _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
06481 REM ===================================================
06482 REM ! ROUTINE FOR GIVING MORE THAN 1 EXAMPLE           !
06486 REM ===================================================!
06500 E1 = 0
06501 GOSUB 3100
06502 GOSUB 2150
06503 E1 = E1 + N1
06504 P3$ = " "
06506 GOSUB 1350
06507 IF L$ <> "Y" THEN 6518
06508 PRINT " **** THIS EXAMPLE HAS BEEN SEEN ALREADY ********"
06509 PRINT " **** TYPE 'NEXT' IF YOU HAVE NOT SEEN ALL 3 ****"
06510 PRINT" **** EXAMPLES OR YOU MAY ENTER ANOTHER REQUEST.  "
06511 T1 = T1 + N4
06512 H1 = N9
06513 A9 = Z1 + M0
06514 GOTO 6550
06518 GOSUB 3145
06519 A9 = A4
06520 IF E1 = N3 THEN 3280
06525 PRINT "!-----------------------------------------------!"
06530 PRINT "! IF YOU WOULD LIKE TO HAVE ANOTHER EXAMPLE:    "
```

```
06535 PRINT "!            TYPE 'NEXT'.                              "
06540 PRINT "!_____________________________________________________!"
06545 H1 = N9
06550 GOSUB 5160
06555 T1 = T1 + N6
06560 IF R$ <> "HE" THEN 6580
06565 GOSUB 8000
06575 GOTO 6550
06580 IF R$ <> "NE" THEN 6596
06590 Z1 = A9
06595 GOTO 6502
06596 P3$ = "Y"
06597 GOTO 3280
06600 REM ================================================
06605 REM END OF ROUTINE FOR GIVING MORE THAN 1 EXAMPLE   !
06610 REM ================================================!
06800 E2 = N0
06801 GOSUB 3100
06802 E2 = E2 + N1
06803 P3$ =" "
06804 L2 = N8
06805 GOSUB 1350
06810 IF L$ <> "Y" THEN 6840
06815 PRINT "!_____________________________________________!"
06820 PRINT "! SORRY ! BUT YOU HAVE ALREADY PRACTICED THIS  "
06825 PRINT "! PROBLEM. YOU MAY TYPE 'NEXT' FOR ANOTHER.    "
06830 PRINT "!_____________________________________________!"
06831 H1 = N9
06832 T1 = T1 + N4
06833 A8 = Z1 + M0
06834 GOTO 6870
06840 A8 = Z1
06842 GOSUB 3145
06849 GOSUB 13000
06850 A8 = A8 + M0
06852 PRINT "! THERE ARE 3 PRACTICES ON THIS FUNCTION       "
06854 PRINT "! IF YOU HAVE NOT DONE THEM ALL YOU MAY        "
06856 PRINT "! GET ANOTHER BY TYPING 'NEXT'.                "
06858 T1 = T1 + N4
06870 IF E2 = N3 THEN 3280
06872 GOSUB 5160
06873 H1 = N9
06874 H1 = 21
06875 IF R$ <> "HE" THEN 6895
06880 GOSUB 8000
06885 GOSUB 2150
06888 GOTO 6870
06895 IF R$ <> "NE" THEN 6930
06900 Z1 = A8
06915 GOSUB 2150
06920 GOTO 6802
06930 P3$ = "Y"
06940 GOTO 3280
07000 REM
```

```
07100 REM ____________________________________________________
07110 REM ! SUBROUTINE  FOR MEMORY SUPPORT                    !
07120 REM ----------------------------------------------------
07122 B3 = B3 + N1
07130 J1 =N1
07140 J2 = M8
07145 GOSUB 2250                    'CLEAR SCREEN
07147 IF A7(N1,N1) <> N0 THEN 7170
07151 PRINT "************** MEMORY SUPPORT NOT AVAILABLE *******"
07152 T1 = N3
07153 H1 = M4
07154 GOTO 5270
07170 PRINT S$
07172 PRINT TAB (54);"!--------------------!"
07175 FOR I = J1 TO J2
07180 IF A7 (I,N1) = N0 OR I = 37 THEN 7340
07190 PRINT TAB (54);"!";A$(A7(I,N1))(N1:20);TAB (75);"!"
07200 NEXT I
07207 GOSUB 2320
07220 PRINT "_____________________________________________"
07230 PRINT "! THESE ARE THE CONCEPTS YOU HAVE SEEN "
07240 PRINT "! DO YOU WANT TO SEE MORE.              "
07250 PRINT "---------------------------------------"
07255 T1 = N5
07260 H1 = M5
07265 GOSUB 5160
07266 IF R1$ = "RV" THEN 5275
07267 IF R1$ <> H$ THEN 7270
07268 GOSUB 8000
07269 GOTO 7260
07270 IF R1$ = "NO" THEN 7340
07272 IF R1$ = "YES" THEN 7290
07274 PRINT "  "
07276 PRINT "  PLEASE ANSWER YES OR NO TO THIS QUESTION "
07277 T1 = N3
07278 H1 = M6
07280 IF R1$ <> H$ THEN 7285
07282 GOSUB 8000
07285 GOTO 7265
07290 J1 = M9
07295 J2 = 37
07310 GOTO 7145
07340 GOSUB 2320                    'TABBING
07344 PRINT "+-------------------------------------+"
07348 PRINT "! WHICH CONCEPT DO YOU WANT TO REVISE? "
07349 T1 = N3
07354 GOTO 6100                  ' GOSUB 6100 VERIFY CONCEPT
07362 FOR J = N1 TO 36
07363 IF A7 (J,N1) = A2 THEN 7380
07365 NEXT J
07367 GOSUB 7500
07369 GOTO 7354
07380 PRINT S$
07381 GOSUB 2250
```

