1 Number Systems

This chapter will cover the following:

- Symbols of a given number system
- Base of a given number system
- Binary number system
- Decimal number system
- Conversion from decimal numbers to binary numbers
- Conversion from binary numbers to decimal numbers
- Representation of data using Binary number system

1.1 Use of number systems

Humans use computers for their everyday activities to make the tasks easier, more accurate and efficient, but computers are unable to understand the data and instruction provided in human languages.

The computer understands data and instructions such as text, numbers, images and sound that are fed to the computer by humans, as numbers (see Figure 1.1).

Figure 1.1 : Computer and user

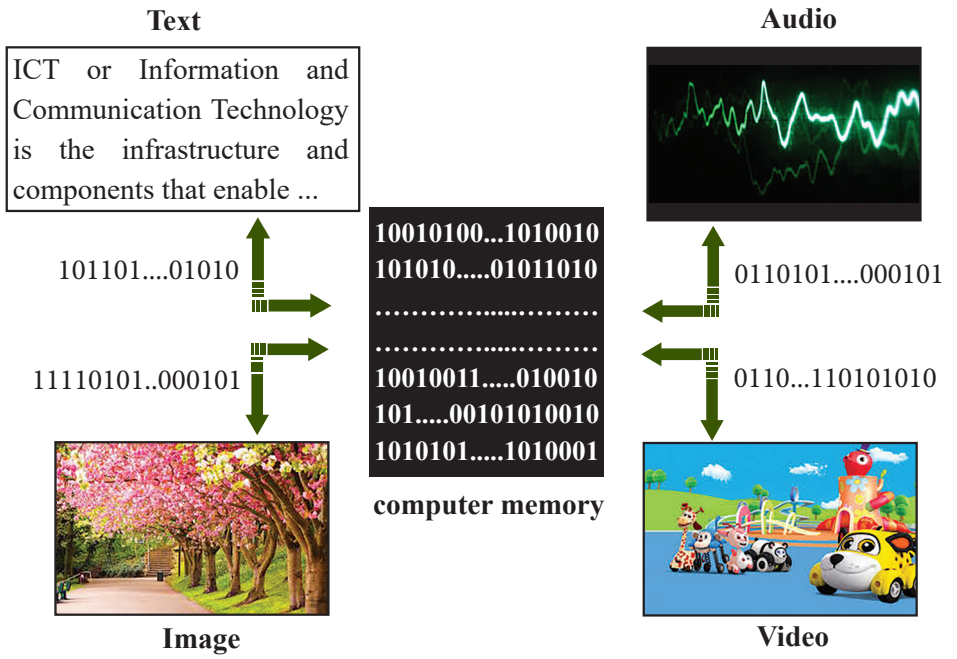


Figure 1.2 : Representation of different types of data in memory as binary digits

What is a number system?

A number system is a method that can be used to represent numbers. There are several different number systems. Each number system has a fixed number of different symbols.

1.2 Types of number systems

The *base* of the number system determines to which number system a given number belongs to :

We will learn about four different number systems. The following table shows the *symbols* and the *base* of each number system. The number of different symbols in a given number systems is the **Base** of that number system.

Number system	Symbols	Base
Binary	0,1	2
Octal	0, 1, 2, 3, 4, 5, 6, 7	8
Decimal	0, 1, 2, 3, 4, 5, 6, 7, 8, 9	10
Hexadecimal (Hex)	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F	16

Note - Only binary and decimal number systems are studied in Grade 8.

1.3 The base of a number system

The *base* indicates to which number system a given number belongs to. The base is shown at the right end of the number as a subscripted text.

e.g. -

binary number system - 101_2, 111011_2 octal number system - 101_8, 573_8

decimal number system - 101_{10}, 47_{10} hexadecimal number system - 101_{16}, $7B_{16}$

Refer to workbook for Activity 1.1.

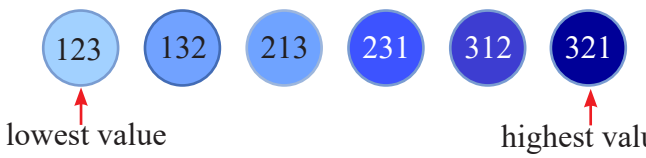
1.4 Decimal number system

Humans are familiar with the decimal number system. We identify the symbols here as numbers. We use the decimal number system for all arithmetic operations.

