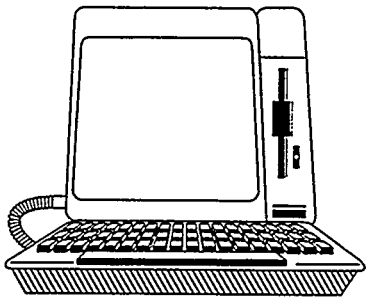
BNL - 52458
UC905

INTRODUCTION TO COMPUTERS

Reference Guide



STUDENT'S REWARDS:

* NO ONE CAN FAIL
* 1 ON 1 TUTORIALS
* USER DOCUMENTATION
* VOCABULARY BUILDERS
* SKILLS DEVELOPMENT
* TRACKING SYSTEM FOR FUTURE JOBS

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FOREWORD

Secretary of Energy Notice (SEN-23-90), Support for Science, Mathematics and Engineering Education, Number SEC-1-92: This notice encourages DOE offices and contractors to provide technical assistance and support to improving precollege science and mathematics education through employee participation and the loaning of scientific equipment to schools involved in formal partnerships with DOE facilities and offices.

Section 31(a) of the Atomic Energy Act of 1954, as amended, historically has been used to authorize DOE facilities to support private or public educational institutions at all levels.

DOE and BNL employees will serve as volunteers to assist the school districts' instruction personnel in improving technical programs, as well as developing new instructional programs; assist teachers in upgrading and expanding their knowledge of scientific and technical concepts; and encourage students to pursue science/ technical careers.

The program not only targets computer skills on the Commodore 64, but encompasses the opportunity to discuss issues of the <u>real world</u>. For example, while presenting a math program, if the material is carefully selected and studied by the instructor, science, social studies and other activities may be brought to life.

These lesson plans were compiled by Frances V. Ligon, Program Coordinator; Jerome Duvall, Teacher for Riverhead Class; Barbara Seaton, Teacher for Bellport Class; and Dr. Karl Swyler, Volunteer Instructor.

NOTE: This course may be used as a first step in your computer literacy training. Upon completing this course, and other courses offered during this series, it is recommended that you contact your local school, colleges, and Adult Continuing Education Offices for additional information.

<u>SPECIAL THANKS</u>: A special thank you is extended to the Department of Energy and Brookhaven National Laboratory staff; Central School District #2, Riverhead; South Country School District, Bellport; Longwood Central School District; First Baptist Church of Riverhead; Victory Church of God, Bellport; Bellport Area Community Action Center; and the BNL Commodore 64 Club, who have assisted in making this course possible.

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JOINT OUTREACH

PARTNERSHIP

INTRODUCTION

Quality education is a major national concern. Criticisms and suggestions have been coming from all directions. However, through all the debate about the direction in which education should proceed, there seems to be a consensus on all fronts about the need for strong school-business partnerships.

Since the Spring of 1984, Brookhaven National Laboratory and Central School District #2 in Riverhead have been involved in a partnership. As a compliment to the success of this program, in 1990, this program was replicated in the South Country School District. A free "Introduction to Computers" course is offered, providing instruction in the field of computer awareness and training with one-on-one instruction. The program is designed to motivate an interest in young people in computer science, and related fields. The program is administered by Brookhaven National Laboratory staff: Frances Ligon, Office of Equal Opportunity, is the Program Director.

These sessions are coupled with field trips to Brookhaven National Laboratory and a mentoring program coordinated by teachers from each community. The annual field trip to Brookhaven National Laboratory offers a wonderful opportunity for these children to visit a research facility that is close by.

The target population for this program is 5th and 6th graders and their parents/guardians. The course may be offered to 7th or 8th graders, depending on the enrollment. All students are invited to participate on a first-come, first-serve basis. Classes are kept small to emphasize individualized attention and small group instruction. The program is offered for a 6-week period, four times a year.

The mentoring portion of the outreach for Computer Education is being developed. The goal is to expose the participants to a variety of settings where the application of computers are useful or necessary in today's careers. There are regular opportunities to experience and learn software applications. These programs will also allow students to solve problems in an enjoyable, advantageous, way.

This program gives students a sense of pride in being chosen to successfully complete an educational course of study outside the traditional setting. Their self esteem is raised as they become successful and gain an understanding of how they can use the computer as a tool, as well as for entertainment.

They finish the course with a lasting memory of how the Laboratory, the community through the church or organization, and their school are working cooperatively to open future opportunities for them.

The program serves as an excellent recruitment tool for Brookhaven National Laboratory's Youth on Campus, High School Co-op, Minority High School Apprenticeship, Career Awareness Events, and the Science & Engineering Opportunities Program for Minorities and Women.

SETUP PROCEDURE

The "Introduction to Computers" program establishes formal partnerships with local school districts and community-based organizations, introduces computer literacy to precollege students and their parents, and encourages students to pursue Scientific, Mathematical, Engineering, and Technical careers (SMET). Hands-on assignments are given in each class, reinforcing the lesson taught.

In addition, the program is designed to broaden the knowledge base of teachers in scientific/technical concepts, and Brookhaven National Laboratory continues to act as a liaison, offering educational outreach to diverse community organizations and groups.

DUTIES & RESPONSIBILITIES

1. SPONSORING ORGANIZATION (i.e., Brookhaven National Laboratory)

The Department of Energy (DOE) and Brookhaven National Laboratory (BNL) will, to the extent practicable and appropriate, and within legal and regulatory requirements, support this activity with each community by providing formal Memoranda of Understanding (MOU), instructional and related equipment, field trips, and liaison support.

2. SCHOOL DISTRICT

Each school district shall spearhead recruitment for this program by distributing letters to each of the 5th and 6th graders in their district. Registration and session assignments will be handled by the administering staff, made up of BNL's Program Director, one representative from the school district, and two representatives from the community.

Recruiting teachers from the school district shall be the responsibility of the school. Contractual agreements shall be made with the selected teacher and Brookhaven National Laboratory.

3. COMMUNITY ORGANIZATIONS (i.e., Churches, Libraries)

There is communication on a regular basis between BNL and the various communities and organizations who are interested in pursuing the computer course and gaining more knowledge about opportunities at the Laboratory.

The local organization is expected to provide a place for this program, and publicity and encouragement to the students and school district in developing and implementing it.

4. INSTRUCTOR

The instructor, under contract with BNL, will teach and serve as mentor to 5th and 6th graders from their local school districts in computer literacy, and also, will provide technical assistance to the Program Director.

5. BNL VOLUNTEER STAFF

Volunteers from BNL will be assigned to act as mentors or speakers to each community's program.

TEACHER'S LESSON

PLANS

TEACHER'S GUIDE

LESSON OUTLINE AND OVERVIEW

Dear Instructor:

The material in this manual is intended to give you, the instructors and our volunteers:

1. a guide to presenting each lesson.

2. a vocabulary and a glossary of terms.

3. a variety of hands-on activities for the classroom and for programming.

4. suggestions for follow-up homework assignments.

There are more activities included than you may be able to complete in a six-session course. Do not feel that they all need to be completed. It is important to remember that this is an "introductory" level course, the intent of which is to expose students to programming skills, the uses of computer, especially word processing, and the vocabulary necessary to understand how the computer works.

This course is designed as an "Introduction to" computer literacy and let students know that "**Computers ARE 'user-friendly'.** These lessons are designed to cover the following areas:

1. Understanding how a computer works.

2. Understanding the hardware and software.

3. Basic computer programming (using B.A.S.I.C.).

4. Introduction to Word Processing. [At present, Commodore 64 equipment is being used, and, therefore, "Bank Street Writer" was the word-processing package selected. The choice of word processing package may vary, and lesson plans should be modified, as needed.]

5. Hands-on software demonstrations.

Each lesson has been divided into the following topics:

- LONG-TERM GOAL
- OBJECTIVES
- TEACHER'S NOTES
- MATERIALS NEEDED
- VOCABULARY WORDS
- LESSON PROCEDURES
- ACTIVITIES

LESSON 1

BEGINNER'S GUIDE

LONG-TERM GOAL: Introduce students to **HOW** the computer works, its hardware, cursor movement, and word processing.

OBJECTIVES

1. This course is designed as an 'introduction to' computer literacy, and to convey the message that computers are 'user friendly'.

2. The student will become familiar with the computer's hardware and software.

3. The student will learn to control the movements of the cursor.

4. The course will introduce students to the keyboard by pointing out the **HOME** key, cursor keys, **SHIFT** keys, " ", **CLR/HOME** key, **RUN/STOP** key, and **RESTORE** key.

5. The program will introduce students to the BANK STREET WRITER, or whatever word-processing program you use.

6. The course will introduce vocabulary terms: menus, delete, edit, modes, scrolling, prep, and format.

TEACHER'S NOTES:

At the beginning of this and each of the six classes, it is necessary to have an orientation session. Topics to include in this session are:

A. Rules - The ground rules of the session should be explained clearly (e.g. appropriate classroom conduct, structure of the session).

B. Safety Precautions - Use of equipment, personal hygiene (e.g. at the beginning of each class, before students begin their lesson, they should have time to wash their hands).

C. Personal Goals and Expectations of Students and Instructors

D. Mixer Activity - Optional.

Part of setting the tone for the class should include mixer periods and discussions. One of our goals is to make the class fun as the students learn these new skills. (Suggestion: Have each student pair up and interview the other person. Then, have them stand and introduce each other to the class. This will enhance their public speaking skills.)

A two-hour lesson needs variety to hold the attention of fifth, sixth, and seventh grades. Therefore, each lesson includes extra activities for students whose keyboarding skills may allow him/her to complete the primary activities quickly.

Students will come into the class with different degrees of computer awareness and educational backgrounds. Those that may have already been exposed to word processing can be a 'buddy' to the true beginner, or you may let him/her complete the activities independently.

MATERIALS NEEDED: Rope, index card with a Capital **A** and the word **CHARACTER**, and eight (8) index cards [two with the number **1** and six with the number **0**], program disks, and data disks.

VOCABULARY: For Lesson 1, vocabulary words are: BITS, BYTES, CPU, B.A.S.I.C., HARDWARE, SOFTWARE, PC, CURSOR, CHARACTER, RAM, ROM, INPUT, OUTPUT, HOME ROW, PRINTER, MENU, HARD COPY, KEYBOARD, MONITOR, DISK DRIVE, EDITING, FUNCTION KEYS, PRINTOUT, SAVE, SCROLLING, and WORDWRAP.

LESSON 1 PROCEDURES:

1. Discuss the purposes and uses of computers.

2. Refer to face (next page) diagram and equate it to the computer. Introduce the terms: INPUT, OUTPUT, and CPU.

3. Have students look at the computer and briefly question them on the hardware terminology. Introduce the term: HARDWARE.

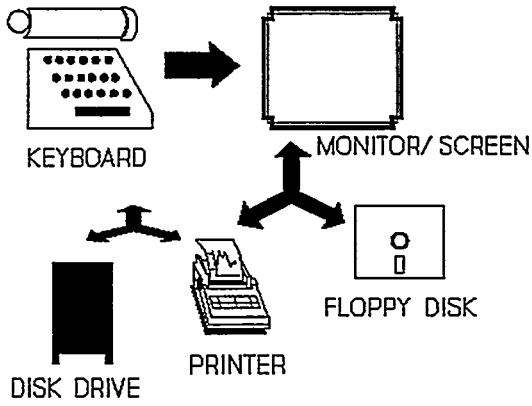
4. After the lesson is over, review key vocabulary words and the objective of lesson.

5. Allow time at the end of the review for distributing, completing, and collecting evaluation sheets.

COMPUTER HARDWARE AND SOFTWARE CONCEPTS

A. **HARDWARE** - Machinery or equipment, such as the keyboard, disk drive, monitor/screen, and printer. The total hardware makeup of the (equipment in use) includes a keyboard, monitor/screen, disk drive, printer, hard disk, and floppy diskettes. (64k means 64 kilobytes of memory; 1k = 1000 kilobytes).

KEYBOARD: Can be used as an input device for entering information into the system. The keyboard is also the CPU (Central Processing Unit) which follows the commands you have instructed it to do such as Save, and Run. (Commodore 64 only). If you use an IBM, or other equipment, refer to the hard drive (c:\).



MONITOR/SCREEN: Output device that displays information as it is entered into the keyboard.

DISK DRIVE: Output device used for storage.

PRINTER: Output device which gives a hard copy (i.e. paper).

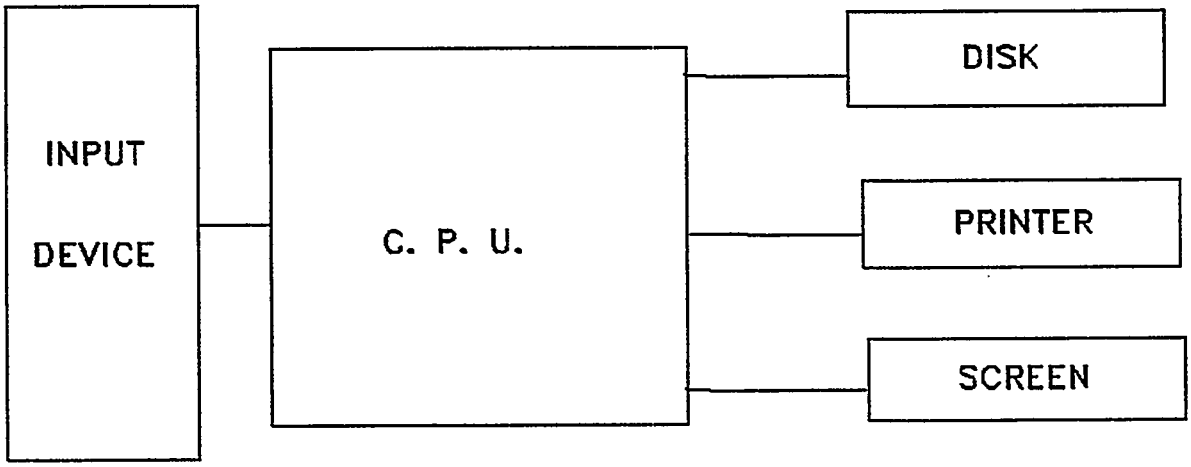
FLOPPY DISK (DISKETTE): Output - Floppy Diskettes are used to store information. One disk can hold from 80 to 150 pages of text.

B. **SOFTWARE** - List of instructions that tells the computer what to do. (Example: Make a Peanut Butter & Jelly Sandwich)

C. **DATA** - Facts and figures that are stored in the hardware and governed by the rules and regulations of both the hardware and the software.

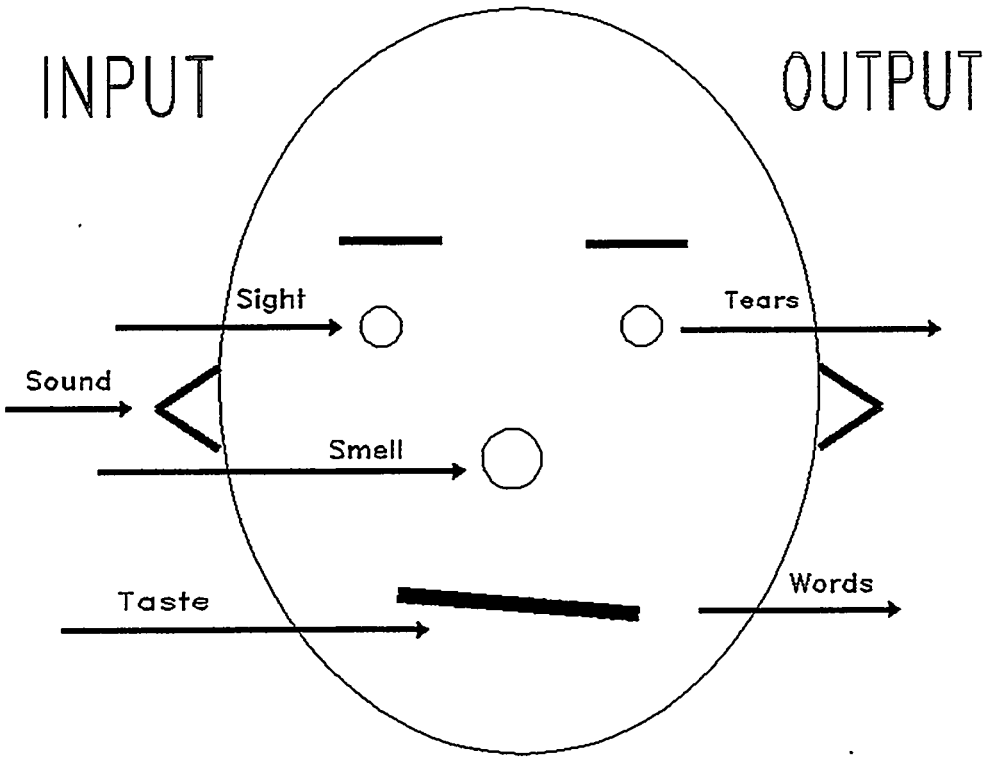
To enter information into the Commodore 64 computer system, one must use an **INPUT** device. The **INPUT** device we use is the keyboard. As you type information on the keyboard, it is transmitted through cables when you **SAVE** the information. Once you have input this information, the **C.P.U.** (CENTRAL PROCESSING UNIT) carries out the commands you have given it, such as save, and run. Data can be assigned to various OUTPUT devices.

INPUT/OUTPUT PROCESS



- **PROGRAM** - Step-by-step list of instructions.
- **STATEMENTS** - The instructions.
- **STRING** - The part of the instructions enclosed by quotes.

LESSON 1



THE HUMAN COMPUTER

ACTIVITIES

ACTIVITY #1 (optional)

1. Give each student two '3x5' cards.

2. Have each student select and interview another person (suggest one boy - one girl) in class, and record on the cards the following information:

    a. Name
    b. What they hope to learn from this class
    c. Their favorite hobby or sport

3. Have each student return to their seat and share the information with the class in round-table discussions.

4. Collect these cards and explain that they now make up a data base that we may use later.

ACTIVITIES

ACTIVITY #2

HOW DOES THE COMPUTER WORK - Object Lesson

A. Ask students if they know how the computer puts what they type onto the screen.

B. Tell them, "We're going to do a play." Have one student hold a card with the letter 'A' (representing the character 'A'), two students hold a rope (representing the electric current), and eight students hold cards with '0' and '1' (representing bits and bytes).

