STUDY GUIDE FOR CLASS

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FOR

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FOR

C L A S S

(Computer Literacy and Studies in Schools)

Utpal Mallik

Pratap Kotwal

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
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Foreword

Launching an innovative project like CLASS (Computer Literacy and Studies in Schools), which has manifold implications and innumerable ramifications, is an arduous enterprise. The selection of a suitable machine and its peripherals, centres, schools and appropriate software, and the training of teachers who would ultimately transact the course, the production of support materials for teachers and students, and coordination between resource centres are but a few of the activities that we in the National Council of Educational Research and Training (NCERT) have kept ourselves concerned and occupied with. Often it has not been easy, but it has always been a rich and satisfying learning experience for my colleagues who have very willingly put in enormous labour during the early days of the project.

The first draft of the booklet has been written jointly by Dr. Utpal Mallik of the Department of Education in Science and Mathematics, NCERT, and Shri Pratap Kotwal of Kale Consultants, New Delhi. Both of them have been associated with the CLASS project since its inception. Prof.S.N. Maheshwari, Indian Institute of Technology, Delhi and Mr. Peter Auchterlounie, Technical Cooperation Officer, British Council, Delhi, both intimately associated with the CLASS project, were kind enough to go through the manuscript and to suggest important changes for its improvement. Professor A.K. Jalaluddin, Joint Director, NCERT, coordinated the preparation of the Guide. Shri Jaipal Nangia, Head, Publication Department and his colleague Shri C.N. Rao, Chief Production

Officer, and Smt. V. Sankaranarayanan, Assistant Editor, have made it possible to bring out the Guide with all care in record time. I would like to sincerely thank all of them for their contribution on behalf of the Council.

I believe this booklet will serve as a study primer for students and teachers alike. This will be followed by a number of other publications for teacher trainers, teachers and students.

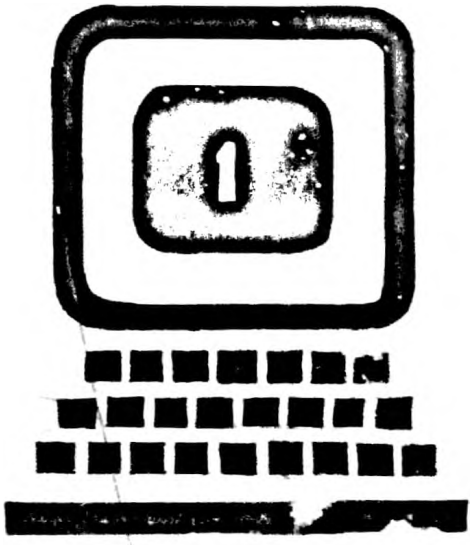
P.L. MALHOTRA
Director
National Council of
Educational Research and Training

New Delhi
May 1985

Contents

PART I

The Microcomputer for You



The Microcomputer for You

By now you might have seen a BBC microcomputer being unpacked in your school! Soon it will be set up in your class and *you* will be using the machine.

Perhaps most of you have not seen a computer before. Perhaps many of you still think that a computer is a mysterious machine that performs very complicated arithmetic operations and is meant for a few highly technical-minded people.

Well, a computer is not just a quick arithmetic device; it is a machine that can choose, copy, move, compare and perform non-arithmetic operations on the many alphabetic, numeric and other symbols that you and we use to represent things and ideas. In short, a computer accepts data, processes them and provides the results of the process; no wonder that it is also referred to as a data processing machine.

Unlike the radio, the TV, the tape-recorder or any other medium of communication that you are familiar with, the computer invites the user to a *dialogue* with itself. It does not just give you a one-way flow of information; it welcomes you to react with it and many a time it gives you some very personal attention. If you develop friendship with the machine and are willing to interact with it, your new friend will do many things for you in exactly the way you want.

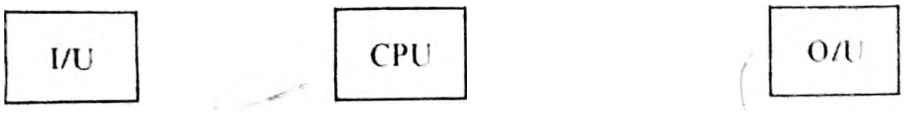
In fact, there is no other device which can match a computer in speed, information, capacity, consistency and accuracy.

Computers can perform hundreds and thousands of calculations in a second! With additional storage devices, computers can record an almost unlimited quantity of data. Unlike us – well, most of us – computers never suffer from boredom. The computer will keep on doing the same work, with the same accuracy, as many times as you want it to do so. And as long as the instructions received by the computer are reliable, the computer is an extremely accurate and reliable machine.

Instructions are stored by the computer and it faithfully executes these instructions. The same computer can be used for a variety of tasks – from teaching you physics, word processing, tabulating your mark sheets to playing music. The instructions given to the computer, however, are different in each case. A set of instructions that makes the computer work is known as a *program*.* A computer is thus a programmable machine capable of processing data. The instructions are given using a set of commands in a *computer language*.

For this reason, it is important that we distinguish between the equipment itself and the programs that can be run on it. The computer equipment – all the electronic parts that you can touch and see–is known as *hardware*. The programs, which make the hardware useful, are referred to as *software*. Together, the hardware and the software form the computer system. You will see various types of software packages during the course. This will give you some idea of the versatility of a computer system.

The three basic tasks of the computer – accepting data, processing them and providing the results of the process – are carried on by three distinct units.

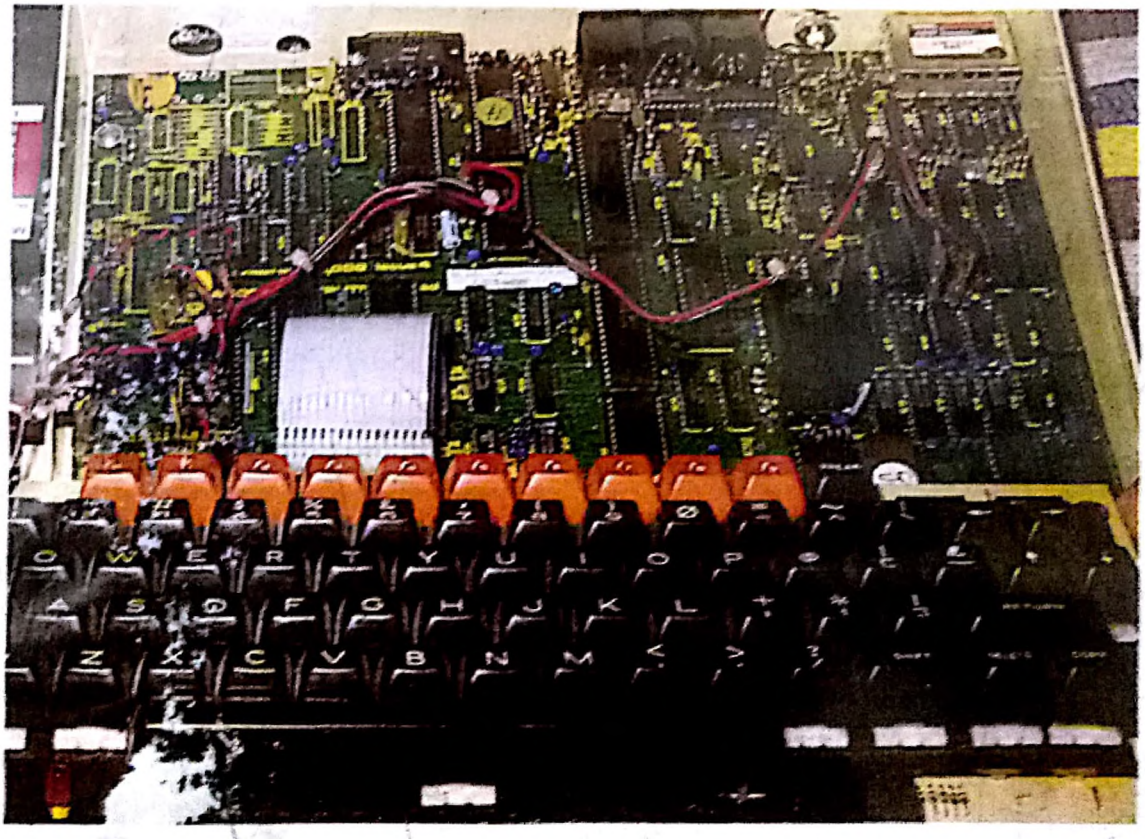


In the Computer that you shall be using (a microcomputer) an input device (input unit) and the CENTRAL PROCESSING UNIT (CPU) are built as a composite body. The input device resemblesthe keyboard of a typewriter. Instructions to the computer are keyed in through this *keyboard*.

