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

Lionel L. Douglas

A Thesis
in
The Department
of
Education

Presented in Partial Fulfillment of the Requirements
for the degree of Master of Arts at
Concordia University
Montreal, Quebec, Canada

June 1982

© Lionel L. Douglas, 1982
ABSTRACT

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

Lionel L. Douglas

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.
ACKNOWLEDGMENTS

It would be a task as huge as this study itself if I were to essay to numerate the various ways in which many have contributed to the success of this study. Every milestone was earmarked by major contributions from various personnel.

Foremost among them is my advisor Dr. Janice Richman whose initial suggestions sparked the flame for the conceptualization of this study and whose timely comments and advice fuelled it to completion.

My sincere gratitude to Dr. Gary M. Boyd whose keen interest and depth of knowledge in the subject matter were evidenced by his reassuring and stabilizing comments.

My friend and co-worker Valerie Hernandez; her keen sense of humour, her skills, arguments, criticisms, suggestions and inquisitiveness coupled with her unfaltering devotion to the cause of this study were an invaluable pivot in every phase.

The contributions of the computer center, the Director Mr. Ivan Fuchs and his staff who freely gave of their equipment, time and expertise were invaluable.
I would also like to express my appreciation to all the students and staff of the Concordia Educational Technology Programme, whose interest and participation in this study were paramount to its success.

Finally there were those whose contribution can not be quantified nor satisfactorily qualified: my friends, family, fellow members of the Bethel Gospel Chapel, and most of all my Dear Wife Grace, whose patience, understanding and encouragement is the substance of my success.
**TABLE OF CONTENTS**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>ii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>viii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>ix</td>
</tr>
<tr>
<td>LIST OF APPENDICES</td>
<td>x</td>
</tr>
<tr>
<td>CHAPTER</td>
<td></td>
</tr>
<tr>
<td>1: Context of the Problem</td>
<td>1</td>
</tr>
<tr>
<td>2: Program Control</td>
<td>3</td>
</tr>
<tr>
<td>3: Learner Control</td>
<td>4</td>
</tr>
<tr>
<td>4: Adaptive Control</td>
<td>4</td>
</tr>
<tr>
<td>2: Review of Related Research</td>
<td>7</td>
</tr>
<tr>
<td>Research on Learner Control</td>
<td>7</td>
</tr>
<tr>
<td>Positive Results Research</td>
<td>9</td>
</tr>
<tr>
<td>Negative Results Research</td>
<td>10</td>
</tr>
<tr>
<td>Summary of Research</td>
<td>11</td>
</tr>
<tr>
<td>Research on Advisory Support</td>
<td>12</td>
</tr>
<tr>
<td>Research on Memory Support</td>
<td>14</td>
</tr>
<tr>
<td>Statement of Purpose</td>
<td>15</td>
</tr>
<tr>
<td>3: Hypothesis</td>
<td>17</td>
</tr>
<tr>
<td>Rationale for Hypothesis 1</td>
<td>17</td>
</tr>
<tr>
<td>Rationale for Hypothesis 2</td>
<td>18</td>
</tr>
<tr>
<td>Variables</td>
<td>22</td>
</tr>
<tr>
<td>Operational Definitions</td>
<td>22</td>
</tr>
<tr>
<td>Performance</td>
<td>22</td>
</tr>
<tr>
<td>Cost</td>
<td>22</td>
</tr>
<tr>
<td>Memory Support</td>
<td>23</td>
</tr>
<tr>
<td>Advisory Support</td>
<td>23</td>
</tr>
<tr>
<td>Complex Content Structure</td>
<td>23</td>
</tr>
<tr>
<td>Learner Control</td>
<td>23</td>
</tr>
<tr>
<td>Anticipated Results</td>
<td>24</td>
</tr>
</tbody>
</table>

### Methodology

- Research Design  
- Covariate  
- Repeated Measures  
- Sample Selection  
- Recruitment  
- Mortality  
- Group Assignment  
- Assignment of Manuals  
- Assignment of Terminals  
- Administration  
- Pre-Treatment  
- During Treatment  
- Post-Treatment  
- Data Collection  

Page 22
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5: CAI Program</td>
<td>33</td>
</tr>
<tr>
<td>Content Description</td>
<td>33</td>
</tr>
<tr>
<td>Content Structure</td>
<td>34</td>
</tr>
<tr>
<td>Program Methodology</td>
<td>35</td>
</tr>
<tr>
<td>Instance Presentation</td>
<td>35</td>
</tr>
<tr>
<td>Program Commencement</td>
<td>36</td>
</tr>
<tr>
<td>Objectives</td>
<td>38</td>
</tr>
<tr>
<td>Rationale for Objectives</td>
<td>39</td>
</tr>
<tr>
<td>6: Evaluation</td>
<td>40</td>
</tr>
<tr>
<td>Formative</td>
<td>40</td>
</tr>
<tr>
<td>Reference Manual</td>
<td>40</td>
</tr>
<tr>
<td>Program</td>
<td>41</td>
</tr>
<tr>
<td>Summative</td>
<td>41</td>
</tr>
<tr>
<td>Test Construct</td>
<td>41</td>
</tr>
<tr>
<td>Test Scoring</td>
<td>42</td>
</tr>
<tr>
<td>Test Analysis</td>
<td>42</td>
</tr>
<tr>
<td>Test Difficulty</td>
<td>43</td>
</tr>
<tr>
<td>Test Reliability</td>
<td>45</td>
</tr>
<tr>
<td>Test-Retest Reliability</td>
<td>45</td>
</tr>
<tr>
<td>Internal Consistency Reliability</td>
<td>45</td>
</tr>
<tr>
<td>Item Discrimination</td>
<td>46</td>
</tr>
<tr>
<td>Relevance</td>
<td>49</td>
</tr>
<tr>
<td>Summary of Test Analysis</td>
<td>49</td>
</tr>
<tr>
<td>Section</td>
<td>Page</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>7: Results</td>
<td>51</td>
</tr>
<tr>
<td>Data Analysis Cost Estimate</td>
<td>51</td>
</tr>
<tr>
<td>Restatement of Hypothesis in Null Form</td>
<td>52</td>
</tr>
<tr>
<td>Hypothesis Testing</td>
<td>52</td>
</tr>
<tr>
<td>Homogeneity of Regression Slopes</td>
<td>52</td>
</tr>
<tr>
<td>Analysis of Covariance—Performance</td>
<td>54</td>
</tr>
<tr>
<td>Advisory Support</td>
<td>54</td>
</tr>
<tr>
<td>Memory Support</td>
<td>54</td>
</tr>
<tr>
<td>Interaction Effects</td>
<td>55</td>
</tr>
<tr>
<td>Analysis of Covariance—Cost</td>
<td>55</td>
</tr>
<tr>
<td>Repeated Measures Effects</td>
<td>57</td>
</tr>
<tr>
<td>8: Conclusion Suggestions Recommendations</td>
<td>58</td>
</tr>
<tr>
<td>Conclusion</td>
<td>58</td>
</tr>
<tr>
<td>Suggestions and Recommendations</td>
<td>60</td>
</tr>
<tr>
<td>Reference Notes</td>
<td>62</td>
</tr>
<tr>
<td>Reference</td>
<td>66</td>
</tr>
<tr>
<td>Table</td>
<td>Page</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>1: Content Structure</td>
<td>20</td>
</tr>
<tr>
<td>2: Group Treatment</td>
<td>37</td>
</tr>
<tr>
<td>3: Item Difficulty Report</td>
<td>44</td>
</tr>
<tr>
<td>4: Item Discrimination Report</td>
<td>47</td>
</tr>
<tr>
<td>5: Discriminant Analysis</td>
<td>48</td>
</tr>
<tr>
<td>6: Total Test Discriminability</td>
<td>49</td>
</tr>
<tr>
<td>7: Attitude Analysis</td>
<td>50</td>
</tr>
<tr>
<td>8: Homogeneity of Regression</td>
<td>53</td>
</tr>
<tr>
<td>9: Analysis of Covariance- Performance</td>
<td>54</td>
</tr>
<tr>
<td>10: Analysis of Covariance- Cost</td>
<td>55</td>
</tr>
<tr>
<td>11: Repeated Measures</td>
<td>57</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

Figure

1: Sample Conceptual Entailment Structure 34
# LIST OF APPENDICES

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Leaflet</td>
<td>71</td>
</tr>
<tr>
<td>B: Registration Form</td>
<td>73</td>
</tr>
<tr>
<td>C: Reference Manual</td>
<td>75</td>
</tr>
<tr>
<td>D: Pretest, Posttest and Delayed Posttest</td>
<td>77</td>
</tr>
<tr>
<td>E: Attitude Questionnaire</td>
<td>93</td>
</tr>
<tr>
<td>F: Conceptual Entailment Structure</td>
<td>95</td>
</tr>
<tr>
<td>Content Analysis</td>
<td>97</td>
</tr>
<tr>
<td>G: Sample CAI Session</td>
<td>107</td>
</tr>
<tr>
<td>H: Sample Lesson Content</td>
<td>118</td>
</tr>
<tr>
<td>I: CAI Program Source Code</td>
<td>135</td>
</tr>
<tr>
<td>J: Data and Formulae</td>
<td>162</td>
</tr>
</tbody>
</table>
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'être' 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 (ATI) 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


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

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 directly related to number of instances. (See Table 1).
<table>
<thead>
<tr>
<th>Content Structure</th>
<th>Simultaneous</th>
<th>Collective</th>
<th>Successive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Strategy</td>
<td>19.7</td>
<td>16.3</td>
<td>15.3</td>
</tr>
<tr>
<td>Adaptive Control</td>
<td>14.5</td>
<td>10.5</td>
<td>12.4</td>
</tr>
<tr>
<td>Learner Control</td>
<td>10.3</td>
<td>13.9</td>
<td>14.3</td>
</tr>
<tr>
<td>Time on Task</td>
<td>7.1</td>
<td>7.8</td>
<td>7.6</td>
</tr>
</tbody>
</table>

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
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.

'Learner 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, i.e. 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 significant 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 $2 \times 2$ 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 recruited 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 exercised 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 posttest. 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
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 relational connection for the concept "se" is illustrated.

![Diagram](image)

**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>
<thead>
<tr>
<th>Features Available to Group</th>
<th>MAS</th>
<th>AS</th>
<th>MS</th>
<th>NMAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ask For Advice</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receive Advice on</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>incorrect answer</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receive Advice on appropriate examples</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ask for reminder of instruc-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tional sequence followed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unlimited Information Access</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowed only one viewing</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>per instance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receive answer on incorrect response</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowed to see list of</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>available concepts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unlimited Time</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attempt Post Test any time</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Ask for Objectives</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ask for Rationale</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ask for Examples</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ask for Practice</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ask for Rules or Definitions</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>
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:

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 participated 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>
<thead>
<tr>
<th>Item No.</th>
<th>Difficulty</th>
<th>Item No.</th>
<th>Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19%</td>
<td>2</td>
<td>22%</td>
</tr>
<tr>
<td>3</td>
<td>28%</td>
<td>4</td>
<td>59%</td>
</tr>
<tr>
<td>5</td>
<td>22%</td>
<td>6</td>
<td>22%</td>
</tr>
<tr>
<td>7</td>
<td>16%</td>
<td>8</td>
<td>22%</td>
</tr>
<tr>
<td>9</td>
<td>28%</td>
<td>10</td>
<td>34%</td>
</tr>
<tr>
<td>11</td>
<td>59%</td>
<td>12</td>
<td>31%</td>
</tr>
<tr>
<td>13</td>
<td>75%</td>
<td>14</td>
<td>41%</td>
</tr>
<tr>
<td>15</td>
<td>49%</td>
<td>16</td>
<td>50%</td>
</tr>
<tr>
<td>17</td>
<td>48%</td>
<td>18</td>
<td>53%</td>
</tr>
<tr>
<td>19</td>
<td>38%</td>
<td>20</td>
<td>42%</td>
</tr>
</tbody>
</table>
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


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 en
test the overall Wilks Lambda was .0033 and the canonical 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

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

41 - 100 High Discriminators 85%
20 - 40 Fair Discriminators 15%
01 - 19 Low Discriminators 0%
< 0 0%
### Table 5
Wilks Lambda (U-Statistic and Univariate F-Ratio with 1 and 30 degrees of freedom)

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

<table>
<thead>
<tr>
<th>Function</th>
<th>Eigen Value</th>
<th>Percent of Variance</th>
<th>Canonical Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>303.70541</td>
<td>100</td>
<td>.998</td>
</tr>
</tbody>
</table>

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**

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

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 following 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 performance 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 Hypothesis of no difference in Regression Slopes. The Statistical Analysis is reported in Table 8.