```
07382 PRINT TAB(58);"   COMMANDS"
07383 PRINT TAB(58);"___________"
07384 FOR I = N2 TO N7
07385 IF A7(J,I) =0 THEN 7400
07386 PRINT TAB (64); A1$(A7(J,I))
07400 NEXT I
07420 PRINT "_____________________________________________"
07430 PRINT " THESE ARE THE COMMANDS YOU HAVE USED."
07440 PRINT " WHICH DO YOU WANT TO REVIEW ?"
07450 PRINT "---------------------------------------"
07455 T1 = N9
07465 GOTO 6300              'GOSUB 6300 VERIFY COMMAND CHOSEN
07466 FOR I = N2 TO N7
07467 IF  A7(J,I) = A1 THEN 7472
07468 NEXT I
07469 GOSUB 7600             'PRINT ERROR
07471 GOTO 7465
07472 GOSUB 3200
07480 GOTO 5270
07482 REM ---------------------------------------------!
07484 REM !  END OF MEMORY SUPPORT ROUTINE.              !
07486 REM _____________________________________________!
07500 GOSUB 2150
07505 PRINT " - - - - - - - - - - - - - - - - - - - - -!"
07510 PRINT " ! PLEASE CHOOSE CONCEPT FROM THOSE SHOWN "
07520 PRINT " ! THE ONE CHOSEN IS NOT VALID !         "
07530 PRINT " - - - - - - - - - - - - - - - - - - - - -!"
07535 T1 = N5
07540 RETURN
07600 GOSUB 2150
07620 PRINT "_____________________________________________"
07630 PRINT "! PLEASE CHOOSE COMMAND FROM THOSE SHOWN     "
07640 PRINT "! THE ONE YOU HAVE CHOSEN IS NOT PERMISSIBLE "
07650 PRINT "_____________________________________________"
07655 T1 = N5
07660 RETURN
07700 REM ---------------------------------------------!
07710 REM  !    SUBROUTINE FOR SHOWING AVAILABLE CONCEPTS    !
07720 REM _____________________________________________!
07724 REM _____________________________________________!
07726 B4 = B4 + N1
07730 REM
07740 J1 = N1
07750 J2 = M8
07760 GOSUB 2250             'CLEAR ENTIRE SCREEN
07770 PRINT S$
07775 PRINT TAB (54);"!--------------------!"
07780 FOR I = J1 TO J2
07790 PRINT TAB (54);"!";A$(I)(N1:20);TAB(75);"!"
07800 NEXT I
07810 IF I > 30 THEN 7940
07820 GOSUB 2320
07830 PRINT "!- - - - - - - - - - - - - - - - - - - - -!"
07840 PRINT "  DO YOU WANT TO SEE MORE ?"
```

```
07842 T1 = N3
07845 H1 = M5
07850 GOSUB 5160
07852 IF R1$ <> H$ THEN 7860
07854 GOSUB 8000
07856 GOTO 7830
07860 IF R1$ = "NO" THEN 7940
07870 IF R1$ = "YES" THEN 7910
07905 GOTO 5275
07910 J1 = M9
07920 J2 = 30
07930 GO TO 7760
07940 GOSUB 2150
07941 PRINT "**** ENTER REQUEST NOW ****"
07942 T1 = T1 + N5
07943 H1 = N5
07944 IF R1$ <> H1$ THEN 7948
07945 GOSUB 8000
07946 GOTO 7941
07948 GOTO 5270        'RETURN TO INPUT
07950 REM
07960 REM ------------------------------------------------------!
07970 REM ! END OF SUBROUTINE  FOR SHOWING AVAILABLE CONCEPTS  !
07980 REM ------------------------------------------------------!
08000 B5 = B5 + N1
08001 JUMP 8100 + (H1-N1)*100
08100 GOSUB 2150
08120 PRINT "!_____________________________________________!"
08130 PRINT "! AT THIS POINT YOU SHOULD TYPE IN YOUR       "
08140 PRINT "! NAME. REMEMBER TO HIT THE 'RETURN' KEY      "
08145 PRINT "!_____________________________________________!"
08146 T1 = N5
08190 GOTO 11000
08200 GOSUB 2150
08230 PRINT "!---------------------------------------------"
08240 PRINT "! AT THIS POINT YOU SHOULD CONTINUE JUST      "
08250 PRINT "! AS BEFORE, BY ENTERING A COMMAND OR A       "
08260 PRINT "! CONCEPT, OR A COMMAND AND A CONCEPT.        "
08270 PRINT "!_____________________________________________"
08271 T1 = N6
08290 GOTO 11000
08300 GOSUB 2150
08320 PRINT " ------------------------------------------------!"
08330 PRINT " ! EITHER THE COMMAND YOU HAVE ENTERED OR THE     "
08340 PRINT " ! CONCEPT YOU HAVE ASKED FOR IS INCORRECT.
SELECT!"
