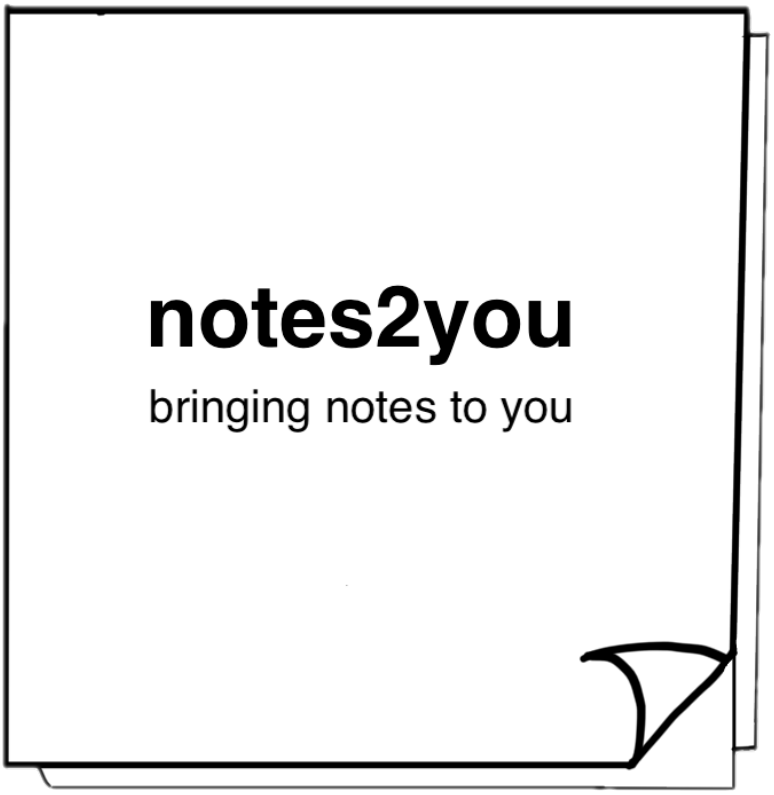
IGCSE COMPUTER SCIENCE



MADE BY KHUSHI MOTWANI

Lesson Objectives

- Able to convert binary to denary & vice versa
- Able to convert binary to Hexa & viceversa

Outcome

- Able to do binary & hexa Conv.
- Able to explore use of binary

B → D = x2

D → B = ÷2

H → D = x16 H → B → D

D → H = ÷16 D → B → H

B → H = group by 4

H → B = split by 4

Size of bytes.

binary digit = bit

8 bits = byte 1 always in multiple of 8 (16, 32)

1 kB = 2^{10}

1 MB = 2^{20}

1 GB = 2^{30}

1 TB = 2^{40}

1 PB = 2^{50}

↓ ↓

memory Size — No. of bits

#RRGGBB

F = Full colour

#FF0000 → Red

#00FF00 → Green

FF8000 → orange = Full red, half green

Hexa = 16

* Answer with example

→ Hexa

HTML = language

USES = Colour code in HTML

URL → Hexa = Represented % (ASCII CODE)

MAC Address → Address of NIC

Memory Dump

Media Access Control

Apple MAC

00-1C-B3

4F-25-FE

MAC Address

NN - NN - NN - DD - DD - DD

Name Comp (HD, Dell) | Serial no. ← of

MAC 48 bits

(most com)

Universally Administered MAC → not change

Locally Administered MAC → change. firewall formatt

binary uses

→ Commands

- when memory contents are output to a printer or monitor

- look at codes & find error

- Hexa more manageable

→ uniquely identifies device on inter

Also

Assembly codes & memory dump.

- Hexa - ~~earier~~ easier faster & less error prone

Communication & Internet technology

3 factors when considering data transmittion

- direction of transmition
- method of trans - how many bits
- method of sync

Direction.

- One direction (Sender to receiver) - Simplex Trans. ex. Comp to print
- both direction but not same time - Half Duplex Trans ex. walkie talkie, mail
- both directions, same time - Full Duplex Trans ex. phone

Bits

- Serial Trans - one bit at a time, single wire, long distance,
  ex. comp to modem. Slower because only one bit, bits sent one by one
- Parallel Trans - Several bits (1 byte), several wires, short distance
  using ribbon. comp to print. faster.

Sync.

- Asynchonoous data Trans - transmitted in one byte, control bits, slow
  - allows to know where data start & end
  - prevents data getting mixed up.
  - sent unevenly in time
- Synchronous Trans - continous stream of data, timing signals
  counts how many bits & assembles in byte
  Timings have to be accurate, faster

USB.

Standard method of Trans data. consists of (1) 4 wire shielded cable. (2) 2 wires for power & the earth (3) 2 wires for data Trans.
Asynchronous Trans. method

Benefits.

- Devices plugged automatically detected.
- connectors only fit one way.
- Support available to all users
- Several data trans rates supported

Drawbacks

- max cable length 5 m.
- rate is limited to less than 5 mb/s

Error checking methods.

1. Parity check
- way of checking whether data is changed or damaged.
- A byte of data is given a parity bit before transmission
- They have even parity or odd parity

2. ARQ - Automatic Repeat Request.
- uses acknowledgement & timeout
- If acknowledgement isnt sent before timeout the message is resent

3. Checksum.
- Data sent in blocks & checksum at end

max value = 255.

If checksum <= 255 ✓

If >255. then.