<table>
<thead>
<tr>
<th></th>
<th>SS</th>
<th>DF</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heterogeneity of slopes</td>
<td>52.15</td>
<td>3</td>
<td>17.38</td>
<td>.42</td>
</tr>
<tr>
<td>Individual residuals</td>
<td>2189.34</td>
<td>53</td>
<td>41.31</td>
<td></td>
</tr>
<tr>
<td>Within residuals</td>
<td>2241.49</td>
<td>58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean Square</th>
<th>F</th>
<th>Tail Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>22056.42</td>
<td>1</td>
<td>22056.42</td>
<td>262.13</td>
<td>.00</td>
</tr>
<tr>
<td>AS</td>
<td>153.55</td>
<td>1</td>
<td>153.55</td>
<td>1.82</td>
<td>.18</td>
</tr>
<tr>
<td>MS</td>
<td>577.49</td>
<td>1</td>
<td>577.49</td>
<td>**6.86</td>
<td>.01</td>
</tr>
<tr>
<td>MAS</td>
<td>7.98</td>
<td>1</td>
<td>7.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Covar</td>
<td>831.73</td>
<td>1</td>
<td>831.73</td>
<td>*9.88</td>
<td>.0027</td>
</tr>
<tr>
<td>Error</td>
<td>4712.08</td>
<td>56</td>
<td>84.14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* P < .05  ** P < .01

Advisory Support

The calculated 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

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean Squares</th>
<th>F</th>
<th>Tail Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>139.46</td>
<td>1</td>
<td>139.46</td>
<td>95.24</td>
<td>.00</td>
</tr>
<tr>
<td>AS</td>
<td>.00</td>
<td>1</td>
<td>.00</td>
<td>.00</td>
<td>.97</td>
</tr>
<tr>
<td>MS</td>
<td>6.16</td>
<td>1</td>
<td>6.16</td>
<td>4.21</td>
<td>.04</td>
</tr>
<tr>
<td>MAS</td>
<td>2.01</td>
<td>1</td>
<td>2.01</td>
<td>1.37</td>
<td>.25</td>
</tr>
<tr>
<td>Error</td>
<td>83.46</td>
<td>57</td>
<td>1.46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 a 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**

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

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 statistically significant effects for Advisory support.

The personal comments of some students expressing their unwillingness 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 necessary 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.
REFERENCE NOTES


5. Gordon, E.W. Utilizing available information from corresponding calculation and surveys, Final
6. McCann, P.H., Lahey, G.F., & Hurlock, R.E.

A comparison of student option versus program control CAI training. San Diego, CA:
Naval Personnel and Training Research Laboratory, April 1973 (Res. Rep. SRR 73-17).


10. Lahey, G.F., & Coady, J.D. Learner control of instructional


14. Leherissey, B.L., O'Neil, H.F., & Hansen, D.
of Naval Research, 1970.

REFERENCES


Klausmeier, H.J., Ghatala, E.S., & Frayer, D.A. *Conceptual Learning and Development: A*


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
<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 VARIABLES, 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 receive 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 definitions 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
QB VARIABLE
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 (i.e., with no Concept) the previous Concept will be assumed

eg.  If you had previously entered, RA, EXPRESSION and then you enter: RD
Then you enter: 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. `LEN(D6)`
2. `LEN("D6")`
3. `LEN(D6)`
4. `LEN(D6) + "D6"`)` = INVALID

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

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

4. `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$(B*+B*+S, 5)$

6. WHICH OF THE ABOVE STATEMENTS IS INVALID?

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

7. WHICH OF THE ABOVE STATEMENTS IS INVALID?

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

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$)
    THE VALUE OF LEN(H$) IS:
        1. HISTORY
        2. 16
        3. 7
        4. 13

11. GIVEN THE BASIC STATEMENTS BELOW:
    A = 2
    A$ = "POSSESS$"
    D = POS$(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 I-
   1. 1000000000000
   2. C$C$C$C$
   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 SORTING "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 "TRÉNÉDOUS"
WRITE 1 BASIC STATEMENT WHICH WILL EXTRACT THE STRING "NEN" 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.

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? 2
Appendix F

Conceptual Entailment Structure

Content Analysis
LEN(se)

LEN

se
RPT$(se, ne)$

RPT  se  ne
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 ALCAIP, this is a learner controlled computer assisted instruction program.

HIT THE 'C' KEY THEN 'RETURN'

ALCAIP (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 ALCAIP. If you have not, you should ask your attendant for a manual.

HIT THE 'C' KEY THEN 'RETURN'

?
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 ALCCAI P WORKS.
NOTE WELL: I ALCCAI P WILL OFTEN PROMPT YOU FOR A RESPONSE WITH THE COMMENT: "WHAT NEXT?"

HIT THE 'C' KEY THEN 'RETURN'
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'

BESTIDE 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'

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'
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. RTRMS$(B$)
2. RTRMS$(B$+C$)
3. LTRMS"YESTERDAY")
4. LTRMS$(B$ + 10)

WHICH OF THE ABOVE STATEMENTS IS INVALID ?

WHAT NEXT ? SKIP
HIT THE 'C' KEY THEN 'RETURN' ?
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'

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'

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'

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'

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$(SE,NE)
2. TRMS$(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 SOMEONE 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'

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:
BS = "MONDAY"
CS = "TUESDAY"
WHAT IS THE VALUE OF LEN (BS+CS)?

***** 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"
BS = "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$BS)

****************************** WRONG ! ******************************

THE CORRECT ANSWER IS LEN(A$+BS)
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?
DO YOU WANT TO SEE MORE?
WHAT NEXT? YES

**** ENTER REQUEST NOW ****
WHAT NEXT?
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 "0" THRU "9" AND CHARACTERS SUCH AS:—" $ ! _ & * ( )"

WHAT NEXT? 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

WHICH CONCEPT DO YOU WANT TO REVISE? 1

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

+ COMANDS
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 SOMEONE 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 PARENTHESES
4. LEN (C$+6) EXPRESSION IS INVALID
EXAMPLE 2. \texttt{LEN(SE)}

\textbf{GIVEN THE FOLLOWING;}
\begin{itemize}
\item \texttt{A$ = "MATHEMATICS"}
\item \texttt{B$ = "SPANISH"}
\end{itemize}
\textbf{THE VALUE OF \texttt{LEN(A$+B$)} IS 18.}
\textbf{IE. THE TOTAL NUMBERS OF CHARACTERS IN \texttt{A$} AND \texttt{B$}.}

EXAMPLE 3. \texttt{LEN(SE)}

\textbf{GIVEN THE FOLLOWING;}
\begin{itemize}
\item \texttt{A$ = "JACK"}
\item \texttt{B$ = "JILL"}
\end{itemize}
\textbf{TO FIND THE TOTAL LENGTH OF THE 2 STRING VARIABLES YOU SHOULD WRITE;}
\texttt{LEN(A$+B$)}

\textbf{PRACTICE 1.} \texttt{LEN(SE)}
\begin{itemize}
\item 1. \texttt{LEN (C4)}
\item 2. \texttt{LEN ("C4")}
\item 3. \texttt{LEN (C4$)}
\item 4. \texttt{LEN (C4$ + "C4")}
\end{itemize}
\textbf{WHICH OF THE ABOVE STATEMENTS IS INVALID ?}

\textbf{PRACTICE 2.} \texttt{LEN(SE)}

\textbf{GIVEN THAT;}
\begin{itemize}
\item \texttt{B$ = "MONDAY"}
\item \texttt{C$ = "TUESDAY"}
\end{itemize}
\textbf{WHAT IS THE VALUE OF \texttt{LEN (B$+C$)} ?}

\textbf{PRACTICE 3.} \texttt{LEN(SE)}

\textbf{IF A$ = "YESTERDAY"}
\begin{itemize}
\item \texttt{B$ = "TODAY"}
\end{itemize}
\textbf{WRITE A STATEMENT WHICH WILL FIND THE TOTAL NUMBER OF CHARACTERS IN THE TWO STRING VARIABLES.}

\texttt{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$S$ 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$S$ FUNCTION.
2. EVALUATE STATEMENTS WHICH USE LEFT$S$
3. USE THE LEFT$S$ 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

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

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

EXAMPLE 1. LEFT$(SE,NE)$

<table>
<thead>
<tr>
<th>INVALID</th>
<th>REASON</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. LEFT$(A$)</td>
<td>MISSING NE</td>
</tr>
<tr>
<td>2. LEFT$(&quot;HOUSE&quot;,A$)</td>
<td>NE NOT NUMERIC</td>
</tr>
<tr>
<td>3. LEFT$(A$+B$,3)</td>
<td>NO CLOSING BRACKET</td>
</tr>
</tbody>
</table>
EXAMPLE 2. \texttt{LEFTS$(SE,NE)$}

\begin{itemize}
  \item \texttt{GIVEN THAT GS = "GOOD MORNING"}
  \item \texttt{HS = "NIGHT TIME"}
  \item \texttt{LEFTS$(GS,5)$ = "GOOD"}
  \item \texttt{LEFTS$(HS,5)$ = "NIGHT"}
  \item \texttt{THE VALUE OF LEFTS$(GS,5)$ + LEFTS$(HS,5)$ IS, "GOOD NIGHT".}
\end{itemize}

EXAMPLE 3. \texttt{LEFTS$(SE,NE)$}

\begin{itemize}
  \item \texttt{GIVEN THAT IS = "MONDAY"}
  \item \texttt{JS = "KEY RING"}
  \item \texttt{IN ORDER TO OBTAIN THE WORD "MONKEY"}
  \item \texttt{YOU WOULD WRITE;}
  \item \texttt{LEFTS$(IS,3)$ + LEFTS$(JS,3)$}
\end{itemize}

PRACTICE 1. \texttt{LEFTS$(SE,NE)$}

\begin{itemize}
  \item WHICH OF THE FOLLOWING IS INVALID?
  \begin{enumerate}
    \item \texttt{LEFTS$("MONDAY",5)$}
    \item \texttt{LEFTS$(AS,"6")$}
    \item \texttt{LEFTS$("7S",1)$}
    \item \texttt{LEFTS$("YESTERDAY",3)$}
  \end{enumerate}
\end{itemize}

2

PRACTICE 2. \texttt{LEFTS$(SE,NE)$}

\begin{itemize}
  \item \texttt{GIVEN THAT :}
  \begin{itemize}
    \item \texttt{GS = "MONOTONY"}
    \item \texttt{HS = "EYE"}
  \end{itemize}
  \item \texttt{WHAT IS THE VALUE OF ;}
  \item \texttt{LEFTS$(GS,3)$ + LEFTS$(HS,2)$,}
\end{itemize}

\textbf{MONEY}

PRACTICE 3. \texttt{LEFTS$(SE,NE)$}

\begin{itemize}
  \item \texttt{GIVEN THAT ; K$S$ = "YESTERDAY"}
  \item \texttt{WRITE A STATEMENT THAT WILL EXTRACT THE STRING "YES" FROM THE STRING VARIABLE K$S$.}
  \item \texttt{LEFTS$(K$S$,3)$}
\end{itemize}
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 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

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
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)

PRACTICE 2.  
RIGHT$(SE,NE)

GIVEN THAT;
    G$ = "MONCTON"
    H$ = "KEY RING"

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

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-----TRMS(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 TRMS FUNCTION.