Some day your teacher will open the box for you to show you

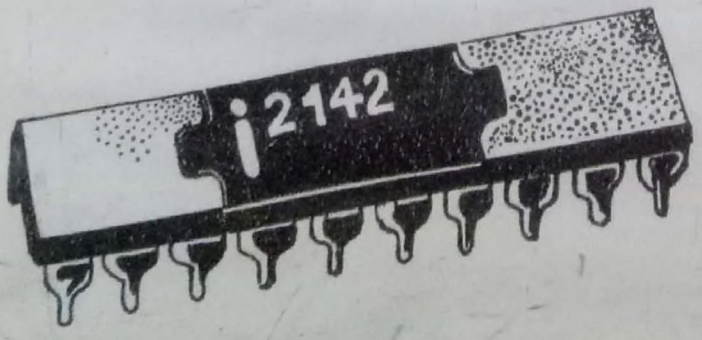
*Please note the spelling.

The keyboard and the CPU



Internal anatomy of the CPU

the CPU which has three electronic sub-units: the *arithmetic unit* which performs calculations and compares quantities; the *internal store* (or internal storage) which holds instructions and data which are to be processed; and the *control unit*, which controls the interaction of all the other units. At the heart of the microcomputer's CPU are one or more *microprocessors* which are *integrated circuits*. An integrated circuit consists of many electrical components etched on to a small piece of silicon. These integrated circuits are also called *silicon chips* or just *chips*.



A chip

There are several characteristics of the internal storage that have important practical implications. The contents of internal storage-data or instructions – are immediately accessible to you (the user). For this reason it is also called the IMMEDIATE ACCESS STORE (IAS). The capacity of the IAS, however, is limited. Only one program may be held in the IAS at any one time. Well, this is not strictly true, but for our present purpose, we can assume it to be so. A feature of most internal storage units is that the store is cleared of all contents as soon as the power supply is switched off. Therefore, additional storage units outside the computer are necessary.

Information may be transferred from the internal storage of the computer to the *external storage* (or *backing storage*), or information held in the backing storage, with suitable instructions, may be transferred to the intenal storage. The backing storage devices you shall be using are either *cassette tapes* or *floppy discs* (or *discette*); the latter are more commonly used. The units that are to be used along with these are, respectively, a *cassette deck* and a *disc drive* (or *discette drive*).

Cassette tapes

Floppy discs

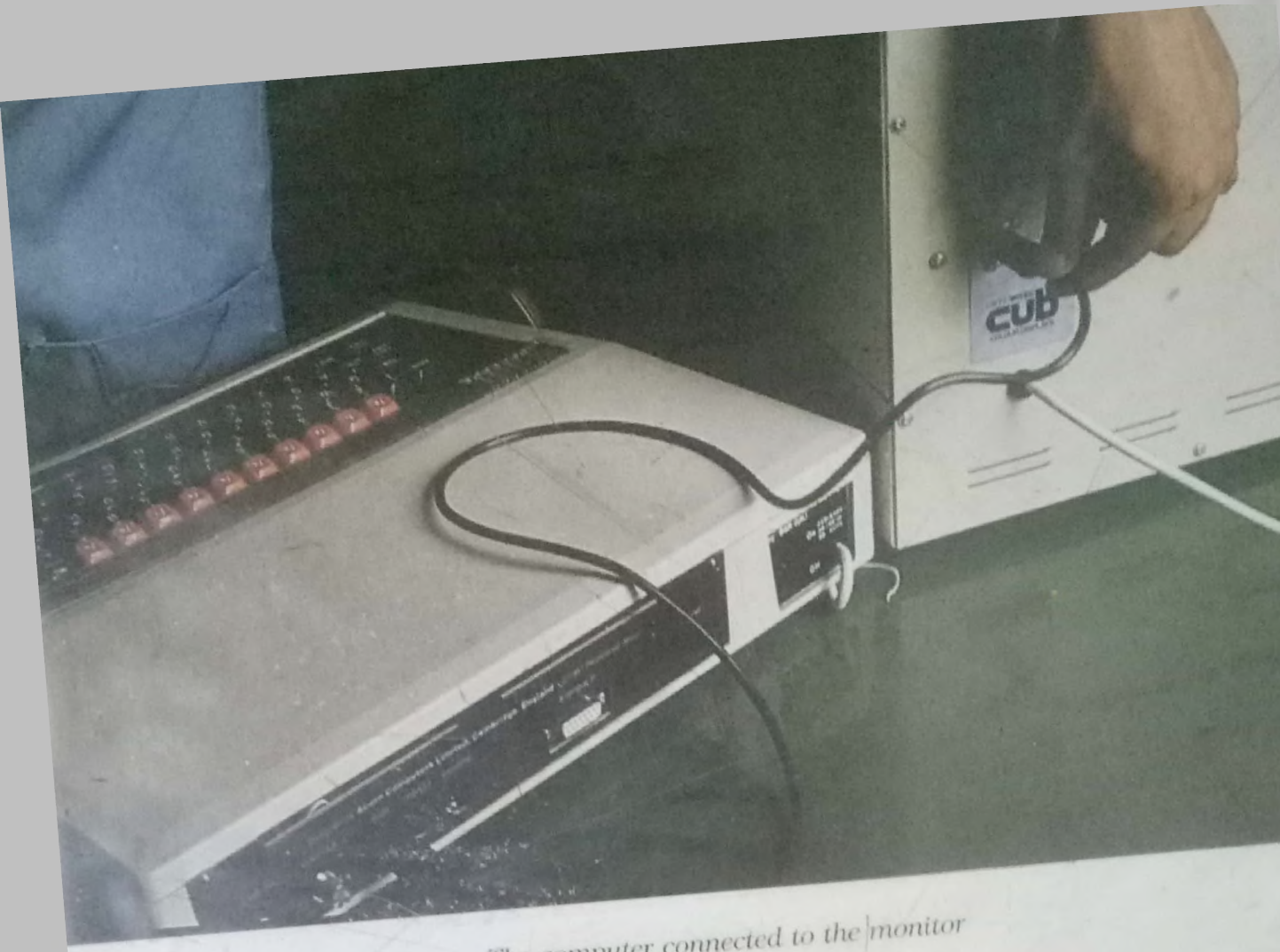
The information held on the backing storage medium (cassette tape or floppy disc) is retained on the medium even though the power supply to the unit is switched off.

Most commonly, the output device that you shall use is a VISUAL DISPLAY UNIT (VDU), which is like a television set *(monitor)*. Sometimes you shall also use a *printer* which will allow you to take away information on paper.

The BBC monitor has a colour display which can be in eight different *formats* or *modes*. In different modes, the number of characters (*i.e.*, letters of the alphabet, numbers, symbols, etc.) which are accommodated on the screen also varies.