X = checksum

1. X ÷ 256 = 4.629
2. Round dow = Y = 4
3. Y x 256 = (1024) → Z
4. X - Z = checksum

④ Echo check

- data sent back to check
- Compares both datas
- IF error sent back to check
- IF correct then sent

Internet technologies

① ISP - Internet Service Provider

Provide user with access to internet

Monthly fee

Set up user account with username & password

② IP - Internet protocol

each device on internet has unique address called IP Address 32 bits

ex. 109.185.158.1

③ HTML

Structure includes meaning & mark up document

Prensentation is how it will look like

④ HTTPS hypertext transfer protocol

- Set of rules to be obeyed when transfering files on internet
- when there is security it becomes https.
- https is slower

⑤ Web browsers

- Software allowing to display webpage
- translates html codes

features - home page, favourites bookmark, history, go back & forward

web browser breaks URL : https://www.google.com/answer

protocol | web server name | web page

Lesson Objectives

→ To explore the ways of designing algorithm & flowchart

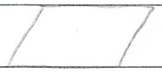
Outcome

→ Able to create flowchart for a given situation

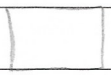
→ Able to explain the functions of each symbols

 → Start & End

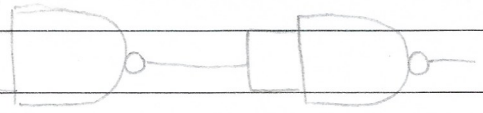
 → Decision

 → Input / output

 → Arrow

 → Process

AND



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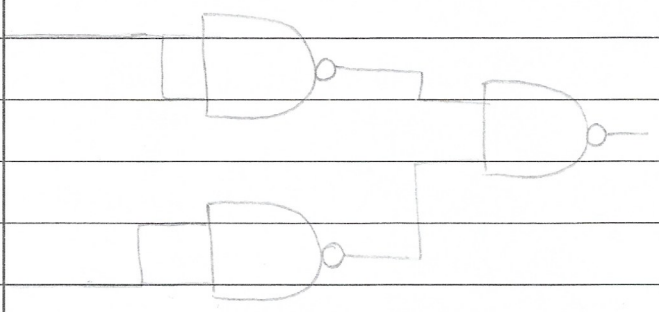
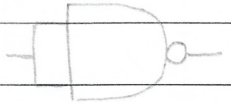


ONLY NAND →

NOT



Chapter 4

Operating systems - software running in the background of a computer system. Manages basic functions.

- ➔ Human computer interface
- ➔ Multitasking
- ➔ Multiprogramming
- ➔ Error handling
- ➔ Management of user accounts
- ➔ File utilities
- ➔ Processor management
- ➔ Memory management
- ➔ Security
- ➔ Input and output control

Operating systems examples: Windows, Linux, Android.

Computer starts up initiating programs are loaded into memory from ROM if there are no errors operating system is loaded into memory.

Interrupt – Signal sent from a device or a software to the processor.

Interrupt examples

- ➔ Paper jam in printer
- ➔ Notifications
- ➔ Software error

When the interrupt is serviced... the status of the current task being run is saved by a interrupt handler.

Buffers – is a temporary memory area. This essentially filled from he processor or memory unit while these are being emptied to the hardware device, the processor carries on with other tasks.

Used in streaming videos from the internet... ensures the video playback doesn't keep on stopping for data from the internet.

Computer architecture also known as **Von Neumann Architecture**

His idea was to hold the programs and data in a memory so the data would then be moved between the memory unit and the processor.

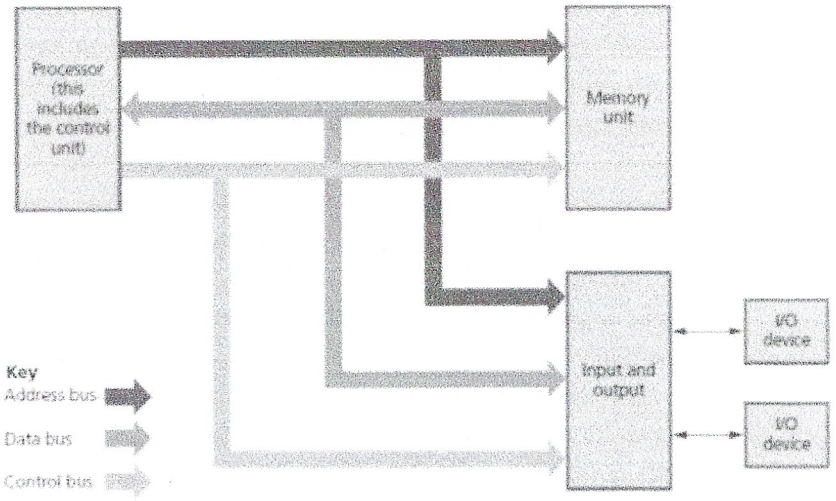


Figure 4.3

Address buses	Carries address from the processor to the memory and Input output devices	Unidirectional
Data buses	Carries data between processor. Memory units and input output devices	Bidirectional
Control buses	Carries the signal of read or write from the processor to the memory and Input output devices	Unidirectional

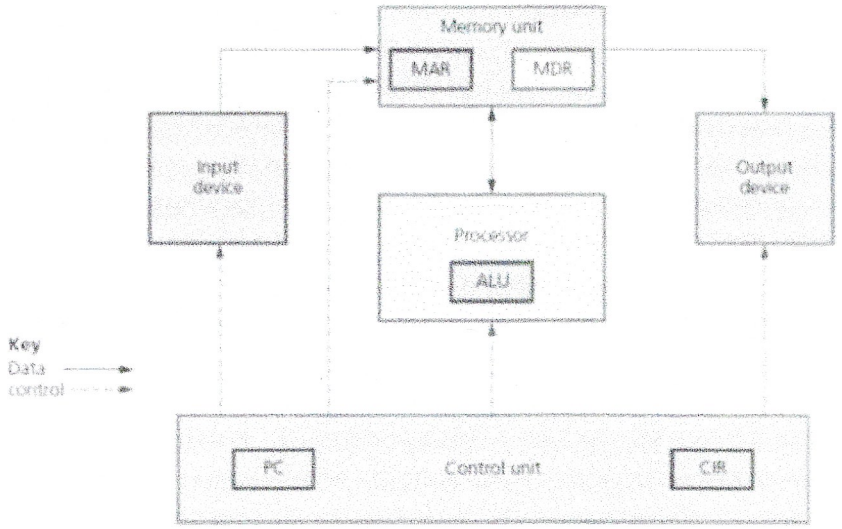


Figure 4.4

MAR - Memory address register
MDR - Memory data register
ALU - Arithmetic and Logical unit
PC - Program counter
CIR - Current instruction register