OBJECTIVE-----TRMS(SE)
TO BE ABLE TO;
1. IDENTIFY INVALID USAGE OF TRMS
2. TO EVALUATE STATEMENTS THAT USES TRMS.
3. CORRECTLY USE THE TRMS FUNCTION.

ADVICE-----TRMS(SE)
FOLLOWING ARE THE CONCEPTS AND RULES THAT
YOU SHOULD ACQUIRE BEFORE DOING THIS LESSON.
1. SE
2. STRING
3. FUNCTION

DEFINITION/RULE-----TRMS(SE)
1. THE TRMS 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
LTRMS$(SE) OR RTRMS$(SE).

EXAMPLE 1.
<table>
<thead>
<tr>
<th>TRMS$(SE)</th>
<th>INVALID STMT</th>
<th>REASON</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTRMS$(B$,6)</td>
<td>LTRMS$ DOES NOT TAKE NE</td>
<td></td>
</tr>
<tr>
<td>TRMS$(&quot;BOY&quot;)</td>
<td>MISSING PREFIX L OR R</td>
<td></td>
</tr>
<tr>
<td>RTRMS$(&quot;HOT&quot;+DOG)</td>
<td>INVALID SE</td>
<td></td>
</tr>
</tbody>
</table>
EXAMPLE 2.

\[ \text{TRMS}(SE) \]
\[ \text{IF } A$ = \text{LTRMS}("HUNDRED") \]
\[ \text{THEN } A$ = "HUNDRED". \]
THE LTRMS FUNCTION SIMPLY REMOVES ALL THE BLANKS ON THE LEFT OF THE STRING.

EXAMPLE 3.

\[ \text{TRMS}(SE) \]

GIVEN THAT;
\[ E$ = "ANIMAL " \]
A STATEMENT TO REMOVE THE BLANKS FROM E$ IS \[ \text{RTRMS}(E$) \].

PRACTICE 1.

\[ \text{TRMS}(SE) \]
WHICH OF THE FOLLOWING IS INVALID?

1. LTRMS(B$)
2. RTRMS(B$+C$)
3. LTRMS("YESTERDAY")
4. RTRMS(B$ + 10)

PRACTICE 2.

\[ \text{TRMS}(SE) \]
GIVEN THAT;
\[ A$ = \text{RTRMS}("FRIDAY ") \]
THE VALUE OF A$ + "MORN" IS;
1. FRIDAYMORN
2. FRIDAY MORN
3. "FRIDAY" "MORN"

PRACTICE 3. USAGE TRMS(SE)

WRITE ONE BASIC STATEMENT THAT WILL CUT THE THREE BLANKS FROM THE RIGHT OF THE STRING CONSTANT "MONDAY ".
\[ \text{RTRMS}("MONDAY ") \]
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                4. FUNCTION
2. NE               5. LEFT$
3. STRING           6. LEN

DEFINITION/RULE-----PAD$(SE,NE)
1. THE PAD$ FUNCTION WHEN PREFIXED BY AN ´L´,
   PAD$ THE STRING SE WITH BLANKS ON THE LEFT.
   WHEN PREFixed BY AN ´R´ IT PAD$ 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.

<table>
<thead>
<tr>
<th>PAD$(SE,NE)</th>
<th>INVAILD STMT</th>
<th>REASON</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAD$(A$,6)</td>
<td>MISSING PREFIX &quot;L&quot; OR &quot;R&quot;</td>
<td></td>
</tr>
<tr>
<td>LPAD$(HISTORY,12)</td>
<td>MISSING QUOTES ON SE</td>
<td></td>
</tr>
<tr>
<td>RPAD$(A$+B$,&quot;12&quot;)</td>
<td>INVALID NE</td>
<td></td>
</tr>
</tbody>
</table>
EXAMPLE 2. \( \text{PAD}(SE, NE) \)

GIVEN THAT; \( G = "\text{HISTORY}" \)

\[ A = 3 \]
\[ HS = \text{RPAD}(G, A*2) \]

THEN \( A*2 = 6 \), AND \( HS \) WOULD BE \( \text{RPAD}(G, 6) \)

\[ H = "\text{HISTORY}" \]

EXAMPLE 3. \( \text{PAD}(SE, NE) \)

GIVEN THAT; \( B = "\text{MONKEY}" \)

TO INCREASE THE SIZE OF \( B \) BY 6 CHARACTERS ON THE LEFT YOU SHOULD WRITE:

\( \text{LPAD}(B, 6) \)

PRACTICE 1. \( \text{PAD}(SE, NE) \)

WHICH OF THE STATEMENTS BELOW IS INVALID

1. \( \text{RPAD} (B, C) \)
2. \( \text{RPAD} (B, 2*6) \)
3. \( \text{RPAD} ("\text{MONDAY}" , A/3) \)
4. \( \text{RPAD} (B, A6) \)

PRACTICE 2. \( \text{PAD}(SE, NE) \)

GIVEN THAT; \( A = 3 \) AND \( C = 2 \)
\( F = "\text{LITTLE}" \)

HOW MANY CHARACTERS WILL BE IN \( G \)
IF \( G = \text{LPAD}(F, A**C) \)

PRACTICE 3. \( \text{PAD}(SE, NE) \)

GIVEN THAT; \( D \) HAVE UNKNOWN VALUES
\( F = "\text{SCIENCE}" \)

WRITE A STATEMENT THAT WILL PAD \( D \) BLANKS TO THE LEFT OF THE STRING VARIABLE.

\( \text{LPAD}(F, D) \)
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)

<table>
<thead>
<tr>
<th>INVALID &quot;STMTS&quot;</th>
<th>REASON</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. RPT(SE,NE)</td>
<td>MISSING $ SIGN ON RPT</td>
</tr>
<tr>
<td>2. RPT$&quot;BOY&quot;,6</td>
<td>MISSING BRACKETS</td>
</tr>
<tr>
<td>3. RPT$(A*B$,3)</td>
<td>INVALID STRING EXPRESSION</td>
</tr>
</tbody>
</table>
EXAMPLE 2. \[ \text{RPT}(SE,NE) \]
GIVEN THAT; \[ B=2 \]
\[ C$="000" \]
\[ D$="1" + \text{RPT}(C$,B) \]
THE VALUE OF D$ IS "1000000".
IE. REPEAT "000" TWICE AND JOIN THE RESULT TO 1.

EXAMPLE 3. \[ \text{RPT}(SE,NE) \]
GIVEN THAT B$ = "BAA"
\[ C$ = "COO" \]
TO PRODUCE "BAAACOOBAACOO"
YOU SHOULD WRITE ; \[ \text{RPT}(B$+C$,2) \].

PRACTICE 1. \[ \text{RPT}(SE,NE) \]
WHICH OF THE STATEMENTS BELOW IS INVALID?
1. \[ \text{RPT}("BIX",5) \]
2. \[ \text{RPT}(A$,5+2) \]
3. \[ \text{RPT}(23,2) \]
4. \[ \text{RPT}(S$,S1) \]

PRACTICE 2. \[ \text{RPT}(SE,NE) \]
1. IF S$ = "A"
   IF T$ = "?"
   IF U$ = \[ \text{RPT}(S$+T$,3) \]
   WHAT IS U$?

AZAZAZ

PRACTICE 3. \[ \text{RPT}(SE,NE) \]
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
\[ \text{RPT}("JOY",B/C) \]
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 position NE.
It returns the location of
SE2.

EXAMPLE 1.
POS(SE1,SE2,NE)
INVALID STMTS 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. \( \text{POS}(\text{SE}_1, \text{SE}_2, \text{NE}) \)

**GIVEN THAT:** \( A = 2 \)

\( A S = "\text{POSSSES}" \)

\( D = \text{POS}(A S, "\text{SS}" , A^{*}(5-3)) \)

IE. \( A^{*}(5-3) = A^{*}2 = 4. \)

THEN LOOK IN \( A S \) FOR AN "\( SS \)" BEGINNING THE

THE SEARCH AT POSITION 4.

SS WILL BE FOUND AT POSITION 6.

---

EXAMPLE 3. \( \text{POS}(\text{SE}_1, \text{SE}_2, \text{NE}) \)

**GIVEN THAT:** \( A S = "\text{ANT}" \)

TO FIND THE LOCATION OF \( A S \) IN THE

STRING CONSTANT "\( \text{ELEPHANT} \)"

YOU SHOULD WRITE; \( \text{POS}("\text{ELEPHANT}" , A S, 1) \)

---

PRACTICE 1. \( \text{POS}(\text{SE}_1, \text{SE}_2, \text{NE}) \)

**WHICH OF THE STATEMENTS BELOW IS INVALID?**

1. \( \text{POS}(A S, "23", 2) \)
2. \( \text{POS}("23", "3", 1) \)
3. \( \text{POS}("A S", "C", 2) \)

---

PRACTICE 2. \( \text{POS}(\text{SE}_1, \text{SE}_2, \text{NE}) \)

**IF \( G S = "\text{ELECTRICITY}" \)**

**IF \( D S = "T" \)**

**IF \( A = \text{POS}(G S, D S, 6) \)**

**WHAT IS THE VALUE OF \( A \)?**

---

PRACTICE 3. \( \text{POS}(\text{SE}_1, \text{SE}_2, \text{NE}) \)

**IF \( E S = "\text{ELEPHANT}" \)**

**IF \( F S = "\text{HA}" \)**

TO FIND THE LOCATION IN \( E S \) WHERE \( F S \) BEGINS

WHAT WOULD YOU WRITE?

\( \text{POS}(E S, F S, 1) \)
**RATIONALE**——MID$(SE, NE1, NE2)
This is almost the opposite of the POS function.
The POS function finds where a string begins in another string.
The MID$ 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.**

<table>
<thead>
<tr>
<th>MID$(SE, NE1, NE2)</th>
<th>INVALID STMTS</th>
<th>REASON</th>
</tr>
</thead>
<tbody>
<tr>
<td>MID$(A$, B$, 2)</td>
<td>INVALID NE1</td>
<td></td>
</tr>
<tr>
<td>MID (A$, 2, 3)</td>
<td>MID TAKES A $SIGN</td>
<td></td>
</tr>
<tr>
<td>MID$(A$, B$, A*C$)</td>
<td>NE2 IS INVALID</td>
<td></td>
</tr>
</tbody>
</table>
EXAMPLE 2. \[ \text{MIDS}(SE, NE1, NE2) \]
GIVEN THAT; \[ A = 2 \]
\[ B = 4 \]
\[ CS = "AUTONOMOUS" \]
THE VALUE OF \[ \text{MIDS}(CS, A**A+1, B) \]
WOULD BE; \[ "NOMO" \]

EXAMPLE 3. \[ \text{MIDS}(SE, NE1, NE2) \]
GIVEN THAT \[ LS = "ALABAMA" \]
\[ NS = "AMANDA" \]
TO CONSTRUCT THE STRING "LABMAN" 
YOU SHOULD WRITE; 
\[ \text{MIDS}(LS, 2, 3) + \text{MIDS}(NS, 2, 3) \]

PRACTICE 1. \[ \text{MIDS}(SE, NE1, NE2) \]
IDENTIFY THE INVALID STATEMENTS BELOW;
1. \[ \text{MIDS}("HOUSING", 2, 4) \]
2. \[ \text{MIDS}("LODGING", "2", 4) \]
3. \[ \text{MIDS}(AS, 2*A, C*4) \]
4. \[ \text{MIDS}("YES" + B$, 2 + 6, 2+3) \]

PRACTICE 2. \[ \text{MIDS}(SE, NE1, NE2) \]
GIVEN THAT; \[ B = 3 \]
\[ CS = "EVALUATION" \]
\[ E = 4 \]
\[ A = 2 \]
WHAT IS THE VALUE OF \[ \text{MIDS}(CS, E*A-6, B**A) \]
VALUATION

PRACTICE 3. \[ \text{MIDS}(SE, NE1, NE2) \]
\[ \text{GIVEN THAT } BS = "DEGENERATE" \]
\[ CS = "EXHILARATING" \]
USE THE MIDS FUNCTION TO CONSTRUCT THE STRING "GENERAL" FROM THE TWO STRING VARIABLES.
\[ \text{MIDS}(BS, 3, 6) + \text{MIDS}(CS, 5, 1) \]
Appendix I