Symbols in decimal number system - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

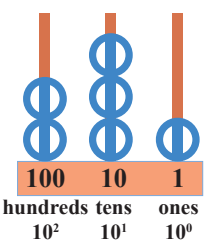
Each position in a given number has a place value.

e.g.- Shown below are examples using symbols 1, 2, 3 :



Let us learn about the formation of a decimal number.

Displaying 231 on a counting frame



231 in expanded form

e.g. - 231_{10}

Place value

$= \underbrace{2 \times 10^2}_{} + \underbrace{3 \times 10^1}_{} + \underbrace{1 \times 10^0}_{}$

$= \underbrace{2 \times 100}_{} + \underbrace{3 \times 10}_{} + \underbrace{1 \times 1}_{}$

$= 200 + 30 + 1$

$= 231$

10^0, 10^1, 10^2 show the place value of decimal symbols.

Refer to workbook for Activity 1.2

1.5 Binary number system

The Binary number system uses two different symbols 0 and 1.

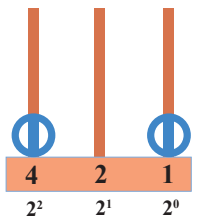
Symbols of binary number system - 0, 1

Binary symbols 0 or 1 are called bits.

Bit = Binary digit → 0 or 1

Let us learn about the formation of a binary number.

Display 101_2 counting frame



101_2 in expanded form

e.g. - 101_2

$= \underbrace{1 \times 2^2} + \underbrace{0 \times 2^1} + \underbrace{1 \times 2^0}$

$= \underbrace{1 \times 4} + \underbrace{0 \times 2} + \underbrace{1 \times 1}$

$= 4 + 0 + 1$

$= 5_{10}$

2^0, 2^1, 2^2 show the positions of binary symbols.

1.6 The necessity of converting one number system to another

All input fed into the computer exist in the binary form. Subsequently, the data in the binary form in the computer is processed and the output is information in the form of text, image, sound, video, etc.

For example, if a user feeds a decimal number into the computer via keyboard, it is represented in binary form inside the computer.