C. Have students press the 'A' key as you explain the term bits, bytes, character, and machine language.

D. Have students return to their computers and let them use their **SHIFT** keys, **QUOTATION MARK**, **CLR/HOME** key, **RUN/STOP**, and **RESTORE**.

E. Introduce the term **B.A.S.I.C.** and the new commands **NEW** and **PRINT**.

F. Have the students take note of the **RETURN** key. Explain the importance of using this key to enter information into the computer's memory.

ACTIVITIES

ACTIVITY #3

"CURSOR JOG"

Objective: Using the cursor key and **SHIFT** key, the student will move the cursor counter-clockwise around the perimeter of the screen until the cursor reaches the **HOME** position (upper left hand corner).

1. Clear Screen - Press **{SHIFT/CLR}**.
2. Give class a time-drill for practice. - FIGURE 1.
3. Vary the game by ending the cursor in the center of the screen. - FIGURE 2.

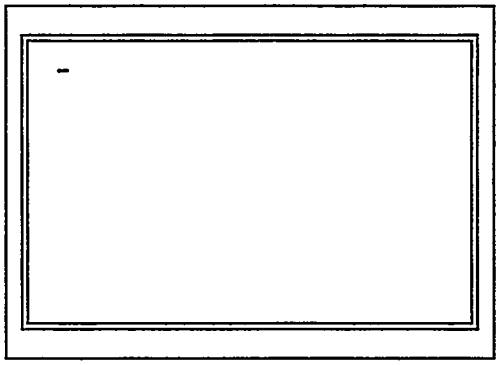


Figure 1

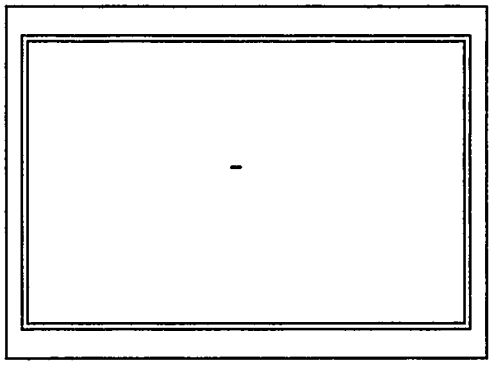


Figure 2

Teach other keys: **"CLR/HOME"**, **"RUN/STOP"**, **"RESTORE"** . . .

ACTIVITIES

ACTIVITY #4

Procedures: Word Processing (using BANK STREET WRITER)

1. Discuss what a word-processing program does and the advantages and disadvantages of using word processors.

2. Have the students initialize and format disks using **PREP** option on **OTHER MENU**.

3. Have the students type a short story, song, or poem on their computers.

4. Teach them how to **delete** and **insert** words.

5. Introduce the **CONTROL** key and its different functions.

6. Encourage students to experiment using the different functions listed in this lesson.

7. Have students switch to the **EDIT MODE** and teach them how to print their work.

8. Instruct students to **SAVE** their work on their disks while in the **EDIT MODE**.

9. List and discuss the hardware and software vocabulary words they have learned so far in Lesson 1.

INTRODUCTION TO WORD PROCESSING

1. Purposes and uses of word processors in our everyday life.

2. Explanation of each component and how it interacts with word processing (hardware/software).

Advantages of Using Word Processors:

a. Rekeying
b. Correcting Mistakes
c. Editing
d. Storage
e. Low Cost
f. Other (to be filled in by class)

Disadvantages of Using Word Processors: (to be filled in by class)

ACTIVITY #4 (cont.)

GETTING STARTED WITH WORD PROCESSING (Hands-on Session)

BANK STREET WRITER

This lesson will give you an introduction to word processing. The software program we will be using is called "The Bank Street Writer" made for the Commodore. This program is designed specifically for the Commodore and cannot be used on any other computer. In computer language, we say, the Bank Street Writer is NOT COMPATIBLE for any other computer.

To **LOAD** your programs, type the following:

LOAD "BSW",8

The menu shows you what the program does. To see the menu of the Bank Street Writer, look at the top of your screen and press the appropriate 'cursor' key.

To use the various functions, press **CONTROL** key with:

B or **E** - Moves cursor to BEGINNING or END of typing.

U or **D** - Moves cursor UP or DOWN twelve lines.

C - CENTERS what you are typing.

I - INDENTS what you are typing.

N - Starts a NEW page.

P - Inserts a PRINTER command.

To erase or **DELETE** words to the right of the cursor, use the **SHIFT** key with the **INST/DEL** key. To erase or **DELETE** words to the left of the cursor, use the **SHIFT** key with the **'INST/DEL'** key alone. To add words, press the **'ARROW'** key, place the cursor where you want to insert the word, press the **'ARROW'** key again, and type in the additional words.

ACTIVITIES

ACTIVITY #4 (cont.)

ADDITIONAL ASSIGNMENTS FOR BANK STREET WRITER

This lesson will continue teaching you about Word Processing.

A. The Bank Street Writer has three different **MODES**. To activate these different **MODES**, use the **'ARROW'** key on the top left-hand side of your screen.

1. **WRITE MODE** - This is used for typing your work.

2. **EDIT MODE** - Allows you to make changes and corrections to your work.

3. **TRANSFER MODE** - Allows you to **SAVE**, **LOAD**, and **PRINT** your work. It allows you to **DELETE** and **RENAME** files or prepare (**FORMAT**) your disk.

B. Using the **RETURN** key: When you reach the end of a line, the cursor automatically returns to the beginning of the next line. You do not need to press the **RETURN** key - unless you want to start a new line before the last line is filled (e.g., when you want to begin a new paragraph).

C. Do an exercise on the computer which will demonstrate how these different **MODES** operate.

D. Pass out disks containing a program to each computer station. Explain how to handle floppy disks (i.e. carefully holding the disks by corners and not touching the shiny exposed areas.)

ACTIVITIES

ACTIVITY #5

BANK STREET WRITER EXERCISE

(Have the students type the following exercises onto a diskette so that they can make the changes on their own computers.)

DIRECTIONS: Read this passage. Replace the nonsense word with the subject of the passage. Use the **EDIT MODE** and the **REPLACE** directions.

* * * * * * * * * * *

Most American homes have at least one BEZICK. In some families, everybody has his or her own BEZICK. Some BEZICKS are so small you can carry them in your pocket; others are so big, they are rarely moved from one spot. Color BEZICKS are more expensive than black- and-white BEZICKS. The BEZICK usually is turned on for several hours a day, depending on when the family is home. Some experts believe that Americans watch too much BEZICK.

* * * * * * * * * * *

1. Now move the last sentence. Put it in the beginning of the paragraph. Use the **EDIT MODE** and the **MOVE** directions.

2. Put the last sentence back where it came from. Use the **EDIT MODE** and the **MOVEBACK** directions.

3. Erase the first sentence. Use the **EDIT MODE** and follow the **ERASE** directions.

4. Now put the sentence back. Use the **EDIT MODE** and follow the **UNERASE** directions.

******************************* E N D *******************************

ACTIVITIES

ACTIVITY #6

DIRECTIONS: Read the sentence below the line of asterisks (*). Change one word at a time until you have an entirely new sentence.

* * * * * * * * * *

At camp this summer, I want to go hiking on the mountain trails early in the morning.

* * * * * * * * * *

HINT: To do this, you can use your **CURSOR** and **INST/DEL** key or the **EDIT MODE** and the **ERASE** key.

********** E N D **********

DIRECTIONS: In this next exercise, you need to put the sentences in the correct order.

* * * * * * * * * *

Charles ate breakfast. He got up quickly. He was excited because it was the first day of school. Then he got dressed. Charles' alarm clock went off at 7:00 a.m. Then he ran off to the bus stop. Charles kissed his mother goodbye.

* * * * * * * * * *

HINT: To do this, use the **EDIT MODE** and the **MOVE** directions.

********** E N D **********

LESSON 2

INTRODUCTION TO B.A.S.I.C.

LESSON GOAL: Introduce students to **B.A.S.I.C.** computer programming language.

OBJECTIVES

1. The student will become familiar with B.A.S.I.C. vocabulary. They will be exposed to the following terms: program, statement, string, directory, and formatting.

2. The student will be introduced to the **SAVE, LOAD, OPEN** and **GOTO** commands.

TEACHER'S NOTES:

In the first lesson, the students loaded Bank Street Writer (BSW), and initialized their data disks using **PREP** from the menu. If students did not initialize their data disk in Lesson 1, the directions are given here.

This lesson will use the disk to store sample programs. By saving programs from Activities 2, 3, and 4, the students will learn how to type program lines and save; these programs can be retrieved and run again at a later date.

The students will learn to bring up the directory on the disk without loading the Bank Street Writer. By pointing this out, note, the BSW file appears as unreadable as the graphics codes. When the directory is listed, we reinforce the fact that we are on the B.A.S.I.C. program mode and not a software user mode.

MATERIALS NEEDED: Activity sheets

VOCABULARY WORDS: LOAD, SAVE, OPEN, GOTO, DELETE, REM, NEW, LIST, END

LESSON 2 PROCEDURES:

1. Explain vocabulary below:

   * **Program** - Step-by-step list of instructions.

   * **Statements** - The instructions.

   * **String** - The part of the instructions enclosed by quotes.

2. Refer students to the vocabulary terms learned in Lesson 1.

3. Reinforce the vocabulary using the 'Peanut Butter and Jelly Sandwich' illustration.

4. Hand out disks and teach the students how to format them. (You may have already used PREP from Bank Street Writer to format your data disks.)

5. Explain the term: **DIRECTORY**.

6. Have the students **LOAD** the Directory to verify that they formatted the disks.

```
LOAD "$",8
LIST
```

7. Distribute the handout, "The Endless Loop." Have students type the program. Introduce the **GOTO** command and point out its purpose and function. Discuss the differences between (,) and (;).

8. Show the students how to insert a line they may have forgotten. Refer to the 'Peanut Butter and Jelly Sandwich' illustration.

9. Show the students how to delete a line. (Type the line number and press **RETURN**).

LESSON 2

TYPING AND RUNNING PROGRAMS

1. A computer **PROGRAM** is a list of instructions that you put in the computer. The instructions are stored as electrical or magnetic signals in the computer's **MEMORY**.

2. Each instruction in the list has to have a number so that the computer knows which one to do next.

3. The numbers do not have to be sequential (1, 2, 3, . . .). They can be 1, 10, 20, 22, etc. All that matters is **what's** the next highest number - that puts the numbered instructions in order. (Question - Why is it a good idea not to number the instructions 10, 20, 30 ...? **Answer - By numbering the lines in tens, nine lines are available for inserting additional instructions).**

4. The instructions are made up of things called **'COMMANDS'** OR **'STATEMENTS'**. You put these together in a program to get the machine to follow your instructions.

5. There are several different commands or statements that the machine understands, just as there are many words that we use to speak our language.

6. These statements, called **COMMANDS**, are translated and understood by the computer as **'COMPUTER** or **MACHINE LANGUAGE'**.

7. The language we are working with is called **'B.A.S.I.C.'** which uses many commands and statements. Some of these include: **RUN, LIST, PRINT, NEW, END, GOTO.**

If you type PRINT "COMMODORE" and press the **RETURN** key, the word COMMODORE will be printed to the screen. If you PRINT 1 + 2 and press the **RETURN** key, you will see the number 3 on the screen.

You see that the **PRINT** statement will print words, text, and numbers if you put them in quotation marks. It will perform arithmetic if you ask to print sums, or products.

If you do not use punctuation marks after a **PRINT** statement, the cursor will move down one line after the statement is **EXECUTED**. If you use punctuation, you can either have the answer printed in two columns (with a comma), or printed along a whole line (with a semicolon).

Finally, some reminders about writing and changing (or editing) a program.

LESSON 2

1. Every instruction line **MUST** have a number. Leave a space after the number before you start typing the instruction.

2. Every time you finish typing a list, you must press the **RETURN** key to enter the instructions into the computer's memory. (This is sometimes called entering an instruction or executing an instruction.)

3. Once all of your instructions are correct, **LIST** the program, and then type **RUN**. If the program does not **RUN**, **LIST** the program again and locate the error.

4. To correct or change a program once you have listed it, you can either move the cursor up to the line where the error occurs and type over it, or you may retype the entire statement, including the number. Either way you **MUST** press the **RETURN** key to enter the new data.

5. To add a new statement, type it, including line number at the bottom of the program listing, and press the **RETURN** key.

6. To remove an unwanted statement **(DELETE)**, type the statement's line number at the end of the program listing and press the **RETURN** key. You also may retype the line number and press the **RETURN** key. **LIST** the program again and the statement will be deleted.

RUN-EXECUTE: When the computer follows the instructions given in a line of your program, it is said to **"EXECUTE"** that line of your program. The computer does not execute the lines of your program as you type them in. It stores them, sequentially, into its memory banks and does not begin executing them until you type the command: **RUN** (without a line number) and press the **RETURN** key.

ORDER OF NUMBERED LINES: If you were to type the following program:

```
20   PRINT "HI
10   PRINT "JOE"
30   END
```

The printout would look like this:

```
JOE
HI
```

JOE is printed before **HI**. Before it executes a program, the computer automatically arranges the lines in sequence so that the line numbers are in ascending order.

INSERTING ADDITIONAL LINES: For most simple programs, it is a good idea to do the line numbering in tens (10, 20, etc.) This is especially useful when you want to insert lines in an existing program. Suppose you have just typed the following program to multiply two numbers. The statement to **PRINT C** has been omitted.

```
10 DATA 146,192
20 READ A,B
30 LET C = A*B
40 END
```

To rectify this, you do not need to retype the whole program. Simply select a line number between 31 and 39, say 34, and type, on a line by itself,

```
34 PRINT C
```

The computer automatically inserts this line between line 30 and 40. When this program is run, it will compute and print the desired product. When you list your program, it will appear as follows:

```
10 DATA 146,192
20 READ A,B
30 LET C = A*B
34 PRINT C
40 END
```

ERRORS: There are two general types of errors in programming. The first type, called **'SYNTAX ERRORS'**, usually involves misspelling instruction words or using incorrect notations. For example, the following two programs have **'SYNTAX ERROR(s)'**. Each program, when run, will produce a printout consisting of error messages informing the programmer of the line(s) on which these errors occur.

LESSON 2

EXERCISE #1

(Illegal instruction in Line (20) = LOT should be LET)

Syntax with Error	Corrected
10 LET A = 4	10 LET A = 4
20 LOT X = A*A	20 LET X = A*A
30 PRINT X	30 PRINT X
40 END	40 END
RUN	

EXERCISE # 2

(Illegal instruction in Line (30) = 9B should be 9*B)
(Illegal instruction in Line (60) = RUN)

Syntax with Error	Corrected
10 DATA 4,6	10 DATA 4,6
20 READ A,B	20 READ A,B
30 LET C=9B	30 LET C=9*B
40 PRINT C	40 PRINT C
50 END	50 END
60 RUN	RUN (System commands do not require line numbers)

CORRECTIONS: To correct or replace a line in a program, you do not have to retype the entire program. You simply retype the number of the line and the corrected or new version of the line. There is also a backspacing method of correcting errors you discover while the cursor is still on the line where the error occurred.

DELETIONS: To delete a line from the program and not replace it, type the line number and press the **RETURN** or **ENTER** key.

LIST: **LIST** is a system command. System commands never have line numbers. If you type **LIST** on a line by itself (without a line number) and press the **RETURN** or **ENTER** key, the computer will show your program on the screen, as it stands in the computer's memory. This is especially useful if, in typing a program, you have made corrections and insertions and want to see a clean copy of your program in proper line-number order.

SYSTEM COMMANDS: **LIST, NEW, LOAD, RUN**

LESSON 2

ACTIVITIES

ACTIVITY #1

OPTIONAL - **HOW TO INITIALIZE A DISK**

1. To allow you to talk to the disk drive in B.A.S.I.C. programming, use the **OPEN** command:

   OPEN 15, 8, 15

   15 - File number (can be from 1 to 127)

   8 - Device number . (The Commodore will assign the number 8 to the disk drive).

   15 - Command Channel. Allows you to send commands to the disk.

2. To initialize the disk, use the **FORMAT** command:

   PRINT #15, "NEW0, NAME, ID"

   15 - File number must match the number in the **OPEN** command.

   0 - Disk Drive (either 0 or 1).

   Name - Name of the disk.

   ID - Any two characters. They are placed on the directory and on every block written on the disk.

3. To see what is on the disk (this is called **DIRECTORY**), type:

   LOAD "$",8
   LIST

4. To load a program from a disk into the computer's memory, use the **LOAD** command:

   LOAD "name of file",8

5. To save a program in memory to a disk, use the **SAVE** command:

   SAVE "name of file",8

ACTIVITIES

ACTIVITY #1 (cont.)

6. To view only certain files on a disk, use wildcards.

```
LOAD "A*",8
LIST
```

Using wildcards, in this program, for example, you will get a listing of all files on your disk that begin with the letter 'A'.

LESSON 2

ACTIVITIES

ACTIVITY #2

REVIEW OF LESSON

1. Turn on keyboard, then the monitor. If you do not see the **COMMODORE 64** title on your screen, raise your hand.

2. Clear the screen. (**SHIFT & CLR/HOME**).

3. The cursor now is in the **HOME** position, which is _____.

4. Complete a cursor jog by moving the cursor around the screen in a counter-clockwise direction using the **CRSR** and **SHIFT** keys. Finish with the cursor in the middle of the screen.

5. Move the cursor to the **HOME** position (**CLR/HOME**).

6. Using the cursor keys and **not RETURN**, type the numbers 1 to 25 in a column. After 25, press **RETURN or ENTER**. What happened and what does it mean?

