IGCSE 0417

IGCSE Information and Communications Technology 0417

Syllabus of 2023 - 2025

Chapter 1: Types and Components of Computer Systems

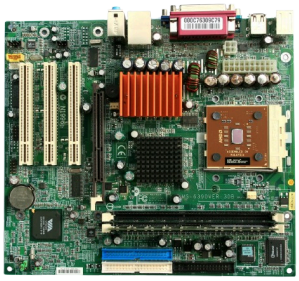
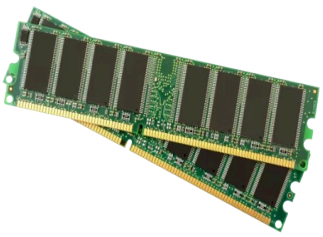
1.1 Hardware and Software

- Hardware: physical components that make up a computer system.
    - falls into two categories: external and internal.
    - e.g. keyboard, mouse, monitor, printer, etc.
- Software: programs that control the computer system.
    - application software: programs that allow the user to do specific tasks
        - word processor - used to create, edit, save and manipulate texts; spell check; import images into a structured page format.
            - text is entered using a keyboard and software provides tools for copying, deleting and other types of formatting.
        - spreadsheet - used to organize and manipulate numerical data, such as integers and dates, into graphs; use of formulas to carry out calculations.
            - numbers are organized in a grid of lettered columns and numbered rows, each cell being a combination of the two, e.g. [F1] is on column F, row 1.
        - database - used to organize, manipulate and analyze data, carrying out queries based on database data and producing a report.
            - a typical database is made up of one or more tables, where each row is called a record and each column, a field.
        - apps - software that runs on mobile phones or tablets, usually downloadable on an App store and ranges from games to m-banking.
        - graphics editing software - change of bitmap and vector images, manipulating lines, curves and text to alter a stored image.
        - video editing software - manipulation of videos to produce an edited video, enabling the addition of titles and text, color correction, altering sound, rearranging, adding or removing sections of clips, or creating transitions between clips.
        - computer-aided design (CAD) software - software used in the creation, manipulation, modification and analysis of a drawing/design, such as producing 2D and 3D diagrams.
        - control and measuring software - designed to allow a computer and microprocessors to interface with sensors in order to measure physical quantities in the real world or compare stored data with sensor data and send signals to alter parameters.

    - system software: programs that allow the hardware to run properly and allow the user to communicate with the computer.
        - operating system (OS) - software running in the background of a computer system, managing many of the basic functions. Without it, most computers would be user-unfriendly and almost impossible for users to work with.
            - allows for input and output operations, loading and running of programs to occur and managing of security.
        - compiler - a computer program that translates a program written in high level language into machine code (code that is understood by the computer) so that it can be used by the computer to perform a task.
            - the original program is called source code, whereas the code after compilation is called object code.
            - e.g. high level languages (HLL) are Python, C++, etc.
        - linker - a computer program that takes one or more object files produced by the compiler and combines them into a single program that can be run on the computer.
        - device driver - a software that enables one or more hardware devices to communicate with the computer's OS. Without it, a hardware device would be unable to work with the computer.
            - all hardware devices have an associated driver.
            - as soon as a device is plugged in, the OS looks for the appropriate driver. If unavailable, an error message is displayed.
        - utilities - a software that has been designed to carry out specific tasks on a computer, which include managing, maintaining and controlling computer resources.
            - e.g. antivirus, backup of files, security, file management.
- Internal Computer Hardware
    - Motherboard: a printed circuit board found in all computers, allowing for the processor and other computer hardware to function and communicate with each other. It acts as a 'hub' that other computer devices connect to.
    - Random Access Memory (RAM): an internal chip where data is temporarily stored when running applications. Memory can be read and written from, however it is referred to as volatile (temporary) memory as its contents are lost when the power of the computer is turned off.
        - it stores data, files and part of the OS that is currently in use.
        - can be increased in size to improve the operational speed of computers.