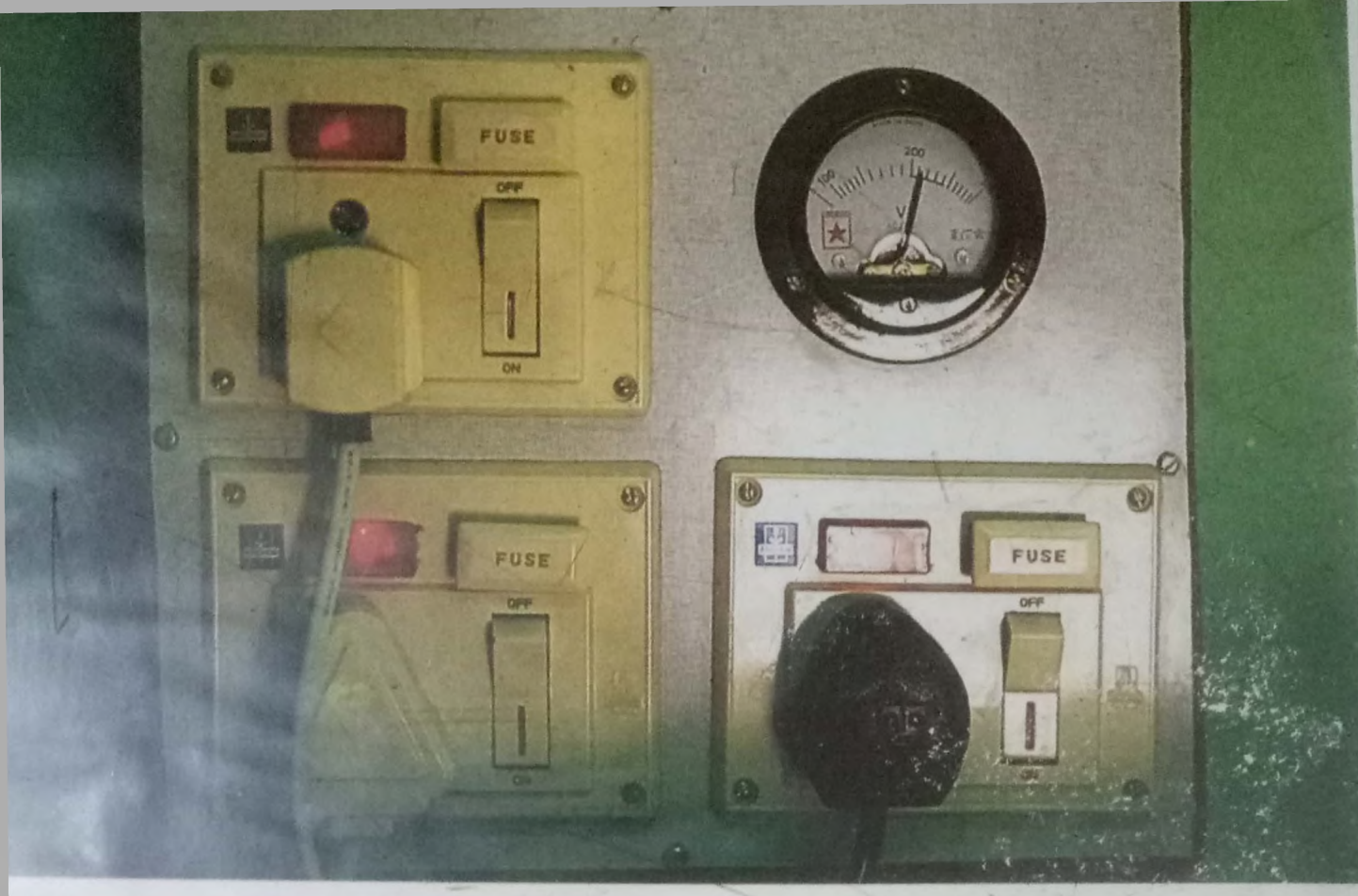
That was just a little bit about the machine and its accessories. Be careful when you set them up. Probably your teacher will do that for you the first time, but remember a few important tips as shown in the pictures on the facing page.

Remember the tips given above. When you switch on the monitor and the computer (do it in this sequence), you should



The computer connected to the monitor

The computer connected to the disc drive through a ribbon cable and a power cable



All electrical connections are made through a voltage stabilizer

hear two distinct sounds – each one characteristic of its unit. If you do not hear them, check your power supply. If the supply is found to be in order but still you do not get the sounds, there is reason to be worried. Talk to your teacher immediately.

It is important that you become familiar with the keyboard first and gradually pick up speed in using it. A part of the first program that your teacher will run for you should give you some training on the keyboard. Do not miss that. You shall still require a little more time to be able to use the versatile keyboard of your microcomputer.

However, if everything goes right for you while setting up the machine, you should find the following message on the upper-left corner of the monitor:

BBC Computer 32K
Acorn DFS
BASIC
>_

32K has something to do with the internal storage capacity or memory of the computer. You shall know more about that from your teacher. Do not worry if it does not appear on the screen. Sometimes it does not.

Acorn is the name of the manufacturer. DFS stands for DISC-FILING SYSTEM. This, again, may or may not appear on the screen.

Tells you that the machine is waiting for your instructions.

>_ (Called *Flashing Cursor)* says where on the screen your instructions would appear.

BASIC is one of the computer languages. It stands for BEGINNER'S ALL–PURPOSE SYMBOLIC INSTRUCTION CODE. This is the language that your machine understands at the moment although it is possible for it to understand others.

We do not really expect you to believe that the computer is a stupid machine. But it really is; it cannot do anything on its own. To make it obey instructions, you have to give it the right commands. Only then will the computer obey you. These sets of commands are called programs.

Programming, however, is a very specialized job. Do not worry a bit. You do not have to be a programmer in order to be a user of the computer.

You will have nearly 60 hours, spread over 30 weeks, for using the computer in the school. We know that you would like to have more time with the machine. But during those 60 hours, you would have hands-on experience in three phases:

Phase I	1. Welcome package
	2. Microprimer
	3. A turtle graphic package
	4. CBL packages (COMPUTER BASED LEARNING PACKAGES)
Phase II	5. A data base package
	6. A word processing package
	7. CBL packages
Phase III	8. A teletext emulator package
	9. CBL packages

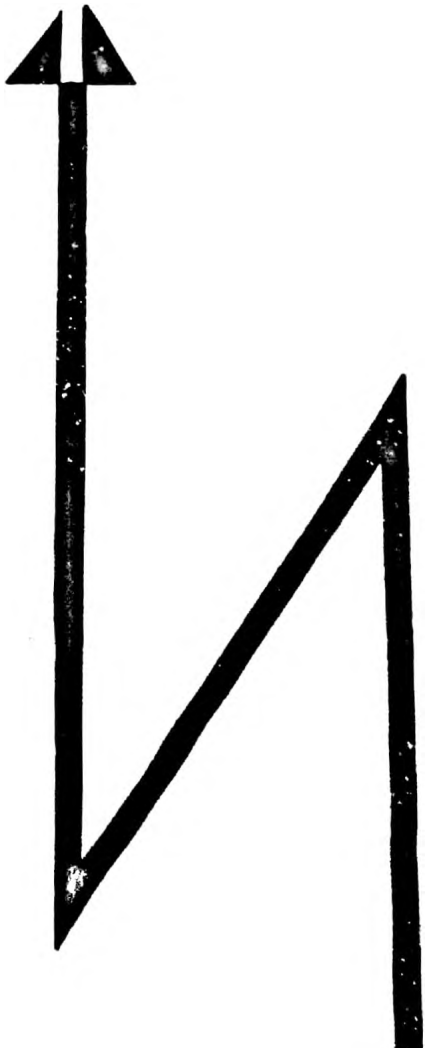
Do not worry! Nobody is going to lecture on those unfamiliar items listed above. There would be demonstrations, discussions

and a lot of time for you to see for yourself what those modules have to offer. You are not familiar with them now. So we shall briefly tell you what they are all about.

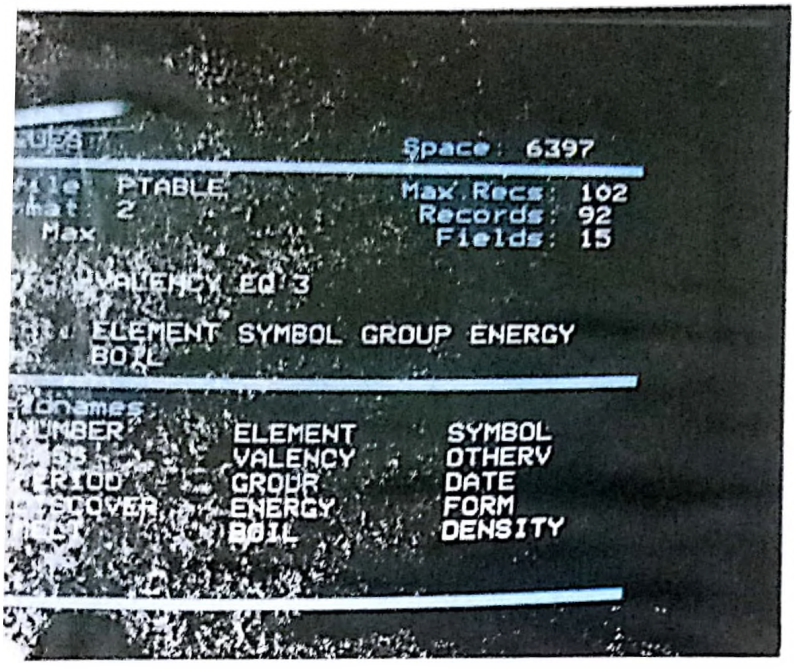
An introductory package (comprising a tape/disc and a booklet) offers programs which range from simple exercises to games, music, colour, and what have you. Rehearse on them thoroughly and make yourself fluent with the keyboard (there is a program for just that). Programs in the introductory package are actually meant for the demonstration of what the micro can do.