_____

_____

7. Leave the numbers on the screen and raise your hand for the teacher to initial here.

_____

8. Scrolling can be controlled with the **RUN/STOP** key. What is scrolling?

_____

_____

ACTIVITIES

ACTIVITY #3

EXERCISE

1. Turn on the keyboard and monitor. Clear the screen. (**SHIFT & CLR/HOME**).

2. Always press _____ to enter a program line.

3. **Type:**
```
NEW (RETURN)
10  Print "your name" (RETURN)
20  Print "your street address" (RETURN)
30  End (RETURN)
```

   Clear screen by _____.

   Type: **RUN (RETURN)**

   Was your program lost when you cleared the screen? _____

   Copy down what was printed when you typed **RUN**.

4. **Type:** **LIST (RETURN)**

   What happened? _____

5. **Type:**
```
NEW (RETURN)
LIST (RETURN)
```

   What did **NEW** do? _____

6. **Type:**
```
50 PRINT "last name"
10 PRINT "HELLO"
70 END
30 PRINT "GOODBYE"
20 PRINT "first name"
LIST (RETURN)
```

   What did the computer do with your program? _____

   _____

ACTIVITIES

ACTIVITY #3 (cont.)

7. **Type: RUN (RETURN)**

   What happened? _____

   _____

8. Clear screen. (**SHIFT & CLR HOME**)

   See if your program was lost by typing **LIST (RETURN)**.

   Was it lost? _____

9. **Type: NEW (RETURN)**

   See if your program was lost by typing **LIST (RETURN)**.

   Was it lost? _____

10. Explain what each command does, then have the teacher initial here. _____

    RUN _____

    LIST _____

    NEW _____

ACTIVITIES

ACTIVITY #4

SAMPLE PROGRAMS

1. Type in the program: (Remember to press the **RETURN or ENTER** key at the end of each line.)

```
10 PRINT "THIS IS A TEST PROGRAM."
20 FOR X = 1 TO 10
30 PRINT "HELLO"
40 NEXT X
RUN
```

What happened? _____

2. Change line 30 to read:

```
30 PRINT "HELLO":
```

Type **LIST**; check to make sure the change is made correctly. Type **RUN**.

What happened? _____

3. Change line 30 to read:

```
30 PRINT "HELLO",
LIST
RUN
```

4.
```
10 PRINT "A PROGRAM TO COUNT"
20 LET K = 0
30 LET K = K + 1
40 PRINT K
50 IF K < 50 THEN 30
60 PRINT "THAT'S ALL FOLKS"
70 END
RUN
```

5. Modify #4 to count horizontally rather than vertically. Type a comma **(,)** after K in line 40.

This activity used the following commands and function keys:

PRINT	**FOR/NEXT (see #1)**	**LET**
IF/THEN (see #4)	**Semicolon (;)**	**Comma (,)**

ACTIVITIES

ACTIVITY #5

ENDLESS LOOP

```
READY.

     1    REM:  "THE ENDLESS LOOP"
     10   PRINT "THE ENDLESS LOOP"
     20   GO TO 10
     RUN
```

Can you change the program so that it prints only once?

Can you change the program so that it prints your name?

Try putting a comma (,) at the end of line 10, thus:

```
     10   PRINT "THE ENDLESS LOOP",
```

Try changing the comma (,) in line 10 to a semi-colon (;):

```
     10   PRINT "THE ENDLESS LOOP";
```

Replace line 10 with your name:

```
     10   PRINT "your name";
```

ACTIVITIES

ACTIVITY #6

MATCHING QUIZ

1.	LOAD "name",8	_____	A command that lets you repeat the command (HINT: LOOP)
2.	SAVE "name",8	_____	Allows you to talk to the disk drive.
3.	GOTO	_____	Initializes or puts grooves in the floppy disk.
4.	FORMAT (prep)	_____	To see what is on the disk.
5.	OPEN	_____	To view the contents of your program on the screen.
6.	LOAD "$",8 LIST	_____	To put a program from memory onto the floppy disk.
7.	LIST	_____	To get a program from the disk into the C.P.U.

LESSON 2

ACTIVITIES

ACTIVITY #7

JOURNAL - WORD PROCESSING PRACTICE

1. Gather notes, commands, vocabulary, key words from today's lesson.

2. LOAD "**BSW**"

3. Make a journal entry listing new words learned today.

4. Describe which word was the most interesting.

5. Print out a draft.

6. For homework, edit the draft.

LESSON 3

INTRODUCTION TO COMPUTER MATH

LESSON GOAL: Introduce students to math terminology and programming in B.A.S.I.C.

OBJECTIVES

1. The student will learn the ORDER OF OPERATIONS - the computer's way of doing math.

2. The student will be introduced to the concept of variables.

3. The student will use the **LET** and **INPUT** commands.

TEACHER'S NOTES:

The major computer concepts presented in LESSON 3 are assigning values to variables using the three different methods (key words) used in B.A.S.I.C.

```
LET A =

INPUT A

READ A
```

Sample programs using these methods are included in Activities 1, 2, 3, and 4. The order of operations also is introduced by asking students to predict the output.

LESSON 3

MATERIALS NEEDED: (NOTE: Computer/Envelope Object Lesson taken from Modern Curriculum Press, Level D Math Textbook.)

Envelopes labeled "A" thru "G"
Posterboard
Index Cards

A. Create computer mailboxes or variables by attaching the envelopes on the posterboard.

B. Let one student be the computer.

C. Have the other student give the commands such as **LET A = 6** and **LET B = A+13**.

D. The computer must write the stated value on a notecard and place it in the correct envelope.

VOCABULARY WORDS: LET, INPUT, READ/DATA, VARIABLE

LESSON 3 PROCEDURES:

1. Introduce the concept of variables using the definition found on page 33.

2. Distribute and discuss Activity #3.

3. Distribute and discuss variable chart, Activity #4. Do A to D with the students, then let them do E, W, and Z by themselves. Review the answers.

4. Let the students type this program on their computers. Explain how they are to do so and refer them to the HINT on the bottom of page 37.

5. Distribute and discuss Activity #1.

6. Optional Activity - Distribute and discuss Activity #5 - the Age Program. Let them type the program on their computers.

7. After they are finished, show them, through this program, how to use variables (pg. 32), pointing out the LET and INPUT commands.

8. Distribute Activity #4; the review of Lesson 3.

LESSON 3 PROCEDURES

DEFINITION OF A VARIABLE
(A BRIEF INTRODUCTION TO ALGEBRA)

This Lesson will focus on **VARIABLES** in B.A.S.I.C. programming.

A **VARIABLE** is a symbol that represents a location in the computer's memory where a value can be stored. A **VARIABLE** can stand for a particular number, word, or character. We use the **LET** command to tell the computer that we are using variables. For example, in the statement: **PRINT A + B**, the variable named **A** stands for the first number in the sum and the other variable **B** stands for the second number in the sum. If you type:

```
LET A = 1      (PRESS RETURN)
LET B = 2      (PRESS RETURN)
PRINT A + B    (PRESS RETURN)
```

What was your answer?

HOW DOES A COMPUTER USE A VARIABLE? When you input information into the computer, this information is stored in its memory after you hit the **RETURN** key. Once you issue a command, the memory processes the data defined by you.

WRITE YOUR ANSWER: How does a computer use a variable?

LESSON 3

ACTIVITIES

ACTIVITY #1

```
1     REM "THE CALCULATING MACHINE"
10    LET A = 2
20    LET B = 2
30    PRINT A*B
40    PRINT A/B
50    PRINT A+B
60    PRINT A-B
70    END
```

Try changing the values of A and B. Make the program only PRINT 3*2. (Hint: Use a GOTO statement after line 30). Now DELETE what you just did.

DEFINITION OF INPUT

INPUT is used to assign a value to a variable. We use an **INPUT** command to tell the computer to give a different value to the variable.

NEW

```
1     REM:  "THE INPUT CALCULATING MACHINE"
10    INPUT "A EQUALS"; A
20    INPUT "B EQUALS"; B
30    PRINT "A*B EQUALS";A*B
40    PRINT "A/B EQUALS";A/B
50    PRINT "A+B EQUALS";A+B
60    PRINT "A-B EQUALS";A-B
70    END
```

Now add a LOOP; ENTER **65 GOTO 10**

To stop running a program, hit **RUN/STOP** and **RESTORE**

Now, let's make the program end: Enter **15 if A = 0, then 70.**
LESSON REVIEW: **VARIABLES** (A brief introduction to algebra).

ACTIVITIES

ACTIVITY #2

REVIEW OF LESSON 1

Fill in the blanks. Use either **INPUT** OR **OUTPUT**.

KEYBOARD _____ DEVICE

MONITOR/SCREEN _____ DEVICE

DISK DRIVE _____ DEVICE

FLOPPY DISK _____ DEVICE

PRINTER _____ DEVICE

MATCHING:

1.	C.P.U.	1	The brains of the computer
2.	Bits	2	Binary digits
3.	Bytes	10	Run the program
4.	Character	3	8 Bits
5.	Hardware	7	A symbol representing something else
6.	Software	5	Keyboard, printer, monitor, disk drive
7.	Variable	6	The program
8.	RETURN/ENTER	9	The programming language
9.	B.A.S.I.C.	8	Puts data into the computer's memory
10.	EXECUTE	4	A single letter, number, or symbol

How do you clear the screen? _____

_____

Why do you type **NEW**?_____

_____

When you use the **PRINT** command, you use these _____ except in math.

What is the command to show all the statements we have typed in?

_____

LESSON 3

ACTIVITIES

ACTIVITY #3

1. Answer the following questions:

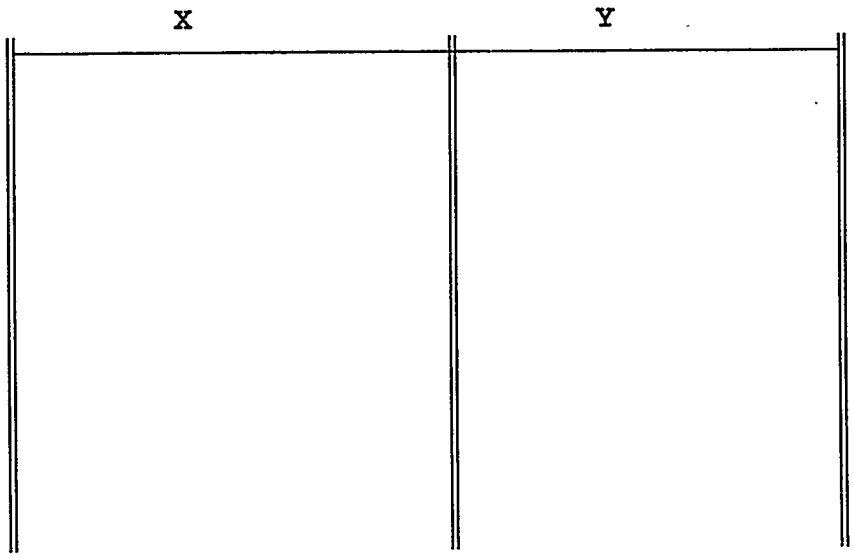
Predicted Output

```
10   Let X = 5
20   Let Y = 3 * X + 5
30   PRINT X,Y                    ANSWER: _____
40   LET X = 2
50   PRINT X,Y                    ANSWER: _____
60   LET Y = 2 * X + 5
70   PRINT X, Y                   ANSWER: _____
RUN
```

2. Classroom discussion on **VARIABLES**.

3. Type and RUN the above program on your computer.

* * * * * * * * * * * * **WORK SPACE** * * * * * * * * * * * *



HOMEWORK ASSIGNMENT

LESSON 3

ACTIVITIES

ACTIVITY #4

VARIABLES - HANDOUT

[THIS LESSON WILL CONTINUE TO TEACH YOU ABOUT THE LET AND INPUT COMMANDS]

A = 5

B = 3

C = A + B

D = A * B + A

E = D + C

W = E / A

Z = A - B

A	B	C	D	E	W	Z

Answer these questions:

C = _____ D = _____ E = _____ W = _____ Z = _____

Print the program on your computer that will print out the values for: C, D, E, W, Z

(HINT: 10 LET A=5, 20 LET B=3, 30 Let C=A+B ... PRINT C,D,E,W,Z)

ACTIVITIES

ACTIVITY #5

SAMPLE B.A.S.I.C. PROGRAMS

This program figures out the year you were born and how old you are in months and days.

```
 10  PRINT "HOW OLD ARE YOU?"
 20  INPUT A
 30  LET Y - 1993 - A
 40  PRINT "YOU WERE BORN IN";Y
 50  PRINT "HOW OLD ARE YOU?"
 60  INPUT R
 70  LET M = R * 12
 80  PRINT "YOU ARE"; M
 90  PRINT "MONTHS OLD"
100  LET D = R * 365
110  PRINT "YOU ARE";D
120  PRINT "DAYS OLD"
130  END
```

LESSON 4

MORE MATH AND VARIABLES

LESSON GOAL: Introduce students to the computer, B.A.S.I.C. programming, and word processing.

OBJECTIVES

1. The student will be able to use a variable in a simple math equation.
2. The student will understand and apply the Order of Operations to simple math sentences.
3. The student will be able to rewrite math expressions into B.A.S.I.C.
4. The experienced student will be able to use exponential notation in B.A.S.I.C. programming language.

TEACHER'S NOTES:

The objective skills taught in Lesson 4 will be valuable for problem-solving on the computer. These skills require the student to know the Order of Operations because all mathematical calculations on computers follow that order.

Try dividing the two-hour block into three modules.

Module 1: In the first module, distribute copies of Activity 3. Allow students time to type in and RUN their programs. After 30 or 40 minutes, have students save what they have typed in. Turn off monitors. Take a short break.

Module 2: During this second module, discuss:

. How to use a computer as a calculator by

typing PRINT, then the expression.

e.g. PRINT 2 * 3 + 4

- Show the students how to translate expressions similar to $\frac{A + B}{2}$ into BASIC code.

LET N = (A+B)/2.

- Finally, discuss how the computer uses the special exponential notation for very large or very small numbers.

- Discuss and then hand out Activities 1, 2, and 4.

Module 3: Have students spend about 20 minutes making an entry into their electronic journal using Bank Street Writer (or a word processing program).

MATERIALS NEEDED: Activity Sheets

VOCABULARY WORDS: FOR/NEXT, LET, INPUT, READ/DATA

LESSON 4 PROCEDURES:

1. Appoint one student as the **COMPUTER** and one student as the **USER**.

2. The **USER** inputs a number by placing it in the envelope, without showing it to the **COMPUTER**.

3. The **COMPUTER** does not know the value of the variable until that variable is used in a statement. For example, someone in the class says **INPUT A** and the **USER** places a number in the envelope marked **A**. Someone else says **LET B** = A+13 and the **COMPUTER** goes to the **A** envelope, gets the number and then solves for **B**.

4. Discuss and distribute Activity #3 and #5.

5. Distribute the lesson review - Activity #3.

LESSON 4

NOTE: The following procedures are included for experienced students:

6. Discuss the information presented in mathematical expressions and notations.

7. Distribute Activity #1.

LESSON 4

Mathematical Expressions and Notation

1. Rules of Priority - Review

In an expression with no parentheses, arithmetic operations are performed according to the following rules of priority.

****

PRIORITY	OPERATION	SYMBOL
Highest	**Exponential**	E or **
2nd Highest	**M**ultiplication & **D**ivision	*, /
	Addition & **S**ubtraction	+, -

[REMEMBER: My Dear Aunt Sally = ORDER OF MATH OPERATIONS]

This is an easy way to remember the way the computer does math.

****

Example: In B.A.S.I.C., "2 + 3 * 4" is not puzzling. It will be viewed by the computer as "2 plus (3 times 4)", since multiplication has a higher priority than addition; it equals 14. Also 2 + 1/3 equals 2 1/3, since division has a higher priority than addition.

TEACHER'S NOTES (cont.):

QUESTION: What is $5 * 3^2 + 1$?

ANSWER: It equals 46 because the exponential has the highest priority. Thus, the expression equals 5 * 9 + 1, which is 46.

QUESTION: What is 1 + 2 * 3 + 4?

ANSWER: It equals 11, because it is the same as 1 + (2*3) + 4.

When an expression with no parentheses contains two operations of the same priority, the computer performs whichever operation occurs first (from left to right).

Example: 2/3*4 = 8/3. The computer first divides 2 by 3; then it multiplies by 4. 8/3 will not be printed as a fraction, but as the decimal 2.66667.

When an expression contains parentheses, arithmetic operations within parentheses are performed first.

QUESTION: How do you write $\frac{1 + 2}{3 + 4}$ in B.A.S.I.C.?

ANSWER: (1 + 2) / (3 + 4).

2. Large Numbers - Scientific Notation on the Computer

In B.A.S.I.C., commas are never used in representing numbers. Fifteen thousand is written 15000 without the commas. Any number beyond a certain size must be expressed using a special exponential notation.

TEACHER'S NOTES (cont.):

Example: In B.A.S.I.C., the number 750,000,000 or 7.5 times 10^8 is written as 7.5E+8. The E + 8 means that 7.5 is multiplied by 10^8.

This is the method for determining the exponent. Consider 750,000,000. Count how many places you must move the decimal point to the left; place it between 7 and the 5. The answer is 8; thus the B.A.S.I.C. notation is 7.5E+8.

QUESTION: How would you express 1,376,000,000 in B.A.S.I.C.?

ANSWER: Consider 1,376,000,000. Count how many places you must move the decimal point to place it between the 1 and the 3. The answer is 1.376E+9.

LESSON 4

ACTIVITIES

ACTIVITY #1

Perform each of the examples on paper, then input them into your computer and write down the answer.