- Read Only Memory (ROM): a memory used to store information that needs to be permanent. They cannot be altered and can only be read from, and it is referred to as non-volatile memory as information stored on the ROM chip is not lost when the power is turned off.
- Central Processing Unit (CPU)
  - part of the computer's motherboard that interprets and executes the commands from the computer hardware and software.
  - is now referred to as the microprocessor.
  - it is a single integrated circuit made up of:
    - a control unit, which controls the input and output devices;
    - an arithmetic logic unit (ALU), which carries out calculations and makes logical decisions; and
    - the immediate access store (RAM).
- Network Interface Card (NIC) is a component that allows a computer that allows a computer or any device to be connected to the network, and can be wired/wireless.
- Graphics Card: a card that allows the computer to send graphical information to a video display device, such as a monitor or projector.
- Sound Card: an integrated circuit board that provides a computer with the ability to produce sound. Sound can be output through speakers or headphones, or input through microphone.
- Internal Hard Disk Drive/Solid State Drive (HDD/SSD)
  - HDDs are magnetic in nature and are one of the main methods for storing data, files and most of the system and app software.
  - However, more modern computers use SSDs, replacing HDDs.
  - They are the computer's main internal storage, where the applications software, disk operating system and files are stored.

- Images of Each Internal Computer Hardware in order


Motherboard, RAM, ROM, Video Card, Graphics Card, SSD, HDD (left to right, top to bottom).

- Analogue data: physical data that changes smoothly from one value to the next, and not in discrete steps (continuous).
- Digital data: data that is in a binary format (0s and/or 1s) and has discrete, discontinuous values.
- If analogue data is being sent to a computer, it must first be converted into digital data in order for the computer to be able to read, using a hardware known as an Analogue-Digital Converter (ADC).
- If the computer is controlling a device, such as a motor or actuator, digital data is converted into analogue data using a Digital-Analogue Converter (DAC).

1.2 Main Components of a Computer System

- The four key components of internal hardware include:
    - CPU (located in the motherboard)
    - Internal HDD - discussed in Topic 1.1 and 3.3
    - RAM - discussed in Topic 1.1
    - ROM - discussed in Topic 1.1
- Random Access Memory (ROM) - continued
    - The ROM also contains some coding known as the boot file, used to tell the computer what to do when it initially starts up. This is also known as the BIOS (basic input/output system).
    - The BIOS carries out a hardware check to find out if all the devices are present and whether they are functional. It then loads the OS into the RAM.
    - The BIOS also stores the date, time and system configuration in a permanent chip called a CMOS (complementary metal oxide semiconductor).

1.3 Operating Systems

- The Operating System (OS) enables computer systems to function and to allow users to communicate with the computer systems.
- Its general tasks include:
    - control of the operation of the input, output and backing storage devices;
    - supervising the loading, running and storage of application programs;
    - dealing with errors that occur in application programs;
    - maintaining security of the entire system; and
    - allowing communication between user and computer system.

1.3.1 User Interfaces

- Command Line Interface (CLI)
    - requires a user to type in instructions to choose options from menus, open software, etc.
    - the user has to learn commands to carry out basic operations, such as when saving or loading a file.
    - the need to key in commands every time an operation has to be carried out is also slow.
    - advantages include:
        - user is in direct communication with the computer;
        - user is not restricted to a number of predetermined options; and
        - it is possible to alter computer configuration settings.
    - disadvantages include:
        - user needs to learn a number of commands to carry out basic operations;
        - commands need to be typed in, which is error prone and takes time;
        - each command must be typed in using proper format/spelling; and
        - it is difficult to edit once commands are entered.
- Graphical User Interface (GUI)
    - allows the user to interact with a computer using pictures or icons rather than having to type in a number of commands.
    - uses various technologies and devices to provide the user interface.
    - a common example is the Windows Icon Menu and Pointing device, which was developed for use on PCs.
    - devices such as touch screen phones use post-WIMP interaction, with actions such as pinching and rotating.
    - advantages include:
        - user doesn't need to learn any commands;
        - more user-friendly (icons represent applications); and
        - a pointing device is used to launch an application.
    - disadvantages include:
        - it uses more computer memory compared to CLI interface;
        - user is limited to icons provided on the screen; and
        - needs an operating system, such as *Windows*, to operate, taking up considerable memory.
- Dialogue-based User Interface
    - uses the human voice to give commands to a computer system, an example is its use in some luxury modern cars, where voice activation controls devices such as in-car entertainment systems or GPS navigation.
    - advantages include:

        - no need for a driver to take hands off a steering wheel, allowing for safer road navigation;
        - very useful for people with disabilities as tasks can be carried out by voice control; and
        - possible to use as a security feature by using voice recognition to identify a certain person's voice.
    - disadvantages include:
        - its complexity to be set up;
        - unreliability due to commands required to be repeated several times;
        - the user needs to know the commands that can be used.
- Gesture-based User Interface
    - relies on human interaction by the moving of hands, head, etc.
    - this type of interface uses computer vision and image processing, where a sensor or camera detects the gesture and a signal is sent to an on-board computer to carry out a required action.
    - it eliminates the need for an array of buttons and dials on a dashboard.
    - examples of gestures:
        - rotating a finger clockwise near the radio to increase volume;
        - moving the foot under the rear bumper of a car opens the boot lid;
        - moving a hand near a window switch automatically opens a window.
    - advantages include:
        - replacement of mechanical input devices;
        - no requirement of physical contact;
        - very natural interface for a human operator; and
        - no training needed to interface with computers.
    - disadvantages include:
        - possible for unintentional movements to be picked up;
        - only works fairly close to the sensor/camera; and
        - may only accept a limited number of movements.

1.4 Types of Computers

- PC/Desktop Computers
    - refers to a general purpose computer that is made up of a separate monitor, keyboard, mouse and processor unit.
    - advantages compared to the laptop:
        - spare parts tend to be standardized, resulting in lower costs;
        - power consumption is not critical since they plug straight into a wall socket and its larger casings allow for better dissipation of heat;
        - since they are usually fixed in one location, there is less likelihood of them being damaged; and
        - internet access is more stable since they are not moved around.

    - disadvantages compared to the laptop:
        - they are not particularly portable;
        - it is necessary to copy files when you want to do work elsewhere, although cloud storage has diminished this disadvantage; and
        - all components are connected by wires or wireless connection, cluttering desk space.
- Laptop Computers
    - refers to a type of computer where the monitor, keyboard, pointing device and processor are all together in a single unit, making them very portable.
    - typical features in a laptop:
        - lightweight;
        - low power consumption; and
        - the processor shouldn't generate too much heat.
    - advantages compared to the PC:
        - its portability as they can be taken anywhere;
        - there are no trailing wires, eliminating tripping hazards;
        - can take full advantage of Wi-Fi; and
        - they can link into any multimedia system due to its portability.
    - disadvantages compared to the PC:
        - easier to steal due to portability;
        - has limited battery life, causing need for the user to carry around a heavy adaptor; and
        - keyboard and/or pointing devices may be awkward to use.
- Tablets
    - relatively new internet-enabled portable computer, which works in a similar way to a smartphone due to its touch-screen technology.
    - it doesn't usually have a conventional keyboard, however, some tablets that are a cross between the tablet and laptop exist.
    - typical features in a tablet:
        - high-definition, anti-glare displays;
        - front and back facing cameras;
        - lower weight and longer battery life as to laptops;
        - Bluetooth connection to other devices;
        - flash memory and cloud storage facilities to back up and synchronize data sources; and
        - sensors.
    - a phablet is the hybrid between a tablet and a smartphone, which have slightly smaller screens than tablets.
    - advantages compared to the laptop:
        - very quick to turn on;