Turtle graphics is another computer language. You can learn through this language, which is very simple, to control the micro so that it draws for you pleasing pictures or difficult geometrical drawings, whichever you want to draw. You will need to know some of the drawing commands but they are not many and none is difficult.

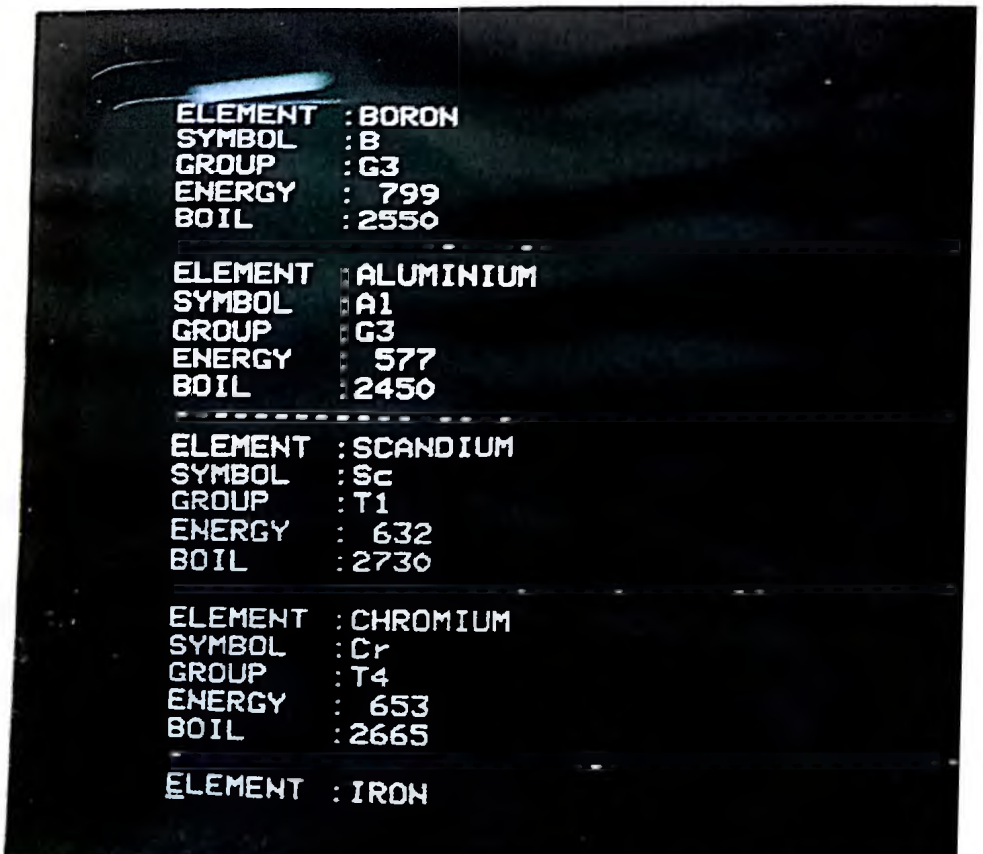
FORWARD 100
LEFT 45
FORWARD 60
RIGHT 45
FORWARD 100



Probably three-quarters of all computer uses are related to looking at information, exploring it, investigating it, doubting it, forming links and making connections. That is precisely what a data base package is all about. Some information files are provided in the package, but you are encouraged to make your own data files using the package and then carry out investigations on them.



You make a query

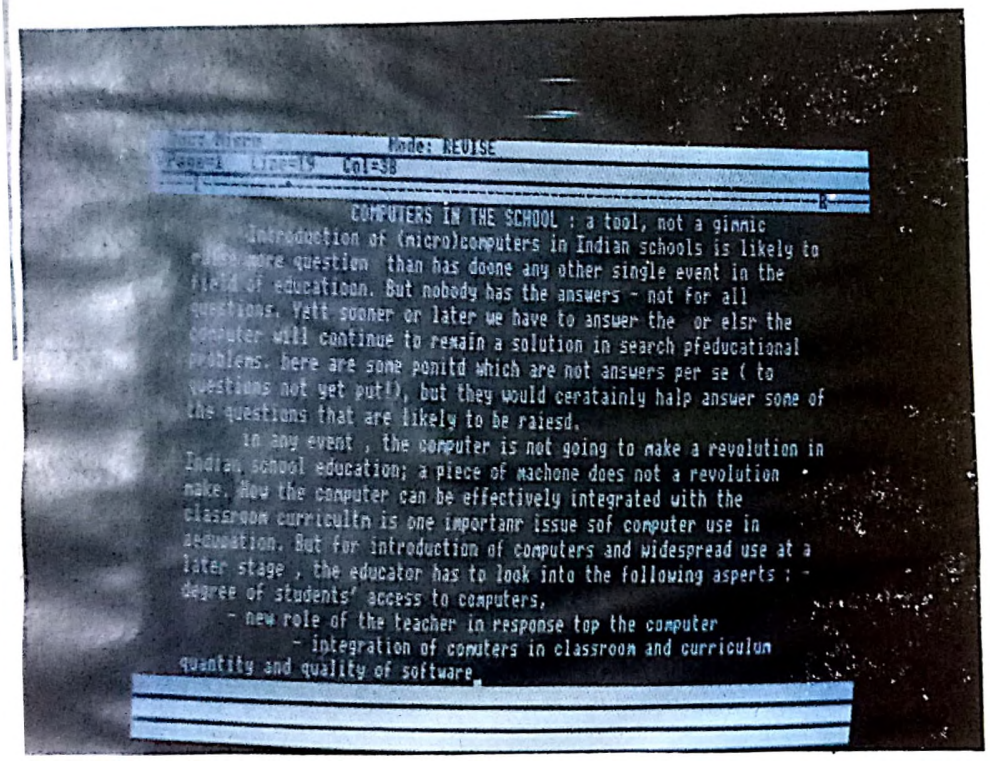


Here is the answer!

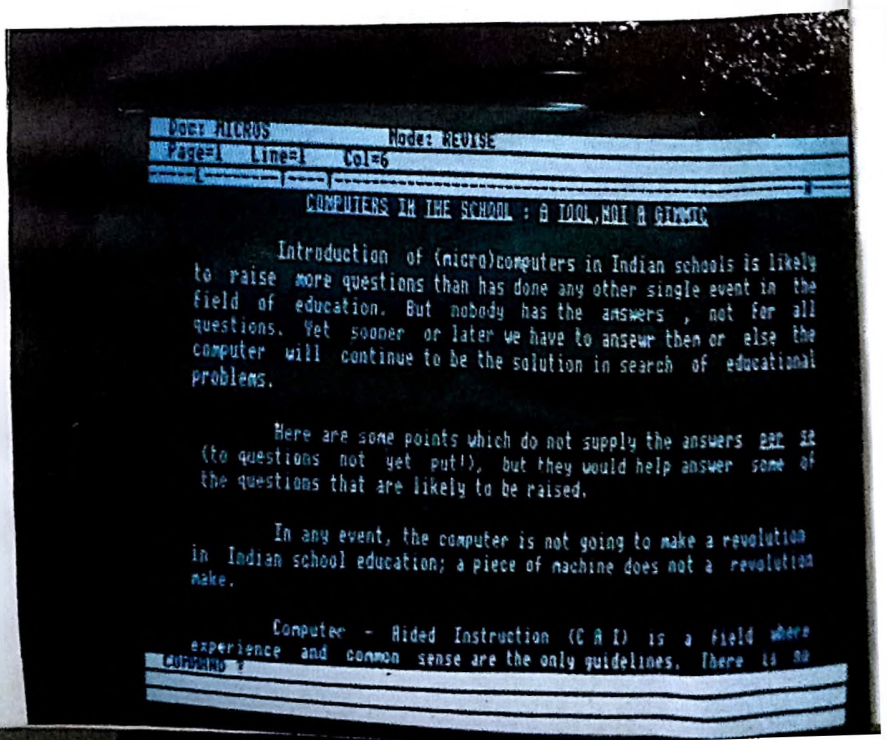
A word processor package allows you to create a document on the screen and to edit it when it is being created or as often as you choose afterwards.