08350 PRINT " ! COMMAND FROM THOSE SHOWN AT THE RIGHT OF THE  "
08360 PRINT " ! SCREEN OR TYPE  'CONCEPTS' TO SEE A LIST OF   "
08370 PRINT " ! AVAILABLE CONCEPTS OR 'CM' FOR COMMANDS.      "
08380 PRINT " _________________________________________________!"
08381 T1 = N8
08390 GOTO 11000
08400 GOSUB 2150
08430 PRINT "!-----------------------------------------------!"
```

```
08440 PRINT "! THE COMMAND YOU HAVE ENTERED IS DEFINITELY   "
08450 PRINT "! O.K. HOWEVER THE CONCEPT IS INCORRECT. TYPE  "
08460 PRINT "! CONCEPTS FOR A LIST OF AVAILABLE CONCEPTS.   "
08470 PRINT "!_____________________________________________!"
08475 T1 = N6
08490 GOTO 11000
08500 GOSUB 2150
08510 PRINT " ---------------------------------------------!"
08520 PRINT " ! JUST KEEP GOING, YOU ARE DOING ALRIGHT.     "
08530 PRINT " ! JUST ENTER A COMMAND FOLLOWED BY THE CONCEPT "
08540 PRINT " ! THAT YOU WANT. TO SEE CONCEPTS TYPE
'CONCEPTS'.!"
08550 PRINT " _____________________________________________!"
08555 T1 = N6
08590 GOTO 11000
08600 GOSUB 2150
08610 PRINT "!=============================================!"
08620 PRINT "! GOOD EFFORT ! I SEE YOU ARE TRYING OUT THE   "
08630 PRINT "! THE HEP COMMAND. NOW YOU ARE CONVINCED THAT  "
08640 PRINT "! IT WORKS. THAT WAS VERY SMART. IF EVER YOU   "
08650 PRINT "! WANT TO SEE THE 8 STRING FUNCTIONS THAT YOU  "
08670 PRINT "! ARE TO LEARN THE USE THE 'CONCEPT' COMMAND.  "
08680 PRINT "!=============================================!"
08688 T1 = N8
08690 GOTO 11000
08700 GOSUB 2150
08710 PRINT "!=============================================!"
08720 PRINT "! ALCAIP IS GENERATING A SEQUENTIAL LESSON     "
08730 PRINT "! BASED UPON THE SEQUENCE OF YOUR COMMANDS.    "
08740 PRINT "! WHEN YOU MAKE THE SAME REQUEST TWICE, ALCAIP "
08750 PRINT "! WILL ALWAYS REJECT IT.                       "
08760 PRINT "!_____________________________________________!"
08775 T1 = N7
08790 GOTO 11000
08800 GOSUB 2150
08810 PRINT "!=============================================!"
08820 PRINT "! THIS WAS JUST AN ADVICE TO YOU TO LET YOU    "
08830 PRINT "! KNOW WHAT CONCEPTS, RULES OR EXAMPLES ARE    "
08840 PRINT "! RELEVANT TO THE PRACTICE YOU KJUST DID.      "
08850 PRINT "!=============================================!"
08860 T1 = T1 + N6
08890 GOTO 11000
08900 GOSUB 2150
08910 PRINT "!=============================================!"
08920 PRINT "! THREE EXAMPLES AND THREE PRACTICES ARE PRO-  "
08925 PRINT "! VIDED FOR THE 8 STRING FUNCTIONS. YOU CAN    "
08930 PRINT "! SEE THEM ALL BY ENTERING 'NEXT'.             "
08940 PRINT "!=============================================!"
08955 T1 = N7
08990 GOTO 11000
08995 T1 = N7
09000 GOSUB 2150
09010 PRINT "!---------------------------------------------"
09020 PRINT "! YOU REQUESTED REVISION .   YOU WERE  SHOWN   "
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09030 PRINT "! ONLY THOSE CONCEPTS THAT YOU HAVE ALREADY   "
09040 PRINT "! SEEN, SINCE YOU CANNOT REVISE THAT WHICH    "
09050 PRINT "! YOU HAVE NOT SEEN. YOU MUST NOW DECIDE      "
09060 PRINT "! WHICH OF THESE CONCEPTS YOU NEED TO  REVISE.!"
09070 PRINT "!_____"
09085 T1 = N8
09090 GOTO 11000
09100 GOSUB 2150
09110 PRINT " ----------------------------------------------!"
09120 PRINT " ! YOU CAN ONLY REVISE THOSE CONCEPTS  THAT HAVE "
09130 PRINT " ! BEEN SHOWN TO YOU. IF YOU WANT TO SEE THEM    "
09140 PRINT " ! AGAIN TYPE   'MS'.                            "
09150 PRINT " _____!"
09165 T1 = N6
09190 GOTO 11000
09200 GOSUB 2150
09210 PRINT " ----------------------------------------------!"
09220 PRINT " ! YOU HAVE BEEN SHOWN THE COMMANDS THAT YOU HAVE "
09230 PRINT " ! USED WITH THE CONCEPT YOU REQUESTED. YOU MUST  "
09240 PRINT " ! NOW DECIDE WHICH OF THESE COMMANDS YOU WANT TO "
09250 PRINT " ! REVISE.                                       "
09260 PRINT " _____!"
09275 T1 = N7
09290 GOTO 11000
09300 GOSUB 2150
09310 PRINT " ----------------------------------------------!"
09320 PRINT " ! YOU HAVE NOT CHOSEN A COMMAND FROM THOSE SHOWN "
09330 PRINT " ! TO YOU. YOU ARE ONLY ALLOWED TO REVISE
CONCEPTS!"