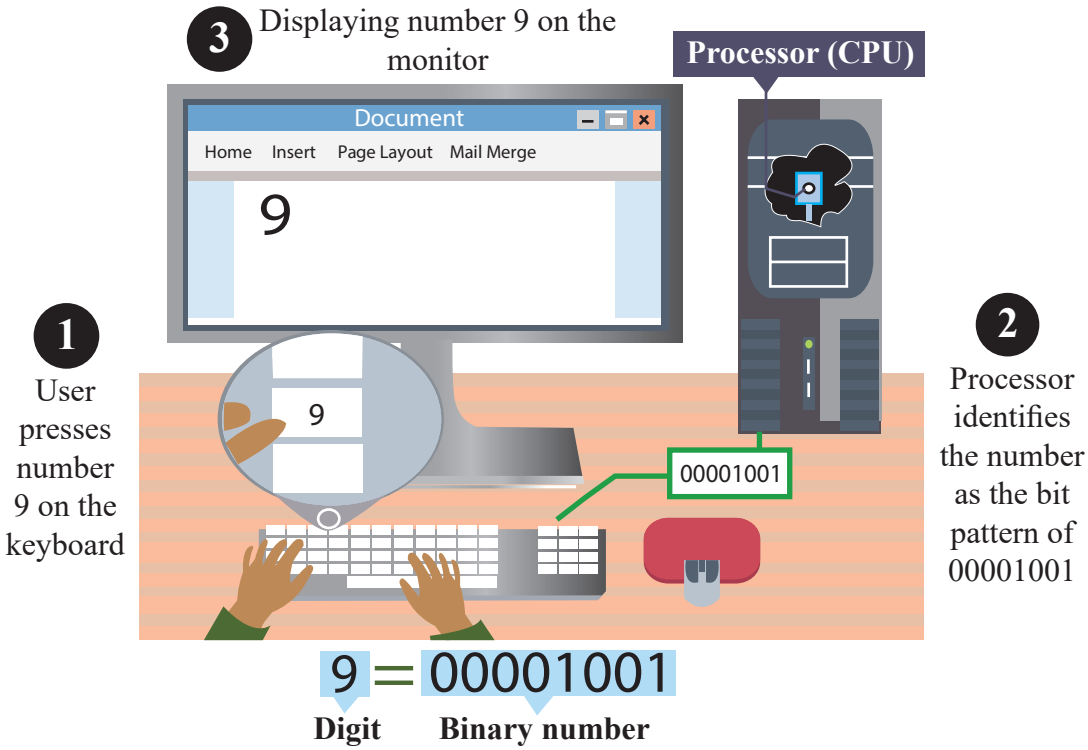


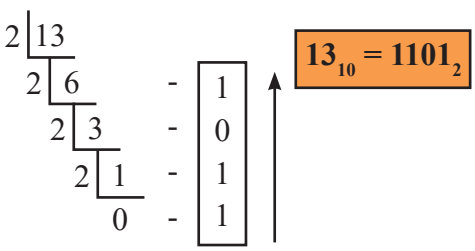
Figure 1.3 : Representation of a decimal number in binary form

Therefore, conversion from one number system to another is important.

1.6.1 Converting decimal numbers to binary numbers

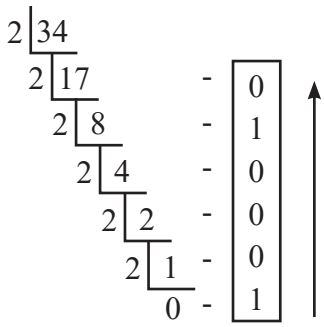
In order to convert a decimal number to a binary number, the decimal number is repeatedly divided by two until the remainder is 0 and the remainder of the division can be written on the right side. After that, write all the remainders from the bottom to top to represent the decimal number in binary form. However, the number is displayed on the display screen as a decimal number.

e.g. - Converting 13_{10} to a binary number



Division	Quotient	Remainder
13/2	6	1
6/2	3	0
3/2	1	1
1/2	0	1

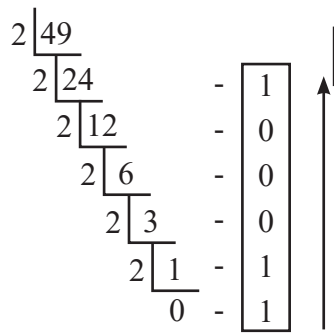
e.g. - 34_{10} Converting number 34 to a binary number



$34_{10} = 100010_2$

Division	Quotient	Remainder
34/2	17	0
17/2	8	1
8/2	4	0
4/2	2	0
2/2	1	0
1/2	0	1

e.g. - 49_{10} Converting number 49 to a binary number



$49_{10} = 110001_2$

Division	Quotient	Remainder
49/2	24	1
24/2	12	0
12/2	6	0
6/2	3	0
3/2	1	1
1/2	0	1

Refer to workbook for Activity 1.3.

1.6.2 Converting binary numbers to decimal numbers

In order to find the decimal equivalent of a given binary number, multiply each bit by its place value (Figure 1.4).

Binary digit	1	0	1	0	1	0	0	0
	×	×	×	×	×	×	×	×
Place value →	128	64	32	16	8	4	2	1
	128	0	32	0	8	0	0	0
Decimal value	128 + 0 + 32 + 0 + 8 + 0 + 0 + 0 = 168							

$10101000_2 = 168_{10}$

Figure 1.4 : Converting binary numbers to decimal numbers

e.g. 1 -

2^4	2^3	2^2	2^1	2^0		
1	0	1	1	1	=	$1\times2^4 + 0\times2^3 + 1\times2^2 + 1\times2^1 + 1\times2^0$
					=	$1\times16 + 0\times8 + 1\times4 + 1\times2 + 1\times1$
					=	$16 + 0 + 4 + 2 + 1$
					=	23_{10}

$10111_2 = 23_{10}$

e.g. 2 -

2^4	2^3	2^2	2^1	2^0		
1	0	0	1	0	=	$1\times2^4 + 0\times2^3 + 0\times2^2 + 1\times2^1 + 0\times2^0$
					=	$1\times16 + 0\times8 + 0\times4 + 1\times2 + 0\times1$
					=	$16 + 0 + 0 + 2 + 0$
					=	18_{10}