It is no more difficult to use a word processor than a typewriter. Many of us who struggle to express ourselves in writing can prepare an initial draft which is edited and re-edited until we are happy about the piece of writing. A word processor package facilitates this process.

Before .....



..... and after editing a text.



EDFAX is a teletext emulator. Teletext is a new communication medium through which information is broadcast alongside other TV programmes in the United Kingdom, as a supplementary service to viewers who have appropriately modified TV sets. The content of teletext is varied — news, weather, sports, entertainment, and what have you! Edfax provides a simulation of teletext. It is not fun alone, however. Through it, you can quickly display any one of upto 80 screen-pages or create and edit your own pages of information. In your classroom, Edfax can be used in many different subject areas such as art and design, language and communication.

Of special interest to you may be the CBL packages (a disc, a booklet for your teacher and activity sheets for you). Ideas or concepts on different subjects are presented in such a way that instead of being passive listeners of what others say about those ideas, you can interact with the computer, change data, alter parameters and see how various components in a given idea interact with each other. There are many such CBL packages on many subject areas. We believe learning will be very different and full of fun through these CBL packages. Old ideas assume new meanings when you interact with them, through models and simulations.

Computers have much more to offer you. They can change your learning style, they can enhance your intellectual skills and they can be a lot of fun.

What you have just gone through gives you glimpses of the CLASS project. The BBC Micro (Model B), which you have just seen and are going to love to use, is a very powerful machine. There are not very many schools, other than yours, who have this computer. Your teacher has undergone long and patient training just for you to be able to use the computer and learn through it. Before long, many more schools will have their own computers, just as you have yours. As the National Resource Centre for the CLASS project, the National Council of Educational Research and Training (NCERT), New Delhi, will be ever ready to help you, should you require any help from us.

Computers are coming. Their present role in our country is confined to scientific research and business. But before you graduate from college, computers are going to be far more widely

used, in almost every sphere of life – payroll and personal records, stock control and sales, insurance and stockbroking, industrial management, space technology, metereology, communication, transportation, traffic control, libraries and museums.

Can you afford to remain computer-illiterate?

PART II

The BBC Microcomputer and Its Accessories

The BBC Microcomputer and Its Accessories

The BBC microcomputer and its accessories consist of: 1. Keyboard, 2. Monitor, 3. Cassette tape recorder, 4. Discette drive, 5. Printer.

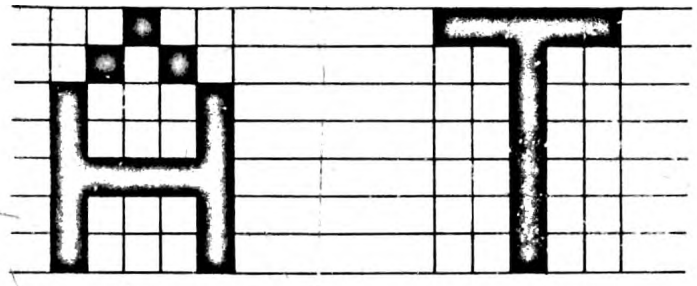
1. Keyboard

The BBC microcomputer keyboard character positions are similar to any standard typewriter. However, there are a number of special keys which need to be mastered. The operation of the keyboard is explained in detail later. The keyboard can be broadly defined as a device for entering data by key depression which causes the generation of selected code elements.

Thus it is a device which converts the readable instructions or characters to corresponding machine-readable codes for these characters.

2. Monitor

The monitor (CATHODE RAY TUBE–CRT) is a colour display consisting of rows and columns of elements. Alphanumeric characters are formed in *dot-matrix elements*. (Please see sketch on the next page). Multiple elements can often be combined to form larger symbols.



A 5×7 dot matrix printing pattern displaying A and T

i. The brightness of the CRT screen should be adjusted to a comfortable level for the operator using the corresponding CRT control knob (behind the monitor).

ii. The monitor should be installed for convenient viewing on a desk, a table, or a special stand just behind the keyboard

iii. The keyboard should be placed at a level that is lower than that of a conventional desk or table. The combination of chair and keyboard heights should be carefully selected and adjusted.

iv. The screen should be kept clean for good vision and the keys should be kept dust-free in order to ensure good contact and to prevent dust accumulation on the printed circuit board underneath the keyboard.

v. Naturally, shocks and vibrations should be avoided as they may dislodge screws or even the power supply inside the keyboard.

vi. In order to prevent overheating, make sure that the air intake and exhaust slits are never obstructed.

vii. Press the keys gently and carefully. Very light pressure is required to get the data entered on the screen from the keyboard.

viii. Make sure that the computer is switched off before cleaning the screen. Use a dry, soft cloth for cleaning. Do not use an alcohol pad or any other organic compound as these could damage the screen and the adjacent area.

ix. Do not attempt to remove the cover of the computer.

x. Care should be taken to see that no liquid or article falls on the keyboard, as there is a danger of short circuit.

xi. If by mistake a metal object or any liquid gets inside the monitor or keyboard, immediately turn it off and call a CMC (COMPUTER MAINTENANCE CORPORATION) representative.
xii. Each of the units should be switched off before switching off the main.
xiii. Before leaving the computer room all the switches should be checked to see that they are in the 'OFF' position.
xiv. Cover the unit to protect it from dust.

3. Cassette Tape Recorder

A cassette is a self-contained package of reel-to-reel blank or magnetic tape for recording computer input signals.

A cassette tape recorder is a device used to read data stored on the cassette tape and write data to it.

Loading a Program from Cassette

Loading a program back into the computer is just like playing a particular piece of music which has already been recorded on the cassette.

i. Type
LOAD "file name"

Note: *"File name" is the name of the program given while saving it. e.g., LOAD "MY FILE"*

Then press the RETURN key. The message "Searching" will appear.
ii. Rewind the cassette to just before the start of your program.
iii. Start playing the cassette by pressing the PLAY button on the recorder.

When the computer finds the program it is looking for, it will print "Loading" to let you know that it is now loading the right program.

When it finishes loading the program it will show the prompt (>). It will also automatically stop the tape if you have automatic motor control; if not, then you will have to stop the tape manually.

Recording Programs on Cassette

You are familiar with the music cassette. When you like a song, you record it on the cassette and then you play the cassette whenever you want — the song remains there. If you don't want a particular song you record another song at the position of the first song.

In a similar way, computer programs can be saved on the cassette and used whenever wanted. You are quite familiar with the problems regarding music recording. You might want to overwrite one piece and by mistake you overwrite some other piece just because you forgot where the particular piece of music was recorded on the cassette. This problem can be avoided by spreading the programs out over the length of the cassette, leaving sufficient gap between two programs so that they are easy to find and are unlikely to overlap each other. It is advisable to use the tape counter* and maintain a catalogue giving the starting counter position of each program.

Saving a Program on a Cassette

i. Insert the cassette into the recorder.
ii. Set the tape counter to 'zero' when the tape is fully rewound.
iii. Type
SAVE "file name"

Note: *A file should have at the most a 10 character name given to the program to be saved, e.g., SAVE "MY FILE".*

Press the RETURN key.

iv. The message "RECORD then RETURN" will appear.
v. Fast forward the cassette to the place where you want to record the program.
vi. Press the RECORD button on the cassette and then the RETURN key. If you want to give up at any time, press the ESCAPE key.

Checking a Recording

You can use * CAT command to check whether your recording is successful or not.

4. Discette Drive

Each discette is a small (about five inches diameter) plastic disc coated so that information may be stored on and erased from its surface. The coating is similar to the magnetic coating on a recording tape. The discette is permanently sealed in a square,

*A device in the cassette recorder which records the positions of the programs taped.

black, plastic cover which allows it to move freely.

The term 'floppy' comes from the fact that the discette is flexible. Older computer information storage devices that worked on similar principles used rigid discs, while the discette (and its plastic cover) are somewhat flexible. Bending the discette can damage it. The discette cover contains both lubricants and cleaning agents to extend trouble free operation.

To LOAD and SAVE programs on a discette use the same commands as for a cassette.