09340 PRINT " ! AND COMMANDS THAT YOU HAVE ALREADY DONE.      "
09350 PRINT " _____!"
09365 T1 = N6
09390 GOTO 11000
09400 GOSUB 2150
09410 PRINT " ----------------------------------------------!"
09420 PRINT " ! YOU HAVE NOT DONE ANY WORK AS YET, HENCE YOU  "
09430 PRINT " ! CANNOT REVISE ANYTHING.                       "
09440 PRINT " _____!"
09455 T1 = N5
09460 GOTO 11000
09500 GOSUB 2150
09510 PRINT " ----------------------------------------------!"
09520 PRINT " ! SINCE THE SCREEN CANNOT HOLD ALL THE CONCEPTS "
09530 PRINT " ! YOU HAVE SEEN, I HAVE DECIDED TO SHOW THEM TO "
09540 PRINT " ! IN GROUPS. YOU CAN SEE MORE IF YOU WISH BY    "
09550 PRINT " ! TYPING 'YES'. IF YOU HAVE SEEN THE CONCEPT YOU "
09560 PRINT " ! WANT TYPE 'NO' TO THE QUESTION.               "
09570 PRINT " _____!"
09585 T1 = N8
09590 GOTO 11000
09600 GOSUB 2150
09610 PRINT " ----------------------------------------------!"
09620 PRINT " ! YOU WERE ASKED WHETHER YOU WANT TO SEE MORE   "
09630 PRINT " ! CONCEPTS OR NOT. YOU MOUST ANSWER 'YES' OR
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'NO'!"
09640 PRINT " ! TO THIS QUESTION BEFORE DOING ANYTHING ELSE.    "
09650 PRINT " _____!"
09665 T1 = N6
09690 GOTO 11000
09700 GOSUB 2150
09710 PRINT "!=============================================!"
09720 PRINT "! YOU MAY BEGIN BY TYPING 'NEXT, THIS COMMAND   "
09730 PRINT "! STARTS YOU AT THE INTRODUCTORY LEVEL. IT       "
09740 PRINT "! ASSUMES THAT YOU DO NOT KNOW ANYTHING AT ALL  "
09745 PRINT "! ABOUT STRING FUNCTIONS. IF YOU WOULD LIKE TO  "
09748 PRINT "! WHERE TO BEGIN TYPE 'CONCEPTS' FOR A LIST OF  "
09750 PRINT "! CONSEPTS. THEN SELECT THE CONCEPT THAT YOU     "
09760 PRINT "!=============================================!"
09770 PRINT "!=============================================!"
09788 T1 = M0
09790 GOTO 11000
09800 GOSUB 2150
09810 PRINT "!=============================================!"
09820 PRINT "! THERE ARE 8 STRING FUNCTIONS THAT YOU SHOULD   "
09830 PRINT "! LEARN TO USE. IF EVER YOU WANT TO SEE THEM USE "
09840 PRINT "! THE 'CONCEPT' COMMAND. AT THE END OF THE LIST  "
09850 PRINT "! YOU WILL SEE ALL 8 OF THEM.                    "
09860 PRINT "!=============================================!"
09870 T1 = T1 + M7
09890 GOTO 11000
09900 PRINT "HELP FOR H19"
09910 PRINT "!=============================================!"
09920 PRINT "! YOU PASSED A NUMBER OF QUESTIONS THAT YOU      "
09930 PRINT "! PROBABLY FOUND TOO DIFFICULT. NOW I AM GIVING  "
09940 PRINT "! YOU A CHANCE TO TRY THEM AGAIN IF YOU WOULD    "
09950 PRINT "! LIKE TO.                                       "
09960 PRINT "!=============================================!"
09970 T1 = T1 + N7
09990 GOTO 11000
10000 GOSUB 2150
10010 PRINT "!=============================================!"
10020 PRINT "! WHEN A QUESTION IS ASKED DEMANDING A 'YES' OR  "
10030 PRINT "! 'NO' ANSWER, ANY OTHER REPLY IS ASSUMED TO BE  "
10040 PRINT "! NEW INPUT.                                     "
10050 PRINT "!=============================================!"
10060 T1 =T1 + N6
10090 GOTO 11000
10100 PRINT " HELP FOR H21 "
10190 GOTO 11000
10200 PRINT " HELP FOR H22"
10290 GOTO 11000
10300 GOSUB 2250
10305 GOSUB 2320
10310 T = N3
10320 GOTO 11000
11000 RETURN
11100 REM ================================================
11110 REM ! END OF SUBROUTINE FOR POST TEST INTRODUCTION  !
```