NOTE: Use the **PRINT** statement

1. What is each of these B.A.S.I.C. expressions equal to?

   (a) 2*3+4 (b) 2+3*4+5

   (c) 5+1/2 (d) (2+1)/3

   (e) 2*2+3*3 (f) 3/4*8

   (g) $2*3^2+1$ (h) 32/4/2*(4+1)

2. Write, in B.A.S.I.C., how you would enter these problems into the computer:

   (a) $\frac{A + B}{2}$ (b) $\frac{A + B}{C + D}$ (c) $\frac{A + B + C / D}{2}$

3. Write in B.A.S.I.C. using the special exponential notation:

   (a) 53,000,000 (b) 792,000,000

   (c) .0000000134 (d) .000256987

4. Write each of the following using ordinary decimal notation:

   (a) 4.72157E+2 (b) 5.81334E+6

   (c) .345678E (d) 9.14567E-3

LESSON 4

ACTIVITIES

ACTIVITY #2

1) What do the following statements do?

Open 15,8,15 _____

PRINT#15,"NEWO:name,id" _____

SAVE "name",8 _____

LOAD "$",8
LIST _____

LOAD "name",8 _____

2) We use the _____ command to assign a value to a variable.

3) When working with variables, we use the _____ command.

4) What does REM mean? _____

5) I'm writing a program and I forgot a few statements. What did I forget?

```
20 PRINT "HELLO" AND

30 GO TO 10
```

_____

_____

_____

_____

6) List the programs that are on your disk.
(HINT: THE DIRECTORY = TABLE OF CONTENTS
THE FLOPPY DISK = THE BOOK)

ACTIVITIES

ACTIVITY #3

INPUTTING DATA

1.
```
10  REM A PROGRAM TO GENERATE THE MULTIPLICATION TABLE FOR 9
20  PRINT "MULT. TABLE FOR 9"
30  FOR K = 0 TO 12
40  PRINT K; "0 TIMES 9 = "; K*9
50  NEXT K
```

2. Use INPUT statement to change program to generate any times table.

```
10  REM
20  INPUT A
30  PRINT "MULT. TABLE FOR ";A
40  FOR K = 0 TO 12
50  PRINT K; " TIMES "; A; "=";
60  PRINT K * A
70  NEXT K
```

3.
```
10  PRINT "ARITHMETIC MEAN PROGRAM"
20  PRINT "TYPE A NUMBER AFTER EACH QUESTION MARK"
30  INPUT A: INPUT B: INPUT C
40  LET SUM =  A+B+C
50  AVG = SUM/3
60  PRINT "THE AVERAGE OF 0"; A; B; C
70  PRINT "IS"; AVG
```

CHALLENGE

Write a program to find the area of a circle. ($Al=r^2$)

1. Ask the user to enter the radius of the circle.

2. Print the answer.

[This is a program to challenge students who have learned how to find the area of a circle.]

LESSON 4

ACTIVITIES

ACTIVITY #4

REVIEW OF LESSON 3

1. Write an easy way to remember how the computer does math:

   _____

2. A computer solves a math problem from _____ to _____.

3. Solve this problem the way a computer would:

   10 + 5 * 3 = _____

4. Write a definition of the word **VARIABLE** (in your own words):

   _____

   _____

5. When we use a VARIABLE, we use the _____ command.

6. When we assign a value to a VARIABLE, we use an _____

   _____ command.

Correct these lines and then type them into your computer:

10 PRINT "GOODBYE _____

50 RUN _____

30 PRINT "6 = " 7 = _____

20 "HELLO THERE _____

40 ADD 6+7 _____

ACTIVITIES

ACTIVITY #5

Using **READ/DATA** to multiply:

```
5     REM P = PRODUCT
10    READ A, B
20    LET P = A * B
30    PRINT A, B, P
99    END
```

Rewrite the program to divide A and B

LESSON 5

PROBLEM SOLVING

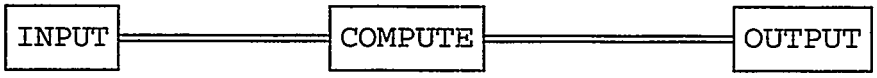
LESSON GOAL: To show students **HOW** to plan and program the computer to solve mathematical problems.

OBJECTIVES

1. The student will write a numbered, step-by-step, plan to solve problems in perimeter and area.
2. The student will translate each step into a line of B.A.S.I.C.

TEACHER'S NOTES:

Lesson 5 has as its goal discovering how a plan to solve a problem can be written step-by-step in English (or flow chart) and then translated, step-by-step, into lines of B.A.S.I.C. code using the idea of



The instructor may have to review the mathematical concepts of perimeter and area with the class.

Then, begin with the perimeter plan and with the class develop the code to input the length of the sides, compute, and then output the perimeter.

Leave 20 minutes to make a journal entry on how to solve a problem with this approach.

LESSON 5 PROCEDURES:

1. Review what a program is:

   - ♦ PROGRAM - Step-by-step list of instructions.
   - ♦ STATEMENTS - The instructions using either LET, INPUT, or READ.
   - ♦ OUTPUT - Solution displayed on screen and/or printer.
   - ♦ INPUT - This statement stops the computer to allow the user to enter data (a number).

2. Discuss how one can find the perimeter of a square. The method is to add all four sides, since they are equal.

   Perimeter of a Square = 5+5+5+5 = 4*5

3. Work through plan first on the chalkboard. Then, develop the code for each instruction.

PROBLEM

	PLAN		**CODE**
1.	Give Directions	10	Print "ENTER the length of one side"
2.	Write or put in a value for any side	20	INPUT S
3.	Use formula to calculate solution	30	LET P = 4*S
4.	Output the value of P	40	PRINT P
5.	Problem finished	50	END
			RUN

LESSON 5 PROCEDURES (cont.):

EXERCISE: Find the perimeter of the following:

1. S = 12

2. S = 85

3. S = 7

4. S = 220

5. Discuss the essential functions of each of these components:

6. Give students the formulas for area of a square and rectangle. Allow them to write a plan and program for each formula.

   - Area of a Square = SIDE x SIDE (S*S)

     (Code A = s^2)

   - Area of a Rectangle = LENGTH X WIDTH (L*W)

     (Code A = l * w)

7. Continue with Activity 1.

LESSON 5

ACTIVITIES

ACTIVITY #1

Area of a Triangle Program

Objective: Write a program to allow the user to enter the Base and Height of any triangle, then print out the Area.

Formula $A = \frac{B\ H}{2}$

PROBLEM

PLAN	CODE
1. Give Directions	10 Print "ENTER Base and Height of Triangle"
2. Enter Base + Height	20 INPUT B, H
3. Calculate $A = \frac{BH}{2}$	30 LET A = B*H/2
4. Output answer	40 PRINT "AREA = " A "SQ""
5. Problem finished	50 END
	RUN

Try these:

1. Base = 6 m
   Height = 2 m

2. Base = 24 cm
   Height = 15 cm

3. Base = 11 cm
   Height = 7 cm

4. Base = 22 ft
   Height = 10 ft

LESSON 6

COURSE OVERVIEW

LESSON GOAL: The students will use B.A.S.I.C. programming as a tool for problem solving.

OBJECTIVES

1. The student will review the terms of B.A.S.I.C. by playing "Computer Feud".

2. The student will see how random and tab functions work.

TEACHER'S NOTES:

[This is the last class of this series.]

Should you wish, this final class may be used to complete any activities from previous lessons that students did not complete.

The goal of the lesson is to extend the skills of problem solving to meet some of the challenges offered.

If the software is available to do exploration, this is a fun activity for the last hour.

"Computer Feud" is a entertaining way to review concepts and vocabulary taught.

MATERIALS NEEDED: Activity Sheets, Bell or Buzzer, Software

LESSON 6 PROCEDURES:

1) Review the course using Activity #1 - Computer Feud.

2) If you directed the students to keep a journal, collect them at this time.

3) Divide class into three (3) groups and have them type a letter (using the computer's word processing package) of thanks to:

   A. The Host Facility

   B. The Staff of Brookhaven National Laboratory

   C. Yourself (instructor)

4) If time permits, teach any of the Activities #2 - #6.

5) Collect the evaluation forms (See, Appendix F).

LESSON 6

ACTIVITIES

ACTIVITY #1

COURSE OVERVIEW

Let's play **"COMPUTER FEUD"**.

A. Divide the students into two teams.

B. Have one student from each team come to the front of the room. They face each other, with a bell between them.

C. Ask a question from any of the previous lessons, including vocabulary words for the students to define.

D. The first student of the two who hits the bell may answer the question.

E. If the answer is correct, their team scores one point. If the student does not get the question correct, the opponent can confer with his/her teammates and together come up with the correct answer, thus earning the point.

F. The team with the most points at the end of 15 minutes is the winner.

ACTIVITIES

ACTIVITY #2

USING SOFTWARE TO ENHANCE PROBLEM SOLVING

[Set up at least 4 work stations]

The students, in three teams, will spend 30 minutes at each station.

STATION #	SOFTWARE
1	SEA ROUTE TO INDIA
2	OREGON TRAIL
3	FACTORY
4	JOURNAL ENTRY

ACTIVITIES

ACTIVITY #3

[This program uses PRINT to create a graphic design.]

NOTE: The **FOR** and **NEXT** commands are similar to the **GOTO** command (Remember: The Endless Loop)

```
 10  PRINT "<CLR/HOME>""****************"
 20  PRINT "*          *"
 30  PRINT "* o    o   *"
 40  PRINT "*          *"
 50  PRINT "*    -     *"
 60  PRINT "*          *"
 70  PRINT "*  (---)   *"
 80  PRINT "*          *"
 90  PRINT "***********"
100  FOR X=1 TO 500
105  NEXT X
110  PRINT "<CLR/HOME>""****************"
120  PRINT "*          *"
130  PRINT "* -    -   *"
140  PRINT "*          *"
150  PRINT "*    -     *"
160  PRINT "*          *"
170  PRINT "*  (===)   *"
180  PRINT "*          *"
190  PRINT "***********"
200  FOR I=1 TO 500
210  NEXT I
220  PRINT "<CLR/HOME>""****************"
230  PRINT "*          *"
240  PRINT "* o    o   *"
250  PRINT "*          *"
260  PRINT "*    .     *"
270  PRINT "*          *"
280  PRINT "*  (---)   *        HI EVERYBODY!"
290  PRINT "*          *"
300  PRINT "***********"
310  FOR T=1 TO 1000
320  NEXT T
330  END
```

REMEMBER: To stop this program, Press the **RUN/STOP** key.

Change statement 330. Make it **LOOP** to Line 10. (HINT: Use the **GOTO** command.)

ACTIVITIES

ACTIVITY #4

BOUNCING BALL PROGRAM

```
  1  REM BOUNCING BALL PROGRAM
  5  CLS:  REM PRINT "(CLR/HOME)"
 10  LET I=O
 20  FOR BL = 1 TO 10
 30  PRINT CHR$ (26); ; REM PRINT "(CRS RIGHT)"
 40  FOR TM = 1 TO 1000
 50  NEXT TM
 60  NEXT BL
 70  FOR BL = 1 TO 10
 80  PRINT CHR$ (26);
 90  FOR TM = 1 TO 1000
100  NEXT TM
110  NEXT TM
120  NEXT BL
125  I = I + 1
130  IF I < 3 GOTO 20
140  END
```

LESSON 6

ACTIVITIES

ACTIVITY #5

JUST FOR FUN

The **TAB** key on your computer can tab like a typewriter.

```
10   LET N = 40 * RND (1)
20   PRINT TAB (N) "*";
30   GOTO 10
40   END
RUN
```

Source: TLC Microcomputer Projects for Growing Minds, H-A Taitt, Creative Learning Association Inc., 1983

LESSON 6

ACTIVITIES

ACTIVITY #6

CHALLENGE: Write a program that will randomly find seats for 25 students in a 25-seat classroom. Assign letters to the students (A to Y) and number the seats (1 to 25). Run your program several times.

CHALLENGE: Change the program to fit your class. Use real students' names. Make a printout for your teacher.

Source: TLC Microcomputer Projects for Growing Minds, H-A Taitt, Creative Learning Association Inc., 1983

STUDENT

DOCUMENTATION

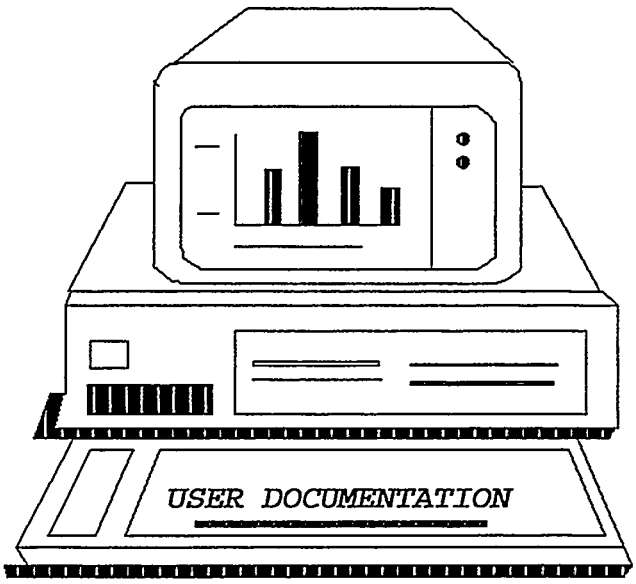
INTRODUCTION TO COMPUTERS

Sponsored Jointly By:

BROOKHAVEN NATIONAL LABORATORY

AND

THE LOCAL COMMUNITIES



_____

SCHOOL DISTRICT

DATE _____ NAME _____

FRANCES V. LIGON
PROGRAM COORDINATOR

TEACHER'S GUIDE

INTRODUCTION TO COMPUTERS

USER DOCUMENTATION

TABLE OF CONTENTS

APPENDICES

* *
Each participant receives this User's
*Documentation, FREE OF CHARGE. *
* *

SPECIAL THANKS: A special thank you is extended to the volunteer staff of Brookhaven National Laboratory (BNL) - Office of Equal Opportunity and Office of Educational Programs; the local community organizations, school districts, BNL's Commodore 64 Club, and local computer clubs who have assisted in making this course possible.

Brookhaven National Laboratory is operated by Associated Universities, Incorporated, Inc., under contract with the U.S. Department of Energy.

TEACHER'S GUIDE

A SPECIAL GREETING

Welcome to the "World Of Computers." You are about to enter into a very exciting new world that you, and you alone, control. Sit back, grab a keyboard, and let's take off!!!

Since 1984, Brookhaven National Laboratory, your school district, and your community, have been involved in a partnership. This program was designed just for you. It is our goal to expose you to new worlds that can be yours when you graduate.

In the Fall, there will be a field trip to Brookhaven National Laboratory where you will have a terrific opportunity to visit a scientific research laboratory and see our large computers.

This course may be used as a first step in your computer training. After completing this course, I recommend that you contact your teacher for additional information.

I am so glad that you came. Remember: We are proud of you and you are *'special'* to us. I know that you will have a good time on this journey.

Your friend,

Ms. Frances V. Ligon, Program Director
Brookhaven National Laboratory
Office of Equal Opportunity, Bldg. 185A
Upton, New York 11973

(516) 282-3709

LESSON 1

REGISTRATION AND BEGINNER'S GUIDE
(Ref: Compute!'s Gazette -- 12/83)

COURSE OBJECTIVES

This course is designed as an 'introduction to' computer literacy. Computers are 'user friendly'.

1. Understanding HOW a computer works.
2. Hardware and Software Concepts.
3. Basic Computer Programming.
4. Introduction to Word Processing.
5. Hands-On Software Demonstrations.

BY THE END OF THIS CLASS YOU WILL:

1. Learn these new words: hardware (keyboard, monitor, disk drive, and printer), software, input, output, C.P.U., bits, bytes, character, and BASIC.
2. Work on the keyboard, pointing out the HOME keys, cursor, shift keys, "", CLR/HOME key, RUN/STOP key, and RESTORE key.
3. Learn two COMMANDS: NEW and PRINT.

LET'S BEGIN: (Space has been left for you to take notes)

A. RULES: _____

_____

_____

B. SAFETY: _____

_____

_____

LESSON 1

C. YOUR GOALS AND EXPECTATIONS: _____

_____

_____

GETTING TO KNOW YOU - THE BUDDY GAME (Write down the names of your new friends in this class - Don't forget the teacher!)

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

KEYBOARD PRACTICE: HOMEROW (A, S, D, F J, K, L, ;)

HANDS-ON EXERCISES/PROJECTS

DISCUSSION: THE HUMAN COMPUTER (see page 2); APPENDIX **A-2:** YOUR WISH IS MY COMMAND; APPENDIX **A-3:** REMEMBER

LESSON REVIEW _____

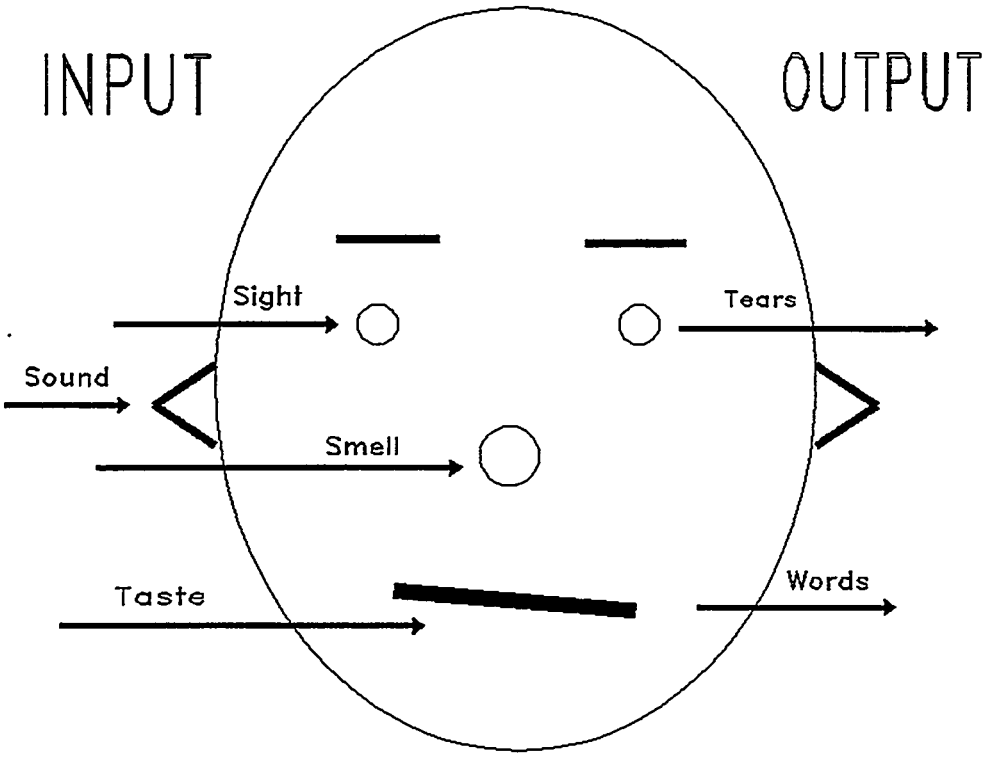
_____

_____

HOMEWORK ASSIGNMENT - WRITE A PROGRAM, IN YOUR OWN WORDS, TELLING ME HOW TO MAKE A PEANUT BUTTER & JELLY SANDWICH.