CAI Program Source Code
REM VARIABLES USED IN THIS PROGRAM
REM A$ A A1$ A3 A3$ A1 A2 A6 A5 A7
REM H I J J1 J2
REM N0 N1 N2 N3 N4 N5 N6 N7 N8 N9 M0 M1 M2
REM M3 M4 M5 M6 M7 M8 M9
REM T T1 T6 R$ R1$ R3$ R2$ P$ C$ Z1 Z T2
REM CS WS L1 R1 D D$ D2 P1$

DIM A$ (36) 'FOR STORING CONCEPTS
DIM A (37,8) 'FOR STRING SUB CONCEPTS LOCATION
DIM A1$ (12) 'FOR STORING LEGAL COMMANDS
DIM Z4(600)
DIM P6 (20) 'FOR STORING PASSED TEST LOCATIONS
DIM A3 (1200) 'FOR STORING STUDENTS CHOICES
DIM A3$ (2370) 'FOR STORING INSTRUCTION DATA
DIM C$5 (5), W$ (5)
DIM H (25), D$ (400)
DIM A7(37,7) 'FOR STORING CONCEPTS AND COMMAND CHOSEN

GOSUB 1750 'SET VALUES TO COUNTER
GOSUB 1200 'INITIAL RECORD SET UP'
GOSUB 400 'INTRODUCTION
GOSUB 1990 'STORE FEEDBACK COMMENTS'
GOSUB 450 'STORE COMMANDS
GOSUB 660 'STORE CONCEPTS
GOSUB 5270 'MAIN CONTROL
GOSUB 4660 'TERMINATION ROUTINE
GOTO 12500

END OF ROUTINE TO FILL CONCEPT CHOSEN TABLE

RETURN

REM SUBROUTINE FOR FILLING ARRAY A1$ WITH COMMANDS

A1$ (N1) = "RA" 'RATIONAL
A1$ (N2) = "OB" 'OBJECTIVES
A1$ (N3) = "AD" 'ADVISORY SUPPORT
A1$ (N4) = "RD" 'RULES OR DEFINITIONS
A1$ (N5) = "EX" 'EXAMPLES
A1$ (N6) = "PR" 'PRACTICE
A1$ (N7) = "RV" 'MEMORY SUPPORT
A1$ (N8) = "NEXT" 'NEXT CONCEPT
A1$ (N9) = "HELP" 'HELP
A1$ (M0) = "CONCEPTS" 'CONCEPTS
A1$ (M1) = "END" 'END
A1$ (M2) = "POST" 'POST TEST
RETURN