```
11120 REM ================================================
11125  P1$ = "YES" 'TO KEEP TRACT OF POST TEST COMPLETION
11130 GOSUB 2250
11140 PRINT "!================================================!"
11150 PRINT "! WELCOME TO THIS POST-TEST. I AM SURE YOU HAVE
■
11160 PRINT "! TRIED YOUR BEST WITH THE LESSONS AND NOW YOU
■
11170 PRINT "! BELIEVE YOU ARE READY TO DO THIS POST-TEST.    ■
11180 PRINT "! THE QUESTIONS ARE SIMILAR TO THOSE YOU HAD ON  ■
11190 PRINT "! ON THE PRACTICE, EXAMPLES AND PRE-TEST. IF YOU ■
11200 PRINT "! UNDERSTOOD THE EXAMPLES AND DID WELL WITH THE  ■
11210 PRINT "! PRACTICE, YOU SHOULD  HAVE  ABSOLUTELY  NO     ■
11220 PRINT "! PROBLEMS AT ALL WITH THIS POST-TEST.           ■
11230 PRINT "!================================================!"
11240 GOSUB 3722
11250 GOSUB 2250
11260 PRINT "!================================================!"
11270 PRINT "! AFTER THIS FRAME THE POST-TEST WILL BEGIN.     ■
11280 PRINT "! IF YOU THINK YOU ARE SPENDING TOO MUCH TIME    ■
11290 PRINT "! ON ANY QUESTION YOU MAY PASS BY TYPING 'PASS'!"
11300 PRINT "! I 'ALCAIP' WILL REMEMBER THAT AND GIVE YOU     ■
11310 PRINT "! ONE CHANCE TO TRY THEM AGAIN AT THE END.       ■
11320 PRINT "! READY ... O.K. HERE WE GO.. GOOD LUCK..        ■
11330 PRINT "!================================================!"
11350 GOSUB 3722
11360 GOSUB 2250
11370 D = D + N1
11480 D$ (D) = CLK$          'TIME POST TEST BEGINS'
11490 D3 = TIM (1)           'CPU TIME WHEN POST TEST BEGINS'
11500 GOSUB 12214            'PRESENTATION OF POST TEST'
11510 D = D + N1
11520 D$ (D) = CLK$          'TIME POST TEST ENDS'
11530 D4 = TIM (1)           'CPU TIME WHEN POST TEST ENDS'
11540 REM ================================================!
11550 REM ! END OF POST TEST INTRODUCTION.                  !
11560 REM ================================================!
11565 GOTO 6095
11600 REM
11610 REM ================================================!
11620 REM ! SUBROUTINE  FOR PRE TEST INTRODUCTION          !
11630 REM ================================================!
11640 GOSUB 2150
11650 PRINT "!_____________________________________________!"
11660 PRINT "! BEFORE YOU BEGIN THIS LESSON, I WOULD LIKE TO  ■
11670 PRINT "! GIVE YOU A PRE-TEST. REMEMBER YOU HAVE:        ■
11675 PRINT "!              NOTHING TO FEAR.                  ■
11680 PRINT "! THIS TEST WAS SIMPLY DESIGNED TO SEE HOW MUCH  ■
11685 PRINT "! YOU ALREADY KNOW ABOUT 'STRING FUNCTIONS'.     ■
11690 PRINT "! IF YOU DO NOT KNOW THE ANSWERS, DO NOT GUESS   ■
11700 PRINT "! THEM. SIMPLY TYPE  'PASS'.  AT THE END OF THIS ■
11705 PRINT "! LESSON YOU WILL BE ABLE TO ANSWER ALL THESE    ■
11710 PRINT "! QUESTIONS THAT SEEM SO DIFFICULT NOW.          ■
11740 PRINT "!================================================!"
```

```
11745 T1 = M2
11750 GOSUB 3722
11760 GOSUB 2150
11761 PRINT "!================================================!"
11762 PRINT "! NOTE WELL: FOR MULTIPLE CHOICE ANSWERS ALWAYS  "
11764 PRINT "! INDICATE YOUR ANSWER BY THE NUMBER THAT COMES  "
11766 PRINT "! BEFORE IT. EG. IF THE QUESTION IS: HOW OLD     "
11768 PRINT "! ARE YOU AND THE ANSWERS ARE:                   "
11770 PRINT "!              1. 6 YEARS                        "
11772 PRINT "!              2. 3 YEARS                        "
11774 PRINT "!              3. 8 YEARS                        "
11776 PRINT "! IF THE CORRECT ANSWER IS 3 YEARS THEN YOU      "
11778 PRINT "! SHOULD ENTER THE NUMBER   2  ONLY.             "
11779 PRINT "!================================================!"
11780 T1 = M2
11781 GOSUB 3722
11782 GOSUB 2150
11783 PRINT "!================================================!"
11785 PRINT "! AFTER THIS FRAME THE PRE-TEST WILL BEGIN. DO   "
11790 PRINT "! NOT WORRY IF YOU DO NOT KNOW THE ANSWERS .IF   "
11795 PRINT "! YOU   CANNOT   ANSWER A PARTICULAR QUESTION    "
11800 PRINT "! JUST TYPE 'PASS'.                              "
11820 PRINT "! READY NOW! OK, HERE WE GO.... GOOD LUCK..      "
11840 PRINT "!________________________________________________!"
11845 T1 = N9
11850 GOSUB 3722
11860 GOSUB 2150
11870 D = D + N1
11890 D$(D) = CLK$          'TIME PRETEST BEGINS'
11900 D1 = TIM (1)          'CPU TIME PRE-TEST BEGINS'
11910 GOSUB 12214           'PRESENT PRE-TEST'
11920 D = D + N1
11930 D$(D) = CLK$          'TIME PRETEST ENDS'
11940 D2 = TIM (1)          'CPU TIME  PRE TEST  ENDS'
11950 GOSUB 3722
11960 GOSUB 2150
11965 GOSUB 2410
11970 PRINT "!------------------------------------------------!"
11980 PRINT "! HELLO AGAIN. YOU HAD ";R2;" CORRECT.
";TAB(48);"!"