        - fully portable;
        - touch-screen technology makes it simple to use;
        - doesn't generate much heat; and
        - battery life is a lot longer.
        - when the power button is pressed, it goes into standby, but remains connected to the internet so the user still receives notifications.
    - disadvantages compared to the laptop:
        - often have limited memory or storage compared to the laptop;
        - typing on touch screen may be slow and error-prone;
        - can be expensive to run if internet is being frequently accessed; and
        - laptops tend to support more file formats than tablets, and are better equipped to run different types of software.
- Smartphones
    - allow users to make normal phone calls, send/receive emails, use a number of apps, use a camera feature, MP3/4 players, etc.
    - has an operating system to run a number of computer applications.
    - functions of a typical smartphone:
        - send/receive emails;
        - surf the internet;
        - global positioning system (GPS);
        - calendar functions;
        - telephone banking;
        - streaming of videos and music; and
        - instant messaging, etc.
    - advantages of smartphones:
        - very small in size and lightweight, making it easier to carry around;
        - can make phone calls and connect to the internet on the move;
        - they can be used almost anywhere as they use Wi-Fi and mobile phone networks;
        - they have hundreds of apps; and
        - they have reasonable battery life compared to laptops.
    - disadvantages of smartphones:
        - small screens make pages difficult to read, and small keyboards make typing things more difficult, slower and error-prone;
        - web browsing and photography drains the battery;
        - memory size isn't very large compared to laptops and PCs;
        - not all website features are compatible with smartphones;
        - it is easier to lose a smartphone or have it stolen; and
        - data transfer rate using mobile phone networks is slower than Wi-Fi.

1.5 Impact of Emerging Technologies

- Artificial Intelligence (AI)
    - AI is a new machine or application that carries out a task requiring some degree of intelligence. For example:
        - the use of language;
        - recognition of a person's face;
        - ability to operate machinery; and
        - analyzing data to predict the outcome of a future event.
    - it duplicates human tasks that require decision-making and problem-solving skills.
    - Negative impacts of AI:
        - could lead to many job losses and unemployment, especially in the manufacturing department, although creating new job opportunities;
        - dependency on technology and inability to carry out tasks done by robots; and loss of skills.
- Extended Reality
    - refers to real and virtual combined environments.
    - includes:
        - Augmented Reality (AR);
        - Virtual Reality (VR);
        - Mixed Reality (MR).
    - Augmented Reality (AR)
        - features of AR:
            - allow the user to experience the relationship between digital and physical worlds;
            - virtual information and objects are overlaid onto real-world;
            - the real world is enhanced with digital details, such as images, text and animation;
            - the user can experience the AR world through special goggles or via smartphone/phablet screens; and
            - the user is not isolated from the real world and is still able to interact and see what is going on in front of them.
        - future impacts of AR:
            - safety and rescue operations by giving the team an opportunity to try out rescue procedures beforehand;
            - entertainment by taking users into a virtual environment;
            - shopping and retail by giving users a 'try-out' of a product before trying out the real thing.
            - healthcare, where doctors can use AR to get a better understanding of a patient's body.

- Virtual Reality (VR)
  - features of VR:
    - the ability to take the user out of the real-world environment into a virtual digital environment;
    - the user is fully immersed in a simulated digital world;
    - users can wear a VR headset or a head-mounted display which allows a 360° view of the virtual world; and
    - this technology can be used to good effect in: medicine, construction, engineering and the military.
  - future impacts of VR:
    - military applications, such as training to operate a new tank;
    - education, such as looking inside an ancient building of the past;
    - scientific visualization, such as looking through molecule structure of a compound in chemistry or biology;
    - entertainment, such as games where gloves, googles or helmets are worn to fully immerse players;
    - healthcare, fashion, heritage, business, engineering, etc.

Chapter 2: Input and Output Devices

2.1 Input Devices and their uses

- Keyboards
  - one of the most common methods used for data entry.
  - relatively slow method of data entry and is prone to error, yet easy to use.
  - causes injuries such as repetitive strain injury (RSI), which can be overcome by the use of ergonomic keyboards, designed to give more support to the hands and wrists when doing a lot of typing.
  - uses of keyboards:
    - input of data into applications software; and
    - typing of commands into the computer.
  - advantages of keyboards:
    - fast entry of new text into a document;
    - well-known method that is easy to use for most people; and
    - easier to do verification checks as data is entered.
  - disadvantages of keyboards:
    - can be difficult to use if user has limited wrist movement;
    - slow method when compared to direct data entry; and
    - fairly large device that takes up desk space.