Processor contains ALU
Control unit controls operation of memory, processor and input output devices also generates control bus to tell other components what to do

Fetch execute cycle

PC has address of next instruction

PC copied to the MAR

Lookup MAR and get contents. Copy contents into the MDR

Copy MDR contents into the CIR

PC is then incremented by 1

The instruction is decoded and then executed

cracking edits program

Chapter 8

Hacking	Act of gaining illegal access to computer system	Lead to identity theft or gaining personal info Data can be deleted changed corrupted	Firewalls Strong passwords Anti hacking softwares
Viruses	Program or program code that replicated itself and corrupts or deletes files or causes malfunction	Computer will crash or stop, deletes files or data's and corrupts them	Anti virus software Don't use softwares from unknown sources

Phishing	Sends out legitimate looking emails and when clicked it's redirected to fake websites	Gain personal info and lead to fraud or identity theft	Filter out phishing emails and be cautious when opening emails
Pharming	Malicious code installed on users hard drive and redirects users to fake websites	Gain personal data and lead to fraud or indentity theft	Anti spyware software and be alert and check for redirected websites
Wardriving	Locating and using WiFi illegally	Steal users internet time and can steal users password and personal info	Uses WEP and complex passwords and firewalls to prevent outside users
Spyware	Gathers info by monitoring key presses and info is sent back to the person who sent the software	Gives access to all data entered and install other spyware and read cookie data	Anti spyware software and be alert and use a mouse to select characters

Cookies
Packet of info sent by the web server to the web browser... carry out user tracking and also maintains user preferences. Only allow the detection of web pages and stores user preferences and doesn't contain personal info.

Firewalls and proxy servers

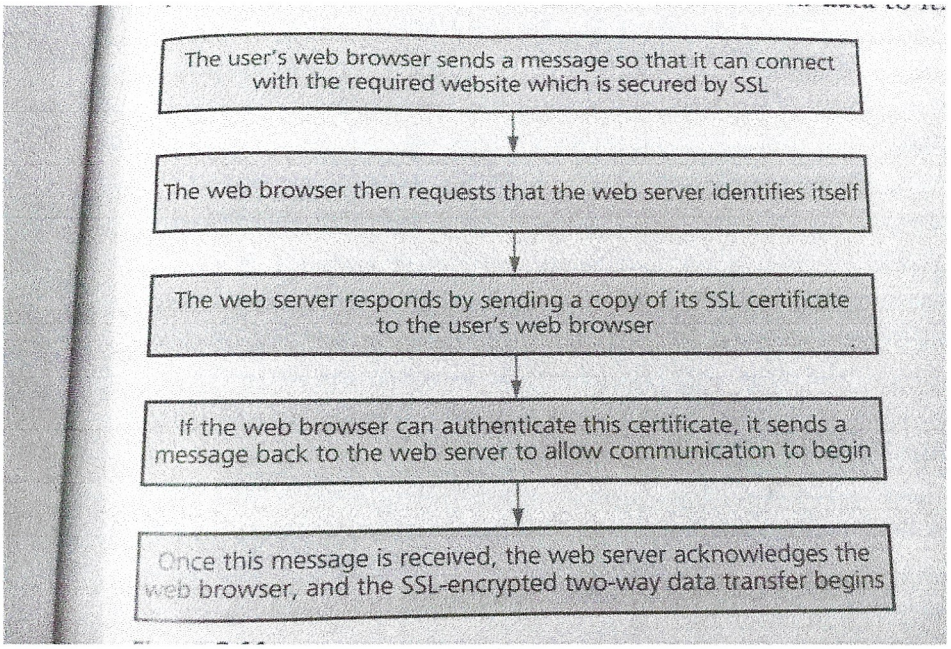
Firewalls can be hardware or software it's between user computer and external network and filters info in and out of the computer and checks if the data meets certain criteria

Proxy servers is an intermediary between users and a web server
Functions.

- ➔ Traffic to be filtered and block access to website if necessary
- ➔ Uses cache and speed up access to info
- ➔ Keeps IP secret
- ➔ Acts as a firewall

Security protocols

SSL (Secure Socket Layer) type of protocol allows data to be sent and received over the internet. https or padlock sign



TLS (Transport Layer Security) form of protocol that ensures the security and privacy of data between device and user over the internet. Prevents third party hacking into this communication
Two layers of TLS

- ➔ Record protocol – with or without encryption
- ➔ Handshake protocol – permits website and client to authenticate and make use of encryption protocol

Encryption
Protects data
Two types

- ➔ Symmetric – secret key combination of characters applied to message and unreadable unless reader has decryption key. When the key is sent hacker can still get it and create a key distribution problem. They make use of encryption algorithm.
- ➔ Asymmetric – public key is available to everyone and private key is only known by computer user and is generated by hashing algorithm this also increases security

Plain text is the normal text and Cypher text is output from an encryption algorithm
Authentication verifies the data that comes from a trusted source.

106 Pg.

Denial of service attack (DOS)
Attempt at preventing users from accessing part of a network
Prevents a user from:

- ➔ Accessing their mails

- ➔ Accessing websites
- ➔ Accessing online services

One way to attack is flood the network with useless traffic
Server can handle only a finite number of requests so if it becomes over loaded by a attacked sending thousands of requests t won't be able to serve the users legitimate request
Guard these attacks by:

- ➔ Using malware and virus checked
- ➔ Setting up firewalls to restrict traffic
- ➔ Applying email filters

Victim signs:

- ➔ Slow network performance
- ➔ Inability to access particular websites
- ➔ Large amount of spam

Application
Ways to protect bank customers from online fraud

- ➔ Many banks use 10-12 digit code unique to the customer
- ➔ Three random numbers from 4 digit pin or from a 10 character password
- ➔ Insert their card and enter their pin eight digit code generated from an internal clock and server stores the pin and bank server will know if the eight digit code entered is correct
- ➔ Ask customers to key part of their password from a drop down box to prevent key logging software
- ➔ Ask for personal data

Free software
Freedom to run, copy, change or adapt and is based on liberty and not price
You can use it for any legal purpose and modify and can pass the software to people
They do not need to seek permission and cannot add source codes from another software and cannot produce copies.