$10010_2 = 18_{10}$

e.g. 3 -

2^4	2^3	2^2	2^1	2^0		
1	1	1	1	1	=	$1\times2^4 + 1\times2^3 + 1\times2^2 + 1\times2^1 + 1\times2^0$
					=	$1\times16 + 1\times8 + 1\times4 + 1\times2 + 1\times1$
					=	$16 + 8 + 4 + 2 + 1$
					=	31_{10}

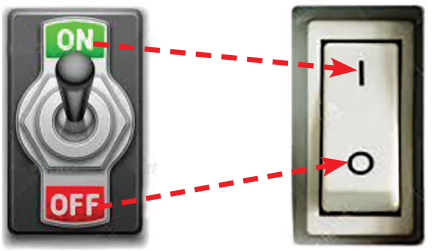
$11111_2 = 31_{10}$

Power of 2
$2^0 = 1$
$2^1 = 2$
$2^2 = 4$
$2^3 = 8$
$2^4 = 16$
$2^5 = 32$
$2^6 = 64$
$2^7 = 128$
$2^8 = 256$
$2^9 = 512$
$2^{10} = 1024$

Refer to workbook for Activity 1.4.

1.7 Binary representation of data and instructions on computers

The computer uses 'ON' and 'OFF' states to represent data and instructions as a bit pattern of 1s and 0s.

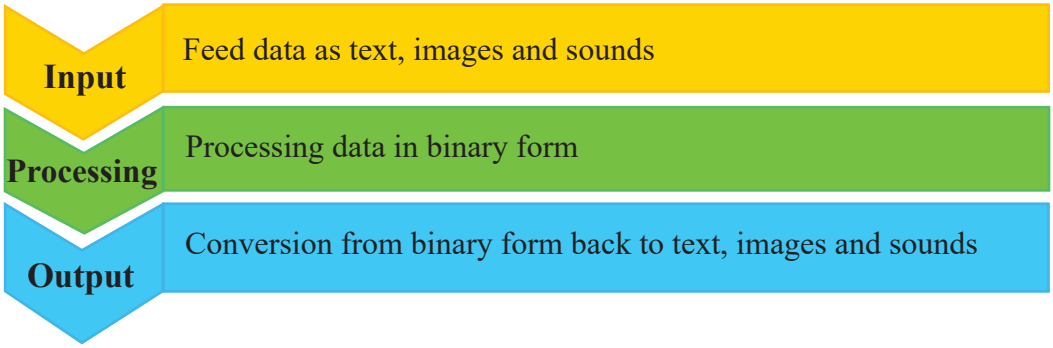


Texts, sounds and images are stored in the computer memory as binary bit patterns. Hence, all data need to be converted into binary form before processing.

e.g. -

Data seen by humans		Data seen by the computer
	converting image to binary numbers	1010...101010 11...11010101 .....
	converting sound to binary numbers	11..1100101.0 010111...0101 .....
	converting letter A to binary numbers	1000001
	converting number 9 to binary numbers	0001001

Hence, the computer takes all inputs in binary form, processes them in binary form and provides them to the output devices in the form of text, images, sounds and videos.



All processes in a computer are performed using 0 (OFF) and 1 (ON) states. Data are fed to the memory of the computer in binary form. The binary data are sent to the processor and then sent back to the memory after processing. Subsequently, they are sent to the output devices. Figure 1.5 illustrates the flow of binary data among the different components of a computer system.