EVALUATION FORM

LESSON 1



THE HUMAN COMPUTER

LESSON 2

COMPUTER HARDWARE & SOFTWARE CONCEPTS

REVIEW OF LESSON 1 (Homework: PEANUT BUTTER & JELLY SANDWICH)

BY THE END OF THIS CLASS, YOU WILL:

1. Learn these new words: PROGRAM, STATEMENT, STRING, DIRECTORY, AND FORMATTING.

2. Learn new COMMANDS: SAVE, LOAD, OPEN, and GOTO.

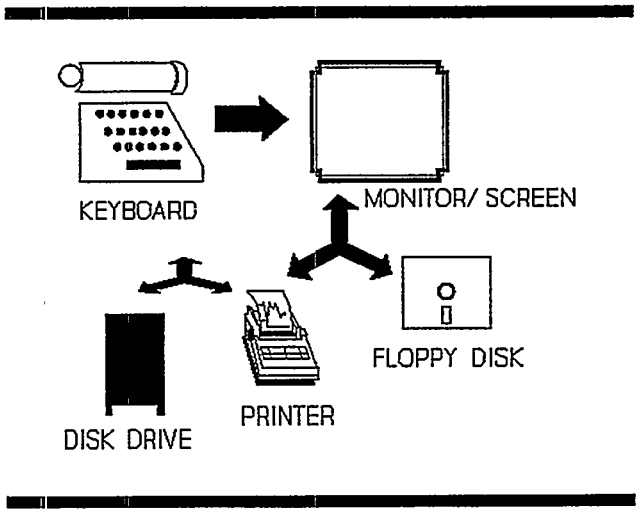
* * * * * * * * * * * *

COMPUTER HARDWARE AND SOFTWARE CONCEPTS

Purposes and Uses of Computers

A. **HARDWARE** - Machinery or equipment, such as keyboard, disk drive, monitor/screen, and printer.

The total hardware makeup of the (name of equipment in use) includes a keyboard, monitor/screen, disk drive, printer, hard disk, and floppy diskettes. (64k means 64 kilobytes of memory.



KEYBOARD: Can be used as an input device for entering information into the system. The keyboard is also the CPU (Central Processing Unit) which follows the commands you have instructed it to do such as Save, and Run.

MONITOR/SCREEN: Output device that displays information as it is entered into the keyboard.

DISK DRIVE: Output device used for storage.

PRINTER: Output device which will give you a hard copy.

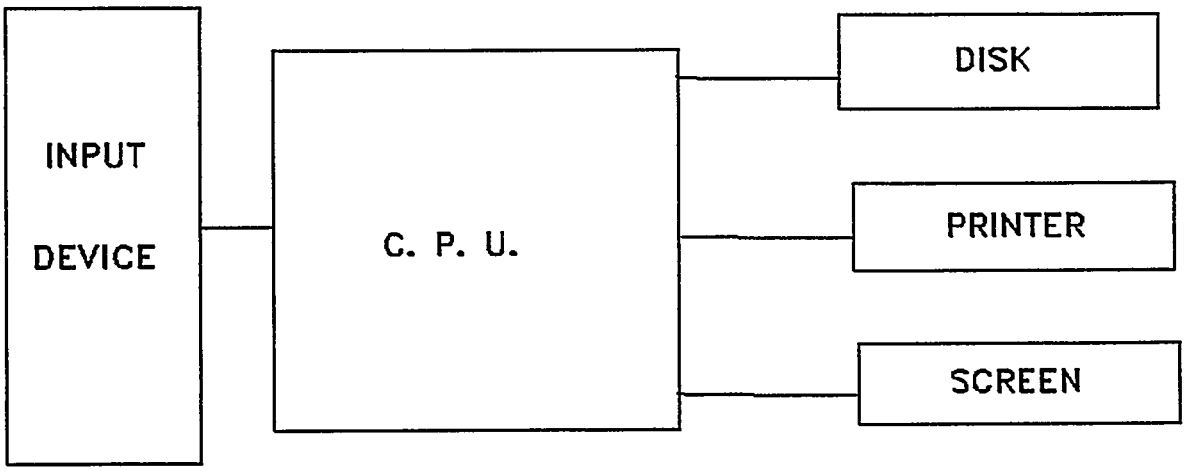
FLOPPY DISK (DISKETTE): Output - Floppy Diskettes are used to store information. One disk can hold from 80 to 150 pages of text.

B. **SOFTWARE** - Set of instructions that tells the computer what to do. (Example: Make a Peanut Butter & Jelly Sandwich)

C. **DATA** - Facts and figures that are stored in the hardware and governed by the rules and regulations of both the hardware and the software.

To enter information into the Commodore 64 computer system, one must use an **INPUT** device. The **INPUT** device we use is the keyboard. As you type information on the keyboard, it is transmitted through cables when you **SAVE** the information. Once you have input this information, the **C.P.U.** (CENTRAL PROCESSING UNIT) carries out the commands you have given it, such as save, and run. Data can be assigned to various OUTPUT devices.

INPUT/OUTPUT PROCESS



- **PROGRAM** - Step-by-step list of instructions.
- **STATEMENTS** - The instructions.
- **STRING** - The part of the instructions enclosed by quotes.

LESSON 2

THIS LESSON WILL TEACH YOU DISK FUNCTIONS:

To allow you to talk to the disk drive, use the **OPEN** command:

OPEN 15, 8, 15

(1st 15 is called the File number, can be from 1 - 127.

8 is called the Device number. The Commodore 64 assigns the number 8 to the disk drive.

2nd 15 is called the Command Channel. Allows you to send commands to the disk.)

To initialize the disk, use the **FORMAT** command:

PRINT# 15, "NEW0, name, id"

(15 is the File Number and must match the number in the **OPEN** command

0 is the disk drive (either 0 or 1)

Name will be the name of this entire disk.

id is any two characters. They are placed on the directory and on every block written on the disk.)

To see what is on the disk (this is called the **DIRECTORY**):

```
LOAD "$",8
LIST
```

To load a program from the disk into the memory of the computer, use the **LOAD** command:

LOAD "NAME",8

To save a program in memory to a disk, use the **SAVE** command:

SAVE "NAME",8

To see only certain files on disk (use of wildcards)

```
LOAD "A*",8
LIST
```

****

LESSON 2

READY.

```
1  REM:  "THE ENDLESS LOOP"
10 PRINT " THE ENDLESS LOOP "
20 GOTO 10
```

CAN YOU CHANGE THE PROGRAM SO IT PRINTS ONLY ONCE?

CAN YOU CHANGE THE PROGRAM SO IT PRINTS YOUR NAME?

TRY PUTTING A COMMA AT THE END OF LINE 10, THUS

```
1  REM:  "THE ENDLESS LOOP"
10 PRINT " THE ENDLESS LOOP ",
20 GOTO 10
```

LESSON REVIEW

HOMEWORK ASSIGNMENT

EVALUATION FORM

LESSON 3

INTRODUCTION TO B.A.S.I.C.

REVIEW OF LESSON 2

BY THE END OF THIS CLASS, YOU WILL:

1. Learn to write a simple program in B.A.S.I.C.
2. Learn these new words: SYNTAX ERRORS, EXECUTE, LIST
3. Learn how to make corrections and insertions in your program.

TYPING AND RUNNING PROGRAMS

A computer **PROGRAM** is a list of instructions that you put in the computer's memory. The instructions are stored as electrical or magnetic signals **(BITS - BYTES)**. The instructions are made up of **'COMMANDS'** or **'STATEMENTS'**. There are lots of possible commands or statements that the machine understands, just as there are lots of words that we speak in our certain language. All the statements of a certain kind that a computer understands are called **'COMPUTER or MACHINE LANGUAGE'**.

1. TYPE [**PRINT "COMMODORE"**] AND HIT **RETURN**.

   What do you see? _____

   TYPE [**PRINT 1 + 2**] and hit **RETURN**

   What do you see? _____

R E M E M B E R :

1. Every instruction line must have a number. Leave a space after the number before you start typing the instruction.
2. Every time you finish typing a line, you have to hit the **RETURN** key to put the instruction into memory. (This is sometimes called entering an instruction or executing).
3. Once you think all your instructions are correct, **LIST** your program, then try to **RUN** it. If it doesn't **RUN**, **LIST** it again and make indicated errors.
4. To fix or change a program once you have listed it, you can either move the cursor up to the line you want and type over it, or retype the entire statement, number and all, at the bottom of the program listing. Either way, you have to hit **RETURN** to enter the new statement.

5. To add a new statement, just type it, line number and all, at the bottom of the program listing, and hit **RETURN** to enter it.

6. To get rid of an old statement (to delete it), just type the statement's line number at the end of the listing and hit **RETURN**. **LIST** the program again, and you will see that the statement has been deleted.

RUN - EXECUTE: When the computer follows the instructions given in a line of your program, it is said to **"EXECUTE"** that line. The computer does not execute the lines of your program as you type. It stores them sequentially in its memory and does not begin executing your program until you type **"RUN"** (without a line number) and press the **RETURN** key.

ORDER OF NUMBERED LINES: Type in the following program:

```
20 PRINT "HI"
10 PRINT "JOE"
30 END
```

What happens? _____

INSERTING ADDITIONAL LINES: For most simple programs, it is a good idea to number the line in tens. This is especially useful when you want to add lines between two lines in a program already typed. Suppose you have just typed the following program to multiply 2 numbers. The statement to **PRINT C** has been omitted.

```
10 DATA 146, 192
20 READ A,B
30 LET C = A*B
40 END
```

To rectify this, you do not need to retype the whole program. Simply select a line number between 31 and 39, like 34, and type, on a line by itself, **34 PRINT C**. The computer automatically inserts this line between line 30 and 40. When this program is run, it will compute and print the desired product.

ERRORS: There are two general types of errors in programs. The first type, called **"SYNTAX ERRORS"**, usually involves misspelling instruction words, or using incorrect notations. For example, the following 2 programs have syntax error(s). When run, each program will produce a printout consisting of error messages informing the programmer of the line(s) that contain syntax error(s).

CORRECTIONS: To correct or replace a line in a program, you do not have to retype the whole program. You simply retype the number of the line and the corrected or new version of the line. There is also a backspacing method for correcting errors you discover while the cursor is still where the error occurred.

DELETIONS: To delete a line from the program and not replace it, type the line number and press the **RETURN** or **ENTER** key.

LIST: **LIST** is a system command. System commands never have line numbers. If you type **LIST** on a line by itself (without a line number) and press the **RETURN** key, the computer will type back your program as it stands in the computer's memory. This is especially useful if in a program, you have made corrections and insertions and want to see a clean copy of your program in proper order of line number.

```
----------------------------
      10 LET A = 4
      20 LOT X = A*A
      30 PRINT X
      40 END
      RUN
```

(ILLEGAL INSTRUCTION IN LINE 20) LOT should be LET.

```
      10 DATA 4,6
      20 READ A,B
      30 LET C = 9B
      40 PRINT C
      50 END
      60 RUN
```

ILLEGAL INSTRUCTION IN LINE 30
ILLEGAL INSTRUCTION IN LINE 60

LESSON REVIEW

HOMEWORK ASSIGNMENT

EVALUATION FORM

LESSON 4

B.A.S.I.C. COMPUTER PROGRAMMING

REVIEW OF LESSON 3

BY THE END OF THIS CLASS, YOU WILL:

1. Learn to write a simple math program in B.A.S.I.C.
2. Learn about variables.
3. Learn new two **COMMANDS**: **LET** and **INPUT**.

This lesson will teach you about variables. Some things to remember: The computer will solve a problem from left to right. The computer always will multiply and divide, before adding and subtracting. The **ORDER OF OPERATIONS** - The computer's way to do math.

10 * 2 + 3 = 20 + 3 = 23

33 - 10/5 + 14 = 33 - 2 + 14 = 31 + 14 = 45

Solve this problem by working the operations in the same order that the computer does.

1. 10 + 6 * 2 =
2. 12 - 10/5 =
3. 3 * 4 - 4 + 3 =

WORK SPACE

DEFINITION OF VARIABLE
(A Brief Introduction to Algebra)

This lesson will focus on **VARIABLES** in **BASIC** programming.

LESSON 4

A variable is a symbol that represents a location in the computer's memory where a value can be stored. A variable can stand for a particular number, word, or character. We use the LET command to tell the computer that we are using variables. For example, in the statement: **PRINT A + B**, the variable named **A** stands for the first number in the sum and the variable **B** stands for the second number in the sum. If you type:

```
LET A = 1  PRESS RETURN
LET B = 2  PRESS RETURN
PRINT A + B PRESS RETURN
```

What do you get? _____

HOW DOES A COMPUTER USE A VARIABLE? When you input information into the computer, this information is restored in its memory after you hit the **RETURN** key. Once you issue a command, the memory processes the data defined by you.

WRITE YOUR ANSWER: **How does a computer use a variable?**

_____

_____

NEW

```
1     REM:  "THE CALCULATING MACHINE"
10    LET A = 2
20    LET B = 2
30    PRINT A*B
40    PRINT A/B
50    PRINT A+B
60    PRINT A-B
70    END
```

Try changing the values of A and B

Make the program only print 3*2. (Hint: Use a **GOTO** statement after line 30)

Now **DELETE** what you just did.

DEFINITION OF INPUT

INPUT is used to assign a value to a variable. We use an **INPUT** command to tell the computer to give a different value to the variable.

LESSON 4

```
1     REM:  "THE INPUT CALCULATING MACHINE"
10    INPUT "A EQUALS";A
20    INPUT "B EQUALS";B
30    PRINT "A*B EQUALS";A*B
40    PRINT "A/B EQUALS";A/B
50    PRINT "A+B EQUALS";A+B
60    PRINT "A-B EQUALS";A-B
70    END
```

NOW ADD A LOOP: ENTER **65 GOTO 10**

> To stop a program, hit **RUN/STOP** and **RESTORE.**

Now, Let's make the program end: ENTER **15 if A = 0 then 70**

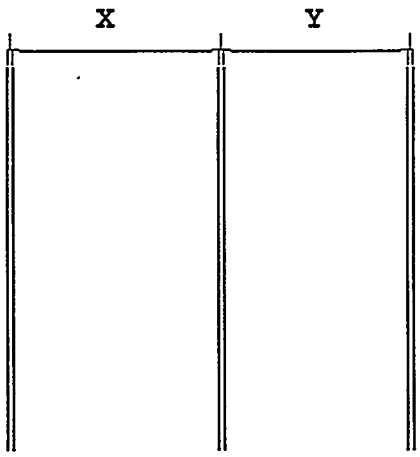
1. Answer questions:

```
10    X = 5
20    Y = 3 * X + 5
30    PRINT X,Y                          ANSWER: _____
40    X = 2
50    PRINT X,Y                          ANSWER: _____
60    Y = 2 * X + 5
70    PRINT X,Y                          ANSWER: _____
RUN
```

2. Classroom discussion

3. Type and run this program on your computer.

WORK SPACE



HOMEWORK ASSIGNMENT

EVALUATION FORM

LESSON 4

Mathematical Expressions and Notation

1. Rules of Priority

In an expression with no parentheses (brackets), arithmetic operations follow the rules of priority listed below.

****

PRIORITY	OPERATION	SYMBOL
Highest	Exponentiation	or **
2nd Highest	Multiplication & Division	*, /
Lowest	Addition & Subtraction	+, -

[REMEMBER: My Dear Aunt Sally = Order of Math Operations]

This is an easy way to remember the way the computer does math.

****

Example: In BASIC, "2 + 3 * 4" - is not puzzling. It will be viewed by the computer as "2 plus (3*4)", since multiplication has a higher priority than addition. It equals 14. Also 2 + 1/3 equals 2 1/3, since division has a higher priority than addition.

QUESTION: What is $5 * 3^2 + 1$? **ANSWER:** ____

QUESTION: What is 1 + 2*3 + 4? **ANSWER:** ____

When an expression with no parentheses contains two operations of the same priority, the computer performs first whichever operation occurs first (from left to right).

Example: 2/3*4 = 8/3. The computer first divides 2 by 3; then it multiples by 4. 8/3 will not be printed as a fraction, but as the decimal 2.66667.

When an expression contains parentheses, arithmetic operations within parentheses are performed first.

QUESTION: How do you write $\frac{1 + 2}{3 + 4}$ in BASIC? **ANSWER:** __

2. Large Numbers

In **BASIC**, commas are never used in representing numbers. Fifteen thousand is written 15000 without the commas. Any number beyond a certain size must be expressed using a special exponential notation. **Example:** In **BASIC**, the number 750,000,000 or 7.5 times 10^8 is written as 7.5E +8. The E + 8 means that 7.5 is multiplied by 10^8.

This is the method for determining the exponent. Consider 750,000,000. Count how many places you must move the decimal point to the left and place it between the 7 and the 5. The answer is 8; thus, the **BASIC** notation is 7.5E + 8.

QUESTION: How would you express 1,376,000,000 in BASIC? **ANS:** __

Perform each of the examples on paper, then input them into your computer and write down the answer.