Care of Discette

i. Rough handling, such as dropping the drive or having things dropped on it, can cause it to malfunction.

ii. The drive should not be placed beside or on the TV set, since the strong magnetic fields put out by the TV may cause damage to the magnetic properties of the drive. Locate disc drives at least two feet from the TV set.

iii. Bending the discette can damage it.

iv. Never let anyone touch the brown or gray surface of the discette itself. Handle it by the black plastic cover only.

v. When the discette is not in use, keep it in the paper packet that it came in. These packets are specially treated to repel dust.

vi. It is best to store discettes vertically when they are not in use. Vinyl note books, especially made for this purpose, are convenient.

vii. A discette can hold a huge amount of information; a single discette holds over 1,146,000 bits of information. An individual bit of information, therefore, occupies a very small portion on the discette. An invisible scratch on the surface of the discette or even a finger print can damage a discette.

viii. Do not place discettes on a dirty or greasy surface.

ix. To write on a discette label, use a felt-tip pen. Do not press hard. It is best not to write on a label attached to a discette, but to write on a separate label then affix it to the discette.

x. Keep the discette away from magnetic fields. This means you should keep it away from electric motors and magnets. It should not be placed on top of electronic devices such as television sets, etc.

xi. Discettes are sensitive to extremes of temperature. Keep the discettes out of the sun, and away from other sources of

heat, that can cause them to warm up and/or lose data.

Inserting and Removing Discettes

Using a disc drive is easier than using a cassette recorder; however, care is necessary to protect the discettes. The drive itself must also be handled with some care.

i. The drive is opened by pulling the shutter out.
ii. The discette is then slipped into the site with the label upward.
iii. The edge of the discette with the oval cut-out in the discette's square plastic cover should enter the drive first. The edge of the discette with the label should enter the drive last.

A good rule of thumb: Hold a discette with your right thumb over the label. This ensures the correct orientation when you put the discette in the drive.

iv. Push the discette gently until the discette is entirely into the drive. Do not bend the discette. If it is pushed too hard, the discette can be permanently damaged.
v. Close the drive door by pushing the shutter down again.
vi. A discette is removed by opening the drive door and pulling the discette carefully out of the drive. The act of opening the door lifts the 'head' of the disc.

Never remove the discette while the drive is in use. (i.e. when the red light is on). This may permanently damage the discette, and is almost sure to destroy the information on it.

5. Printer

The printer is simply an output device for displaying computer data. It generates printed characters on a piece of paper. Its main advantage is that it has a very high printing speed. Another advantage is its ability to print multiple copies.

DOs

1. The computer peripherals are expensive pieces of instruments and due care of these will have to be taken by all those who use them.
2. The keyboard, the monitor, the disc drive and the printer should be placed on top of a table/cabinet and the area should be free from dust, direct sunlight and direct heat.

3. The equipment should be wiped with a dry, soft, clean cloth daily. The cleaning should be done when the peripherals are switched off.

4. If the computer or the printer are not to be used for some time, please switch them off.

5. When switching on your computer or printer, ensure that you are in visual contact with the equipment. If you observe any sparks/smoke or any unusual feature, switch off the computer immediately and inform CMC.

6. While switching on your terminal please ensure that the following procedure is strictly followed:
   i. Switch on the keyboard and monitor.
   ii. After adjustment the output on the monitor should be clear and should not strain the eyes.

7. Cover your system with a matric cover after using it. This will protect the system from dust.

8. All the switches should be checked to ensure that they are switched off before leaving the computer hall.

9. Check the voltage before you switch on the computer. The voltage should be in the range of 200 to 230 volts.

10. Keep the discette in the appropriate paper cover provided. Store it in the vertical position.

DON'Ts

1. Do not change the position/location of the computer or the printer yourself. Please call the concerned person. The system's engineer will come and help you in changing the position/location.

2. Do not tamper with the power socket to which your computer/printer is connected. Ensure that the power supply cord is never stretched tightly. Also ensure that no other connections are fixed to the same power socket.

3. Do not attempt to remove the cover of the components.

4. Do not touch any of the cables connected to the back of your computer/printer.

5. Do not use an alcohol pad or abrasive compound, as these could damage the screen and adjacent areas.
6. Do not let any liquid or other article fall on the keyboard as there is the danger of short circuit. Particular care will have to be taken not to drop pins and clips on the keyboard.
7. Do not bang on the keys when working on the keyboard.
8. Do not allow the printer to run out of computer paper when the printer is in use.
9. Do not keep any scribbling pad/register/forms over the computer. This would cover the vent holes and not allow air circulation for the internal components.
10. Do not switch on the main switch unless you have checked whether the keyboard, monitor and printer are switched off. This will prevent the damage that can be caused by sudden voltage rise.
11. Do not leave the discette in the drive while it is not in use.

HAVE FUN!

PART III

Computer Glossary

Computer Glossary*

ALGORITHM: A prescribed set of well-defined processing rules for the solution of a problem in a finite number of steps.

ALPHABETIC: The set formed by the letters of the alphabet and special characters like period, comma, asterisk, etc.

ALPHANUMERIC: A general term for alphabetic letters (A to Z), numerical digits (0 to 9), and special characters (−, /, *, $, (,) ' +, etc.) that are machine-processable.

ARITHMETIC LOGIC UNIT (ALU): It is the portion of the hardware of a computer that performs the mathematical and logical operations. It is a basic element of the central processing unit.

ANALYSIS: The methodological investigation of a problem by any one of the consistent, systematic procedures.

APPLICATION PROGRAMS: The programs normally written by the user organisation that enable the computer to produce useful work; for example, inventory control, payroll, general ledger, class results processing, etc.

ARRAY
(1) A series of related items.
(2) An ordered arrangement or pattern of items or numbers, such as a determinant, matrix, vector, or a table of numbers.

AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE (ASCII): Pronounced 'asskey'. A seven-bit standard code adopted by computers to represent characters. For example, in ASCII code, '2' is '0110010', 'A' is '1000001' and '$' is '0100100'.

ASSEMBLER: A computer program that takes symbolic language instructions prepared by a computer user and converts them into computer readable

* *It is not intended that the reader should learn the contents of this glossary but that they should use it as a reference guide.*

instructions or machine language.

ASSEMBLY LANGUAGE: A programming language that allows a computer user to write a program using symbolic instructions. It is a low-level symbolic programming language that closely resembles machine code language.

BACKUP: Procedures or equipment that are available for use in the event of failure or overloading of the normally used procedures or equipment.

BEGINNER'S ALL-PURPOSE SYMBOLIC INSTRUCTION CODE (BASIC): It is a higher-level computer programming language. BASIC has a small set of commands and simple statement formats. BASIC is thus widely used in programming, instruction, in personal computing and in business and industry.

BATCH PROCESSING: A technique by which programs that are to be executed are coded and collected together into groups for processing in groups or batches. The user gives the job to a computer centre where it is put into a batch of programs and processed, and then the data with the output are returned. The user has no direct access to the machine.

BAUD: It is the number of bits of data transmitted in one second. The unit of baud is one bit per second.

BINARY:It is the number system with a power of 2, or numbering system which uses only the digits 0 and 1.

BINARY ARITHMETIC: A mathematical numeration system equivalent to our decimal arithmetic system but involving only two digits: 0 and 1.

BINARY DIGIT: Either of the characters 0 or 1. Abbreviated – *bit.*

BIT: A binary digit; a digit (0 or 1) in the representation of a number in binary notation. Several bits make up a *byte* or a computer word.

BLACK BOX: An electronic or mechanical device that alters input signals in a predictable manner but whose inner workings are often a mystery to the user.

BUG: A term used to denote a mistake in a computer program or system or a malfunction in a computer hardware component.

BUS: A channel or path for transferring data and electrical signals. A bus structure would consist of a circuit which carries data or power.

BYTE

(1) A grouping of adjacent binary digits operated on by the computer as a unit. The most common-size byte contains eight binary digits.

(2) A group of binary digits used to represent a single character.

CARD READER: An input device that reads information punched into cards. The information read is transferred into the computer's memory.

CASSETTE: A small plastic cartridge containing one-eighth-inch magnetic tape for use in cassette recorders.

CASSETTE RECORDER: A device designed to use cassettes to record and store digital data and, at a later time, reload this data into the computer's internal storage. It is used widely with microcomputers.

CATHODE RAY TUBE (CRT): An electronic tube with a screen upon which information may be displayed.