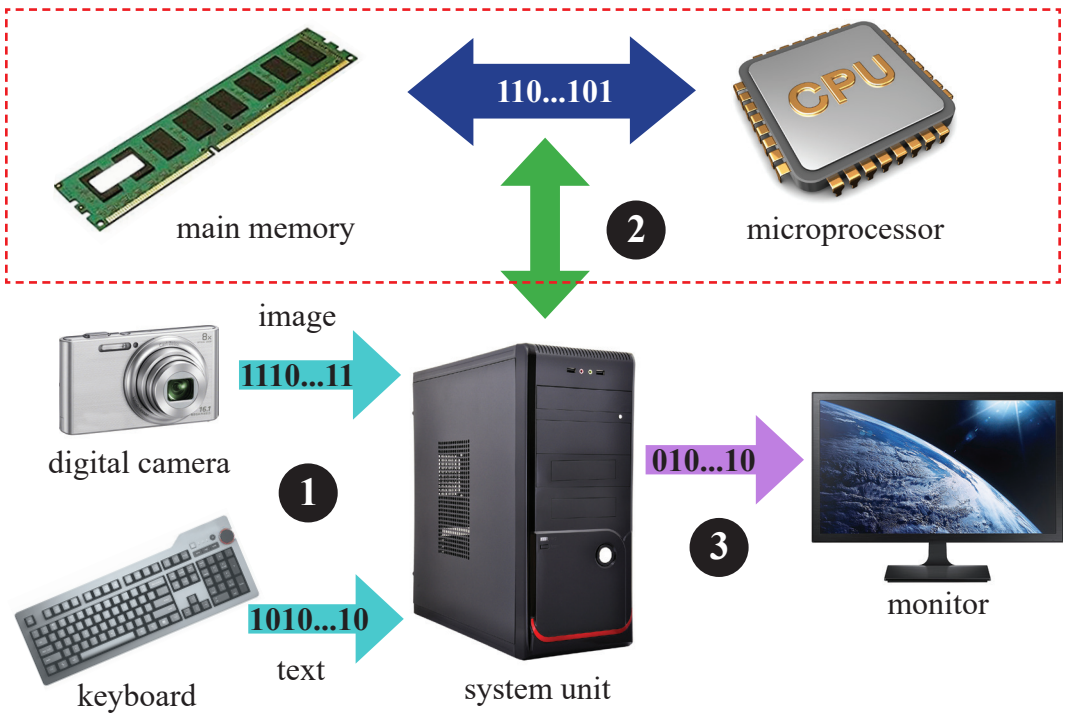


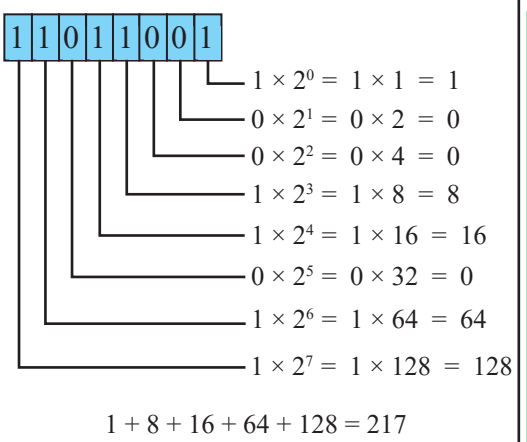
Figure 1.5 : Flow of binary data in a computer

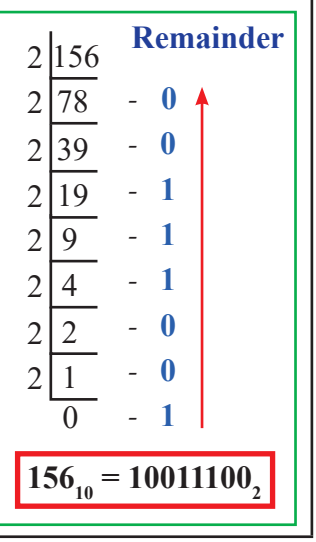
All activities in the computer such as data input from the input devices (e.g., camera, keyboard), saving data temporarily in the main memory and saving permanently in the hard disk, processing data and sending processed data (information) to the output devices are carried out using digits 0s and 1s.

Refer to workbook for Activity 1.5.

Summary

Number system	Binary	Decimal
Symbols	0, 1	0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Base	2	10
Number representation example	111010_2	367_{10}
Conversion examples	binary to decimal	decimal to binary



