

# COMPUTER STUDIES

## ORDINARY LEVEL

### SYLLABUS

SECTION 1 - Background and development of information processing

SECTION 2 - Automatic information processing

SECTION 3 - The structure and organisation of digital computer software and hardware.

SECTION 4 - Theory and techniques of programming

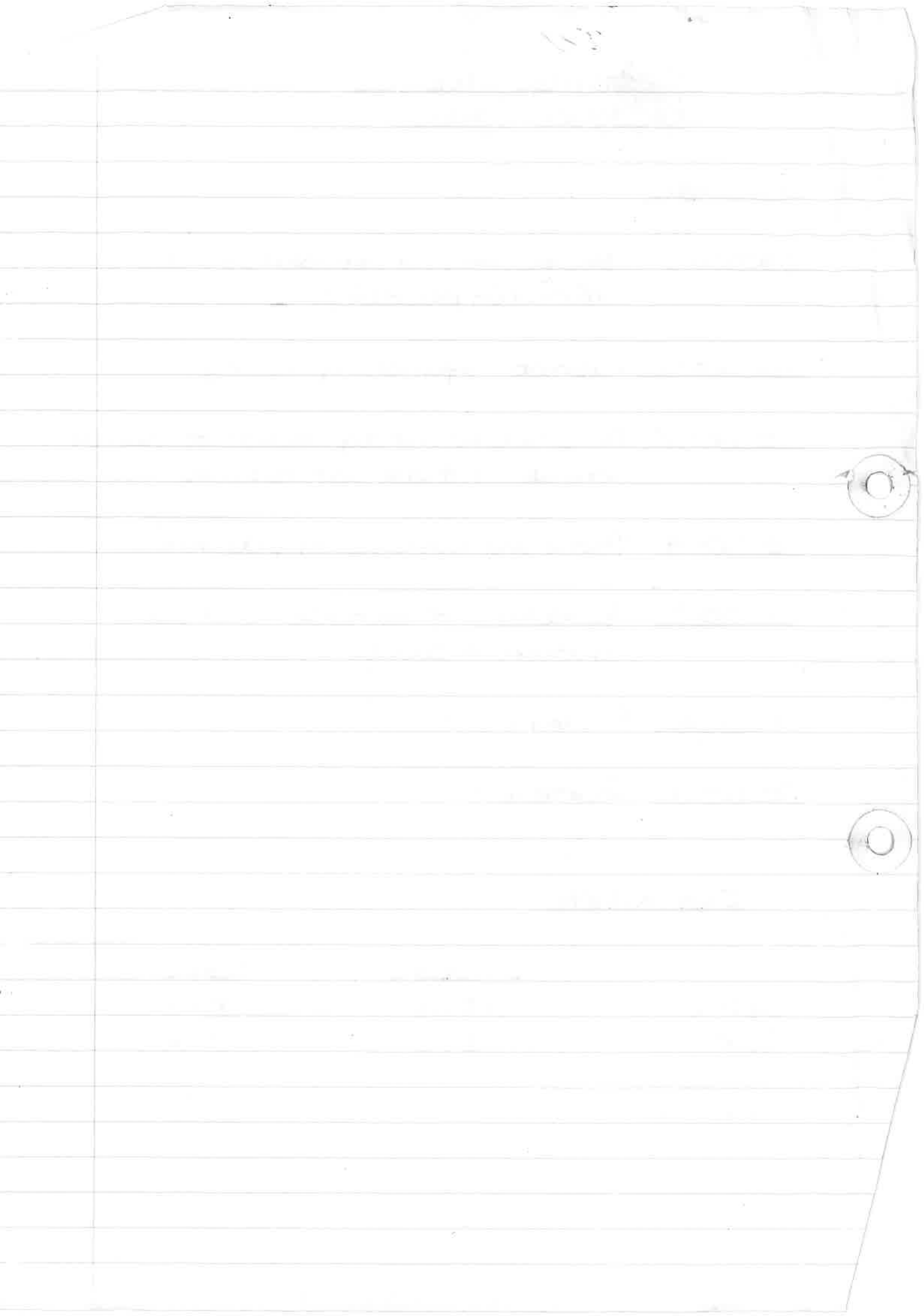
SECTION 5 - Applications of computer and their importance in society