11990 PRINT "! I ASSURE YOU THAT WHEN YOU FINISH THIS LESSON!"
12000 PRINT "! YOU WILL BE DOING MUCH BETTER.                 "
12010 PRINT "! LOOK TO THE RIGHT OF THE SCREEN. THESE ARE     "
12020 PRINT "! THE COMMANDS THAT YOU MUST USE TO GUIDE        "
12030 PRINT "! YOURSELF THROUGH THE LESSON. DO NOT BE         "
12040 PRINT "! AFRAID TO USE THEM.                            "
12050 PRINT "!________________________________________________!"
12060 GOSUB 3722
12070 T1 = M5
12080 GOSUB 2150
12090 PRINT "!------------------------------------------------!"
12100 PRINT "! I WILL BEGIN BY SHOWING YOU                    "
12104 PRINT "!          THE RATIONALE,                        "
12106 PRINT "!          THE OBJECTIVE,                        "
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12108 PRINT "! AND THE PRE-REQUISITES FOR STRING FUNCTIONS.  "
12110 PRINT "! FROM THERE ON, YOU ARE ON YOUR OWN.           "
12120 PRINT "! PLEASE FEEL FREE TO USE ALL THE COMMANDS.     "
12130 PRINT "! YOUR GOAL IS TO LEARN TO USE THE 8 STRING     "
12140 PRINT "! FUNCTIONS.                                    "
12150 PRINT "! O.K. GOOD LUCK NOW. FEEL FREE.                "
12160 PRINT "!_____________________________________________!"
12165 T1 = M2
12166 GOSUB 3722          ' HALT A MOMENT
12170 GOSUB 2150          ' CLEAR SCREEN
12175 A1 = N1
12180 A2 = 22
12183 GOSUB 3100          'SET Z1
12184 GOSUB 3145          ' PRINT INFORMATION
12185 T1 = M2
12186 GOSUB 3722          'HALT
12187 GOSUB 2150          'CLEAR SCREEN
12188 A1 = N2
12189 GOSUB 3100               'SET Z1
12190 GOSUB 3145                'PRINT INFORMATION
12191 T1 = M2
12192 GOSUB 3722
12193 GOSUB 2150
12194 A1 = N3
12195 GOSUB 3100
12196 GOSUB 3145
12197 A1 = N4
12198 PRINT "! USE THE COMMANDS TO THE RIGHT TO LEARN ABOUT  "
12199 PRINT "! ALL OF THE 8 FUNCTIONS LISTED ABOVE.          "
12200 PRINT "! THE 'CONCEPTS' COMMAND WILL SHOW YOU  THE 8   "
12201 PRINT "! STRING FUNCTIONS. THEY ARE THE LAST 8.        "
12202 H1 = M8
12203 PRINT "!_____________________________________________!"
12204 RETURN
12205 REM ----------------------------------------------!
12206 REM ! END OF PRE TEST INITIATION                    !
12208 REM _____________________________________________!
12210 REM ----------------------------------------------------!
12212 REM ! BEGINNING OF TEST PRESENTATION                     !
12214 REM _____________________________________________________!
12220 Z1 = 2121
12240 GOSUB 2150
12245 FOR A4 = Z1 TO Z1 + M0
12250 PRINT A3$ (A4)
12260 NEXT A4
12270 GOSUB 5160
12275 T1 = M2
12280 IF R$ <> "PA" THEN 12320
12281 P5 = P5 +1
12282 P6(P5) = Z1
12285 D = D+1
12288 D$(D) = "PA"
12290 Z1 = A4 + N1
12300 IF Z1 > 2360 THEN 12450
```

```
12310 GOTO 12240
12320 IF R$ = "SK" THEN 12450
12325 IF R1$  <> A3$ (A4) THEN 12390
12330 D = D + N1
12340 D$ (D) = R1$
12350 IF P1$ = "YES" THEN R3 = R3 + N1 ELSE R2 = R2 + N1
12360 Z1 = A4 + N1
12370 IF Z1 > 2360 THEN 12450
12380 GOTO 12240
12390 D = D + N1
12400 D$ (D) = R1$
12410 IF P1$ = "YES" THEN W2 = W2 + N1 ELSE W1 = W1 + N1
12420 Z1 = A4 + N1
12430 IF Z1 > 2360 THEN 12450
12440 GOTO 12240
12450 GOSUB 2150
12452 IF P6(N1)<>N0 THEN GOSUB 13500 'GIVE PASSED POST TEST'
12454 FOR M = N1 TO P5
12455 P6(M) = N0
12456 NEXT M
12457 P5 = N0
12460 RETURN
12470 REM ------------------------------------------------!
12480 REM ! END OF SUBROUTINE FOR GIVING TESTS             !
12490 REM ------------------------------------------------!
12500 GOSUB 2250
12520 PRINT "-------------------------------------------------"
12525 PRINT "! HI, IT WAS QUITE GOOD WORKING WITH YOU. IF  "
12530 PRINT "! IF YOU WOULD LIKE TO KNOW YOUR SCORE ON THE!"
12540 PRINT "! POSTTEST PLEASE SEE THE ATTENDANT IN CHARGE!"
12545 PRINT "! OF THIS LESSON. THANK YOU VERY MUCH FOR     "
12550 PRINT "! FOR WORKING WITH ME. YOU MAY LEAVE NOW,     "
12555 PRINT "! BUT BLEASE CALL THE MONITOR BEFORE LEAVING.!"
12560 PRINT "!-----------------------------------------------!"
12590 GOTO 14000
13000 REM ================================================
13010 REM ! SUB ROUTINE FOR GIVING RESPONSE ON PRACTICE   !
13020 REM ================================================
13030 PRINT "!***** ENTER YOUR ANSWER WHEN YOU ARE READY ***!"
13040 GOSUB 5160
13050 T1 = T1 + N2
13060 D = D+N1
13070 D$(D) = R1$
13080 R1 = INT(((RND(-N1)*M0)+N2)/N2)
13090 IF R1$ <> A3$(A4) THEN 13140
13110 PRINT C$(R1)
13120 T1=T1+N1
13130 GOTO 13400
13140 PRINT W$(R1)
13145 PRINT "! THE CORRECT ANSWER IS ";A3$(A4);TAB(48);"!"
13146 T1 = T1 + N2
13160 A1 = N3
13170 GOSUB 3722
13180 GOSUB 3100
```