Freeware
Download from the internet free of charge and is subject to copyright laws and are not allowed to modify the source code

Shareware
Allowed to try out some softwares free of charge for a trial period it is fully protected by copyright laws and needs to get permission before copying or passing it on to people

Chapter 5

Input devices:

Scanners	Digital cameras	Sensors
Barcode reader	Pointing devices	Interactive whiteboards
QR CODE readers	Touchscreens	

Output devices:

Inkjet printers	3D printers	LCD/LED monitors
Laser printers	Actuators	Projectors
2D printers	Loudspeakers	

Scanners

Scanners are of 2 types: 2D scanner and 3D scanner

	2D scanner	3D scanner
ABOUT	Used to input hard copy documents	Scans a solid object and takes images at several points with x, y and z coordinates and then a digital
PROCESS	1.. The cover is raised and the document is put on the glass panel and the cover is shut	1.. The scanner will scan the object at several points along with the x, y and z coordinates and a digital image is formed
	2.. A bright white light is flashed which is then reflected by the white cover on the opposite side	2.. With the help of CAD to produce a working model of the scanned image and the image is printed
	3.. A scan head moves across the whole document and scans it. An image is then sent to a lens using a series of mirrors	
	4.. The image taken by the mirror falls on a CCD (charge couple device) and the scanned image turns into an electronic form	
	5.. The software produces a digital image from the electronic form	
APPLICATION	Used in airports to scan passports. They make use of OCR. The OCR scans the passport and select the text parts and put them in the correct fields in the computer	CT scanners are used to create 3D images. They use tomography which builds an image through a series of thin slices. All the 2D slices put together forms a 3D object

Barcode scanners

Is a series of black and white parallel lines in varying thickness

The numbers 0-9 are represented by a unique series of lines and the left hand side and the right hand side of the barcodes are separated using guard bars. The digits on the left side have an odd number of black lines and always begin with a white line whereas the digits on the right side have an even number of black lines and always begin with a dark line. This arrangement allows the barcode to be scanned in any direction

Process

1.. The barcode is first read by a red laser

2.. The light is reflected back from the white lines only and not from the black lines which creates a pattern

3.. The reflected light is read by a sensor

4.. The pattern is generated and converted into a digital format which can be read by the computer

After the barcode is read (management)

1.. The barcode number is looked up in the database

2.. The price and the other stock details are sent back to the checkout

3.. The number of the stock item is reduced by one everytime the barcode is scanned

4.. The new value of stock is written back into the database

5.. The new value is compared to the reorder level value. If its less then more stock items are automatically ordered

6.. When the new stock arrives the stock levels are updated in the database

ADVANTAGES	DISADVANTAGES
Easier and faster	Faster checkout queues
More up to date	Lesser errors in charging customers
Reduces time and cost of management	Customers is given detailed bill
Allows automatic stock control	

QR CODE

This is made up of a matrix filled with black squares on a white background. Barcodes can hold around 30 digits while QR codes can hold around 7000 digits. Few advantages include the fact the user doesn't need to type down a website address the QR code automatically does it

Digital cameras

The old traditional cameras needed film to record the photo. The film needed to be developed and printed before the photographer could see the picture so this could lead to wastage of photos

Digital cameras are controlled by a microprocessor that automatically adjust the shutter speed, focuses on the image, operates the flash, adjusts the size, removes red eyes when flash is used

The photos are captured when the light passes through the lens onto a light sensitive cell. The cell is made up of pixels and the number of pixels determine the size of the image. The quality also depends on the type of lens and lighting

Keyboards

Most common method of data entry. The keys are made of plastics that fits perfectly in a hole in the keyboard when its pressed. There's a small piece of rubber beneath the keys which makes it pop up once pressed so its ready to be pressed again. When a key is pressed it pushes through the hold and makes contact with the conducting membrane and the key is inserted

Pointing Devices

The selection of an icon is done with a pointing device. These are usually 3 types: Touch pad, Humble Mouse and Tracker ball

HUMBLE MOUSE	Tracker ball	Touch pad
Connected through a USB port	Mostly in industrial environment	Tactile surface on the pad
Requires desk space to allow movement	Doesn't need any desk space or any special surface	Buttons for left and right are the same as the humble mouse
Needs a particular texture of surface to operate correctly	Ball on top is used to control the cursor on the screen	Simply tapping the surface is a quick method of selection
Has a scroll wheel	Buttons are used to select	
There's a rubber ball beneath the mouse which moves and the sensors work out the orientation	Operators are less likely to suffer from RSI	

Microphones

Used to input sound to a computer

When a microphone picks up a sound, the diaphragm vibrates and makes the coil vibrate too which causes changes in the magnetic field by the magnet. Changes in the current are detected and produce electric signals. This signal goes to a sound card which converts it to a digital value and is then stored in a computer

Microphone in voice recognition system – The user's voice is detected and is converted into digital. A few words spoken will be stored in memory so if they match the user has been correctly identified

Microphone in speed recognition system – The use's speech and the spoken words are recognized

Touch Screens

4 types of touch screen technologies – Capacitive, Infra-red, Resistive and Surface acoustic wave (SAW)

CAPACITIVE	INFRA-RED	RESISTIVE	SAW
Made up of many glass layers that act like capacitors creating electric fields between the layers	The glass is the screen material and uses warm objects to carry out functions	Uses upper layer polyester and bottom layer glass	
When the top glass is touched, the electric current changes and the coordinates is determined by the microprocessor	Uses an array of sensors in a grid and the point of contact is based on the grid coordinates	When the top layer is touched, the bottom and the top later completes a circuit and signals are sent which is interpreted by the microprocessor and that determines the coordinates of contact	
Medium costing tech, strong visibility, multi touch	Multi touch, bare fingers, gloves, stylus	Inexpensive tech, use of bare fingers, stylus, gloves	
Only allows the use of bare hands and a stylus	Expensive tech, Heat sensitive only allows fingers, average visibility	Poor visibility, no multi touch, screen wears out through time	