- Numeric Keypads
    - used to enter numbers only
    - uses of numeric keyboards:
        - Automatic Teller Machines (ATMs), where customers can key in their PIN, amount of money, etc;
        - mobile phones to key in phone numbers;
        - Point of Sale terminals (POS) in case the barcode fails to read the barcode;
        - chip and PIN devices when paying by card; and
        - fast entry of numeric data into a spreadsheet.
    - advantages of numeric keypads:
        - faster than standard keyboards when entering numeric data; and
        - small devices, therefore easy to carry around.
    - disadvantages of numeric keypads:
        - sometimes have small keys which makes input more difficult; and
        - sometimes the order of the numbers on the keypad is not intuitive.
- Mouse
    - the user controls the position of a pointer on the screen by moving it around.
    - uses of mouse:
        - opening, closing and minimizing software;
        - grouping, moving and deleting files;
        - image editing, controlling the size and position of a drawing pasted into a document; and
        - controlling the position of a pointer on the screen.
    - advantages of mouse:
        - faster method of choosing an option compared to a keyboard;
        - very quick way of navigating through applications; and
        - does not need a large desk area when compared to a laptop.
    - disadvantages of mouse:
        - can be more difficult for people with restricted wrist movement;
        - easy to damage; and
        - difficult to use if no flat surface is readily available.
- Touchpad
    - used as a pointing device in many laptops.
    - uses of a touchpad are similar to that of a mouse, where the user moves their finger across the touchpad to move the pointer.
    - advantages of touchpad:
        - faster than a keyboard for choosing options or navigating apps;
        - integrated into the laptop, making no need for a mouse, aiding for portability and no flat surfaces are needed.

    - disadvantages of touchpad:
        - people with limited wrist movement find the device difficult to use;
        - can be more difficult to control the pointer compared to mouse; and
        - more difficult to perform operations such as drag and drop.
- Trackerball
    - similar to a mouse, except that a ball is on the top or the side of the device.
    - the pointer is controlled by rotating the ball with their hand.
    - uses of trackerball:
        - can be a good alternative to people with limited wrist movement;
        - used in an industrial control room environment where it is faster than a mouse to navigate through process screens; and
        - used in some luxury cars to select functions on screen.
    - advantages of trackerball:
        - easier to use than a mouse for operators with limited wrist movement;
        - more accurate positioning of the pointer on screen than a mouse;
        - they are more robust than a mouse; and
        - needs less desk space than a mouse or keyboard.
    - disadvantages of trackerball:
        - not supplied with the computer as standard, making it more costly;
        - users may need training as it is not standard equipment.
- Remote control
    - used for operation of other devices through infrared signals.
    - uses of remote control:
        - televisions, satellite systems, DVD/Blu-ray players and Hi-Fi systems all use remote controls to alter functions such as sound volume, on/off, change channels, etc;
        - used to control multimedia systems; and
        - used in industrial applications to remotely control processes, stop and start machinery, etc.
    - advantages of remote control:
        - can be operated from any reasonable distance, unlike a wired mouse that is restricted by length of the wire.
    - disadvantages of remote control:
        - difficult to use if the operator has limited hand/wrist movement.
        - it is easier to block the signal if the walls in the building are very thick.
- Joysticks
    - similar functions to a mouse and trackerball.
    - uses of joystick:
        - used in video/computer games; and
        - used in simulators to mimic actual controls.

    - advantages of joystick:
        - easier than a keyboard to navigate the screen; and
        - control is more realistic for some applications.
    - disadvantages of joystick:
        - more difficult to control the on-screen pointer than with other devices.
- Driving wheel
    - similar to a joystick in many ways, connects to a computer through a USB port.
    - uses of driving wheel:
        - video/computer games; and
        - simulators to mimic actual vehicle controls.
    - advantages of driving wheel:
        - easier than a keyboard or joystick to control steering movements; and
        - the 'driving experience' is nearer to how an actual steering wheel and other controls operate in real life.
    - disadvantages of driving wheel:
        - it can be a rather expensive input device;
        - movements in the steering wheel can be too unsensitive; and
        - unless it is an expensive stimulator, feedback to the driving wheel is non-existent.
- Touch Screen
    - uses of touch screen:
        - self-service tills, where user selects payment method;
        - ATMs to choose from on-screen options;
        - point of sale terminals such as in restaurants;
        - public information systems at airports, railway stations, etc;
        - mobile phones, tablets and satellite navigation systems;
        - interactive white boards in education;
        - computer-based training; and
        - can also be used as an output device.
    - advantages of touch screen:
        - faster entry of options than using keyboard or mouse;
        - very easy method for choosing options;
        - user-friendly method; and
        - has the option to expand the size of display if necessary.
    - disadvantages of touch screen:
        - limited number of input options available;
        - can lead to problems if an operator has to use frequently; and
        - the screen can get very dirty with constant touching.