REM END OF ROUTINE FOR FILLING ARRAY A1$
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 *****************************************************
00750  REM **************************************************************************
00760  REM * DATA FOR CONCEPTS TO BE COVERED                        *
00780  REM **************************************************************************
00810  DATA "CHARACTERS"
00820  DATA "ALPHABETIC"
00830  DATA "NUMERIC"
00840  DATA "SPECIAL"
00850  DATA "ALPHANUMERIC"
00860  DATA "CONSTANTS"
00870  DATA "VARIABLES"
00880  DATA "STRING"
00890  DATA "STRING CONSTANTS"
00900  DATA "IDENTIFIERS"
00910  DATA "STRING VARIABLES"
00920  DATA "NUMERIC VARIABLES"
00930  DATA "NUMERIC CONSTANT"
00940  DATA "OPERATORS"
00950  DATA "OPERAND"
00960  DATA "EXPRESSIONS"
00970  DATA "NUMERIC EXPRESSIONS"
00980  DATA "STRING EXPRESSIONS"
00990  DATA "SE,SE1,SE2"
01000  DATA "NE,NE1,NE2"
01010  DATA "FUNCTIONS"
01020  DATA "STRING FUNCTIONS"
01030  DATA "LEN(SE)"
01040  DATA "LEFT$(SE,NE)"
01050  DATA "RIGHT$(SE,NE)"
01060  DATA "TRIM$(SE)"
01070  DATA "PAD$(SE,NE)"
01080  DATA "RPT$(SE,NE)"
01090  DATA "POS(SE,SE1,SE2,NE)"
01100  DATA "MID$(SE,NE1,NE2)"
01110  REM **************************************************************************
01115  REM * END OF DATA FOR CONCEPTS TO BE COVERED                        *
01120  REM **************************************************************************
01125  REM **************************************************************************
01130  REM **************************************************************************
01135  REM **************************************************************************
01140  REM **************************************************************************
01145  REM **************************************************************************
01150  REM **************************************************************************
01155  REM **************************************************************************
01160  REM **************************************************************************
01165  REM **************************************************************************
01170  REM **************************************************************************
01175  REM **************************************************************************
01180  REM **************************************************************************
01185  REM **************************************************************************
01190  REM **************************************************************************
01195  REM **************************************************************************
01200  D = D + N1
01210  D$ (D) = "ALCCAIP"
01220  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 RESTOR$E 2
01295 RETURN
01300 REM ********************************************
01310 REM ! END OF INITIAL SET UP RECORD PROCEDURES
01340 REM ********************************************
01345 REM SUB ROUTINE FOR CHECKING DOUBLE ENTRIES
01346 REM ********************************************
01347 REM
01350 L$. = "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
01369 NEXT I
01400 RETURN
01410 REM *********** END OF SEARCH FOR DOUBLE ENTRY ***********
01450 REM ********************************************
01510 REM ! ROUTINE FOR CAUTION ABOUT END OF LESSONS. !
01520 REM ********************************************
01530 GOSUB 2150
01540 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 ********************************************
01611 REM END OF ROUTINE FOR PRINTING CAUTION.
01620 REM
01623 REM ********************************************
01630 T1 = T1 + N9
01640 RETURN
01730 REM ********************************************
01740 REM ! SUBROUTINE FOR INITIALIZING VARIABLES
01745 REM ********************************************
01750 REM
01752 N0 = 0
01753 N1 = 1
01754 Z1 = 9999
01760 N2 = 2
01765 N3 = 3
01770 N4 = 4
01775 N5 = 5
01780 N6 = 6
01785 N7 = 7
01790 N8 = 8
REM ! SUBROUTINE FOR STORING FEEDBACK MESSAGES
REM
CS(N1) = "*************** BRAVO !
***************"
CS(N2) = "*************** GOOD WORK !
***************"
CS(N3) = "*************** KEEP IT UP !
***************"
CS(N4) = "*************** THAT'S FINE !
***************"
CS(N5) = "*************** YOU'RE DOING WELL
***************"
WS(N1) = "*************** WRONG !
***************"
WS(N2) = "*************** INCORRECT !
***************"
WS(N3) = "*************** BE CAREFUL NOW !
***************"
WS(N4) = "*************** TRY A LITTLE HARDER !
***************"
WS(N5) = "*************** NO, THAT'S NOT THE ANSWER
***"
REM
REM ! END OF SUBROUTINE FOR STORING FEEDBACK COMMENTS!
REM
RETURN
REM
REM ! SUBROUTINE FOR CLEARING PART OF SCREEN
REM
GOTO 2200
T = T + T1
02180 GOSUB 2320
02185 T = N0
02188 T1 = N0
02190 GOSUB 2320
02200 RETURN
02215 REM
02220 REM I END OF SUBROUTINE FOR CLEARING PART OF SCREEN I
02230 REM -----------------------------------------------------
02240 REM
02250 REM I SUBROUTINE TO CLEAR ENTIRE SCREEN I
02260 REM ---------------------------------------------
02270 REM
02280 T2 = N0
02290 PRINT ":I+
02295 PRINT S$  "SET OFF WHEN DISPLAY IS OFF
02300 RETURN
02305 REM
02310 REM I END OF SUBROUTINE FOR CLEARING SCREEN I
02315 REM -----------------------------------------------------
02320 REM
02322 REM I SUBROUTINE FOR TABBING AND CLEARING I
02324 REM -----------------------------------------------------
02326 PRINT ":I"
02330 FOR I = N1 TO T
02340 PRINT S$  "PRINT BLANK LINES TO CLEAR
02350 NEXT I
02360 RETURN
02365 REM
02366 REM I END OF TABBING ROUTINE AND CLEARING I
02370 REM -----------------------------------------------------
02375 REM
02380 REM I SUBROUTINE FOR DISPLAYING COMMANDS I
02385 REM -----------------------------------------------------
02390 REM
02395 IF T2 = N1 THEN 2580
02400 PRINT S$
02405 PRINT TAB (54);"|---|-------------|
02410 PRINT TAB (54);"| RA | RATIONALE |
02415 PRINT TAB (54);"| OB | OBJECTIVES |
02420 PRINT TAB (54);"| AD | FOR ADVICE |
02425 PRINT TAB (54);"| RD | RULE OR DEF |
02430 PRINT TAB (54);"| EX | EXAMPLES |
02435 PRINT TAB (54);"| PR | PRACTICE |
02440 PRINT TAB (54);"| RV | REVISION |
02445 PRINT TAB (54);"|-------------|
02450 PRINT TAB (54);"| CM | FOR COMMANDS |
02455 PRINT TAB (54);"| CO | FOR CONCEPTS |
02460 PRINT TAB (54);"-------------|
02465 PRINT TAB (54);" POST FOR POST TEST |
02470 PRINT TAB (54);"-------------|
02475 PRINT TAB (54);"| NEXT |
02480 PRINT TAB (54);"| HELP |
02485 PRINT TAB (54);"| PASS |
02490 PRINT TAB (54);"| END |
02495 PRINT TAB (54);"| CL | CLEAR SCREEN |
02500 PRINT TAB (54);"-------------|
02572 T2 = N1
02575 GOSUB 2320
02580 RETURN
02590 REM "SET ON IF DISPLAY IS ON"
02600 RETURN
02600 REM * END OF SUBROUTINE FOR DISPLAYING COMMANDS *
02610 REM "SUBROUTINE FOR STORING INSTRUCTIONAL DATA"
02620 REM "SUBROUTINE FOR STORING CHOICES"
02630 REM "SUBROUTINE FOR GOING TO TOP OF SCREEN"
02640 REM "SUBROUTINE FOR FINDING Z1...." !
02650 REM "SUBROUTINE FOR GOING TO TOP OF SCREEN" ***
02660 Z=Z+N1
02670 A3 (Z) = (A2 * 100 ) + A1
02680 IF Z > 500 THEN Z = N1
02690 RETURN
02700 REM "SUBROUTINE FOR STORING CHOICES"
02710 REM "SUBROUTINE FOR GOING TO TOP OF SCREEN"
02720 REM "SUBROUTINE FOR FINDING Z1...." !
02730 FOR I = N1 TO N3
02740 PRINT CHR$ (N7);CHR$(M3)
02750 NEXT I
02760 RETURN
02770 REM "SUBROUTINE FOR STORING INSTRUCTIONAL DATA"
02780 REM "END OF SUBROUTINE FOR RINGING BELL"
02790 REM "SUBROUTINE FOR STORING CHOICES"
02800 REM "SUBROUTINE FOR GOING TO TOP OF SCREEN"
02810 REM "SUBROUTINE FOR FINDING Z1...." !
02820 FOR I = N1 TO N3
02830 PRINT CHR$ (N7);CHR$(M3)
02840 NEXT I
02850 RETURN
02860 REM "SUBROUTINE FOR STORING CHOICES"
02870 REM "SUBROUTINE FOR GOING TO TOP OF SCREEN"
02880 REM "SUBROUTINE FOR FINDING Z1...." !
02890 FOR I = N1 TO N3
02900 PRINT CHR$ (N7);CHR$(M3)
02910 NEXT I
02920 RETURN
02930 REM "SUBROUTINE FOR STORING CHOICES"
02940 REM "SUBROUTINE FOR GOING TO TOP OF SCREEN"
02950 REM "SUBROUTINE FOR FINDING Z1...." !
02960 FOR I = N1 TO N3
02970 PRINT CHR$ (N7);CHR$(M3)
02980 NEXT I
02990 RETURN
03000 REM "SUBROUTINE FOR STORING CHOICES"
03010 REM "SUBROUTINE FOR GOING TO TOP OF SCREEN"
03020 REM "SUBROUTINE FOR FINDING Z1...." !
03030 FOR I = N1 TO N3
03040 PRINT CHR$ (N7);CHR$(M3)
03050 NEXT I
03060 RETURN
03070 REM "SUBROUTINE FOR STORING CHOICES"
03080 REM "SUBROUTINE FOR GOING TO TOP OF SCREEN"
03090 REM "SUBROUTINE FOR FINDING Z1...." !
03100 A5 =A1 
03102 A6 = A2
03103 GOSUB 2930
03104 GOSUB 3360
03105 IF A2 > 22 THEN 3120
\[ z_1 = 60 \times (A_2 - N_1) + M_0 \times (A_1 - N_1) + N_1 \]
\[ \text{GO TO 3130} \]
\[ z_2 = 1320 + (A_2 - 23) \times 100 \]
\[ \text{IF A}_1 = 6 \text{ THEN } z_1 = z_2 + 71 \text{ ELSE } z_1 = z_2 + M_0 \times (A_1 - N_1) + N_1 \]
\[ \text{IF A}_1 = N_6 \text{ THEN } L_2 = N_8 \text{ ELSE } L_2 = N_9 \]
\[ \text{RETURN} \]
\[ \text{REM} \]
\[ \text{REM ! START OF SUB ROUTINE FOR PRINTING INFORMATION} \]
\[ \text{REM} \]
\[ \text{REM ! ROUTINE FOR PRINTING} \]
\[ \text{REM} \]
\[ \text{REM ! SUBROUTINE FOR STORING CONCEPTS CHOSEN} \]
\[ \text{REM} \]
\[ \text{REM} \]
\[ \text{REM FOR A}_4 = z_1 \text{ TO } z_1 + L_2 \]
\[ \text{PRINT A}_3 \times (A_4) \]
\[ \text{NEXT A}_4 \]
\[ \text{RETURN} \]
\[ \text{REM} \]
\[ \text{REM ! ROUTINE FOR DECISION MAKING} \]
\[ \text{REM} \]
\[ \text{IF A}_2 > 22 \text{ THEN IF A}_1 = N_5 \text{ THEN 6500 ELSE IF A}_1 = N_6 \text{ THEN 6000} \]
\[ \text{GOSUB 2150} \]
\[ \text{GOSUB 3100} \]
\[ \text{FIND Z1} \]
\[ \text{GOSUB 4350} \]
\[ \text{FIND LS} \]
\[ \text{IF LS} \neq "Y" \text{ THEN 3255} \]
\[ \text{GOSUB 2150} \]
\[ \text{PRINT \"! PLEASE NOTE THAT ALCAIP PROVIDES YOU WITH A \"} \]
\[ \text{PRINT \"! BASED ON YOUR SEQUENCE OF REQUEST. IT DOES \"} \]
\[ \text{PRINT \"! EXPECT YOU TO GIVE A REQUEST MORE THAN ONCE. \"} \]
\[ \text{PRINT \"! YOUR LAST REQUEST YOU HAVE ENTERED BEFORE. \"} \]
\[ \text{H}_1 = N_7 \]
\[ \text{T}_1 = T_1 + N_7 \]
\[ \text{GOTO 3280} \]
\[ \text{GOSUB 3145} \]
\[ \text{IF A}_1 = N_6 \text{ THEN GOSUB 3450} \]
\[ \text{RETURN} \]
\[ \text{REM ** END OF DECISION ROUTINE} \]
\[ \text{REM} \]
\[ \text{FOR } i = N_1 \text{ TO 30} \]
\[ \text{IF A}_7 ((i,N_1)) = A_2 \text{ THEN 3380} \]
\[ \text{IF A}_7 ((i,N_1)) \neq N_0 \text{ THEN 3400} \]
\[ \text{A}_7 ((i,N_1)) = A_2 \]
\[ \text{A}_7 ((i,A_1 + N_1)) = A_1 \]
3390 GOTO 3410
3400 NEXT I
3410 RETURN
3420 REM
3430 REM ! END OF SUBROUTINE FOR STORING CONCEPTS
3440 REM __________________________________________
3450 REM __________________________________________
3460 REM ! SUBROUTINE FOR ACCEPTING PRACTICE ANSWERS
3470 REM __________________________________________
3480 PRINT "** PLEASE ENTER YOUR ANSWER WHEN YOU'RE READY
3485 T1 = T1 + N2
3490 GOSUB 5160
3495 D = D + N1
3497 DS (D) = R1$
3498 REM ****** GENERATE RANDOM NUMBER FOR RANDOM
3499 REM ****** SELECTION OF POS AND NEG. FEEDBACK.
3500 R1 = INT(((RND(-N1)*M0)+N2)/N2)
3505 IF R1$ <> A3$(A4) THEN 3610
3506 PRINT CS (R1)
3507 T1=T1 + N2
3510 GOTO 3900
3515 PRINT W$(R1)
3520 PRINT ": ! THE CORRECT ANSWER IS ";A3$(A4);TAB(4B);"!
3525 GOSUB 3720
3530 T1 = T1 + N3
3535 GOSUB 2150
3540 A1 = N3
3545 GOSUB 3100
3550 GOSUB 1350
3555 IF L$ = "Y" THEN 3653
3560 GOSUB 3150
3565 H1 = N8
3570 PRINT ": ! FROM THE LIST OF CONCEPTS ABOVE YOU SHOULD
3575 PRINT ": ! SELECT AND STUDY THOSE YOU WISH TO REVIEW.
3580 PRINT ": !" !
3585 T1 = T1 + N5
3590 IF L$ = "Y" THEN Z1 = Z1 + 20 ELSE Z1 = A4 + 10
3595 GOSUB 1350
3600 IF L$ = "Y" THEN 3669
3605 PRINT ": ! YOU MAY ALSO WANT TO LOOK AT THE FOLLOWING."
3610 PRINT . A3$(Z1+N1)
3615 PRINT ": !==================================================================================
3620 H1 = Z0
3625 T1 = T1 + N5
3630 H1 = N8
3635 REM
3640 T1 = T1 + N1
3650 REM __________________________________________
3660 REM ! END OF ROUTINE FOR GIVING FEEDBACK TO PRACTICE
3665 REM __________________________________________
3670 RETURN
3675 REM __________________________________________
3680 REM ! SUBROUTINE FOR PAUSING FOR A WHILE
3685 REM __________________________________________
REM " HIT THE 'C' KEY THEN 'RETURN'"
INPUT P$  
T1 = T1 + N3  
RETURN  
REM  
REM THIS IS WHERE THE PROGRAM REALLY BEGINS  
REM  
REM  
DELIMIT (CR)
GOSUB 2640  
GOSUB 2250  
T = N3  
GOSUB 2320  
PRINT "HELLO, WELCOME TO ALCCAIP, THIS IS A LEARNER CONTROLLED COMPUTER ASSISTED INSTRUCTION PROGRAM."
PRINT "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.
PRINT ""  
T1 = M3  
GOSUB 3710  
GOSUB 2250  
GOSUB 2320  
PRINT "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."
PRINT ""  
T1 = M2  
GOSUB 3720  
GOSUB 2250  
GOSUB 2320  
PRINT ""  
PRINT "I WOULD YOU PLEASE ENTER YOUR NAME NOW?"
PRINT ""  
PRINT "$  
GOSUB 5160  
T1 = N5  
H1 = N1  
IF R1$ <> H$ THEN 4410
04388 GOSUB 8000
04389 GOTO 4380
04410 GOSUB 2250
04412 D = D + N1
04414 DS (D) = R1$  
04415 GOSUB 2320
04419 PRINT "-------------------------------------------------------------1"
04420 PRINT "! HELLO "; R1$ ; "TAB (48) ; "!"
04430 PRINT "! I WILL NOW GIVE YOU A BRIEF RE-CAP"
04440 PRINT "! OF HOW ALCAIP WORKS."
04441 PRINT "! NOTE WELL: I ALCAIP 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 "!-------------------------------------------------------------1"
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 "!-------------------------------------------------------------1"
04526 PRINT ""
04530 GOSUB 3720  
04535 T1 = M4
04540 GOSUB 2150
04545 PRINT "!-------------------------------------------------------------1"
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 "!-------------------------------------------------------------1"
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 -----------------------------------------------
REM I SUBROUTINE FOR PRINTING CHOICES D$, A3, H
REM
PRINT 2,"-----------------------------------------------"
FOR K = N1 TO D
PRINT 2,D$(K);" ";
IF K/M0 = INT (K/M0) THEN PRINT 2, " ";
NEXT K
FOR J = N1 TO 1200
IF A3 (J) = 0 THEN 4800
PRINT 2,A3(J);
IF J/M0 = INT (J/M0) THEN PRINT 2, " ";
NEXT J
PRINT 2,B1;D1;D2;D3;D4;W1;W2;R2;R3
PRINT 2,B2;B3;B4;B5