SECTION 6 - Related topics

SECTION 7 - Coursework

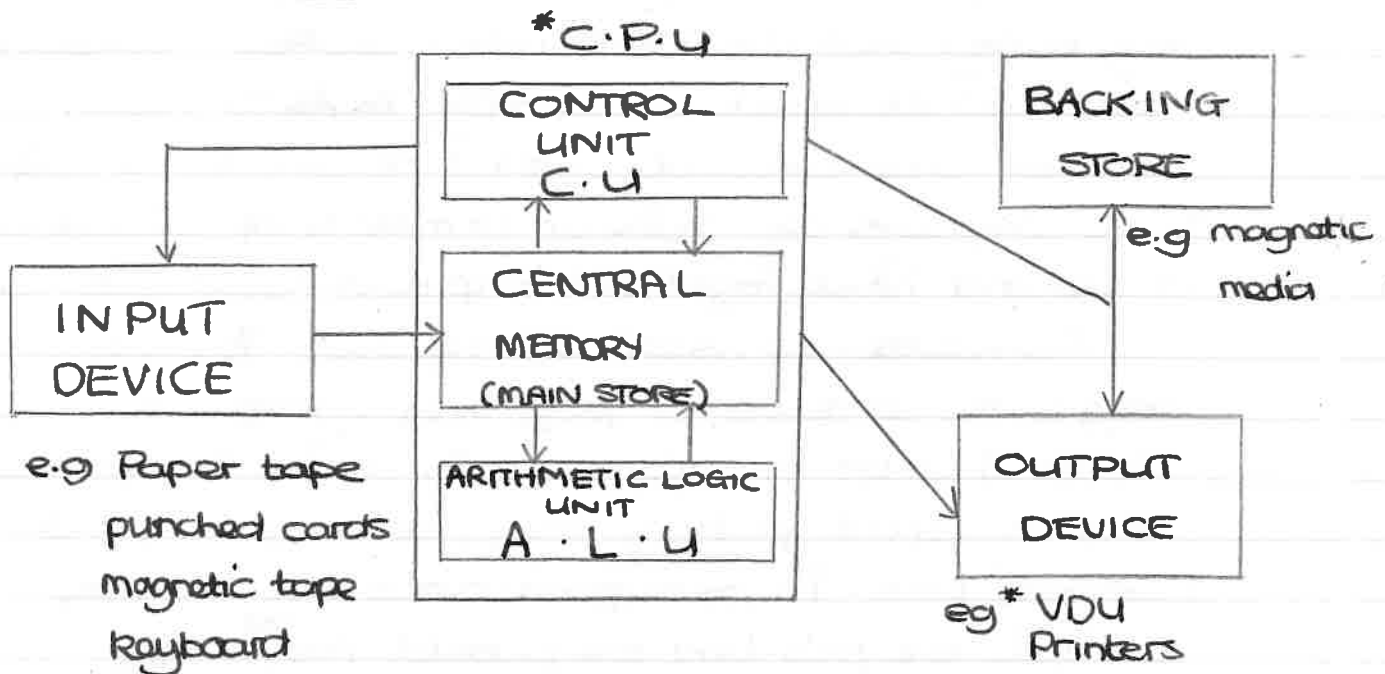
### EXAMINATION

	<u>Duration</u>	<u>Marks</u>
Paper 1	2½ hrs	40%
Paper 2	2½ hrs	40%
Coursework		20%



Computer ScienceIntroduction

Def<sup>n</sup>: A computer is an electronic device which can accept data, apply a series of logical operations and supply the results of these operation as information.

The main components of a computer system

\* C.P.U = Central Processing Unit  
V.D.U = Video Display Unit

Various types of information (data) can be entered into the main store via some input device e.g card keyboard. Once inside the main store information can be "fetched" and manipulated in the arithmetic logic unit under the control of the control unit.

Being of a fixed size the main store can be supplemented by auxiliary storage (backing storage) e.g disc tape. After manipulation the rearranged data can be displayed/output on some output device, e.g line printer or visual display unit (VDU.)

## The Advantages of using a computer and how computers help man.

The advantages of using computers are many. They are extremely accurate and have a consistent performance. They never get ill or depressed or have 'bad days,' the only thing that can go wrong is that perhaps it might break down. It is also very rarely that computers make mistakes. Computers add, subtract, divide, or multiply ~~multiply~~ much quicker than anybody with a pencil and a notepad. Some computers can make up to millions of calculations a second. People forget, but computers never can. *wireless power fails.*

Computers are used in video games. You can programme computer to play video games like Space Invaders and Pac-man. In a few Supermarkets and in Coventry Library they use computers with barcode pens. In ~~as~~ supermarkets the barcode tell you the price and the product. At <sup>the</sup> library in Coventry the barcode tells you what book it is and the computer stores the names of the people who have taken out the books. Computers can also be used to design cars, buildings etc, in business, eg insurance brokers use computers to hunt around and get you the best deal. Also it can be used in banking filing and accounts. Traffic lights, satellites, telephone exchanges, payroll, medical records, diagnosis and research in medicine can all be controlled by computer.