- Scanner
    - uses of scanner:
        - scan in documents and convert them into a format for use in various software packages and applications;
        - scan in old/valuable documents/books, thus protecting the originals, as well as producing records in case the paper copies are lost;
        - scan in photographs; and
        - scan in barcodes at POS terminals.
    - advantages of scanner:
        - images can be stored for editing at a later date;
        - When used with OCR, it is much faster and more accurate than typing in documents again; and
        - it is possible to recover damaged documents and photographs by scanning in and then using appropriate software to produce an acceptable copy.
    - disadvantages of scanner:
        - quality can be limited depending on how good a resolution the scanner is capable of; and
        - they can be fairly slow at scanning, especially if the color scanning mode is chosen or if the chosen scanning resolution is high.
- Digital cameras
    - images are stored on a memory card (SSD) and can be transferred by:
        - directly reading the memory card by slotting it into a card reader;
        - connecting the camera to the computer using a USB port; and
        - using wireless data transfer.
    - uses of digital camera:
        - taking photographs generally better than smartphones or tablets due to use of expensive lenses and dedicated software;
        - used as a data-capture device; and
        - creation of virtual reality (VR) tours around property.
    - advantages of digital camera:
        - easier to produce higher quality photographs than traditional camera;
        - easier and faster to upload images to a computer rather than having to scan in hard copies when using traditional methods;
        - no need to develop film and print out photographs anymore; and
        - a memory card can store thousands of images.
    - disadvantages of digital camera:
        - need to be computer literate to use camera properly;
        - there is some artistry lost as clever software can correct errors; and
        - images often need to be compressed to reduce memory used.

- Microphones
    - how a microphone work:
        - when sound is created, it causes the air to vibrate.
        - when a diaphragm in the microphone picks up the air vibrations, the diaphragm also begins to vibrate.
        - a copper coil is surrounded by a permanent magnet and the coil is connected to the diaphragm using a cone. As the diaphragm vibrates, the cone moves in and out causing the copper coil to move backwards and forwards relative to the magnet.
        - this forwards and backwards motion cuts through the magnetic field around the permanent magnet, inducing an electric current.
        - the electric current is then either amplified or sent to a recording device, where the electric current is analogue in nature.
    - uses of microphones:
        - to input speech/sounds to be used in various applications;
        - input in voice-recognition software:
            - software converts the speech into text that can be used in a word processor or to input commands into a computer.
            - to recognise commands; for example, some cars now have voice-activated.
        - systems to switch on the lights, turn up the radio volume, etc;
        - microphones can also be used as a sensor to pick up sound (for example, in an intruder alarm system).
        - used in video-conferencing or Voice over Internet Protocol (VoIP) applications.
    - advantages of microphones:
        - faster to read in text than to type it in using a keyboard;
        - it is possible to manipulate sound in real time using special software rather than work on a recording done at some earlier stage; and
        - if used in a voice activation system, it has the advantage of improving safety.
    - disadvantages of microphones:
        - sound files can use up a lot of computer memory; and
        - voice-recognition software is not as accurate as typing in manually.
- Sensors
    - a device that inputs data to a computer, where the data is a measurement of some physical quantity that is continuously changing.
    - the information provided by sensors are analogue in nature, therefore they need to be converted by an Analogue-Digital Converter (ADC), so that the computer can understand the data.