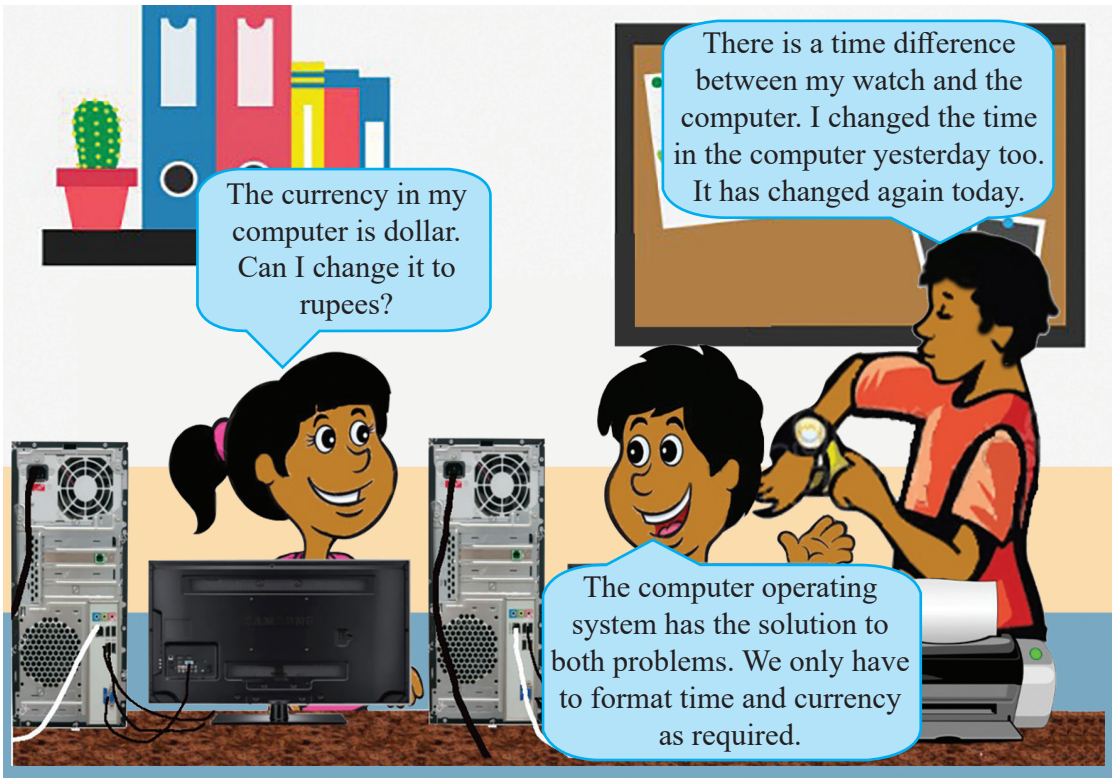


2 Configuring and Formatting a Computer

This chapter will cover the following:

- Format date, the time zone, the time and currency
- File attribute configuration
- File searching
- Hardware troubleshooting
- Software troubleshooting

2.1 Formatting date, time zone, currency and numbers



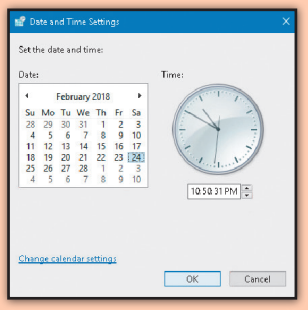
It is important to format the date, time zone, time, currency and number to suit the country where the computer is used.

2.1.1 The date, the time zone and time in a computer

The importance of setting up the date, the time zone and time in a computer

Format is useful in :

- Installing and updating software
- Working with application software, in scheduling to activate, shut down and updating.
- Updating the operating system software
- Activating software licenses



Date and time of a computer

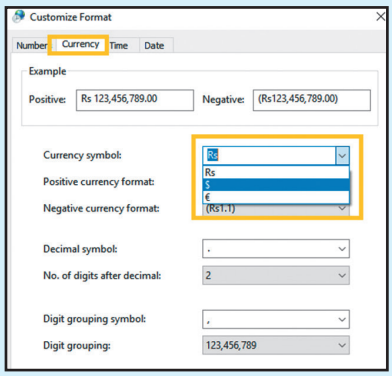
It is important to have the correct date and time in a computer and maintain them, because file saving, searching, sending reminders, preparation of business letters, etc. use date and time of the computer.

Time zone of a computer

The countries in the world are divided into different time zones and they maintain a unique time according to an international standard. These time zones are used for legal, commercial and social purposes.

e.g. - 6.00 am in Sri Lanka will be 1.30 am in United Kingdom

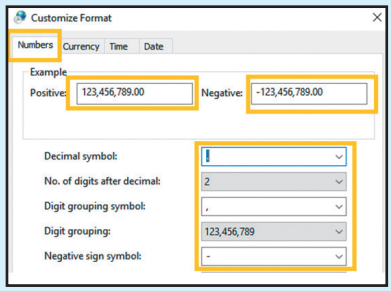
Currency and its formats



The default currency setting of a computer is the currency of the country of which the operating system is produced.