```
13190 GOSUB 1350
13200 IF L$ = "Y" THEN 13250
13210 GOSUB 3145
13220 PRINT "! FROM THE LIST OF CONCEPTS ABOVE YOU SHOULD   "
13230 PRINT "! SELECT AND STUDY THE ONES YOU WISH.          "
13242 PRINT "!=============================================!"
13243 H1 = N8
13244 T1 = T1 + N5
13250 IF L$ = "Y" THEN Z1 = Z1 + 20 ELSE Z1 = A4 + M0
13260 GOSUB 1350
13270 IF L$ = "Y" THEN 13320
13280 PRINT "! YOU MAY ALSO WANT TO LOOK AT THE FOLLOWING.  "
13281 H1 = N8
13290 PRINT A3$(A8-29)
13300 T1 = T1 + N1
13310 Z4 (I) = N0
13320 REM ****** END  OF ROUTINE *****
13400 RETURN
13480 REM ============================================!
13485 REM ! SUB ROUTINE FOR GIVING QUESTIONS THAT WERE  !
13490 REM ! PASSED ON POST TEST.                        !
13495 REM ============================================!
13500 GOSUB 2250
13510 PRINT "!=============================================!"
13520 PRINT "! I CAN GIVE YOU THE TEST QUESTIONS THAT YOU   "
13530 PRINT "! PASSED. DO YOU WANT TO TRY THEM AGAIN ?      "
13540 PRINT "!=============================================!"
13542 H1 = N9
13550 GOSUB 5160
13552 IF R$ <> "HE" THEN 13560
13553 GOSUB 8000
13554 GOTO 13510
13560 IF R1$ = "NO" THEN 13999
13570 IF R1$ = "YES" THEN 13580
13572 PRINT "***** PLEASE ANSWER 'YES' OR 'NO' ************!"
13574 GO TO 13550
13580 GOSUB 2250
13590 FOR I = 1 TO P5
13600 K = P6(I)
13610 FOR J = K TO K + M0
13620 PRINT A3$(J)
13630 NEXT J
13635 P6(I) = N0
13640 GOSUB 5160
13642 D = D +N1
13644 D$(D) = R1$
13650 IF R1$<>A3$(J) THEN 13750
13680 IF P1$ = "YES" THEN R3 = R3 + N1 ELSE R2 = R2 + N1
13690 GOTO 13800
13750 IF P1$ = "YES" THEN W2 = W2 + N1 ELSE W1 = W1 + N1
13800 GOSUB 2250
13805 NEXT I
13810 REM ============================================
13820 REM ! END OF ROUTINE FOR GIVING POST TEST PASSED. !
```

Appendix J

Data and Formulae

SS	GRP	PRS SCOR	POST SCOR	DEL POST SCOR	GAI-NED SCOR	ON LINE TIME	CPU TIME	TOTAL COST	TOT ADV ICE	TOT INST ANCE	TIM PER INST	COST PER SCOR
1	AS	2	8	12	6	187	3.05	28.63	16	35	5.34	4.77
2	AS	2	15.5	6.5	13.5	192	14.39	31.53	17	105	1.83	2.34
3	AS	0	5.5	5.5	5.5	126	2.39	19.35	26	61	2.07	3.52
4	AS	0	10.5	3	10.5	74	8.89	12.79	31	83	.89	1.22
5	AS	1	18.5	19.5	17.5	116	13.6	19.98	26	134	.87	1.14
6	AS	0	24	21.5	24	108	6.98	17.53	7	56	1.93	.73
7	AS	0	24	27	24	114	8.05	18.63	7	90	1.27	.78
8	AS	0	25	27	25	93	10.92	16.02	14	84	1.11	.64
9	AS	0	23	26.5	23	114	6.84	18.4	19	89	1.28	.8
10	AS	0	7.5	7.5	7.5	125	8.48	20.36	20	90	1.39	2.71
11	AS	0	10	4	10	81	17.18	15.41	7	75	1.08	1.54
12	AS	1	15.5	20.5	14.5	123	9.32	20.22	16	115	1.07	1.39
13	AS	9	26	27	17	61	4.14	9.94	10	63	.97	.58
14	AS	0	3	3	3	117	6.44	18.77	16	90	1.3	6.26
15	AS	0	10	10	10	118	3.05	18.28	14	82	1.44	1.83
Means		1.0	15.1	14.7	14.1	116.6	8.2	19.06	16.4	83.5	1.59	2.02
		2.3	7.9	9.7	7.4	35.5	4.3	5.35	7.2	24.3	1.10	1.67

SS	GRP	PRS SCOR	POST SCOR	DEL POST SCOR	GAI-NED SCOR	ON LINE TIME	CPU TIME	TOTAL COST	TOT ADV ICE	TOT INST ANCE	TIM PER INST	COST PER SCOR
1	MAS	9	24.5	24.5	15.5	161	12.48	26.52	41	235	.69	1.71
2	MAS	3	28	26.5	25	94	9.52	15.91	7	52	1.81	.64
3	MAS	0	26.5	20.5	26.5	86	4.84	13.82	14	63	1.37	.52
4	MAS	6.5	28	27	21.5	95	9.6	16.07	6	72	1.32	.75
5	MAS	7	24	22.5	17	76	3.75	12.11	8	42	1.81	.71
6	MAS	0	14.5	9	14.5	159	11.12	25.96	29	158	1.01	1.79
7	MAS	2	19	21.5	17	83	4.71	13.34	12	61	1.36	.78