    - uses of sensors:
        - *temperature sensor* - used in automatic washing machines, central heating systems, automatic glasshouses, ovens, etc.
        - *pressure sensor* - used in intruder alarm systems, washing machines, robotics, environmental monitoring, etc.
        - *light sensor* - used in automatic glasshouses, automatic doors, intruder alarm systems, street lighting control, etc.
        - *sound/acoustic sensor* - used in intruder alarm systems, monitoring liquid and powder flow in pipes, etc.
        - *humidity sensor* - used in automatic glasshouses, environmental monitoring, in factories where moisture levels are crucial; etc.
        - *pH sensor* - used in automatic glasshouses, chemical processes, environmental monitoring, etc.
    - advantages of sensors:
        - more accurate readings taken when compared to human operators;
        - readings are continuous – no break in the monitoring;
        - because it is a continuous process, any necessary action or warning will be initiated immediately; and
        - systems can be automatic, removing the need for human intervention.
    - disadvantages of using sensors:
        - faulty sensors can give false results – for example, sensors on the rear bumper of a car that monitors obstacles; if these become dirty, they may either not identify an obstacle or give a continuous alarm.
        - most sensors are analogue, therefore they require conversion using an ADC.
- Light pens
    - contain sensors that send signals to a computer whenever light changes are detected, but only works with Cathode-Ray Tube monitors.
    - uses of light pens:
        - selecting objects on CRT screens; and
        - drawing on screen (for example, with CAD packages).
    - advantages of light pens:
        - greater accuracy than touch screens;
        - small (can be used where space is an issue); and
        - easy-to-use technology.
    - disadvantages of light pens:
        - problems with lag when drawing on screen;
        - only works with CRT monitors;
        - not that accurate when drawing; and
        - rather outdated technology.

2.2 Direct Data Entry (DDE) devices

- Magnetic stripe readers
    - used to read information on the magnetic stripe found on, containing useful information such as account number, expiry date, start date, etc.
    - uses of magnetic stripe readers:
        - on credit/debit cards for use at ATMs or EFTPOS terminals; and
        - security devices to allow entry to buildings, hotel rooms, etc.
    - advantages of magnetic stripe readers:
        - fast data entry, rather than keying in with a keyboard or keypad;
        - error-free as no typing is involved;
        - secure as it is not in human readable form and, because there is no typing, removes the risk of somebody observing you keying in data;
        - prevents access to restricted/secure areas;
        - not affected by oil, water, moisture, etc; and
        - no moving parts – so physically very robust.
    - disadvantages of magnetic stripe readers:
        - if the magnetic stripe gets damaged, the data is lost;
        - does not work at a distance (the card needs to be in close contact with the reader); and
        - because the information is not human readable, this can be a disadvantage in some applications.
- Contactless debit card readers
    - the shop assistant enters the amount needed for payment, the card reader informs the customer to present their contactless card, then the customer holds their card close to the front of the card reader, in which the terminal display will indicate if the card has been read successfully.
    - advantages of contactless cards:
        - faster transactions;
        - the contactless card system uses 128–bit encryption systems to protect the data;
        - customers do not have to worry about typing errors;
        - retailers no longer have access to the customer's credit/debit card information; and
        - the chip in the contactless credit card responds to the payment terminal reader with a unique number used for that transaction only; it does not simply transmit the consumer's account number.
    - disadvantages of contactless cards:
        - they are more expensive than normal credit/debit cards;
        - a thief with a suitable reader could monitor your contactless card transaction while standing at the counter with you, or just behind you;

        - can take money twice if the customer uses it as a chip and PIN card;
        - transactions are usually limited to a small maximum value; and
        - transactions have been carried out without the card holder being aware of this while they were just standing in the payment queue.
- Chip and PIN readers
    - customer has to key in their PIN to make a transaction and these cards do not use radio frequency technology;
    - used where payments are made using cards;
    - advantages of chip and PIN readers:
        - more secure system than contactless payments; and
        - more robust system than magnetic stripe cards.
    - disadvantages of chip and PIN readers:
        - fraud as there is a need to be careful to ensure PIN is not read by somebody else while you're keying it in.
- Radio Frequency Identification (RFID) readers
    - RFID readers use radio waves to read and capture information stored on a tag.
        - The RFID tag is made up of:
            - a microchip that stores and processes information; and
            - an antenna which is used to receive and transmit information.
        - The tag can be passive or battery-powered.
            - passive: use the reader's radio wave energy to return back information;
            - battery-powered: use a small embedded battery to power the RFID.
    - uses of RFID:
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