PRINT 2,"-----------------------------------------------"
RETURN
REM ! END OF SUBROUTINE FOR PRINTING FINAL STATISTICS !
REM ! ALL THE LESSONS FOR NEXT COMMAND !
REM
B2 = B2 + N1
IF A6 = N0 THEN A6 = N1
IF A5 = N0 THEN A5 = N1 ELSE A5 = A5 + N1
IF A5 < N7 THEN 5085
A6 = A6 + N1
A5 = N1
A2 = A6
A1 = A5
GOSUB 3200
RETURN
REM
REM ! SUBROUTINE FOR ACCEPTING INPUT !
REM
PRINT "WHAT NEXT "; 'INPUT REQUEST
INPUT C$"FIND LENGTH
IF C$(L1:L1) = " " THEN L1 = L1 - N1 'VERIFY LENGTH
R3$ = C$ (N3:N3) 'SEPARATOR CHARACTER
R1$ = C$ (N1:L1) 'THE ENTIRE ENTRY
R$ = C$ (N1:N2) 'EXTRACT FIRST 2 CHARACTERS
IF R$ = "CL" THEN GOSUB 2250
IF R$ = "CL" THEN 5200
RETURN
REM ! END OF SUBROUTINE FOR ACCEPTING INPUT !
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
05350 IF L1 <= N2 THEN 5600 'INCORRECT COMMAND
05370 IF L1=L3 THEN R3$<>","AND R3$ <> "" . THEN 5440 ELSE'
05400 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$(N4:L1) ELSE
05500 R2$ = 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
05550 GOTO 7362
05550 GOSUB 3200
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
05620 GOSUB 2410
05620 GOSUB 2410
05625 IF R5 = "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
05870 IF R$ = "CO" THEN GOTO 7700
05875 GOTO 5270
05880 REM ____________________________
05884 REM ____________________________
05886 REM ____________________________
05890 REM ____________________________
05900 REM ! SUBROUTINE FOR CAUTION ABOUT NO COMMAND !
05920 REM ____________________________
05930 REM ____________________________
05940 A1 = A5
05945 GOSUB 3200
05960 IF P3$ = "Y" THEN 5270 ELSE 5270
05970 REM ____________________________
05990 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
06065 RETURN
06080 REM ____________________________
06090 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$ <> N$ 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 --------
06490 REM
06500 REM ' ROUTINE FOR GIVING MORE THAN 1 EXAMPLE
06506 REM
06507 E1 = 0
06508 E1 = E1 + N1
06509 P3$ = " "
0650A GOSUB 1350
0650B IF L$ <> "Y" THEN 6518
0650C IF L$ <> "Y" THEN 6518
0650D IF L$ <> "Y" THEN 6518
0650E PRINT " **** THIS EXAMPLE HAS BEEN SEEN ALREADY *******
0650F 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
06515 GOSUB 3145
06516 A9 = A4
06519 IF E1 = N3 THEN 3280
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
06570 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 =-------------------------------------------------------------!
06620 E2 = N0
06625 GOSUB 3100
06630 E2 = E2 + N1
06635 P3$ = "!"
06640 L2 = N8
06645 GOSUB 1350
06650 IF L$ <> "Y" THEN 6840
06660 PRINT "!
06670 PRINT "! SORRY! BUT YOU HAVE ALREADY PRACTICE THIS!
06675 PRINT "! PROBLEM. YOU MAY TYPE 'NEXT' FOR ANOTHER."
06680 PRINT "!
06685 H1 = N9
06690 T1 = T1 + N4
06695 A8 = Z1 / M0
06700 GOTO 6870
06705 A8 = Z1
06710 GOSUB 3145
06715 GOSUB 13000
06720 A8 = A8 + M0
06725 PRINT "! THERE ARE 3 PRACTICES ON THIS FUNCTION
06730 PRINT "! IF YOU HAVE NOT DONE THEM ALL YOU MAY
06735 PRINT "! GET ANOTHER BY TYPING 'NEXT'.
06740 T1 = T1 + N4
06745 IF E2 = N3 THEN 3280
06750 GOSUB 5160
06755 H1 = N9
06760 H1 = 21
06765 IF R$ <> "HE" THEN 6895
06770 GOSUB 8000
06775 GOSUB 2150
06780 GOTO 6870
06785 IF R$ <> "NE" THEN 6930
06790 Z1 = A8
06795 GOSUB 2150
06800 GOTO 6802
06805 P3$ = "Y"
06810 GOTO 3280
07000 REM
07100 REM
07110 REM 1 SUBROUTINE FOR MEMORY SUPPORT
07120 REM ------------------------------
07122 B3 = B3 + N1
07130 J1 = N1
07140 J2 = M8
07150 GOSUB 2250 'CLEAR SCREEN
07160 IF A7(N1,N1) <> N0 THEN 7170
07170 PRINT "*************** MEMORY SUPPORT NOT AVAILABLE ******
07180 T1 = N3
07190 H1 = M4
07200 GOTO 5270
07210 PRINT $S$
07220 PRINT TAB (54); "!------------------------!
07230 FOR I = J1 TO J2
07240 IF A7(I,N1) = N0 OR I = 37 THEN 7340
07250 PRINT TAB (54); "!"; AS(A7(I,N1))(N1:20);TAB (75); "!"
07260 NEXT I
07270 GOSUB 2320
07280 PRINT "
07290 PRINT "I THESE ARE THE CONCEPTS YOU HAVE SEEN"
07300 PRINT "I DO YOU WANT TO SEE MORE.
07310 PRINT "
07320 PRINT T1 = N5
07330 H1 = M5
07340 GOSUB 5160
07350 IF R1$ = "RV" THEN 5275
07360 IF R1$ <> HS THEN 7270
07370 GOSUB 8000
07380 GOTO 7260
07390 IF R1$ = "NO" THEN 7340
07400 IF R1$ = "YES" THEN 7290
07410 PRINT "
07420 PRINT " PLEASE ANSWER YES OR NO TO THIS QUESTION"
07430 T1 = N3
07440 H1 = M6
07450 IF R1$ <> HS THEN 7285
07460 GOSUB 8000
07470 GOTO 7265
07480 J1 = M9
07490 J2 = 37
07500 GOTO 7145
07510 GOSUB 2320 'TABBING
07520 PRINT "----------------------------------------"
07530 PRINT "I WHICH CONCEPT DO YOU WANT TO REVISE?
07540 T1 = N3
07550 GOTO 6100 'GOSUB 6100 VERIFY CONCEPT
07560 FOR J = N1 TO 36
07570 IF A7 (J,N1) = A2 THEN 7380
07580 NEXT J
07590 GOSUB 7500
07600 GOTO 7354
07610 PRINT $S$
07620 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))
07388 NEXT I
07390 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 "END OF MEMORY SUPPORT ROUTINE:"
07484 REM "".
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
07560 GOSUB 2150
07562 PRINT "".
07570 PRINT ""!PLEASE CHOOSE COMMAND FROM THOSE SHOWN"
07580 PRINT ""!THE ONE YOU HAVE CHosen IS NOT PERMISSIBLE".
07590 PRINT "".
07605 T1 = N5
07606 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 $5-
07775 PRINT TAB(54);"!-----------------------------------!
07780 FOR I = J1 TO J2
07790 PRINT TAB(54);"!;A$(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$ <> H1$ 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 I 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"
08260 PRINT "! A 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.
08350 PRINT "! 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
08545 PRINT "CONCEPTS'.
08550 PRINT "
08555 T1 = N6
08560 GOTO 11000
08570 GOSUB 2150
08580 PRINT "==================================================================
08590 PRINT "GOOD EFFORT! I SEE YOU ARE TRYING OUT THE
08600 PRINT "HELP COMMAND. NOW YOU ARE CONVINCED THAT
08610 PRINT "IT WORKS. THAT WAS VERY SMART. IF EVER YOU
08620 PRINT "WANT TO SEE THE 8 STRING FUNCTIONS THAT YOU
08630 PRINT "ARE TO LEARN THE USE THE 'CONCEPT' COMMAND.
08640 PRINT "==================================================================
08650 T1 = N8
08660 GOTO 11000
08670 GOSUB 2150
08680 PRINT "==================================================================
08690 PRINT "ALCAIP IS GENERATING A SEQUENTIAL LESSON
08700 PRINT "BASED UPON THE SEQUENCE OF YOUR COMMANDS.
08710 PRINT "WHEN YOU MAKE THE SAME REQUEST TWICE, ALCAIP
08720 PRINT "WILL ALWAYS REJECT IT.
08730 PRINT "==================================================================
08740 T1 = N7
08750 GOTO 11000
08760 GOSUB 2150
08770 PRINT "==================================================================
08780 PRINT "THIS WAS JUST AN ADVICE TO YOU TO LET YOU
08790 PRINT "KNOW WHAT CONCEPTS, RULES OR EXAMPLES ARE
08800 PRINT "RELEVANT TO THE PRACTICE YOU JUST DID.
08810 PRINT "==================================================================
08820 T1 = T1 + N6
08830 GOTO 11000
08840 GOSUB 2150
08850 PRINT "==================================================================
08860 PRINT "THREE EXAMPLES AND THREE PRACTICES ARE PRO-
08870 PRINT "VIDED FOR THE 8 STRING FUNCTIONS. YOU CAN
08880 PRINT "SEE THEM ALL BY ENTERING 'NEXT'.
08890 PRINT "==================================================================
08895 T1 = N7
08900 GOTO 11000
08910 PRINT "==================================================================
08920 PRINT "YOU REQUESTED REVISION. YOU WERE SHOWN
09030 PRINT "1 ONLY THOSE CONCEPTS THAT YOU HAVE ALREADY
09040 PRINT "1 SEEN, SINCE YOU CANNOT REVISE THAT WHICH
09050 PRINT "1 YOU HAVE NOT SEEN. YOU MUST NOW DECIDE
09060 PRINT "1 WHICH OF THESE CONCEPTS YOU NEED TO REVISE."
09070 PRINT "1"
09080 T1 = N8
09090 GOTO 11000
09100 GOSUB 2150
09110 PRINT "1"
09120 PRINT "1 YOU CAN ONLY REVISE THOSE CONCEPTS THAT HAVE
09130 PRINT "1 BEEN SHOWN TO YOU. IF YOU WANT TO SEE THEM
09140 PRINT "1 AGAIN TYPE 'MS'.
09150 PRINT "1"
09160 T1 = N6
09170 GOTO 11000
09180 GOSUB 2150
09190 PRINT "1"
09200 PRINT "1 YOU HAVE BEEN SHOWN THE COMMANDS THAT YOU HAVE
09210 PRINT "1 USED WITH THE CONCEPT YOU REQUESTED. YOU MUST
09220 PRINT "1 NOW DECIDE WHICH OF THESE COMMANDS YOU WANT TO
09230 PRINT "1 REVISE.
09240 PRINT "1"
09250 T1 = N7
09260 GOTO 11000
09270 GOSUB 2150
09280 PRINT "1"
09290 PRINT "1 YOU HAVE NOT CHOSEN A COMMAND FROM THOSE SHOWN
09300 PRINT "1 TO YOU. YOU ARE ONLY ALLOWED TO REVISE
09310 PRINT "1 CONCEPTS!"
09320 PRINT "1 AND COMMANDS THAT YOU HAVE ALREADY DONE.
09330 PRINT "1"
09340 T1 = N6
09350 GOTO 11000
09360 GOSUB 2150
09370 PRINT "1"
09380 PRINT "1 YOU HAVE NOT DONE ANY WORK AS YET, HENCE YOU
09390 PRINT "1 CANNOT REVISE ANYTHING.
09400 PRINT "1"
09410 T1 = N5
09420 GOTO 11000
09430 GOSUB 2150
09440 PRINT "1"
09450 PRINT "1 SINCE THE SCREEN CANNOT HOLD ALL THE CONCEPTS
09460 PRINT "1 YOU HAVE SEEN, I HAVE DECIDED TO SHOW THEM TO
09470 PRINT "1 IN GROUPS. YOU CAN SEE MORE IF YOU WISH BY
09480 PRINT "1 TYPING 'YES'. IF YOU HAVE SEEN THE CONCEPT YOU
09490 PRINT "1 WANT TYPE 'NO' TO THE QUESTION.
09500 PRINT "1"
09510 T1 = N8
09520 GOTO 11000
09530 GOSUB 2150
09540 PRINT "1"
09550 PRINT "1 YOU WERE ASKED WHETHER YOU WANT TO SEE MORE
09560 PRINT "1 CONCEPTS OR NOT. YOU MUST ANSWER 'YES' OR
'NO'!
09640 PRINT "1 TO THIS QUESTION BEFORE DOING ANYTHING ELSE.
09650 PRINT "1
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 "! CONCEPTS. THEN SELECT THE CONCEPT THAT YOU
09756 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 I END OF SUBROUTINE FOR POST TEST INTRODUCTION !
11120 REM ==========================================
11125 PI$ = "YES" 'TO KEEP TRACT OF POST TEST COMPLETION
11130 GOSUB 2250
11140 PRINT "=========================================
11150 PRINT "I WELCOME TO THIS POST-TEST. I AM SURE YOU HAVE
11160 PRINT "I TRIED YOUR BEST WITH THE LESSONS AND NOW YOU
11170 PRINT "I BELIEVE YOU ARE READY TO DO THIS POST-TEST."
11180 PRINT "I THE QUESTIONS ARE SIMILAR TO THOSE YOU HAD ON"
11190 PRINT "I ON THE PRACTICE, EXAMPLES AND PRE-TEST. IF YOU"
11200 PRINT "I UNDERSTOOD THE EXAMPLES AND DID WELL WITH THE"
11210 PRINT "I PRACTICE, YOU SHOULD HAVE ABSOLUTELY NO"
11220 PRINT "I PROBLEMS AT ALL WITH THIS POST-TEST."
11230 PRINT "I=========================================
11240 GOSUB 3722
11250 GOSUB 2250
11260 PRINT "=========================================
11270 PRINT "I AFTER THIS FRAME THE POST-TEST WILL BEGIN."
11280 PRINT "I IF YOU THINK YOU ARE SPENDING TOO MUCH TIME"
11290 PRINT "I ON ANY QUESTION YOU MAY PASS BY TYPING 'PASS'!"
11300 PRINT "I 'ALCAIP' WILL REMEMBER THAT AND GIVE YOU"
11310 PRINT "I ONE CHANCE TO TRY THEM AGAIN AT THE END."
11320 PRINT "I READY ... O.K. HERE WE GO... GOOD LUCK...
11330 PRINT "I=========================================
11340 GOSUB 3722
11350 GOSUB 2250
11360 GOSUB 2250
11370 D = D + N1
11480 D$ (D) = CLKS$ '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) = CLKS$ '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 "I"
11660 PRINT "I BEFORE YOU BEGIN THIS LESSON, I WOULD LIKE TO"
11670 PRINT "I GIVE YOU A PRE-TEST. REMEMBER YOU HAVE:
11675 PRINT "I NOTHING TO FEAR.
11680 PRINT "I THIS TEST WAS SIMPLY DESIGNED TO SEE HOW MUCH"
11685 PRINT "I YOU ALREADY KNOW ABOUT 'STRING FUNCTIONS'.
11690 PRINT "I IF YOU DO NOT KNOW THE ANSWERS, DO NOT GUESS"
11700 PRINT "I THEM. SIMPLY TYPE 'PASS'. AT THE END OF THIS"
11705 PRINT "I LESSON YOU WILL BE ABLE TO ANSWER ALL THESE"
11710 PRINT "I QUESTIONS THAT SEEM SO DIFFICULT NOW.
11740 PRINT "I========================================="
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."
11985 ;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,"
12100 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 I END OF PRE TEST INITIATION
12207 REM --------------------------------------------------
12210 REM --------------------------------------------------
12212 REM I 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 DS(D) = "PA"
12290 Z1 = A4 + N1
12300 IF Z1 > 2360 THEN 12450
12310 GOTO 12240
12320 IF RS = "SK" THEN 12450
12325 IF R1S <= A3$ (A4) THEN 12390
12330 D = D + N1
12340 D$ (D) = R1S
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$. (D) = R1S
12410 IF P1$ = "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 "! 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 PLEASE 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$(D) = R1S
13080 R1 = INT((RND(-N1)*M0+N2)/N2)
13090 IF R1S <= A3$(A4) THEN 13140
13110 PRINT C$(R1)
13120 T1=T1+N1
13130 GOTO 13400
13140 PRINT WS(R1)
13145 PRINT "! THE CORRECT ANSWER IS ";A3$(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."
13240 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$(A8-29)
13300 T1 = T1 + N1
13310 Z4 (I) = N0
13320 REM ***** END OF ROUTINE *****
133400 RETURN
13340 REM ======================================================================
133410 REM ! SUB - ROUTINE FOR GIVING QUESTIONS THAT WERE !
133420 REM ! PASSED ON POST TEST. !
133430 REM ======================================================================
133500 GOSUB 2250
133510 PRINT "!======================================================================"
133520 PRINT "! I CAN GIVE YOU THE TEST QUESTIONS THAT YOU"
133530 PRINT "! PASSED. DO YOU WANT TO TRY THEM AGAIN ?"
133540 PRINT "!======================================================================"
133542 H1 = N9
133550 GOSUB 5160
133552 IF R$ <> "HE" THEN 13560
133553 GOSUB 8000
133554 GOTO 13510
133560 IF R1$ = "NO" THEN 13999
133570 IF R1$ = "YES" THEN 13560
133572 PRINT "***** PLEASE ANSWER 'YES' OR 'NO' ******" !
133574 GOTO 13550
133580 GOSUB 2250
133590 FOR I = 1 TO P5
133600 K = P6(I)
133610 FOR J = K TO K + M0
133620 PRINT A3$(J)
133630 NEXT J
133635 P6(I) = N0
133640 GOSUB 5160
133642 D = D + N1
133644 D$(D) = R1$
133650 IF R1$<>A3$(J) THEN 13750
133660 IF P1$ = "YES" THEN R3 = R3 + N1 ELSE R2 = R2 + N1
133690 GOTO 13800
133750 IF P1$ = "YES" THEN W2 = W2 + N1 ELSE W1 = W1 + N1
133800 GOSUB 2250
133805 NEXT I
133810 REM ======================================================================
133820 REM ! END OF ROUTINE FOR GIVING POST TEST PASSED. !
Appendix J