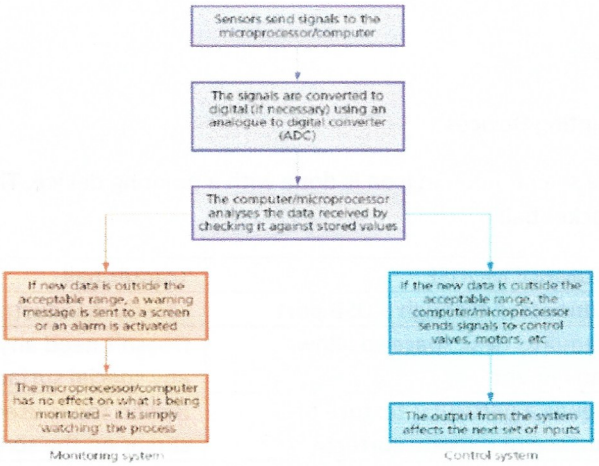
Sensors

Devices used to read or measure physical properties

An actuator is an electromechanical device

Monitoring application – no action is taken the sensors and microprocessor works and only outputs the data or signal but no action is taken and humans are needed to take necessary steps

Control application – The data value from the sensor causes the microprocessor to take actions depending on the data from the sensors. No human intervention is required



Interactive whiteboards

Devices that allow computer images to be displayed on a whiteboard using a digital projector. It also allows users to write, type a text or draw and then they can be stored for later use

Inkjet printers

Consists of print head that has nozzles that spray droplets of ink on the paper, an ink cartridge, stepper motor and belt which moves the print head from side to side and a paper feed

Inkjet printers use two technologies – thermal and piezoelectric

THERMAL	PIEZOELECTRIC
Tiny resistors create heat. The heat causes the ink to vaporize and form tiny bubbles, as the bubbles expand the ink is ejected on the paper. As it cools the bubbles collapse and fresh ink is drawn	Small piezoelectric crystals are located at the back of each nozzle, when the crystal gets a little charge it starts vibrating. As it vibrates inwards the ink is ejected on the paper as it vibrates outwards the ink is drawn
Less expensive and its possible to use more print nozzles	Specific ink droplets can be produced, wide range of ink types are accepted, work longer as lesser heat is generated
Produces large droplet size, only certain inks can be used because of high heats, more maintenance as high degrees are reached	More expensive and uses fewer print heads

Printer drivers – software that converts the data to be printed in a specific format the printer requires, the purpose is allowing the user to be able to print anything without needing to be aware of the specific format or details the printer uses

Printer buffer – temporary memory that stores the data that needs to be printed till its printed, this allows the processor to do other tasks while the printing is slowly happening in the background

Stage	Description
1	The data of the document is sent to the printer driver
2	The printer driver puts it in a format the printer can understand
3	A check is made to see if the printer is available to print (ready, offline)
4	The data is sent to the printer and is stored in printer buffer
5	A sheet of paper is fed into the printer and a sensor checks if there's paper in the paper feed tray
6	The sheet of paper is fed and the print head moves side to side printing the image
7	The sheet is pushed ahead slightly to allow the next line to be printed
8	If there are more pages to be printed or is there in the printer buffer stages from stage 5 is repeated
9	When the printer buffer is empty an interrupt is sent to request more data to be printed again.

Laser printer

Uses dry powder ink rather than liquid ink and makes use of static electricity to produce texts and images. They also print the whole page at once

Stage	Description
1	The data of the document is sent to the printer driver
2	The printer driver puts it in a format the printer can understand
3	A check is made to see if the printer is available to print (ready, offline)
4	The data is sent to the printer and is stored in printer buffer
5	The printing drum is given a positive charge as it rotates a leaser beam is scanned and removes the positive charge in certain areas and leaves the negatively charged areas which made the text/image
6	The drum is coated with a positively charge toner and since its positive charge it sticks only to the negative charged parts
7	A negatively charged sheet of paper is rolled over the drum
8	The toner on the drum sticks to the paper to produce an exact copy of the page sent to the printer
9	To prevent the paper from sticking to the drum, the electric charge on the paper is removed after one rotation of the drum
10	The paper goes through a fuser which is a set of heated rollers, the heat melts the ink so it fixes it permanently on the paper
11	A discharge lamp removes all the electric charge from the drum making it ready for the next print

INKJET	LASER
Best for one off photo where only few pages of good quality and color prints are needed	High quality printouts are required and very fast in making multiple copies and doesn't mind high volume printing

3D printers

Used in CAD applications

They can produce solid objects that work and are built layer by layer using materials like powered resin, powered metal, paper or ceramic powder.

Can print different sizes, sharp contrast, supports subtractive method of manufacturing, direct 3D printing – print head moves left and right and up and down and builds layer by layer, binder 3D printing – first sprays dry powder in each layer and then sprays binder to form a solid layer, newer tech uses lasers and UV light to harden liquid polymers

Stages	Description
1	A design is made using CAD
2	Finalized drawing is imported by a software and puts it in a format the printer understands
3	The 3D printer is set up to allow the object to be made
4	The object is built layer by layer
5	The object is removed from the printer and is prepared

Few uses are prosthetic limbs, reconstructive surgery, aerospace manufacturing, fashion and art, etc

Actuator is a device that causes another device or machine to operate

Loudspeakers and Headphones

Sound passes through a DAC and then through an amplifier and comes out of a speaker. The sound is produced by voltage differences vibrating a cone in the speaker in different frequencies and amplitudes. The rate at which the DAC can translate is called sampling rate

LCD Monitors

Liquid Crystal Display monitors. The front layer of the monitor is made up of liquid crystal diodes and these tiny diodes are grouped together in three or fours to form pixels

LCD monitors use LED (light emitting diode) this gives the image better contrast and quality. Before using LED they used CCFL (cold cathode fluorescent lamp). CCFL used two florescent tubes behind the LCD screen which supplied light source. This way tiny LEDs used to form a matrix behind the LCD screen