1. What is each of these **BASIC** expressions equal to?

(a) 2*3 + 4 (b) 2 + 3 * 4 + 5

(c) 5 + 1/2 (d) (2 + 1) / 3

(e) 2 * 2 + 3 * 3 (f) 3 / 4 * 8

(g) $2 * 3^2 + 1$ (h) 32 / 4 / 2 * (4 + 1)

2. Write, in **BASIC**, how you would enter these problems into the computer?

(a) $\frac{A + B}{2}$ (b) $\frac{A + B}{C + D}$ (c) $\frac{A + B + C / D}{2}$

3. Write in **BASIC** using the special exponential notation:

(a) 53,000,000 (b) 792,000,000

(c) .0000000134 (d) .000256987

4. Write each of the following using ordinary decimal notation:

(a) 4.72157E + 2 (b) 5.81334E + 6

(c) .345678E + 3 (d) 9.14567E - 3

LESSON REVIEW

HOMEWORK ASSIGNMENT

EVALUATION FORM

LESSON 5

WORD PROCESSING

REVIEW OF LESSON 4

BY THE END OF THIS CLASS, YOU WILL:

1. Learn to use the Bank Street Writer Word-Processing Program.

2. Learn new vocabulary terms: **COMPATIBLE, MENU, DELETE, WRITING, EDIT MODES, and SCROLLING.**

3. Learn these COMMANDS: **BOLD, Underline, CENTER, INSERT, DELETE**

ADVANTAGES OF USING WORD PROCESSORS:

a. Rekeying
b. Correcting Mistakes
c. Editing
d. Storage
e. Low Cost
f. Other (to be filled in by the class)

DISADVANTAGES OF USING WORD PROCESSORS: _____

_____

DIRECTIONS: Read the sentence below and type in your computer. Listen carefully to the directions for making the corrections.

TYPE: **NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF THEIR COUNTRY.**

A. **DISCUSSION:** _____

_____

B. **PRESS: CTRL + P** - This command tells the computer to print your document on the paper.

C. **PRESS: CTRL + RESTORE** - This command allows you to exit from your program and returns you to Commodore's BASIC language mode.

D. **TURN PRINTER, DISK DRIVE, MONITOR, AND KEYBOARD -- OFF!**

LESSON 5

BANK STREET WRITER

This lesson will briefly introduce you to word processing. The software program we will use is called "The Bank Street Writer", which was made for Commodore. It cannot be used on any other computer. In computer language, we say the Bank Street Writer is not **COMPATIBLE** for any other computer.

To LOAD your program, use the name: **LOAD "BSW",8**

The menu shows you what the program does. To see the **MENU** of the Bank Street Writer, look at the top of your screen and press the **ARROW** key.

To use the different functions, press **CONTROL** key with:

B or E - puts cursor at **BEGINNING** or **END** of writing.

U or D - puts cursor **UP** twelve lines or **DOWN** twelve lines.

C - **CENTERS** what you are writing.

I - **INDENTS** what you are writing.

N - Starts a **NEW** page.

P - Inserts **PRINTER** command.

To erase or **DELETE** words to the right of the cursor, use the **SHIFT** key with the **INST/DEL** key. To erase or **DELETE** words to the left of the cursor, use the **SHIFT** key with the **INST/DEL** key alone. To put something in that you forgot, press the **ARROW** key. Put the cursor where you want the word to go. Press the **ARROW** key again, and type in what you want.

LESSON REVIEW _____

_____

_____

HOMEWORK ASSIGNMENT

EVALUATION FORM

LESSON 6

COURSE OVERVIEW

REVIEW OF LESSON 5

BY THE END OF THIS CLASS, YOU WILL:

1. Learn to play **"COMPUTER FEUD"**.
2. Learn the **EDIT** and **TRANSFER** mode.
3. Learn the vocabulary words: **TRANSFER** mode and **RETRIEVE**.

COURSE OVERVIEW: REVIEW MATERIALS PRESENTED IN LESSONS 1 - 5
(Use your notes)

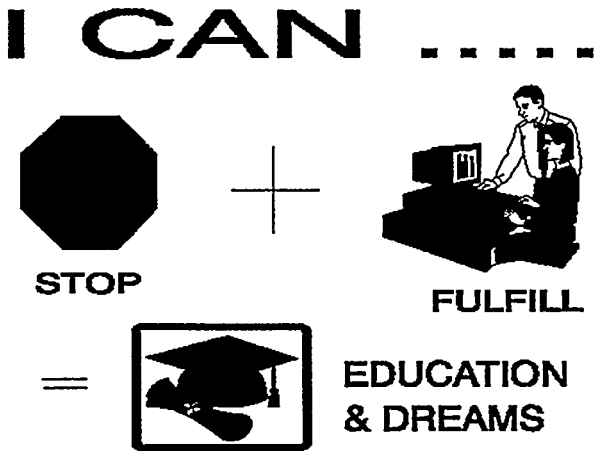
BEGINNER'S GUIDE

COMPUTER HARDWARE & SOFTWARE CONCEPTS

INTRODUCTION TO B.A.S.I.C.

BASIC COMPUTER PROGRAMMING
(A brief introduction to algebra)

INTRODUCTION TO WORD PROCESSING



FINAL REVIEW

HOMEWORK ASSIGNMENT

EVALUATION FORM

APPENDIX A-1

PEANUT BUTTER & JELLY SANDWICH

1. Go to the kitchen and take out a loaf of bread. Place the bread on the counter.

2. From cabinet get one jar of peanut butter and one jar of jelly. Place jars on the counter.

3. Take out two knives; one for the jelly, and one for the peanut butter. Place them on the counter.

4. Open the peanut-butter and jelly jars. Place the lids on counter.

5. Unwrap the loaf of bread.

6. Take out two slices of bread. Place the bread on the counter.

7. Pick up a knife with your left or right hand.

8. Place flat end of knife into the peanut butter jar.

9. Pick up knife, with a small amount of peanut butter on it, and spread on one slice of bread, the side facing up. Repeat until you have spread the desired amount of peanut butter on the bread.

10. Place the knife on the counter.

11. Repeat the same procedure (#9) for the jelly.

12. Place the knife on the counter.

13. Pick up the bread with the peanut butter on it, from the bottom, with your right hand.

14. Turn bread over with peanut butter side facing the counter, and place on top of the slice of bread with the jelly on it. This = SANDWICH.

15. Pick up the entire sandwich, place left corner of sandwich about 1/2" into your mouth, bite off one end. Repeat until last bite has been taken.

M - M - M - M **GOOD!!**

16. Put the bread and jars away; wash the knives carefully.

YOUR WISH IS MY COMMAND
(Compute!s Gazette - 12/83)

What can a Personal Computer do? **NOTHING** unless you give it orders. You are the **KING** or **QUEEN** and the computer is your **SERVANT**.

Like a good **KING** or **QUEEN**, you want to put your **SERVANT** to work. But, how do you get the computer to do what you say?

TYPE the command: **PRINT "HI"**

TYPE the command: **RUN**

You give the orders and it **HAS** to follow them! The computer obeys you -- **ALWAYS** -- if it can understand what you want to do. What can I make my servant do?

- -

- ☺ My homework so I can get an "A".
- ☺ Play games with me.
- ☺ Play music.
- ☺ Teach me history, spelling, math, and English.
- ☺ Draw pictures.
- ☺ Perform scientific experiments.

- -

Math on the Computer:

Computers will help you with your homework to get an "A", just as we, your parents and teachers, want you to do.

What do you want your **SERVANT** to do?

APPENDIX A-3

REMEMBER

To have the computer print words, you must use quotation marks (" ") around them.

You must type **NEW** before each program.

Run each program and write its output on the screen.

```
10  PRINT "HELLO"
20  PRINT "GOODBYE"
30  END
```

```
10  PRINT "**********************"
20  PRINT "                      "
30  PRINT "**********************"
40  END
```

ON LINE 20
PRINT YOUR
NAME

```
10  PRINT "PLEASE SOLVE THIS:"
20  PRINT "13 + 25 ="
30  PRINT 13 + 25
40  END
```

```
***********
*         *
*  O   O  *
*         *
*    ^    *
*         *
*  (---)  *
*         *
***********
```

```
 10   PRINT "***********"
 20   PRINT "*         *"
 30   PRINT "*  O   O  *
 40   PRINT "*         *"
 50
 60
 70   PRINT "*  (---)  *
 80
 90
100   END
```

APPENDIX A-4

SAMPLE PROGRAMS TO TRY

I. B.A.S.I.C. PROGRAMMING

A. DEVELOP A PROGRAM TO FIND THE AVERAGE OF 3 NUMBERS.

B. DEVELOP A PROGRAM TO FIND THE AREA OF A RECTANGLE.

C. DEVELOP A PROGRAM TO FIND THE AREA OF A TRIANGLE.

II. **VARIABLES: THIS LESSON WILL CONTINUE TO TEACH YOU ABOUT THE LET AND INPUT COMMAND**

```
A = 5
B = 3
C = A + B
D = A * B + A
E = D + C
W = E / A
Z = A - B
```

A	B	C	D	E	W	Z

Answer these questions:

C = _____ D = _____ E = _____ W = _____ Z = _____

PRINT THE PROGRAM ON YOUR COMPUTER

(HINT: 10 LET A = 5, 20 LET B=3, LET C=A+B ... PRINT C,D,E,W,Z)

III. SAMPLE PROGRAMS:

```
10   PRINT "HOW OLD ARE YOU?"
20   INPUT A
30   LET Y = 1991 - A
40   PRINT "YOU WERE BORN IN";Y
50   PRINT "HOW OLD ARE YOU?"
60   INPUT R
70   LET M = R * 12
80   PRINT "YOU ARE";M
90   PRINT "MONTHS OLD"
100  LET D = R * 365
110  PRINT "YOU ARE";D
120  PRINT "DAYS OLD"
130  END
```

THIS PROGRAM FIGURES OUT THE YEAR YOU WERE BORN AND HOW OLD YOU ARE, IN MONTHS AND DAYS.

```
1    REM SUMMATION PROGRAM
5    B=0
10   INPUT " A EQUALS";A
15   IF A = 0 THEN 80
20   INPUT "B EQUALS" ;8
30   PRINT "A*B=";A*B
40   PRINT "A/B=";A/B
50   PRINT "A+B=";A+B
60   PRINT "A-B=";A-B
70   GOTO 10
80   END
```

```
1    REM SUMMATION PROGRAM
5    B=0
10   INPUT "NUMBER",A
15   IF A=0 GOTO 50
20   LPRINT A
30   B=A+B
40   GOTO 10
50   LPRINT "TOTAL",B
55   PRINT "TOTAL",B
```

```
1    REM SUMMATION PROGRAM USING DATA STATEMENT
10   DATA 1,2,3,4,5,6,7,8.9,10,0
15   B=O
20   READ A
30   B=A+B
40   GOTO 20
50   PRINT "TOTAL",B
60   END
```

PROBLEM: MAKE PROGRAM RUN WITHOUT RUNNING OUT OF DATA (HINT: USE GOTO)

THIS PROGRAM INTRODUCES YOU TO SOME DIFFERENT COMMANDS.

1. **CLR/HOME** puts the cursor in the **HOME** position. When typing the **CLR/HOME** command, press **SHIFT + CLR/HOME key.**

2. **FOR** and **NEXT** commands are similar to the **GOTO** command.

```
10   PRINT "<CLR/HOME>"***********"
20   PRINT "*          *"
30   PRINT "*  O   O   *"
40   PRINT "*          *"
50   PRINT "*    -     *"
60   PRINT "*          *"
70   PRINT "*  (---)   *"
80   PRINT "*          *"
90   PRINT "***********"
100  FOR X=1 TO 500
105  NEXT X
110  PRINT "<CLR/HOME>"***********"
120  PRINT "*          *"
130  PRINT "*  -   -   *"
140  PRINT "*          *"
150  PRINT "*    -     *"
160  PRINT "*          *"
170  PRINT "*  (===)   *"
180  PRINT "*          *"
190  PRINT "***********"
200  FOR I = 1 TO 500
210  NEXT I
220  PRINT "<CLR/HOME>"***********"
230  PRINT "*          *"
240  PRINT "*  o   o   *"
250  PRINT "*          *"
260  PRINT "*    .     *"
270  PRINT "*          *"
270  PRINT "*  (---)   *    HI EVERYBODY!"
290  PRINT "*          *"
300  PRINT "***********"
310  FOR T=1 TO 1000
320  NEXT T
330  END
```

REMEMBER: To stop this program from running, press the **RUN/STOP** key.

Change Statement 330. Make it Loop to Line 10. (Hint use the GOTO command.)

APPENDIX A-5

ADDITIONAL WORD-PROCESSING EXERCISES

(Type the following exercises onto your diskette and make the changes on the computers.)

DIRECTIONS: Read this passage. Replace the nonsense word with the subject of the passage. Use the EDIT MODE and the REPLACE directions.

* * * * * * * * * * *

Most American homes have at least one BEZICK. In some families, everybody has his or her own BEZICK. Some BEZICKS are so small you can carry them in your pocket; others are so big, they are rarely moved from one spot. Color BEZICKS are more expensive than black- and-white BEZICKS. The BEZICK usually is turned on for several hours a day, depending on when the family is home. Some experts believe that Americans watch too much BEZICK.

* * * * * * * * * * *

1. Now move the last sentence. Put it in the beginning of the paragraph. Use the **EDIT MODE** and the **MOVE** directions.

2. Put the last sentence back where it came from. Use the **EDIT MODE** and the **MOVEBACK** directions.

3. Erase the first sentence. Use the **EDIT MODE** and follow the **ERASE** directions.

4. Now put the sentence back. Use the **EDIT MODE** and follow the **UNERASE** directions.

****************************** **E N D** ******************************

DIRECTIONS: Read the sentence below the line of asterisks (*). Change one word at a time until you have an entirely new sentence.

* * * * * * * * * * *

At camp this summer, I want to go hiking on the mountain trails early in the morning.

* * * * * * * * * * *

HINT: To do this, you can use your **CURSOR** and **INST/DEL** key or the **EDIT MODE** and the **ERASE** key.

********** **E N D** **********

DIRECTIONS: In this next exercise, you need to put the sentences in the correct order.

* * * * * * * * * * *

Charles ate breakfast. He got up quickly. He was excited because it was the first day of school. Then he got dressed. Charles' alarm clock went off at 7:00 a.m. Then he ran off to the bus stop. Charles kissed his mother goodbye.

* * * * * * * * * * *

HINT: To do this, use the **EDIT MODE** and the **MOVE** directions.

********** **E N D** **********

APPENDIX B

INTRODUCTION TO SPREADSHEETS

1. Advantages of Spreadsheets:

   a. Columns and rows
   b. Menu driven
   c. Calculations
   d. User friendly
   e. Other (To be filled in by class)

2. Disadvantages of Using Spreadsheets: (Filled in by class)

DEFINITIONS: Spreadsheet, Cells, Function Keys, Directory/Menu, Printout, Commands (such as Print, Quit), Scrolling, Editing

GETTING STARTED WITH SPREADSHEETS: (HANDS-ON SESSION)

(NOTE: C = columns R = row)

A. **TYPE** in C1, R3 & R4: **CLASS A, CLASS B** (see attached)

B. **TYPE** in C2, C3, C4, and C5: **1984, 1985, 1986, CLASS AVERAGE**

C. **ENTER DATA**: C4R2 (75), C4R3 (77), C4R4 (89)
C5R2 (82), C5R3 (85), C5R4 (75)

D. **TYPE:** in C2R7: (+C2R4+C2R5)/2 [PRESS **RETURN**]

E. **TYPE:** in C3R7: (+C3R4+C3R5)/2 [PRESS **RETURN**]

F. **TYPE:** in C4R7: (+C4R4+C4R5)/2 [PRESS **RETURN**]

G. **TYPE:** in C5R4: (+C2R4+C3R4+C4R4)/3 [PRESS **RETURN**]

H. **TYPE:** in C5R5: (+C2R5+C3R5+C4R5)/3 [PRESS **RETURN**]

I. **TYPE:** in C5R7: (+C5R4+C5R5)/2 [PRESS **RETURN**]

J. **SELECT:** Print from the menu and [PRESS **RETURN**]

K. **SELECT:** Quit from the menu, **PRESS** Yes to confirm, and [PRESS **RETURN**] to exit the program.

L. **TURN PRINTER, DISK DRIVE, MONITOR, AND KEYBOARD -- OFF!!**

NOTE: Your final spreadsheet should look like this:

ROW	COLUMNS 1	2	3	4	5
1					
2		1984	1985	1986	AVERAGE
3					
4	CLASS A	75	77	89	80.333*
5	CLASS B	82	85	80	80.667*
6					
7	CLASS AVERAGE	78.5	81*	82*	80.5*

*Mathematical formulas (calculated by spreadsheet)

LESSON REVIEW

HOMEWORK ASSIGNMENT

EVALUATION FORM

APPENDIX C

INDEX OF TERMS

B.A.S.I.C. Beginner's All-Purpose Symbolic Instruction Code: Developed in 1965 at Dartsmouth College. An easy-to-learn, easy-to-use, algebraic programming language.

BITS Abbreviation for Binary Digits, and has either the value of 1 or 0, as opposed to a decimal digit which may have a value from 0 through 9. Also, the smallest unit of information.

BUFFER A separate area in memory that stores information temporarily.

BYTES A group of BITS representing a character or number, and containing 8 BITS.

CHARACTER A single letter, number, or other symbol.

CPU Central Processing Unit: The part of the computer which performs all the operations of the computer, such as memory, manipulation, arithmetic, logic, interpretations, and execution of instructions.

CURSOR A small, moving, sliding, or blinking light on the screen, that indicates where the next character will appear.

DATA A general term meaning any and all information which can be acted on or processed by a computer. Facts and figures that are stored in the hardware and governed by the rules and regulations of both the hardware and software.

DATABASE A collection of related data that can be retrieved by a computer, such as a mailing list or list of accounts.