Data and Formulae
<table>
<thead>
<tr>
<th>SS</th>
<th>GRP</th>
<th>PRT</th>
<th>POST</th>
<th>DEL</th>
<th>GAINE</th>
<th>ON</th>
<th>CPU</th>
<th>TOTAL</th>
<th>TOT</th>
<th>TOT</th>
<th>TIM</th>
<th>COST</th>
<th>CO</th>
<th>ST</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AS</td>
<td>2</td>
<td>8</td>
<td>12</td>
<td>6</td>
<td>187</td>
<td>3.05</td>
<td>28.63</td>
<td>16</td>
<td>35</td>
<td>5.34</td>
<td>4.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>AS</td>
<td>2</td>
<td>15.5</td>
<td>6.5</td>
<td>13.5</td>
<td>192</td>
<td>14.39</td>
<td>31.53</td>
<td>17</td>
<td>105</td>
<td>1.83</td>
<td>2.34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>AS</td>
<td>0</td>
<td>5.5</td>
<td>5.5</td>
<td>5.5</td>
<td>126</td>
<td>2.39</td>
<td>19.35</td>
<td>26</td>
<td>61</td>
<td>2.07</td>
<td>3.52</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>AS</td>
<td>0</td>
<td>10.5</td>
<td>3</td>
<td>10.5</td>
<td>74</td>
<td>8.89</td>
<td>12.79</td>
<td>31</td>
<td>83</td>
<td>0.89</td>
<td>1.22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>AS</td>
<td>1</td>
<td>18.5</td>
<td>19.5</td>
<td>17.5</td>
<td>116</td>
<td>13.6</td>
<td>19.98</td>
<td>26</td>
<td>134</td>
<td>0.87</td>
<td>1.14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>AS</td>
<td>0</td>
<td>24</td>
<td>21.5</td>
<td>24</td>
<td>108</td>
<td>6.98</td>
<td>17.53</td>
<td>7</td>
<td>56</td>
<td>1.93</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>AS</td>
<td>0</td>
<td>24</td>
<td>27</td>
<td>24</td>
<td>114</td>
<td>8.05</td>
<td>18.63</td>
<td>7</td>
<td>90</td>
<td>1.27</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>AS</td>
<td>0</td>
<td>25</td>
<td>27</td>
<td>25</td>
<td>93</td>
<td>10.92</td>
<td>16.02</td>
<td>14</td>
<td>84</td>
<td>1.11</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>AS</td>
<td>0</td>
<td>23</td>
<td>26.5</td>
<td>23</td>
<td>114</td>
<td>6.84</td>
<td>18.4</td>
<td>19</td>
<td>89</td>
<td>1.28</td>
<td>0.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>AS</td>
<td>0</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
<td>125</td>
<td>8.48</td>
<td>20.36</td>
<td>20</td>
<td>90</td>
<td>1.39</td>
<td>2.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>AS</td>
<td>0</td>
<td>10</td>
<td>4</td>
<td>10</td>
<td>81</td>
<td>17.18</td>
<td>15.41</td>
<td>7</td>
<td>75</td>
<td>1.08</td>
<td>1.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>AS</td>
<td>1</td>
<td>15.5</td>
<td>20.6</td>
<td>14.5</td>
<td>123</td>
<td>9.32</td>
<td>20.22</td>
<td>16</td>
<td>115</td>
<td>1.07</td>
<td>1.39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>AS</td>
<td>9</td>
<td>26</td>
<td>27</td>
<td>17</td>
<td>61</td>
<td>4.14</td>
<td>9.94</td>
<td>10</td>
<td>63</td>
<td>0.97</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>AS</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>127</td>
<td>6.44</td>
<td>18.77</td>
<td>16</td>
<td>90</td>
<td>1.3</td>
<td>0.26</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>AS</td>
<td>0</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>118</td>
<td>3.05</td>
<td>18.28</td>
<td>14</td>
<td>82</td>
<td>1.44</td>
<td>1.83</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Means</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SS</td>
<td>GRP</td>
<td>PRS</td>
<td>POST SCOR</td>
<td>POST SCOR</td>
<td>DEL SCOR</td>
<td>NED SCOR</td>
<td>GAIN LINE</td>
<td>ON TIME</td>
<td>CPU TIME</td>
<td>TOTAL COST</td>
<td>TOT ADV INST</td>
<td>PER INST</td>
<td>TOT TIM</td>
<td>TIM PER</td>
</tr>
<tr>
<td>---</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----------</td>
<td>-----------</td>
<td>----------</td>
<td>----------</td>
<td>-----------</td>
<td>---------</td>
<td>----------</td>
<td>------------</td>
<td>-------------</td>
<td>----------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>1</td>
<td>MAS</td>
<td>9</td>
<td>24.5</td>
<td>24.5</td>
<td>15.5</td>
<td>161</td>
<td>12.46</td>
<td>26.52</td>
<td>41</td>
<td>235</td>
<td>.69</td>
<td>1.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>MAS</td>
<td>3</td>
<td>28</td>
<td>26.5</td>
<td>25</td>
<td>94</td>
<td>9.52</td>
<td>15.91</td>
<td>7</td>
<td>52</td>
<td>1.81</td>
<td>.64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>MAS</td>
<td>0</td>
<td>26.5</td>
<td>20.5</td>
<td>26.5</td>
<td>85</td>
<td>4.84</td>
<td>13.82</td>
<td>14</td>
<td>63</td>
<td>1.37</td>
<td>.52</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>MAS</td>
<td>6.5</td>
<td>28</td>
<td>27</td>
<td>21.5</td>
<td>95</td>
<td>9.6</td>
<td>16.07</td>
<td>6</td>
<td>72</td>
<td>1.32</td>
<td>.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>MAS</td>
<td>7</td>
<td>24</td>
<td>22.5</td>
<td>17</td>
<td>76</td>
<td>3.75</td>
<td>12.11</td>
<td>8</td>
<td>42</td>
<td>1.81</td>
<td>.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>MAS</td>
<td>0</td>
<td>14.5</td>
<td>9</td>
<td>14.5</td>
<td>150</td>
<td>11.12</td>
<td>25.96</td>
<td>29</td>
<td>158</td>
<td>1.01</td>
<td>1.79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>MAS</td>
<td>2</td>
<td>19</td>
<td>21.5</td>
<td>17</td>
<td>83</td>
<td>4.71</td>
<td>13.34</td>
<td>12</td>
<td>61</td>
<td>1.36</td>
<td>.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>MAS</td>
<td>5</td>
<td>25</td>
<td>21.5</td>
<td>18</td>
<td>42</td>
<td>4.49</td>
<td>7.15</td>
<td>8</td>
<td>55</td>
<td>.76</td>
<td>.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>MAS</td>
<td>11</td>
<td>26</td>
<td>27</td>
<td>15.3</td>
<td>94</td>
<td>6.77</td>
<td>15.39</td>
<td>15</td>
<td>97</td>
<td>.97</td>
<td>1.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>MAS</td>
<td>4</td>
<td>18.5</td>
<td>17.5</td>
<td>14.5</td>
<td>161</td>
<td>8.8</td>
<td>25.82</td>
<td>19</td>
<td>116</td>
<td>1.39</td>
<td>1.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>MAS</td>
<td>0</td>
<td>21</td>
<td>19.5</td>
<td>21</td>
<td>172</td>
<td>15.74</td>
<td>28.79</td>
<td>27</td>
<td>111</td>
<td>1.55</td>
<td>1.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>MAS</td>
<td>0</td>
<td>14.5</td>
<td>12.5</td>
<td>14.5</td>
<td>119</td>
<td>5.2</td>
<td>18.92</td>
<td>20</td>
<td>79</td>
<td>1.51</td>
<td>1.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>MAS</td>
<td>0</td>
<td>27.5</td>
<td>28</td>
<td>27.5</td>
<td>69</td>
<td>7.36</td>
<td>11.75</td>
<td>1</td>
<td>82</td>
<td>.84</td>
<td>.43</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>MAS</td>
<td>12.5</td>
<td>23.5</td>
<td>25.5</td>
<td>11</td>
<td>59</td>
<td>1.71</td>
<td>9.17</td>
<td>6</td>
<td>32</td>
<td>1.84</td>
<td>.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>MAS</td>
<td>3</td>
<td>20</td>
<td>20.5</td>
<td>17</td>
<td>123</td>
<td>12.38</td>
<td>20.8</td>
<td>27</td>
<td>97</td>
<td>1.27</td>
<td>1.22</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Means:**