8	MAS	5	23	21.5	18	42	4.49	7.15	8	55	.76	.4
9	MAS	11	26	27	15	94	6.77	15.39	15	97	.97	1.03
10	MAS	4	18.5	17.5	14.5	161	8.8	25.82	19	116	1.39	1.78
11	MAS	0	21	19.5	21	172	15.74	28.79	27	111	1.55	1.37
12	MAS	0	14.5	12.5	14.5	119	5.62	18.92	20	79	1.51	1.3
13	MAS	0	27.5	28	27.5	69	7.36	11.75	1	82	.84	.43
14	MAS	12.5	23.5	25.5	11	59	1.71	9.17	6	32	1.84	.83
15	MAS	3	20	20.5	17	123	12.38	20.8	27	97	1.27	1.22
Means		4.2	22.6	21.6	18.4	106.2	7.9	17.44	16	90	1.30	1.01
SD		4.2	4.5	5.4	4.9	41.0	3.9	6.77	11.1	51.6	.38	.48

SS	GRP	PRS SCOR	POST SCOR	DEL POST SCOR	GAI-NED SCOR	ON LINE TIME	CPU TIME	TOTAL COST	TOT ADV ICE	TOT INST ANCE	TIM PER INST	COST PER SCOR
1	MS	1	23.5	21	22.5	105	22.59	20.04	1	129	.81	.89
2	MS	0	25	25	25	116	11.19	19.53	1	94	1.23	.78
3	MS	2	17	17	15	105	5.96	16.88	1	41	2.56	1.13
4	MS	3	23.5	19	20.5	74	2.88	11.65	1	60	1.23	.57
5	MS	0	20	14.5	20	123	5.9	19.57	1	124	.99	.98
6	MS	1	7.5	13.5	6.5	143	5.73	22.54	1	106	1.35	3.47
7	MS	0	12.5	20	12.5	128	2.33	19.64	1	51	2.51	1.57
8	MS	3	24.5	24	21.5	113	8.08	18.49	1	88	1.28	.86
9	MS	0	6.5	3.5	6.5	148	6.07	23.35	1	82	1.8	3.59
10	MS	12	24.5	23	12.5	44	2.19	7.02	1	77	.57	.56
11	MS	2	24	27	22	56	6.42	9.62	1	64	.88	.44
12	MS	0	21.5	21.5	21.5	88	4.6	14.07	1	67	1.31	.65
13	MS	0	4.5	7	4.5	69	4.08	11.13	1	107	.64	2.47
14	MS	0	14	8	14	121	6.77	19.44	1	75	1.61	1.39
15	MS	.5	22.5	25	22	71	3.04	11.23	1	42	1.69	.51
16	MS	0	10.5	7	10.5	131	11.7	21.87	1	170	.77	2.08
Means		1.5	17.6	17.3	16.1	102.2	6.8	16.63	1	86.1	1.36	1.37
SD		3.0	7.3	7.5	6.7	31.6	5.0	5.1	0	34.8	.60	1.02

SS	GRP	PRS SCOR	POST SCOR	DEL POST SCOR	GAINED SCOR	ON LINE TIME	CPU TIME	TOTAL COST	TOT ADVICE	TOT INSTANCE	TIM PER INST	COST PER SCOR
1	NMAS	0	5.5	3	5.5	68	4.23	11	1	67	1.01	2
2	NMAS	2	6	3	4	104	4.9	16.53	1	90	1.16	4.1
3	NMAS	1	9	6	8	70	2.66	11.01	1	68	1.03	1.38
4	NMAS	0	12	14	12	125	9.13	20.48	1	73	1.71	1.71
5	NMAS	0	15	13	15	155	7.81	24.73	1	121	1.28	1.65
6	NMAS	0	2	2	2	66	4.33	10.72	1	41	1.61	5.36
7	NMAS	0	16	20.5	16	111	7.5	18.07	1	61	1.82	1.13
8	NMAS	0	16.5	16.5	16.5	117	3.48	18.21	1	51	2.29	1.1
9	NMAS	.5	18	11	17.5	106	5.53	16.97	1	71	1.49	.97
10	NMAS	2	15.5	12.5	13.5	106	3.83	16.63	1	61	1.74	1.23
11	NMAS	2	12.5	16	10.5	95	4.88	15.18	1	37	2.57	1.45
12	NMAS	21	26.5	26	5.5	23	1.58	3.75	1	14	1.64	.68
13	NMAS	0	21.5	13.5	21.5	93	3.15	14.55	1	49	1.9	.68
14	NMAS	0	17.5	18	17.5	56	2.11	8.8	1	35	1.6	.5
15	NMAS	.5	23.5	22	23	100	4.73	15.9	1	58	1.72	.69
Means		1.9	14.5	13.1	12.5	93	4.7	14.84	1	59.8	1.64	1.35
SD		5.3	6.8	7.2	6.4	32.1	2.1	5.13	0	25.2	.43	1.35

FORMULAE

1. Kuder-Richardson formula for ESSAY TEST SCORES

$$r = \frac{k}{k-1}\left[1 - \frac{\Sigma\sigma_i^2}{\sigma^2_t}\right]$$

2. Spearman-Brown Split-Half Correction Formula

$$r_H = \frac{2r}{1+r}$$

3. Odd-Even Formula

$$\frac{n\Sigma XY - \Sigma X \Sigma Y}{\sqrt{[n\Sigma X^2 - (\Sigma X)^2][n\Sigma Y^2 - (\Sigma Y)^2]}}$$

In 1 above k represents the number of separately scored test questions or independent ratings of a performance, σ_i^2 is the variance of student's scores, $\Sigma\sigma_i^2$ is the sum of these questions and σ_t^2 is the variance of the total test scores.

In 2 above r is the p Pearson correlation for the items in the odd and even half of the test.

In 3 above X is the score for each odd item
Y is the score for each even item
n is the number of students.