LED is used because:

- ➔ It reaches maximum brightness immediately
- ➔ Gives whiter light which sharpens image and make colours more vivid
- ➔ Produces a brighter light and improves colour definition
- ➔ Monitors using LED are thinner
- ➔ It lasts almost indefinitely
- ➔ Consumes very little power

Future LED technology will make use of OLED (organic light emitting diodes). These organic materials will be made of carbon compounds to create semi conductors which are flexible. Organic film will be sandwiched between two charged electrodes. When an electric field is applied, they will give off light. This allows thinner screens and also means it will no longer need to use LCD technology since OLED is a self contained system and allows screens to be curved and bend screens in any shape

Advantages of using OLED:

- ➔ Thinner, more flexible
- ➔ OLED layers are lighter so they can be made from plastic rather than glass
- ➔ Brighter light than LED
- ➔ Does not require backlighting like LCD screens
- ➔ Use a lot less power than any of them
- ➔ Essentially plastic so they can be made larger and in thin sheets
- ➔ Very large field of view so can be ideal for TV

Light projectors are of two types: DLP (digital light projectors) and LCD projectors
Generally projectors are used to project computer output onto larger screens or interactive white boards

DLP uses millions of micro mirrors on a small DLP chip. The number of micro mirrors and the way they are arranged determine the resolution of the digital image. When the micro mirrors tilt towards the light source, they are ON. When they tilt away from the light source, they are OFF. Ex – If the mirror switches on more than it switches off, it will produce a lighter shade of grey.
A bright white light source passes through a colour filter on its way to the DLP chip. The white light is split into the primary colours. The ON and OFF state of each micro mirror is linked with colours from the filter to produce a coloured image.

LCD projectors are older, essentially a high beam of light passes through a LCD display and then onto a screen
How this happens:

1. A powerful beam of white light is generated from a bulb or the LED inside the projector
2. This beam is sent to a group of chromatic coated mirrors and these reflect the light in different wave lengths
3. When the white light hits these mirrors, the reflected light has a wavelength corresponding to a colour
4. The primary colour components pass through three LCD screens and show the image to be produced as millions of pixels in a grey scale
5. When the coloured light passes through the LCD screen, red, green or blue versions of the grey scale emerges
6. Theses images are combined using a special prism to full colour and the final image consists of millions of colors
7. Finally the image passes through the projector lens onto the screen

Chapter 6

Lossless file compression

All bits from the original file are reconstructed when the file is uncompressed. Ex – Spreadsheet

Lossy file compression

The file compression algorithm eliminates unnecessary bits of data as seen in MP3 and JPEG formats and it is impossible to get the original file back

Primary Memory

➔ RAM – Random Access Memory
Volatile/temporary memory – memory is lost when the power to RAM is turned off
Stores – data, files, parts of operating system currently in use
It can be written to or read from and the contents in memory can be altered
Larger the size of RAM, the faster the computer operates
RAM never runs out of memory, it continues to operate but gets slower

Reason: As RAM becomes full, the processor has to access the hard disk drive (offline storages like USB) to overwrite old data on RAM with the new data. When the RAM size is increased, this process is reduced thus making it faster

There are 2 types of RAM technology: DRAM (dynamic RAM) and SRAM (static RAM)

- DRAM – each chip consists of a number of transistors and capacitors. Its very tiny since a single RAM chip has a million of these.
  Capacitor – holds the bits of information (1,0)
  Transistor – acts like a switch and allows the chip to control circuitry to read or change the capacitor's value
  This type of RAM needs to be refreshed again and again. If its not been refreshed the capacitors charge would leak quickly and make all values 0
  DRAM is better than SRAM because its less expensive, consumes less power and has higher storage capacity
- SRAM – biggest difference is that it doesn't need to be refreshed. It makes use of flip flops which hold each bit of memory. SRAM is father than DRAM when it comes to data access. Ex – the processor's memory cache is the high speed portion of the memory it is effective because most programs access the same data many times. By storing most of the information in SRAM, the computer avoids accessing the slower DRAM

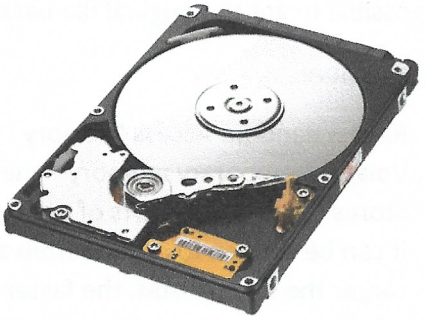
➔ ROM – Read Only Memory
Main features:

- Non volatile/permanent memories
- Stores start up instructions
- Contents of ROM can only be read from

Secondary Memory

➔ HDD (Hard Disk Drives)

Data is stored in digital format on a magnetic surface of the disks. The hard disk drive has a number of platters which can spin up to 7000 times a second. A number of read or write heads can access all of the surfaces in the disk. Data is stores on the surface in sectors and tracks. A sector on a given track will contain a fixed number of bytes. Hard disk drives are very slow compared to Ram. Many applications require the read and write heads to constantly move so there's a large number of head movements and the effects of latency becomes very significant. Latency is the time it takes for a specific block of data on a data track to rotate around a read-write head



➔ SDD (Solid State Drives)

This drive has no moving parts and all the data is retrieved at the same rate and do not reply on any magnetic properties. The most common type of storing data is by controlling the movement of electrons within NAND chips. The data is stored as 1 and 0 in millions of tiny transistors within the chip. This allows blocks of data to be read or erased. NAND chips also known as flash.
Some devices sometimes use EEPROM (electronical erasable program read only memory). The main difference is that they use NOR chips instead of NAND chips. But this is more expensive and allows data to be read or erased in single bytes at a time.