DEFAULT Default Settings: Preset variables by a program such as margins, tabs, and line spacings.

DELETE Removes a character, sentence, paragraph, or file.

DISK DRIVE Output device used for storage.

EDITING Making corrections, deletions, or changes to a document.

FLOPPY DISK Output - Floppy Diskettes are used to store information. One disk can hold from 80 to 150 pages of text.

HARDWARE Equipment, such as monitor, keyboard, disk drive, printer, and disk(ettes).

K Kilobytes (represents 1,024 units of space)

KEYBOARD Can be used as an input device for entering information into the system. The keyboard also is the CPU (Central Processing Unit) which performs the commands you have instructed it to do, such as Save, and Run.

MONITOR Output device that displays information as it is entered into the keyboard.

PC Personal Computer, such as the Commodore, IBM, or Apple.

PRINTER Output device which will give you a hard copy.

RAM Random Access Memory: The section of the memory where your programs and data reside.

ROM Read Only Memory: The section of the main memory where the computer stores special system programs and data.

SAVE Stores your document on the disk.

SCROLLING When you have typed on the last line of the screen, the screen will automatically move upward one line at a time to make room for a new line at the bottom of the screen. (The screen also will scroll right when you have reached position 41.)

SOFTWARE A set of program instructions used with a computer to write other programs, perform operations. These instructions tell the computer what to do.

VARIABLE A variable is a defined unit of data/information in a record; a variable defines the physical storage location of a unit of data/information. A variable is a name which represents a value (i.e. A=1).

WORDWRAP When the cursor reaches the right margin setting, it automatically advances to the beginning of the next line.

REFERENCE MATERIAL: For additional information on any software package demonstrated in this course, refer to COMPUTE!S GAZETTE.

APPENDIX D-1

REVIEW OF LESSON 1

Fill in the blanks. Use either INPUT or OUTPUT.

KEYBOARD	_____	DEVICE
MONITOR/SCREEN	_____	DEVICE
DISK DRIVE	_____	DEVICE
FLOPPY DISK	_____	DEVICE
PRINTER	_____	DEVICE

MATCHING:

1.	C.P.U.	_____	The Brains of the Computer
2.	Bits	_____	Binary digits
3.	Bytes	_____	Run the program
4.	Character	_____	8 Bits
5.	Hardware	_____	Holds the memory chip
6.	Software	_____	Keyboard, printer, monitor, disk drive
7.	B.A.S.I.C.	_____	The program
8.	Return Key	_____	The programming language
9.	Execute	_____	Puts data into the computer memory
10.	Variable	_____	A single letter, number, or symbol

How do you clear the screen? _____

_____

Why do you type NEW? _____

_____

When you use the PRINT command, you must use these _____ except in math.

What is the command to show all the statements we have typed in?

_____

APPENDIX D-1 - REVIEW OF LESSON 1

REVIEW QUESTIONS:

1. What is the name of the computer language we are working with?

2. What do we call the list of instructions we give the computer?

3. What is the command to show all the statements we have typed in?

4. What is the command to execute those statements?

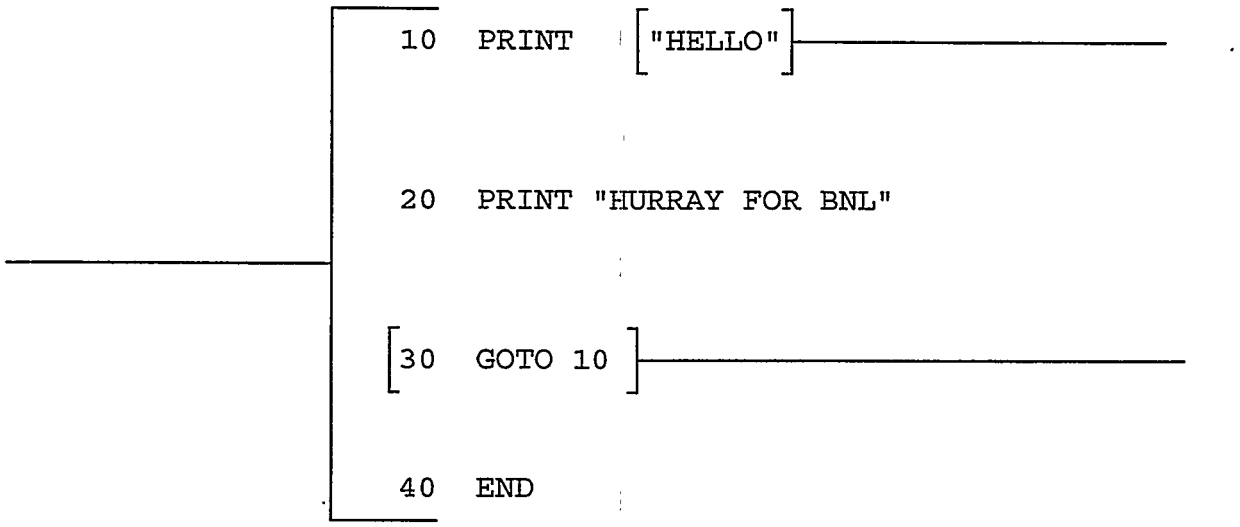
5. What word is used to tell the computer that the statement is a remark?

6. List all the commands you know.

APPENDIX D-2

REVIEW OF LESSON 2

Label the program. Use program, statement, and string.



MATCHING:

1.	LOAD "name",8	_____	To look at lines of a BASIC program.
2.	SAVE "name",8	_____	Allows you to communicate with the disk drive.
3.	GOTO	_____	Initialize or put grooves in the floppy disk.
4.	FORMAT	_____	To see what is on the disk.
5.	OPEN	_____	To transfer the program from the disk into the C.P.U.
6.	LOAD "$",8	_____	To transfer the program from memory onto the floppy disk.
7.	LIST	_____	A command that lets you repeat commands. (Hint, loop)

APPENDIX D-2 - REVIEW OF LESSON 2

Write the commands needed to:

Save a program _____

Load a program _____

See what is on the floppy disk _____

What does REM mean? _____

I'm writing a program and I forgot a statement that goes between

```
20  PRINT "HELLO" and
30  GOTO 10
```

What command do I use to put it in? _____

_____

APPENDIX D-3

REVIEW OF LESSON 3

1. Write an easy way to remember how the computer does math.

   _____

2. A computer solves a math problem from _____ to _____.

3. Solve this problem the way a computer does:

   10 + 5 * 3 =

4. Write a definition of the word **VARIABLE** (in your own words):

   _____

   _____

5. When we use a variable we use the _____ command.

6. When we assign a value to a variable, we use an _____

   _____ command.

Correct these lines and then type them into your computer:

10 PRINT "GOODBYE _____

50 RUN _____

30 PRINT "6+"7= _____

20 "HELLO THERE _____

40 ADD 6+7 _____

APPENDIX D-4

REVIEW OF LESSON 4

What do the following statements do:

```
OPEN 15,8,15
```
_____

```
PRINT#15,"NEW0":name,id"
```
_____

```
SAVE "name",8
```
_____

```
LOAD "$",8
LIST
```
_____

```
LOAD "name",8
```
_____

We use the _____ command to assign a value to a variable.

When working with variables, we use the _____ command.

List the programs that are on your disk.

(Hint: The DIRECTORY = TABLE OF CONTENTS)

(Hint: The FLOPPY DISK = THE BOOK)

LOAD THE FACE PROGRAM

APPENDIX E

EVALUATION FORM

Please complete this form and return to the Instructor at the end of your 6-week session. Your comments and suggestions are important to us and also are greatly appreciated.

LOCATION: _____ RIVERHEAD _____ BELLPORT _____ CORAM

NAME OF INSTRUCTOR: _____

EVALUATION OF COURSE MATERIAL:

_____ EXCELLENT _____ GOOD

_____ FAIR _____ POOR

EVALUATION OF INSTRUCTORS:

_____ EXCELLENT _____ GOOD

_____ FAIR _____ POOR

COMMENTS: _____

_____

SUGGESTIONS: (We would like your suggestions on what we can do to improve this class. Feel free to state your opinion. **REMEMBER:** You don't have to sign this form!!)

_____

_____

_____

_____

_____

APPENDICES

APPENDIX 1

... GETTING TO KNOW YOU ...
[The Buddy Game]

(Write down the names of your new friends in this class - Don't forget the teacher!)

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

KEYBOARD PRACTICE: HOME ROW: A,S,D,F (left hand) J,K,L,; (right hand)

HANDS ON EXERCISES/PROJECTS:

DISCUSSION: THE HUMAN COMPUTER (see page 2 of your workbook); YOUR WISH IS MY COMMAND (A-3): REMEMBER

LESSON REVIEW _____

_____

_____

HOMEWORK ASSIGNMENT: Write a program, in your own words, telling me how to make a **Peanut Butter and Jelly Sandwich.**

EVALUATION FORM

APPENDIX 2

PEANUT BUTTER AND JELLY SANDWICH

1. Go to the kitchen and take out a loaf of bread. Place the bread on the counter.

2. From cabinet get one jar of peanut butter and one jar of jelly. Place jars on the counter.

3. Take out two knives; one for the jelly, and one for the peanut butter. Place them on the counter.

4. Open the peanut-butter and jelly jars. Place the lids on the counter.

5. Unwrap the loaf of bread.

6. Take out two slices of bread. Place the bread on the counter.

7. Pick up a knife with your left or right hand.

8. Place flat end of knife into the peanut butter jar.

9. Pick up knife, with a small amount of peanut butter on it, and spread on one slice of bread, the side facing up. Repeat until you have spread the desired amount of peanut butter on the bread.

10. Place the knife on the counter.

11. Repeat the same procedure (#9) for the jelly.

12. Place the knife on the counter.

13. Pick up the bread with the peanut butter on it, from the bottom, with your right hand.

14. Turn bread over with the peanut butter side facing the counter, and place on top of the slice of bread with the jelly on it. This = SANDWICH.

15. Pick up the entire sandwich, place left corner of sandwich about 1/2" into your mouth, bite off one end. Repeat until last bite has been taken.

M - M - M - M **GOOD!!**

16. Put the bread and jars away; wash the knives carefully.

NOTE TO TEACHER: You may wish to have one or two of the students demonstrate (act out) their program to help illustrate the point.

APPENDIX 3

YOUR WISH IS MY COMMAND
(Compute!s Gazette - 12/83)

What can a Personal Computer do? **NOTHING** unless you give it orders. You are the **KING** or **QUEEN** and the computer is your **SERVANT**.

Like a good **KING** or **QUEEN**, you want to put your **SERVANT** to work. But, how do you get the computer to do what you say?

TYPE the command: **PRINT "HI"**

TYPE the command: RUN

You give the orders and it **HAS** to follow them! The computer obeys you -- **ALWAYS** -- if it can understand what you want to do. What can I make my **SERVANT** do?

- -

- ☺ My homework, so I can get an "A".
- ☺ Play games with me.
- ☺ Play music.
- ☺ Teach me history, spelling, math, and English.
- ☺ Draw pictures.
- ☺ Perform scientific experiments.

- -

MATH on the Computer:

Computers will help you with your homework to get an "A", just as we, your parents and teachers, want you to do.

What do you want your SERVANT to do?

APPENDIX 4

INTRODUCTION TO SPREADSHEETS

1. Advantages of Using Spreadsheets:

   a. Columns and Rows
   b. Menu driven
   c. Calculations
   d. User Friendly
   e. Other (To be filled in by class)

2. Disadvantages of Using Spreadsheets: (Filled in by class)

DEFINITIONS: Spreadsheet, Cells, Function Keys, Directory/Menu, Printout, Commands (Print, Quit, etc.), Scrolling, Editing

GETTING STARTED WITH SPREADSHEETS: (HANDS-ON SESSION)

(NOTE: C = columns R = rows)

A. **TYPE** in C1, R3 & R4: **CLASS A CLASS B** (see attached sample)

B. **TYPE** in C2, C3, C4, and C5: **1984 1985 1986 CLASS AVERAGE**

C. **ENTER DATA:** **C4R2** (75), **C4R3** (77), **C4R4** (89)
C5R2 (82), **C5R3** (85), **C5R4** (75)

D. **TYPE** in **C2R7:** **(+C2R4 + C2R5)/2** (PRESS **RETURN/ENTER**)

E. **TYPE** in **C3R7:** **(+C3R4 + C3R5)/2** (PRESS **RETURN/ENTER**)

F. **TYPE** in **C4R7:** **(+C4R4 + C4R5)/2** (PRESS **RETURN/ENTER**)

G. **TYPE** in **C5R7:** **(+C2C4+C3R4+C4R4)/3** (PRESS **RETURN/ENTER**)

H. **TYPE** in **C5R5:** **(+C2R5+C3R5+C4R5)/3** (PRESS **RETURN/ENTER**)

I. **TYPE** in **C5R7:** **(+C5R4 + C5R5)/2** (PRESS **RETURN/ENTER**)

J. **SELECT:** Print from the menu - and -

K. **SELECT:** Quit from the menu, **PRESS** Yes to confirm, and **PRESS RETURN/ENTER** to exit the program.

L. **TURN PRINTER, DISK DRIVE, MONITOR AND KEYBOARD -- OFF !!**

APPENDIX 4 (cont.)

INTRODUCTION TO SPREADSHEETS (cont.)

NOTE: Your final spreadsheet should look like this:

ROW	COLUMNS				
	1	2	3	4	5
1					
2		1984	1985	1986	AVERAGE
3					
4	CLASS A	75	77	89	80.333*
5	CLASS B	82	85	80	80.667*
6					
7	CLASS AVERAGE	78.5	81*	82*	80.5*

* Mathematical formulas (will be calculated by spreadsheet).

LESSON REVIEW

HOMEWORK ASSIGNMENT

APPENDIX 5

EVALUATION FORM

Please complete this form and return to the instructor at the end of the six-week session. Your comments and suggestions are greatly appreciated.

EVALUATION OF COURSE MATERIAL:

_____ EXCELLENT _____ GOOD

_____ FAIR _____ POOR

EVALUATION OF INSTRUCTORS:

_____ EXCELLENT _____ GOOD

_____ FAIR _____ POOR

COMMENTS/SUGGESTIONS:

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APPENDIX 6

TABLE OF CONTENTS

ADDITIONAL MATH LESSON PLANS

APPENDIX 6-1

ADDITIONAL MATH LESSON PLANS (1)
(Additional Math Lessons)

TRANSLATING ENGLISH SENTENCES INTO ALGEBRAIC EXPRESSIONS

AIM: How do we translate an English sentence into an algebraic expression?

PERFORMANCE OBJECTIVES: The student will be able to:

1. Use a variable to represent the unknown quantity.
2. Translate the sentence into an equation or inequality.
3. Distinguish between an equation and an inequality.

VOCABULARY: Equation, Variable, Inequality, Increased By, Decreased By, Diminished By, More Than, Less Than, Quotient, Product, Difference

MOTIVATION:

1. In a trial, a judge refused to accept evidence which was "hearsay". Why was this less valid than "eye-witness" testimony?
2. Six times a number is 492. If **x** represents the number, which of the following sentences correctly expresses this relationship?

a) $x = 6(492)$ b. $x = \frac{6}{492}$ c. $6x=492$ d. $6 = 492x$

DEVELOPMENT (Include pivotal questions):

1. Discuss motivation. "Hearsay" information is less acceptable because distortions may have been introduced as the story was told through a chain of listeners, each of whom rephrased the facts. In translating mathematical sentences from English to symbolic notation, students must be careful to represent all of the included information accurately and unambiguously.

APPENDIX 6-1 (cont.)

TRANSLATING ENGLISH SENTENCES INTO ALGEBRAIC EXPRESSIONS

2. Verbal sentences can be translated into equations. An <u>equation</u> is a sentence that uses the symbol = to state that two expressions are equal. We use a letter called a <u>variable</u> to represent or hold the place for a number. For example,

three times a number equals 21:	$3n = 21$
a number increased by 12 equals 17:	$x + 12 = 17$
a number decreased by 4 equals 5:	$y - 4 = 5$
a number divided by 2 equals 10:	$\frac{x}{2} = 10$

To write a verbal sentence as an equation, choose a letter (or variable) to represent a number. Then, proceed to use the letter, with arithmetic operations, to express the sentence as an equation.

3. Do application **1** (pg. A-71).

4. Some verbal sentences and equations involve two operations. For example, two times a number decreased by 3 equals 13. Let **n** equal the number ($2n - 3 = 13$).

5. Do application **2** (pg. A-71).

6. An <u>inequality</u> is a statement that one quantity is <u>not</u> equal to another. What are three symbols of inequality? Review the meaning of the symbols of inequality $\neq$ (not equal to), $>$ (greater than), $<$ (less than). For example,

the sum of 8 and 10 is not equal to the product of 8 and 2.	$8 + 10 \neq 8 \times 2$
28 is greater than 21.	$28 > 21$
15 + 9 is less than 30.	$15 + 9 < 30$
10 diminished by 2 is greater than 5.	$10 - 2 > 5$

7. Do application **3** (pg. A-72).

TRANSLATING ENGLISH SENTENCES INTO ALGEBRAIC EXPRESSIONS

8. Determine, by inspection, the solution of open sentences written in application 1.

   a) $x + 7 = 15$ b) $x - 5 = 3$

   c) $4x = 24$ d) $x - 6 = 1$

   e) $\frac{x}{5} = 7$ f) $x - 12 = 88$

9. If the domain of each variable is an integer between -10 and 10 inclusive, solve: (NOTE: "$\geq$" means is not greater than and "$\leq$" means is not less than.)

   a) $x + 7 \geq 0$ b) $2y + 1 \leq 0$

   c) $(2y + 1) \leq 0 \text{ V } (7 - y) > 0$

APPLICATIONS:

1. Translate each of the following sentences into equations.

   a) Seven more than a number is 15.

   b) Five less than a number is 3.

   c) Four times a number is 24.

   d) A number decreased by 6 is 1.

   e) A number divided by 5 is 7.

   f) If 12 is subtracted from a number, the result is 88.