**BT** Computers can also be used in training people (e.g flight simulation). Physically and mentally handicapped people gain from computer games. They help them think and teach them to co-ordinate their hands and minds.

## SECTION 1

Shelley T Hunt page 189 Qs 2, 3, 4

- 2a) Herman Hollerith invented 80 column punched card. ✓  
b) Charles Babbage invented the Analytical Engine ✓  
c) Dr A.P Booth invented the magnetic drum ✓  
d) Howard Aiken invented Harvard Mark I. ✓  
e) Professor Maurice Wilkes invented EDSAC. ✓
- 3a) LSI = Large Scale integration ✓  
b) IBM = International <sup>at</sup> Business Machines Corporation ✓  
c) BASIC = Beginners All-purpose Symbolic Instruction Code. ✓  
d) VDU = Visual Display unit: ✓  
e) ICL = International Computers Limited. ✓
- 4a) Dr. von Neumann wrote a paper in 1945 on the design principles of the Digital computer. It had the concept of the stored program that would make the computer fully automatic ✓
- 4) Charles Babbage invented the Difference Engine and the Analytical Engine. The both performed addition, subtraction, division and multiplication, as well as other mathematical functions but the Analytical Engine also had a store to store up to 50 numbers, input on punched cards and output on metal plates for printing, but never got further than the design stage as, due to the accuracy of the engineering then, the parts could not be made. ✓
- e) Herman Hollerith invented the 80 column punched card and the tabulating machine, and also card punches readers and sorters. They were used to process census data in the USA in 1890. He founded the Hollerith Tabulating Company which helped to form part of IBM. ✓

9/2/84

## Development

### 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> generation computers

The main difference between first, second, and third generation computers is their circuitry. The first generation computer had circuits consisting of vacuum tubes and valves. These were slow and bulky. The central memory consisted of mercury delay lines, cathode ray tubes and magnetic drum. Input and output was via punched cards, paper and magnetic tape and printers.

The second generation began to use transistors and diodes and were faster and more reliable. The central memory was a magnetic core. Time sharing and multiprogramming was introduced. Input/output was via teletypewriter terminals, VDUs, OCR and MICR readers and also these methods used in first generation.

Third generation computers used integrated circuits and were faster and more reliable still. They used ECS (Extended Core Storage) and Key to tape / disk / cassettes and more high level languages such as PL/I, Basic, and Pascal are becoming available as well as Fortran, Algol, and Cobol introduced at the start of the second generation.

The period after the 1970s is generally termed as the late third generation. This is because there has been no completely new component introduced into computing. However components have become much smaller and much cheaper.

The ability to create microscopic integrated circuits etched onto 1 silicon chip has led to the microprocessor. Large Scale Integration (L.S.I) is the term used when many thousands of circuits are fitted onto one chip.

### Mainframe Computers

These are large computer systems capable of quickly handling the requirements of many different people. Together with a vast amount of other peripheral equipment, these computers form the largest installations. eg Universities or large

governments offices like the inland revenue

### Mini computers

These are medium sized computers found in businesses such as supermarkets and small banks. They are not as fast or powerful as the mainframe computers but are less expensive

### Microcomputer

These are small and relatively inexpensive. They are based on a microprocessor which is merely a silicon chip containing information necessary to run the C.P.U. Microprocessors are also found in washing machines, central heating systems, toys and games.

### Memory Types

#### ROM, RAM, PROM, EPROM

ROM is an abbreviation for Read Only Memory. This means that you cannot add to it or take from it, but just read it. It makes up the operating system of the computer and governs such things as graphics, and arithmetic and contains the Basic ~~to~~ interpreter or any interpreter to convert basic and other high level languages into low level languages, i.e. machine code. This memory remains intact when the power is switched off.

R.A.M stands for Random Access Memory. This may be added to or taken from at will. It contains the memory locations and this is where your program is stored. This memory does not remain intact when the power is switched off and everything in the RAM is lost. When we say a computer is 16K, 32K, 48K, 64K etc this is referring to ~~RAM~~ how many characters the memory can hold i.e. 16K = 16,000 characters. Basic takes up more memory than machine code.

PROM is programmable Read only memory. This is similar to ROM in that you cannot erase parts of the memory, but unlike

ROM it can be programmed using ultra-violet light, but this is then permanent and cannot be erased, even by turning off the power, but apart from the fact that it is programmable it behaves very much like a ROM.

EPROM (Erasable Programmable Read only memory) is one step further. Not only can this ROM be programmed by ultra violet light it can be erased and reprogrammed over and over again. The contents are not lost when the power is turned off, like a ROM. An EPROM is a bit like a cross between a ROM and a RAM, but needing ultra-violet light to program it.