Benefits of using SSD rather than HDD:

- More reliable
- Considerably lighter
- Lower power consumption
- Run cooler than HDD
- No moving parts
- Data access is faster

Main drawback of SSD is that its rates at only 20 GB write operations per day over a three-year period

Blu-ray Disks

This is another example of optical storage media, they are a little different than DVD

The main differences are:

- A blue laser is used rather than a red to carry out read and write operations
- The wavelength of a blue light is only 405 nanometers
- Pits and bumps are much smaller but can store up to five more times than DVD
- Uses 1.1 mm thick polycarbonate disk
- Using two sandwiched layers can cause birefringence (light is refracted into two separate beams causing errors). BLU RAY USES ONE LAYER SO DOESN'T SUFFER FROM BIREFRINGENCE
- It comes automatically with a secure encryption system

USB Flash Memories

Memory sticks/Flash memories use solid state technology. It connects to the computer using a USB port. Main advantage is that they are very small thus they are portable and light weight which makes it suitable of transferring data between computers. Expert systems often use memory sticks as a dongle. The dongle contains additional files which are needed to run the software. The dongle prevents illegal or unauthorized use of the software and also prevents copying of the software since without the dongle its useless.

Digital Cameras

This uses a different form of SSD, known as XD (eXtreme Digital) or SD (Secure Digital) cards.

Each memory card is made up of NAND chips and with SSD there are no moving parts.

Removable hard disk drives

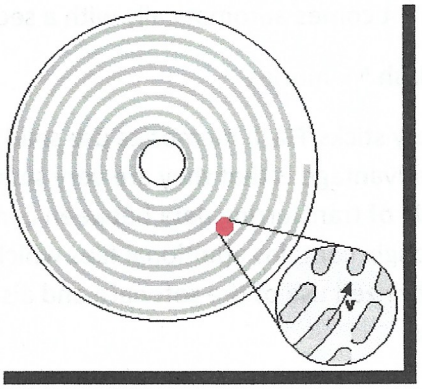
Essentially HDD but can be connected to the computer using one of the USB ports. They can be used as a backup device or another way of transferring files between computers

➔ Off-Line Storage

These include:

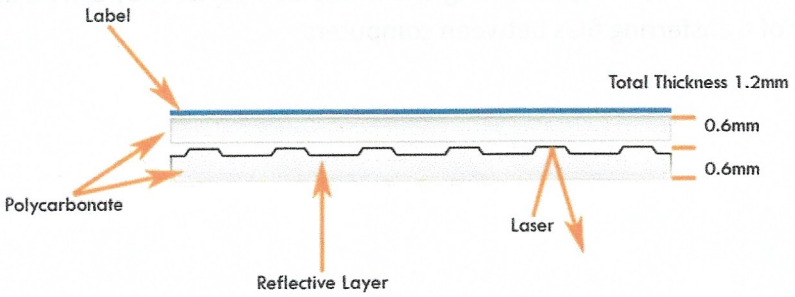
- CD/DVD/DVD-Ram
- Blu-ray disks
- USB
- External Hard Disks

CD/DVD disks



These are described as optical storage devices. A laser light is used to read and write data in the surface of the disk. They use a thin layer of metal allow to store the data. Their systems use a single spiral track which runs from the center of the disk to the edge. The data is stores in pits and bumps on the spiral track. A read laser is used to read or write. These characteristics are similar DVD is slightly different from CD.

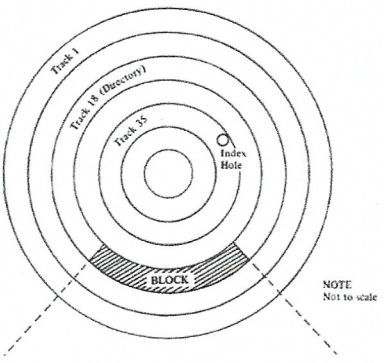
One of the main differences is the use of dual layering which increases storage capacity. Basically this means that there are two individual recording layers. Two layers of a standard DVD are joined together with a transparent spacer and a thin reflector is sandwiched between the two layers. Reading and writing of the second layer is done by a red laser focusing at a fraction of a mm difference compared to the first layer. DVD uses lasers with a wavelength of 650 nanometers and CD uses lasers with a wavelength of 780 nanometers. The shorter the wavelength, the greater the storage capacity



DVD RAM

Features:

- Instead of single, spiral track, they use a number of concentric tracks
- Use of concentric tracks allows simultaneous read and write operates
- Allow numerous read and write operations and last longer



High & Low Level Language

Program.

- a way of telling a computer what to do, how & when to do

computer program is a list of instructions that enables a computer to perform a task

high level languges.

- enables a programmer to focus on the problem to be solved & no knowledge of hardware & instructions is needed.
- they are portable
- closer to humans
- shorter time
- debug
- maintain

ex. C++, Python, Java

low level languges

- machine code
- binary
- assembly language that needs to be translated to machine code

→ Assembly Language

why.

- use of special hardware
- use of special machine dependent instructions
- code that doesnt take much space
- code that performs tasks fast

LDA load the value of the variable

ADD add value of another variable to value

STO replace the value

Machine code

- complicated to manage data manipulation & storage
- shown in Hexa

Translators pg 94

→ Compliers. General use
- HLL to machine code , so directly used by computers, 1 HLL trans many machine

→ Intrepreters developing program
- reads in HLL & performs , one statement at time, needs many machine codes

→ Assemblers General use
- Assembly language into machine code

LLL - Machine code

Errors

→ Syntax error.
- doesnt obey rules of language
- translation not done
- Interprets finds error.

→ Logic error
- when run program doesnt do what its suppose to
- Found by test data with expected results

Problem Solving & Design

Computer System.

- made up of Software, data, hardware, communications & people
- divided into set of sub systems
- further divided into sub system until each sub system performs a single action

- Can be shown using
  - Top down design
  - Structure diagram
  - Flowchart
  - Pseudocode

  ] → Standard method.

- Subsystem be developed using ~~program~~, sub routine, or library routine,
  - sub routine: set of prog. inst... already written in high lev.. (procedures)
  - library routine: available pretested.