|       | 4.2 | 22.6 | 21.6 | 18.4 | 106.2 | 7.9  | 17.44 | 16 | 90     | 1.30 | 1.01 |

**SD:**

<p>|       | 4.2 | 4.5  | 5.4  | 4.9  | 41.0  | 3.9  | 6.77  | 11.1| 51.6   | .38  | .48  |</p>
<table>
<thead>
<tr>
<th>SS</th>
<th>GRP</th>
<th>PRS</th>
<th>POST SCOR</th>
<th>DEL POST SCOR</th>
<th>GAINED SCOR</th>
<th>ON LINE TIME</th>
<th>CPU TIME</th>
<th>TOTAL COST</th>
<th>TOT ADV INST</th>
<th>TOT PER ICE ANCE</th>
<th>TIM INST</th>
<th>COST PER SCOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MS</td>
<td>1</td>
<td>23.5</td>
<td>21</td>
<td>22.5</td>
<td>105</td>
<td>22.59</td>
<td>20.04</td>
<td>1</td>
<td>129</td>
<td>.81</td>
<td>.89</td>
</tr>
<tr>
<td>2</td>
<td>MS</td>
<td>0</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>116</td>
<td>11.19</td>
<td>19.53</td>
<td>1</td>
<td>94</td>
<td>1.23</td>
<td>.76</td>
</tr>
<tr>
<td>3</td>
<td>MS</td>
<td>2</td>
<td>17</td>
<td>17</td>
<td>15</td>
<td>105</td>
<td>5.96</td>
<td>16.88</td>
<td>1</td>
<td>41</td>
<td>2.56</td>
<td>1.13</td>
</tr>
<tr>
<td>4</td>
<td>MS</td>
<td>3</td>
<td>23.5</td>
<td>19</td>
<td>20.5</td>
<td>74</td>
<td>2.88</td>
<td>11.65</td>
<td>1</td>
<td>60</td>
<td>1.23</td>
<td>.57</td>
</tr>
<tr>
<td>5</td>
<td>MS</td>
<td>0</td>
<td>20</td>
<td>14.5</td>
<td>20</td>
<td>123</td>
<td>5.9</td>
<td>19.57</td>
<td>1</td>
<td>124</td>
<td>.99</td>
<td>.98</td>
</tr>
<tr>
<td>6</td>
<td>MS</td>
<td>1</td>
<td>7.5</td>
<td>13.5</td>
<td>6.5</td>
<td>143</td>
<td>5.73</td>
<td>22.54</td>
<td>1</td>
<td>106</td>
<td>1.35</td>
<td>3.47</td>
</tr>
<tr>
<td>7</td>
<td>MS</td>
<td>0</td>
<td>12.5</td>
<td>20</td>
<td>12.5</td>
<td>128</td>
<td>2.33</td>
<td>19.64</td>
<td>1</td>
<td>51</td>
<td>2.51</td>
<td>1.57</td>
</tr>
<tr>
<td>8</td>
<td>MS</td>
<td>3</td>
<td>24.5</td>
<td>24</td>
<td>21.5</td>
<td>113</td>
<td>8.08</td>
<td>18.49</td>
<td>1</td>
<td>88</td>
<td>1.28</td>
<td>.86</td>
</tr>
<tr>
<td>9</td>
<td>MS</td>
<td>0</td>
<td>6.5</td>
<td>3.5</td>
<td>6.5</td>
<td>148</td>
<td>6.07</td>
<td>23.35</td>
<td>1</td>
<td>82</td>
<td>1.8</td>
<td>3.59</td>
</tr>
<tr>
<td>10</td>
<td>MS</td>
<td>12</td>
<td>24.5</td>
<td>23</td>
<td>12.5</td>
<td>44</td>
<td>2.19</td>
<td>7.02</td>
<td>1</td>
<td>77</td>
<td>.57</td>
<td>.56</td>
</tr>
<tr>
<td>11</td>
<td>MS</td>
<td>2</td>
<td>24</td>
<td>27</td>
<td>22</td>
<td>56</td>
<td>6.42</td>
<td>9.62</td>
<td>1</td>
<td>64</td>
<td>.88</td>
<td>.44</td>
</tr>
<tr>
<td>12</td>
<td>MS</td>
<td>0</td>
<td>21.5</td>
<td>21.5</td>
<td>21.5</td>
<td>PR</td>
<td>4.6</td>
<td>14.07</td>
<td>1</td>
<td>67</td>
<td>1.31</td>
<td>.65</td>
</tr>
<tr>
<td>13</td>
<td>MS</td>
<td>0</td>
<td>4.5</td>
<td>7</td>
<td>4.5</td>
<td>69</td>
<td>4.08</td>
<td>11.13</td>
<td>1</td>
<td>107</td>
<td>.64</td>
<td>2.47</td>
</tr>
<tr>
<td>14</td>
<td>MS</td>
<td>0</td>
<td>14</td>
<td>8</td>
<td>14</td>
<td>121</td>
<td>6.77</td>
<td>19.44</td>
<td>1</td>
<td>75</td>
<td>1.61</td>
<td>1.39</td>
</tr>
<tr>
<td>15</td>
<td>MS</td>
<td>.5</td>
<td>22.5</td>
<td>25</td>
<td>22</td>
<td>71</td>
<td>3.04</td>
<td>11.23</td>
<td>1</td>
<td>42</td>
<td>1.69</td>
<td>.51</td>
</tr>
<tr>
<td>16</td>
<td>MS</td>
<td>0</td>
<td>10.5</td>
<td>7</td>
<td>10.5</td>
<td>131</td>
<td>11.7</td>
<td>21.87</td>
<td>1</td>
<td>170</td>
<td>.77</td>
<td>2.08</td>
</tr>
<tr>
<td><strong>Means</strong></td>
<td></td>
<td>1.5</td>
<td>17.6</td>
<td>17.3</td>
<td>16.1</td>
<td>102.2</td>
<td>6.8</td>
<td>16.63</td>
<td>1</td>
<td>86.1</td>
<td>1.36</td>
<td>1.37</td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td></td>
<td>3.0</td>
<td>7.3</td>
<td>7.5</td>
<td>6.7</td>
<td>31.6</td>
<td>5.0</td>
<td>5.1</td>
<td>0</td>
<td>34.8</td>
<td>.60</td>
<td>1.02</td>
</tr>
<tr>
<td>SS</td>
<td>GRP</td>
<td>PRS</td>
<td>POST SCOR</td>
<td>DEL NED SCOR</td>
<td>GAINED NED SCOR</td>
<td>ON LINE TIME</td>
<td>CPU TIME</td>
<td>TOTAL COST</td>
<td>TOT ADV INST</td>
<td>TOT PER INST</td>
<td>TIP SCOR</td>
<td>COST SCOR</td>
</tr>
<tr>
<td>----</td>
<td>-------</td>
<td>------</td>
<td>-----------</td>
<td>--------------</td>
<td>-----------------</td>
<td>--------------</td>
<td>----------</td>
<td>------------</td>
<td>-------------</td>
<td>-------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>1</td>
<td>NMAS 0</td>
<td>5.5</td>
<td>3</td>
<td>5.5</td>
<td>68</td>
<td>4.23</td>
<td>11</td>
<td>1</td>
<td>67</td>
<td>1.01</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>NMAS 2</td>
<td>6</td>
<td>3</td>
<td>4</td>
<td>104</td>
<td>4.9</td>
<td>16.53</td>
<td>1</td>
<td>90</td>
<td>1.16</td>
<td>4.25</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>NMAS 1</td>
<td>9</td>
<td>6</td>
<td>8</td>
<td>70</td>
<td>2.65</td>
<td>11.01</td>
<td>1</td>
<td>68</td>
<td>1.03</td>
<td>1.38</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>NMAS 0</td>
<td>12</td>
<td>14</td>
<td>12</td>
<td>125</td>
<td>9.13</td>
<td>20.48</td>
<td>1</td>
<td>73</td>
<td>1.71</td>
<td>1.71</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>NMAS 0</td>
<td>15</td>
<td>13</td>
<td>15</td>
<td>155</td>
<td>7.81</td>
<td>24.73</td>
<td>1</td>
<td>121</td>
<td>1.28</td>
<td>1.65</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NMAS 0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>66</td>
<td>4.33</td>
<td>10.72</td>
<td>1</td>
<td>41</td>
<td>1.61</td>
<td>5.36</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>NMAS 0</td>
<td>16</td>
<td>20.5</td>
<td>16</td>
<td>111</td>
<td>7.5</td>
<td>18.07</td>
<td>1</td>
<td>61</td>
<td>1.82</td>
<td>1.13</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>NMAS 0</td>
<td>16.5</td>
<td>16.5</td>
<td>16.5</td>
<td>117</td>
<td>3.48</td>
<td>18.21</td>
<td>1</td>
<td>51</td>
<td>2.29</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>NMAS 0.5</td>
<td>18</td>
<td>11</td>
<td>17.5</td>
<td>106</td>
<td>5.53</td>
<td>16.97</td>
<td>1</td>
<td>71</td>
<td>1.49</td>
<td>.97</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>NMAS 2</td>
<td>15.5</td>
<td>12.5</td>
<td>13.5</td>
<td>106</td>
<td>3.83</td>
<td>16.63</td>
<td>1</td>
<td>61</td>
<td>1.74</td>
<td>1.23</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>NMAS 2</td>
<td>12.5</td>
<td>16</td>
<td>10.5</td>
<td>95</td>
<td>4.88</td>
<td>15.18</td>
<td>1</td>
<td>37</td>
<td>2.57</td>
<td>1.45</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>NMAS 21</td>
<td>26.5</td>
<td>26</td>
<td>5.5</td>
<td>23</td>
<td>1.59</td>
<td>3.75</td>
<td>1</td>
<td>14</td>
<td>1.64</td>
<td>.68</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>NMAS 0</td>
<td>21.5</td>
<td>13.5</td>
<td>21.5</td>
<td>93</td>
<td>3.15</td>
<td>14.55</td>
<td>.49</td>
<td>49</td>
<td>1.9</td>
<td>.68</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>NMAS 0</td>
<td>17.5</td>
<td>18</td>
<td>17.5</td>
<td>56</td>
<td>2.11</td>
<td>8.8</td>
<td>1</td>
<td>35</td>
<td>1.6</td>
<td>.5</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>NMAS 0.5</td>
<td>23.5</td>
<td>22</td>
<td>23</td>
<td>100</td>
<td>4.73</td>
<td>15.9</td>
<td>1</td>
<td>58</td>
<td>1.72</td>
<td>.69</td>
<td></td>
</tr>
<tr>
<td><strong>Means</strong></td>
<td><strong>1.9</strong></td>
<td><strong>14.5</strong></td>
<td><strong>13.1</strong></td>
<td><strong>12.5</strong></td>
<td><strong>93</strong></td>
<td><strong>4.7</strong></td>
<td><strong>14.84</strong></td>
<td><strong>1</strong></td>
<td><strong>59.8</strong></td>
<td><strong>1.64</strong></td>
<td><strong>1.35</strong></td>
<td></td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td><strong>5.3</strong></td>
<td><strong>6.8</strong></td>
<td><strong>7.2</strong></td>
<td><strong>6.4</strong></td>
<td><strong>32.1</strong></td>
<td><strong>2.1</strong></td>
<td><strong>5.13</strong></td>
<td><strong>0</strong></td>
<td><strong>.25.2</strong></td>
<td><strong>.43</strong></td>
<td><strong>1.35</strong></td>
<td></td>
</tr>
</tbody>
</table>
FORMULAE

1. Kuder-Richardson formula for ESSAY TEST SCORES

\[ r^* = \frac{k}{k-1} \left[ 1 - \frac{\sum \sigma_i^2}{\sigma^2_T} \right] \]

2. Spearman-Brown Split-Half Correction Formula

\[ \Gamma_{PH} = \frac{\Gamma}{1 + \Gamma} \]

3. Odd-Even Formula

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

In 1 above k represents the number of separately scored test questions or independent ratings of a performance, \( \sigma^2_i \) is the variance of student's scores, \( \Sigma \sigma^2_i \) is the sum of these questions and \( \sigma^2_T \) 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.