2. Translate each of the following sentences into equations.

   a) Twice a number increased by 3 is 23.

   b) Twice a number decreased by 2 is 5.

   c) The sum of four times a number and 3 equals 35.

TRANSLATING ENGLISH SENTENCES INTO ALGEBRAIC EXPRESSIONS

3. Translate each of the following sentences into inequalities.

   a) 40 increased by a number is less than 80.

   b) A number decreased by 9 is greater than 11.

   c) The product of 7 and 4 is not equal to 21.

   d) If 6 is subtracted from 8 times a number, the result is greater than 26.

   e) Three less than two times a number is more than 11.

SUMMARY:

1. What are the advantages of having a mathematical sentence in algebraic notation?

2. Make up verbal problems that could be solved using the equations:

   a) $2x + 3 = 5$

   b) $4n = 12$

3. Explain why the answer to a verbal problem should not be checked only in the equation.

4. What are three symbols of inequality?

TRANSLATING ENGLISH SENTENCES INTO ALGEBRAIC EXPRESSIONS

HOMEWORK: Write an equation or inequality for each of the following sentences:

1. Twice a number decreased by 9 is 7.
2. A number increased by 11 is 33.
3. Three times a number is 54.
4. The sum of three times a number and 4 is 19.
5. A number divided by 5 is 11 more than the number.
6. Four times a number decreased by 9 is less than 31.
7. The product of 10 and 3 is not equal to 32.
8. Twice a number increased by 3 is more than 9.
9. A number decreased by 2 is greater than 7.
10. If 17 is subtracted from 4 times a number, the result is less than 3.
11. Compute the quotient and check:

    a) $\frac{9x - 6}{3}$

    b) $\frac{9y - 6y}{3y}$

APPENDIX 6-2

ADDITIONAL MATH LESSON PLANS (2)
(Additional Math Lessons)

ORDER OF OPERATIONS

AIM: What is meant by "Order of Operations?"

PERFORMANCE OBJECTIVES: The student will be able to:

1. State the order of operations.
2. Identify grouping symbols.
3. Evaluate numerical expressions using order of operations.

VOCABULARY: Order of Operations, Evaluate, Parentheses

MOTIVATION:

1. Find the value of (evaluate):
   a) 3 + 6 * 2
   b) 12 - 3 * 2
   c) 7 - 3 + 2
2. Write in symbols and find the value of the sum of four and nine multiplied by two.

DEVELOPMENT (Include pivotal questions):

1. Discuss answers to Motivation 1. Elicit the need for a unique answer. Ask, "In what order should we do the operations in the examples so that we all get the same answer?"
2. Develop conventional agreement:
   a) We do all the multiplications and divisions first, in the order in which they appear, from left to right.
   b) Then, we do all the additions and subtractions in the order in which they appear, from left to right.

ORDER OF OPERATIONS (cont.)

3. Demonstrate that the answers to motivation 1 (a), (b), and (c) above are 15, 8, and 6, respectively.

4. Do application 1.

5. Discuss motivation 2. How can we show the sum of four and nine is multiplied by two? Develop the reasons for needing parentheses to group numerals within an expression. The expression is written (4 + 9) * 2. Ask, "How do these parentheses affect the order of operations?" Elicit that operations indicated within parentheses are performed before other arithmetic operations. Show that for this particular problem:

   (4 + 9) * 2 = 13 * 2 = 26

6. Do applications 2 and 3.

APPLICATIONS:

1. Evaluate:

   a) 18 - 6 ÷ 3

   b) 38 - 12 * 3

   c) 21 - 6 ÷ 3 + 5 * 2

   d) 6 + 4 * 3 - 12 ÷ 3

2. Find the value of:

   a) 55 - (7 - 3)

   b) 5(3 + 3) (7 - 3)

3. Write in symbols and evaluate:

   a) Fifteen is subtracted from the product of four and six.

   b) The product of eight and four is added to twenty.

APPENDIX 6-2 (cont.)

ORDER OF OPERATIONS (cont.)

SUMMARY:

1. Which is greater:

   $(18 - 6) \div 3$ or $18 - (6 \div 3)$

2. What is the value of $18 - 6 \div 3$?

3. Why must there be a conventional agreement about the order of operations?

HOMEWORK:

1. Find the value of:

   a) $5 + 1 * 2$

   b) $4 * 3 - 5$

   c) $(11 - 9) \div 2$

   d) $25 - 15 \div 3 + 5$

   e) $32 \div 8 \div 4$

   f) $32 \div (8 \div 4)$

   g) $8(7 + 2)(9 - 4)$

   h) $8(7 + 2) - (9 - 4)$

   i) $18 \div 2 - (11 - 3)$

   j) $15 - (6 + 4) \div 2 - 10$

   k) $[15 - (6 + 4)] \div 2 + 3$

   l) $(6 + 4) \div (2 + 3) \div 4$

2. Write, using symbols, and evaluate:

   a) the sum of eleven and four divided by the product of five and three

   b) nine decreased by the product of two and three

*3. For each of the following problems, which words might create difficulty for someone trying to solve it?

   a) Find the sum of the smallest two positive odd composite numbers.

   b) Find two different integers whose reciprocals add up to ½.

   c) Prove that 3.25 is a rational number.

APPENDIX 6-3

ADDITIONAL MATH LESSON PLANS (3)
(Additional Math Lessons)

EVALUATING ALGEBRAIC EXPRESSIONS

AIM: How do we evaluate algebraic expressions?

PERFORMANCE OBJECTIVES: The student will be able to:

1. State what is meant by an algebraic expression.
2. State what is meant by evaluating an algebraic expression.
3. Evaluate algebraic expressions using powers and parentheses.

VOCABULARY: Algebraic Expression, Exponent, Factor

MOTIVATION:

1. According to the radio, the temperature is 20°C. What is the temperature in Fahrenheit degrees? (The Fahrenheit temperature is 32°, more than nine-fifths of the Centigrade reading.)
2. Write an expression involving the variable **c** which could be used to find Fahrenheit equivalents for any Centigrade temperature.

DEVELOPMENT (Include pivotal questions):

1. Ask, "What must we know in order to evaluate a phrase which contains a variable?" Show how the value of the expressions changes as the value of the variable changes. In 3n,

if n = 1	if n = 5	if n = 100
= 3n	= 3n	= 3n
= 3(1)	= 3(5)	= 3(100)
= 3	= 15	= 300

2. Develop the concept that an algebraic expression is an expression which contains one or more variables.

APPENDIX 6-3 (cont.)

EVALUATING ALGEBRAIC EXPRESSIONS (cont.)

3. Demonstrate that to find the value of an algebraic expression, we

   a) replace the variable in the expression with its given value at each occurrence.

   b) follow the Order of Operations.

4. Show if x = 5:

   a) $3x + 2$
   $= 3(5) + 2$
   $= 15 + 2$
   $= 17$

   b) $3\ (x + 2)$
   $= 3\ (5 + 2)$
   $= 3\ (7)$
   $= 21$

   c) $4x + 2x$
   $= 4(5) + 2(5)$
   $= 20 + 10$
   $= 30$

5. Do application **1** (pg. A-79).

6. Introduce exponents as a short way of indicating repeated multiplication with the same factor. Show 4^3 means 4*4*4. Define x^n, the product of n factors, each equal to x.

7. Demonstrate:

   a) $2 * 4^3 + 7 = 2 * 4 * 4 * 4 + 7$
   $= 2 * 64 + 7$
   $= 128 + 7$
   $= 135$

   b) $(2 * 4)^3 + 7 = 8^3 + 7$
   $= 8 * 8 * 8 + 7$
   $= 512 + 7$
   $= 519$

8. Expand order of operations to include exponents, as follows:

   a) Parentheses

   b) Exponents

   c) Multiplication and division, in order, from left to right.

   d) Addition and subtraction, in order, from left to right.

9. Do application **2** (pg. A-79).

APPENDIX 6-3 (cont.)

EVALUATING ALGEBRAIC EXPRESSIONS (cont.)

APPLICATIONS:

1. Evaluate each of the following if a=8, b=4, d=3, x=6, y=1, and z=5.

a)	$3x + 7$	b)	$2dx$
c)	$4y - 2$	d)	$7y - 4b - d$
e)	$3(2b - z)$	f)	$\frac{3x - 2}{b}$

2. Evaluate each of the following if a, b, d, x, y, and z have the same values as in application 1.

a)	d^4	b)	$3b$
c)	$(3b)$	d)	$2a + a$
e)	$4x * b$	f)	$\frac{d(a+b)}{2}$

3. a) How can we write 3xxyyz using exponents?

   b) Evaluate the above if x=2, y=4, z=5.

SUMMARY:

1. State the complete convention for the Order of Operations.

2. What is an algebraic expression?

3. Why should we know how to evaluate algebraic expressions?

HOMEWORK: Find the numerical value of the following algebraic expressions if a=4, b=8, x=3, y=7, and z=5.

a)	$\frac{11 + a}{xz}$	b)	$4a - 3x$
c)	$2b + y - (z - 1)$	d)	$4(b - x) + 2y$
e)	$e + \frac{b}{a} + \frac{3z}{x}$	f)	$\frac{2(x + z) + a}{a + b}$
g)	b	h)	$5a^3xy$
i)	x^3	j)	$3a^3 + b$
k)	$3x$	l)	a^3xy^2
m)	$3z^2xb$	n)	$x^3 + 5x + 4$

EVALUATING ALGEBRAIC EXPRESSIONS (cont.)

2. Express in words:

   a) $\frac{a + b + c}{3}$ b) $a^3 + b^3 = c$ (c) $= \frac{2a + b}{3}$

3. Evaluate which is greater:

   a) 2^5 or 5^2 ?

   b) 7^8 or 8^7 ?

4. When is the logical sentence: (rVq)/\(rVs)

   a) TRUE b) FALSE

APPENDIX 6-4

ADDITIONAL MATH LESSON PLANS (4)
(Additional Math Lessons)

ORDERING SIGNED NUMBERS, ABSOLUTE VALUE

AIM: What is the set of signed numbers?

PERFORMANCE OBJECTIVES: The student will be able to:

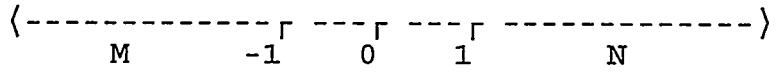
1. Order and locate signed numbers on a number line.
2. State the opposite of the number.
3. Define what is meant by the absolute value of a number.
4. Find the absolute value of signed numbers.

VOCABULARY: Positive, Negative, Absolute Value, Opposite, Is Greater Than, Is Less Than, Integers

MOTIVATION: At 6 p.m. one evening last winter, the temperature was 10°C above zero. During the night, the temperature dropped fifteen degrees. What was the temperature the next morning?

DEVELOPMENT (Include pivotal questions):

1. Have students discuss motivation. Draw a number line. Elicit that 5 units from zero could be to the right or to the left of zero (on a horizontal number line). Points M and N are each 5 units from zero.



2. Review that numbers increase without limit as we move to the right on the number line. A point to the right of zero represents a positive number. A point 5 units to the right of zero (point N above) represents 5 more than 0 and is denoted by 5 or +5 (read, "positive five").

3. How shall we identify numbers to the left of zero? Elicit from the students that they are called negative numbers and are less than zero. Point M represents 5 less than zero and is denoted -5 (read, "negative five").

APPENDIX 6-4 (cont.)

ORDERING SIGNED NUMBERS, ABSOLUTE VALUE (cont.)

4. Do applications **1** and **2** (pg. A-83).

5. Elicit from the students that a number line may be extended indefinitely in both directions. What happens to the value of the numbers as we move to the left on a number line? Develop that the numbers represented get smaller as we move to the left on a number line from any position (point) to any other position. Indicate that movement to the left is movement in the negative direction while movement to the right is movement in the positive direction.

6. Review symbols of inequality, > (is greater than), < (is less than).

7. Do applications **3** and **4** (pg. A-83).

8. How many units from zero are -5, +6, +2, 3, -2? Compare the distances +2 and -2 from zero. Have students note that +2 and -2 are both 2 units from zero, with +2 being 2 units to the right of zero, and -2 being 2 units to the left. Develop the idea that such numbers are called <u>opposites</u>.

9. Do application **5** (pg. A-83).

10. Define the set of whole numbers and their opposites as the set of integers, where

    z = (..., -5, -4, -3, -2, -1, +2, +3, +4, +5, ...)

11. How can we tell which of two opposite numbers is larger? ... which of two numbers is larger? .. which of two numbers is further from zero?

    Elicit that of two opposites, the positive one is larger; of two numbers, the one to the right on the number line is larger; of two numbers, the one with the larger value disregarding its being further from zero.

12. Develop the fact that we call the distance between the point for a number and zero on a number line the <u>absolute value</u> of the number. Alternately, we may define absolute value as the greater of a number and its opposite.

APPENDIX 6-4 (cont.)

ORDERING SIGNED NUMBERS, ABSOLUTE VALUE (cont.)

13. Demonstrate that the absolute value of -3 is written $|-3|$, the absolute value of +5 is written $|+5|$.

    $|+5| = 5$ is read, "The absolute value of positive five equals five."

    $|-3| = 3$ is read, "The absolute value of negative three equals three."

14. Do applications **6** and **7** (pg. A-84).

APPLICATIONS:

1. On a number line, what signed number is represented by:

   a) a point 3 units to the right of zero.

   b) a point 8 units to the left of zero.

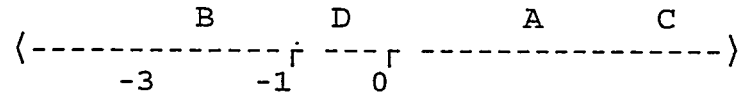
   c) a point 3 units to the right of 4.

   d) a point 3 units to the right of -5.

   e) a point 4 units to the left of +7.

   f) a point 5 units to the left of +3.

2. Name the points A, B, C, and D by a signed number.



3. True or false?

   a) $-20<5$ b) $-10>-3$ c) $0>-9$

4. Use < to order:

   a) -5, +1 b) -6, -8 c) -8, +7

5. What is the opposite of:

   a) -5 b) +8 c) -2 d) 0

APPENDIX 6-4 (cont.)

ORDERING SIGNED NUMBERS, ABSOLUTE VALUE (cont.)

6. True or False?

   a) $|-5| = 5$ b) $|+21| = 21$

   c) $|-11| = 5$ d) $|7| < |-14|$

7) Find the value of (evaluate):

   a) $|+6| + |-2|$ b) $|-5 + +10|$

   c) $|-10| - |-5|$

SUMMARY:

1. What is the absolute value of:

   a) +3 b) +5 c) -50 d) 10

2. What is the opposite of:

   a) +3 b) +5 c) -50 d) 10

3. What number is its own opposite?

4. If two numbers are placed on a number line, where will the larger one lie?

5. What integer lies immediately to the right of:

   a) 5 1/3 b) -4 c) 7 d) -27/8

APPENDIX 6-4 (cont.)

ORDERING SIGNED NUMBERS, ABSOLUTE VALUE (cont.)

HOMEWORK:

1. Represent as a signed number:
   a) a point 8 units to the left of +7
   b) a point 8 units to the right of +7
   c) a point 2 units to the right of +2
   d) a point 5 units to the left of +2

2. Find the value of:
   a) $|+3| + |-8|$
   b) $|-3| + |-1|$
   c) $|-6| + |+2|$
   d) $|-22| + |+25|$
   e) $|+20| - |-6| - |-11|$

3. True or false?
   a) $-21 + |-21|$
   b) $|+13| = 13$
   c) $|4| + |+2| + |-5| = +1$

4. What number is opposite of:
   a) -4
   b) 0
   c) $|+8| + |-2|$

APPENDIX 6-5

ADDITIONAL MATH LESSON PLANS (5)
(Additional Math Lessons)

OPERATIONS WITH MONOMIALS

AIM: What is a monomial?

PERFORMANCE OBJECTIVES: The student will be able to:

1. Define what is meant by a monomial
2. Combine like terms
3. Add and subtract monomials

VOCABULARY: Monomial, Like Term, Unlike Term, Distributive Property, Communitive Property

MOTIVATION: Add the following:

Nancy has: 6 red delicious apples; 12 oranges; 3 peaches

Joshua has: 14 bananas; 5 peaches; 15 nectarines

Danielle has: 9 oranges; 7 pineapples; 15 cantaloupes

Robyn has: 1 plum; 8 peaches; 2 watermelons, 20 honeydew melons

Traci has: 1 Kiwi; 5 nectarines; 4 green granny apples

How much fruit is available?

DEVELOPMENT (Include pivotal questions):

1. Have students discuss the various ways to answer the question. Elicit discussion of grouping "like" terms.

   Definition - **MONOMIAL:** Algebraic expression consisting of one term that is a constant, variable, or the product of constants and variables.

   eg. $5 * 8z - 4y^2\ 7\ a^2b^3$

OPERATIONS WITH MONOMIALS (cont.)

2. Define <u>like</u> vs. <u>unlike</u> terms:

Definition - **LIKE TERMS:** Two or more terms containing the same variable and/or exponent

eg. 7 bananas and 5 bananas
6k and k
5x and -7x
9ab and 2ab
$9x^2y^3$ and $-11x^2y^3$

Definition - **UNLIKE TERMS:**
Two or more terms containing different variables and/or exponents

eg. 8 oranges and 6 plums
3x and 5y
$5x^2$ and $-7x^3$
9ab and 2a
$8x^3y^2$ and $4x^2y^3$

3. Have students write two **LIKE TERMS** and two **UNLIKE TERMS**.

4. How do we add **LIKE TERMS** and **LIKE MONOMIALS**?

Definition - **DISTRIBUTIVE PROPERTY:**
The product of one number times the sum of a second and a third number equals the product of the first and second numbers plus the product of the first and third numbers.

eg. (1) $a(b + c) = ab + ac$ **and** $ab + ac = a(b + c)$

(2) $9x + 2x = (9 + 2)x = 11x$

(3) $-16cd + 3cd = (-16 + 3)\,cd = -13cd$