CENTRAL PROCESSING UNIT (CPU): The component of a computer system with the circuitry to control the interpretation and execution of instructions.

CHAIN PRINTER: A typical high speed line printer in which the type slugs are carried by the links of a revolving chain or belt which is hit on the fly by a component hammer as the type moves across the paper.

CHARACTER: Any symbol, digit, letter, or punctuation mark stored or processed by computing equipment.

CHIP: A small, integrated circuit package containing many logical elements. A small piece of silicon impregnated with impurities in a pattern to form transistors, diodes, and resistors. Electrical paths are formed on it by depositing thin layers of aluminium or gold.

CIRCUIT: A pathway designed for the controlled flow of electrons. A system of conductors and related electrical elements through which electrical currents flow. A communication link between two or more points.

CLOCK

(1) A timing device that generates the basic periodic signal used to control the timing of all operations in a synchronous computer.

(2) A device that records the progress or real time, or some approximation of it, and whose contents are available to a computer program.

COMMON BUSINESS ORIENTED LANGUAGE (COBOL): A higher-level language developed for business data processing applications.

CODING FORM: A form on which the instructions for programming a computer are written. Also called a coding sheet.

COMMAND: A control signal, a computer instruction.

COMMAND LANGUAGE: A source language consisting primarily of commands capable of invoking a function.

COMPILER: A computer program that produces a machine language program from a source program that is usually written in a higher-level language by a computer user.

COMPUTER: A device capable of solving problems or manipulating data by accepting data, performing prescribed operations (mathematical or logical) on the data, and supplying the results of these operations.

COMPUTER-ASSISTED INSTRUCTION (CAI): (Also called Computer Aided Instructions) The use of the computer to augment individual instruction by providing the student with programmed sequences of instructions under computer control. The manner of sequencing and progressing through the materials permits students to progress at their own rate. CAI is a response to the individual need of the student.

COMPUTER LITERACY: The non-technical study of the computer and its effect upon society. It is an important area in computer education as it provides the student with some of the knowledge, tools and understanding, necessary to live in a society which is going to be dominated by computers.

COMPUTER PROGRAM: The series of statements and instructions that cause a computer to perform a particular operation or task.

COMPUTER PROGRAMMER: A person skilled in the preparation of programs for a

computer. A programmer designs, codes, debugs, and documents computer programs.

COMPUTER SCIENCE: The field of knowledge embracing all aspects of the design and use of computers.

COMPUTER SYSTEM: The physical equipment and instructions, that is hardware and software, used as a unit to process data. It includes the CPU, its operating system and the peripheral equipment, like printer, disc drive, keyboard, etc., and programs.

CONSOLE: The part of the computer system that enables the operator to communicate with the system.

CONTINUOUS FORMS: Paper that is used on printers and accounting machines. This paper can be blank or it can be any type of preprinted form as long as the small holes are on the outer edges of the form. The holes are used by the equipment to advance the paper line-by-line.

CONVERSATIONAL LANGUAGE: A programming language that uses a near-English character set that facilitates communication between the user and the computer. BASIC is an example of a conversational language.

DATA: A formalized representation of facts or concepts suitable for communication, interpretation, or processing by people or by automatic means.

DATA BASE: The collection of all data used and produced by a computer program. In large systems, data base analysis is usually concerned with large quantities of data stored in discs and tape files. Smaller microcomputer systems are more frequently concerned with data base allocations of available memory locations between the program and data storage areas, also known as dat bank.

DATA PROCESSING

(1) One or more operations performed on data to produce desired results.

(2) The functions of a computer centre.

(3) A term used in reference to the operation performed by data processing equipment.

DEBUG: To detect, locate, and remove all mistakes in a computer program and any malfunctions in the computing system itself.

DELETE: To remove or eliminate.

DEVICE

(1) A mechanical or electrical unit with a specific purpose.

(2) A computer peripheral.

DISCETTE: A floppy disc. A low-cost, bulk storage medium for microcomputers and minicomputers.

DISC PACK: A removable, direct access storage device containing magnetic discs on which information is stored. Disc packs are mounted on a disc storage unit, called disc drive.

DISPLAY: A visual representation of data (*i.e.*, lights or indicators on computer consoles, cathode ray tube, or diagram produced by a plotter).

DISPLAY UNIT: A device that provides a visual representation of data. These are the cathode ray tube, the line printer, and the plotter.

DOCUMENT

(1) A medium and the information recorded on it for human use(*e.g.*, a report, a book, a listing, etc.).

(2) A record that has permanence and that can be read by a person or machine (e.g., a floppy disc containing report data).

DOCUMENTATION: The preparation of documents, during systems analysis and subsequent programming, that describe such things as the system, the programs prepared, and the changes made at later dates.

DOT-MATRIX PRINTER: A printer that forms characters as a series of impact by a linear print head. The characters are formed by rearranging the matrix of dots.

DRUM PRINTER: A printing device that uses a drum embossed with alphabetic and numeric characters. A type of line printer.

EDIT

(1) To check the correctness of data.

(2) To change, if necessary, the form of data by adding or deleting certain characters. For example, part of program can edit data for printing, adding special symbols, spacing, deleting non-significant zeros, and so on.

ELECTRONIC DATA PROCESSING (EDP): Data processing performed largely by electronic digital computers.

ERROR: A general term referring to any deviation of a computer or of measured quantity from the theoretically correct or true value. (Contrast with fault, malfunction and mistake.)

EXECUTE: To run a program on the computer or to carry out an instruction.

FEEDBACK

(1) A means of automatic control in which the actual state of a process is measured and used to obtain a quantity that modifies the input in order to initiate the activity of the control system.

(2) In data processing, information arising from a particular stage of processing could provide a feedback to affect the processing of subsequent data; for example, the fact that an area of storage was nearly full might either delay the acceptance of more data or divert it to some other storage area.

FILE: A collection of related records treated as a unit.

FILE NAME: Alphanumeric characters used to identify a particular file.

FLOPPY DISC: A flexible disc (discette) coated with magnetic substance that is stored in paper or plastic envelopes. The entire envelope is inserted in the

disc unit. Floppy discs provide low-cost storage and are used widely with minicomputers and microcomputers. Floppy discs were originally developed for low capacity storage, low cost, and relatively low data transfer rates. Regular floppy discs have a diameter of 20.32 cm (8 inches), and mini floppy disc unit. Floppy discs provide low-cost storage and are used widely with minicomputers and microcomputers. Floppy discs were originally developed for low capacity storage, low cost, and relatively low data transfer rates. Regular floppy discs have a diameter of 20.32 cm (8 inches), and mini floppy discs have a diameter of 12.70 cm (5 inches.).

FLOPPY DISC UNIT: A peripheral storage device in which data are recorded or read using floppy discs (discettes).

FLOWCHART: A diagram that uses symbols and inter-connecting lines to show:

(1) the logic and sequence of specific program operations (program flowchart), or

(2) a system of processing to achieve an objective (system flowchart).

FORMAT: The specific arrangement of data.

FORTRAN: An acronym for FORmula TRANslator. A higher-level programming language used to perform mathematical, scientific, and engineering computations.

GRAPHICS: Facilities to provide computer output in the form of displays, drawings, and pictures.

HARD COPY: A printed copy of machine output in readable form, for example, reports, listing, documents, or summaries.

HARD DISC: Storage disc made of rigid material. Hard disc devices can generally store more information and access it faster. Cost considerations, however, usually restrict their usage to medium and large scale applications.

HARDWARE: Physical equipment such as electronic, magnetic, and mechanical devices. (Contrast with software.)

HEAD

(1) Device that reads, records or erases data on a storage medium, for example, a small electromagnet used to read, write, or erase data on a magnetic disc.

(2) A special data item that points to the beginning of a list.

HEADER RECORD: A record containing constant, common, or identifying information for a group of records that follow.

HEXADECIMAL: Pertaining to a numeral system with a radix of 16. Digits greater than nine are represented by letters of the alphabet. For example, the binary numeral, 1110001011010011 can be represented as hexadecima F2D3.

HIGHER LEVEL LANGUAGE: A programming language oriented towards the problem to be solved or the procedures to be used. (Contrast with machine language.)

IMPLEMENTATION

(1) The process of installing a computer system. It involves choosing the equipment, installing the equipment, training the personnel, and establishing the computer centre's operating policies.

(2) The representation of a programming language on a specific computer system.