# Development of calculating devices and information processing

- C500BC Abacus - a device consisting of beads strung on rods invented by the CHINESE and EGYPTIANS
- C100BC Number system based on base 10 using a 0 symbol invented by the HINDUS
- 1614 LOGARITHMS invented by John Napier as an aid to multiplication.
- 1617 Napiers bones a mechanical calculating aid for MULTIPLICATION and DIVISION
- 1632 SLIDE RULE invented by Rev. William Oughtred to perform multiplication and division.
- 1645 ADDING MACHINE invented by Blaise Pascal. It used counting wheels to perform addition.
- 1694 Calculating device invented by Von LEIBNIZ to carry out addition, subtraction, MULTIPLICATION and DIVISION.
- c1714 Typewriter designed by Henry Mill.
- 1805 Jacquard's loom invented by JOSEPH JACQUARD. Used punched cards to control the warp threads to enable complex patterns to be created.
- 1822 Difference engine invented by CHARLES BABBAGE who is known as the father of computing. Was designed to produce mathematical tables. It could compute many thousands of values without error and without human intervention.
- 1837 ANALYTICAL ENGINE also invented by Charles Babbage. Was a very significant step forward because it had:
  - (a) A mill to perform arithmetical operations
  - (b) A STORE to retain one thousand 50 digit numbers
  - (c) An input section using PUNCHED CARDS
  - (d) An output on to metal plates(c) A control device  
Unfortunately the device could not be built because the device was mechanical and needed too high a standard of engineering for that time. It is an important invention because .....
- 1837 Lady LOVELACE the first female programmer.
- 1890 Tabulating machine invented by HERMAN HOLLERITH for the processing of census data. It used PUNCHED CARDS as an input medium.
- c1930 Z1 the first program controlled computer designed by K. Zuse. Totally mechanical.
- 1943 Colossus an electronic computer used to crack secret codes during World War II. Main components were VALVES and the input medium was PUNCHED TAPE.
- 1944 Harvard Mark I Designed by HOWARD AIKEN. It was electronic and mechanical and was in use for approximately 15 years.
- 1945 Dr. John VON NEUMANN wrote a paper concerned with computer design and in particular the idea of a STORED program. This was important because IT WOULD MAKE THE COMPUTER FULLY AUTOMATIC.
- 1946 ENIAC Fully electronic. Used 18000 valves. It was invented for RESEARCH INTO BALLISTICS. The programs were part of the circuitry.

# Development of calculating devices and information processing

- 1948 Manchester Mark I. Important because it was the first electronic computer to USE A CRT (Cathode Ray Tube) memory system and stored programs
- 1949 EDSAC Built at Cambridge by M.V.W WILKES. Used MERCURY for storage and PAPER TAPE for input and output. DELAY SWITCHES
- 1951 Leo LYONS ELECTRONIC OFFICE. The first computer used in Britain for commerce. The first computer available commercially.
- 1951 First generation computers. Main characteristic is that they use VACUUM TUBES as opposed to relays or counting wheels. Majority of programming was done using MACHINE CODE and assembly language. Input and output was mainly by PUNCHED CARDS and PAPER TAPE.
- 1956 FORTRAN A HIGH level language introduced by IBM. FORTRAN stands for FORMULA TRANSLATOR. It is used mainly by SCIENTISTS and MATHEMATICIANS.
- 1959 Second generation computers. Characterised by their use of solid state components i.e. TRANSISTORS instead of valves. High level languages were used more frequently. Additional peripherals were introduced i.e. PRINTERS and MAGNETIC DISCS.
- 1965 BASIC A HIGH level language mainly used for instructional purposes. BASIC is an abbreviation for Beginners all-purpose symbolic instruction code
- 1964 <sup>4</sup> Third generation computers - Characterized by their use of INTEGRATED CIRCUITS. High level languages became extensively used. Operating systems became widespread. The advent of the mini computer. Magnetic DISC storage now being used extensively.
- 1966 MICR and OCR equipment invented. Abbreviations for Magnetic ink character recognition and Optical character recognition
- 1969 PASCAL A structured HIGH level language. Mainly used for education but used by some other organisations as well.
- 1969 L.S.I. LARGE SCALE INTEGRATION the development of circuits containing in excess of 10000 components on a single piece of silicon.
- 1970 Late third generation computers. Use LSI technology. Array processors. Super computers such as CRAY 1. Microcomputers. High speed new technology printers e.g. \_\_\_\_\_
- 1971 INTEL 4004 The first single chip microprocessor.  
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Microcomputers such as TANDY TRS80 and commodore PET introduced into high street shops.  
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Bubble memories - solid state backing storage