Top Down Design

- breaking down of subsystems
- provides solution to a problem
- Process called 'Stepwise refinement'

Structure Diagram

- Shows top down design in a diagrammatic form

Flowchart

- Shows steps diagramatically required for a so system (in order)
- Steps with order called ALGORITHM

Pseudocode

- Showing algorithm using English like words & math operations to look like a program

For more accuracy.

- Require the use of test data & trace tables

TEST DATA

→ computer programs be tested by running on computer using required data & seeing if you get expected result.

TYPES

- Normal data
- Abnormal data
- Extreme data
- Boundary data. for 0 = -1, 0

NORMAL DATA.

→ work through a solution to find actual results & see if it matchs expected results

→ Avg marks. of 8 students

Normal data. = 50, 50, 50, 50, 50, 50, 50, 50

Expected result = 50.

ABNORMAL DATA. / ERRONEOUS.

→ test data should be rejected as values not suitable.

→ ~~Avg~~ Percentage marks

Abnormal data = -12, eleven

Expected result = values should be rejected.

EXTREME DATA

→ largest & smallest values normal data can take

→ Percentage marks.

Extreme data = 0, 100

Expected result = values should be accepted.

BOUNDARY DATA.

- two values required
- one value accepted, other value rejected
- Boundary data for 0 = -1, 0 (marks)

  Expected result = -1, rejected = 0, accepted

- Validation & Verification
- only accept resonable & accurate ~~res~~ data.
- data needs to be examined before being accepted.
- TWO METHODS.
  - VALIDATION - computer checks data accepted is reasonable
  - VERIFICATION - used to check that data does not change when being entered.

VALIDATION

- if data is rejected a message should output explaining why. & another chance to enter data.
- TYPES.
  - Range check - no. btw specific range = marks between 0 - 100
  - Length check - exact or reasonable character no. = Password 8 ~~or~~ 30
  - TYPE Check - given type = Sibblings, class students be integer (whole no)
  - Character check - does not include invalid symbols = name has no$ %, +, ÷
  - format check - pre defined pattern = CAR PLATE = L99999 (only 5 digit cars)
  - Presence check - some data is entered, nothing left blank.
  - Check digits. - barcode. check ÷
    - incorrect digits 008 instead of 007
    - 2 no. change order = 070 instead of 007
    - left or extra no. = 07 or 0007 instead of 007
    - phoneic errors = eleven, 11 instead of Seven 7

Trace Table - manual run
- DRY RUN.
- record value each time changes.

ISBN.

→ To find last digit.

a. Add odd (place) digits - excluding last digit

b. Add even (place) digits & multiply by 3

c. Add results from a & b. divide by 10

d. If remainder is 0, use the value

If not 0, Subtract from 10.

1 2 3 4 5 6 7 8 9 10 11 12

Ex 9 7 8 1 9 0 6 1 2 4 0 0 x

a. 34.

b. 13 × 3 = 39

c. 34 + 39 = $\frac{73}{10}$ = 3

d 10 - 3 = 7

$x = 7$

→ if remaider 0

ex = $\frac{70}{10}$ = (7) → x

→ To check if last digit right

a. Add odd placed digits

b. Add even placed digits & multiply by 3

c. Add a & b. divide by 10

d. If remainder 0 = correct

if not = wrong.

VERIFICATION.

→ check if copied data is right

- double entry - enter data twice
- Screen check - manual check by user
- parity check
- check sum.

130 Pg.

PSEUDOCODE.

- not bound by rules of programming language
- pretends to be programming language.
  - Courier New Font is used
  - All keyword in caps
  - All names for - data items & Subroutines start in caps.
  - Conditional & loop Statements represented by two spaces.

SYMBOLS.

assigned ← x ← 10

cost ← 10

+	add.
−	Subtract.
*	multiply
/	divide
^	raise to power to
( )	group.

Conditional Statements.

- True or False. IF... THEN .... ELSE... ENDIF
- Choices. CASE ... OF .... OTHERWISE... ENDCASE

```
CASE Grade OF
   "A" : PRINT "Excellent"
   "B" : PRINT "Good"
   "C" : PRINT "Ok"
   OTHERWISE PRINT "Improvement needed"
ENDCASE
```

LOOP STRUCTURE.

- need repeating called - iteration
- FOR ... TO ... NEXT
- REPEAT... UNTIL
- WHILE .. DO... ENDWHILE

FOR..TO..NEXT

- IF you know the answer to "how many"

REPEAT.. UNTIL

- dont have how many
- keep doing Something till Something happens.

WHILE .. DO... ENDWHILE

- while the Statement is true, do Something
- when its not true, endwhile.

BASIC DATA TYPES.

INT	Positive or Negetive whole no.	77
REAL	positive or Negetive no. with fractional part	77.0
CHAR	Single character	"F"
STRING	Several Charater in length	"Emma"
BOOLEAN	TRUE OR FALSE	AgeOver18 = true

File Formats

- Musical Instrument Digital interface (MIDI)
- MP3
- MP4
- JPEG
- Text & number format

MIDI

associated with the storage of music files however they do not contain any music or sounds. It is a communication protocol that allows musical instruments to interact with eachother.

The protocol uses 8 bit serial transmission with one start & stop bit (Asynchro..

MIDI consits of a list of commands that instruct the device: note on/off, key pressure

Sequence of byte: 1 - status byte, informs what to perform & has 16 channels to operate in

- Pitch byte - which note to play
- Velocity byte - how loud to play note

extension = .mid

MP3 & MP4

uses technology known as Audio compression to convert music & other sounds into MP3 format. Reduces the size of normal music file by 90%. & uses lossy format

MP4 allows the storage of more than just sounds.

JPEG

REDUCING PICTURE RESOLUTION - reducing the number of ~~pixels~~ pixels per centimetre used to store the image

One of the file formats used to reduce photographic file sizes is known as JPEG

This is another example of lossy file compression

A raw bitmap is TIFF or BMP

Highest quality because unlike JPEG, this is not in a compressed format

Text & number format

Text is usually stored in ASCII format

Number can be stored in - real, integer, date, time, currency