INPUT: The introduction of data from an external storage medium into a computer's internal storage unit. (Contrast with output.)

INTERACTIVE SYSTEM: A system in which the human user or device serviced by the computer can communicate directly with the operating program. For human users, this is termed as a conversational system.

INTERFACE: A common boundary between two pieces of hardware or between two systems.

I/O: Abbreviation for input/output.

K

(1) Abbreviation for kilo or 1000 in decimal notation. For example, "100 K ch/s" means "a reading speed of 100,000 characters per second".

(2) Loosely, when referring to storage capacity, two to the tenth power; in decimal notation 1024. The expression 8 K represents 8192 (8 times 1024).

KEYBOARD: A group of marked levers operated manually for recording characters.

KILOBYTE: A kilobyte is 2^{10} or 1024 bytes. It is commonly abbreviated to "K" and used as suffix when describing memory size. Thus, 24 K really means a 24 x 1024 = 24,576 byte memory system.

LANGUAGE: A set of rules, representations and conventions used to convey information. (See programming language).

LINE PRINTER: An output peripheral device that prints data one line at a time.

LOAD

(1) To read information into the storage of a computer.

(2) To put cards into a card reader, to put a paper tape into a paper tape reader, or to put a disc pack on a disc drive unit.

LOGIC

(1) The science dealing with the formal principles of reasoning and thought.

(2) The basic principles and application of truth tables and the interconnection between logical elements required for arithmetic computation. An automatic computation in an automatic data processing system.

LOGO: A higher-level, interactive programming language that assumes the user has access to some type of on-line terminal. The language was designed for school students and seems particularly suited to students in the younger age groups.

MAGNETIC TAPE: A plastic tape having a magnetic surface for storing data in a code of magnetized spots. Data may be represented on tape using a six- or eight-bit coding.

MAIN STORAGE: The fastest general purpose storage of a computer (same as internal storage).

MAINTENANCE: Tests, adjustments, repairs, or replacements that keep hardware and/or software in proper working order.

MANAGEMENT INFORMATION SYSTEM (MIS): An information system designed to supply organizational managers with the information needed to plan, organize, staff, direct and control the operations of the organization.

MANUAL INPUT: Data entered manually by the computer user to modify, continue, or resume processing of a computer program.

MASTER FILE: A file containing relatively permanent information that is used as a source of reference and is generally updated periodically. (Contrast with detail file.)

MEGA: A prefix indicating million.

MEGABYTES: A million bytes.

MEMORY: The storage facilities of the computer, capable of storing vast amounts of data. (See auxilliary storage, floppy disc, internal storage, magnetic bubble memory, magnetic core storage, magnetic disc, magnetic drum, magnetic tape, PROM, RAM, ROM, semiconductor storage, and virtual storage.)

MENU: A set of options listed on a terminal; the user may select from the list those he/she desires.

MICROCOMPUTER: A complete small computer system, consisting of hardware and software. The main processing parts are made of semiconductor integrated circuits.

MICROPROCESSOR

(1) A simple computer on a single chip.

(2) The central processing unit of a microcomputer.

(3) An integrated circuit that will perform a variety of operations in accordance with a set of instructions. Microprocessors are used widely as the control devices for business machines, game machines, household appliances, automobile electrical systems, and microcomputers.

MINICOMPUTER: A digital computer that is characterized by higher performance than microcomputers, a more powerful instruction system, high in price, and a wide selection of available programming languages and operating systems.

MINI FLOPPY DISC: A 12.70 cm (5 inch) diameter disc used in a microcomputer system.

NUMERIC: Pertaining to numerals or to representation by means of numerals.

OBJECT CODE: Output from a compiler or assembler that itself is an executable machine code or is suitable for processing to produce executable machine code. It is also called object program.

OBJECT COMPUTER: A computer used for the execution of an object program.

OFF-LINE: A term describing equipment, devices, or persons not in direct communication with the central processing unit of a computer. Equipment that is not connected to the computer. (Contrast with on-line.)

ON-LINE: A term describing equipment, devices, and persons who are in direct communication with the central processing unit of a computer. Equipment that is physically connected to the computer. (Contrast with off-line.)

ON-LINE PROCESSING: Data processing involving direct entry of data into the computer or direct transmission of output from the computer.

OPERATING SYSTEM: An organized collection of software that controls the overall operations of a computer. The operating system does many basic operations that were performed by hardware in older machines, or that are common to many programs. It is available to the computer at all times by being held either in internal storage or on an auxilliary storage device.

OUTPUT

(1) Data transferred from a computer's internal storage unit to some storage or output device.

(2) The final result of data processing; data that has been processed by the computer. (Contrast with input.)

OUTPUT DEVICE: A unit that is used for taking out data values from a computer and presenting them in the desired form to the user. (Contrast with input device.)

PASCAL: A programming language that is of particular interest to computer scientists and is used increasingly for applications. PASCAL is a general purpose language with a simple but elegant syntax. It has been implemented on both large systems and microcomputers.

PERIPHERAL EQUIPMENT: The input/output units and auxilliary storage units of a computer system. The units are attached by cables to the central processing unit. Used to get data in and data out, and to act as a reservoir for large amounts of data that cannot be held in the central processing unit at one time. The card reader, typewriter, and disc storage unit are examples of peripherals.

PERSONAL COMPUTER: A microcomputer used in the home or office to perform a wide variety of tasks, including game playing, business calculations and to perform control functions.

PROGRAM

(1) A sequence of instructions that permits a computer to perform a particular task.

(2) A plan to achieve a solution to a problem.

(3) To design, write, and test one or more routines.

(4) Loosely, a routine.

PROGRAMMER: A person whose job is to design, write, and test programs and the instructions that get the computer to do a specific job. Also called computer programmer.

PROGRAMMING: The process of translating a problem from its physical environment to a language that a computer can understand and obey. The process of planning the procedure for solving a problem. This may involve, among other things, the analysis of the problems, establishment of input/output formats and testing and checkout procedures, allocation of storage, preparation of documentation, and supervision of the running of the program on a computer.

RANDOM ACCESS MEMORY (RAM)

(1) A memory chip used with microprocessors. It is the main memory of a microcomputer. Information can be written into and read out of this memory and can be changed at any time by a new operation, but the contents are lost when the power is shut off.

(2) Random access pertains to the process of obtaining data from, or placing data into storage (memory), where the time required for such access is independent of the location of the data most recently obtained or placed in storage.

READ: To get information from any input or file storage media, for example, reading punched cards by detecting the pattern of holes, or reading a magnetic disc by sensing the patterns of magnetism.

REAL TIME: Description of on-line computer processing systems that receive and process data quickly enough to produce output to control, direct, or affect the outcome of an ongoing activity or process. For example, in an airline reservation system, a customer's booking inquiry is entered into the computer to see if space is available. If a seat is booked, the file of available seats is updated immediately, thus giving an up-to-date record of seats reserved and seats available.

READ-ONLY MEMORY (ROM): Non-erasable, permanently programmed memory usually used to store monitors, I/O drivers, interpreters, or special application functions. ROM is very similar to RAM except for one feature. It is not possible to write into ROM memory as it is to write into RAM. When purchasing a ROM, the user must specify to the manufacturer exactly what is wanted in the memory. Programs stored in ROM are called firmware.

RUN: The single and continuous execution of a program by a computer on a given set of data. Also called execute.

SAVE: To store a program somewhere other than in the computer.

SOFTWARE: A set of programs, procedures, routines, and documents associated with the operation of a computer system. Software is the name given to the programs that cause a computer to carry out particular operations. The software for a computer system may be classified as application programs and systems programs. Contrast with hardware.

SOFTWARE HOUSE: A company that offers software support services to computer users.

SOFTWARE PACKAGE: A collection or set of related computer programs, often accompanied by printed materials which supplement the ideas in a computer program.

SOURCE COMPUTER: A computer used to translate a source program into an object program.

SOURCE LANGUAGE: The original form in which a program is prepared prior to processing by the computer; for example, a program written in FORTRAN or assembly language. (Contrast with object language.)

SYSTEMS ANALYST: One who studies the activities, methods, procedures, and techniques of organizational systems in order to determine what actions need to be taken and how these actions can best be accomplished.

SYSTEM SOFTWARE: The software used as development tools during the designing of application programs.

VARIABLE: A quantity that can assume any of a given set of values.