Therefore, we need to modify the currency to suit our country.

Number formats



Absence of a currency and number formats to suit international acceptance, could be a drawback when working with the Internet.

Refer to workbook for Activity 2.1.

2.1.2 File attributes

Figure 2.1 given below shows most of the attributes of a file stored in the computer.

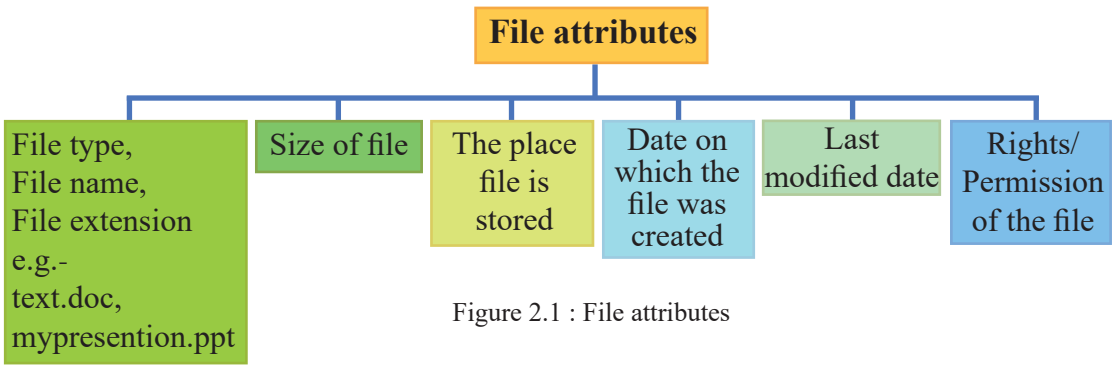


Figure 2.1 : File attributes

Note - File extension shows the file type
e.g. - executable file in the computer (.exe)

Advantages of file permission attributes

- File permission attributes provide important details regarding the file. Changing file rights can also help with the following;
  - The file can be made hidden.
  - As a file protection strategy, others may see the file, but it can be converted to a read only file which does not allow for modification.

Refer to workbook for Activity 2.2.

2.1.3 Searching files

Files are searched when the name of file or the place stored in, is unknown.

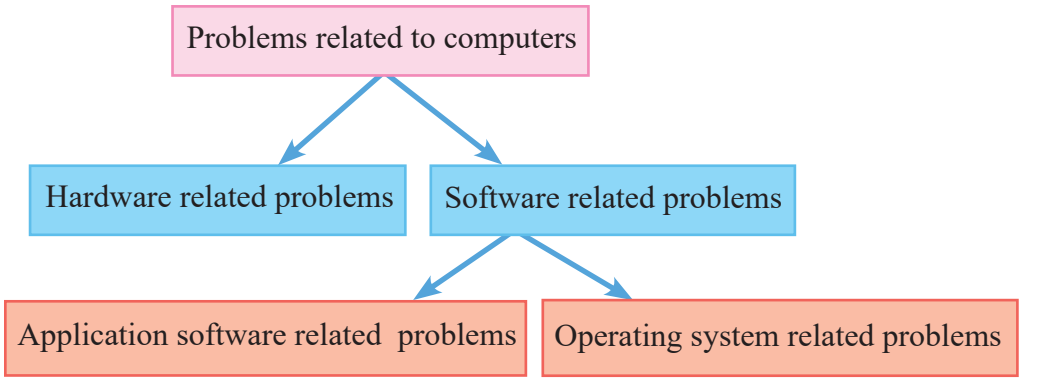
Several search methods are provided by an operating system. Files can be search by file name, file extension or date saved.

File extension can be used to search files by type. Using this, let us search for a file.

Refer to workbook for Activity 2.3.

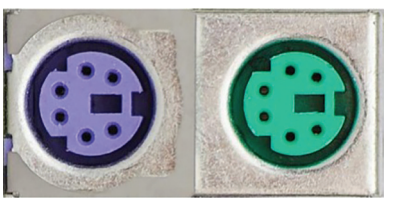
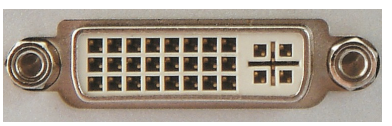
2.2 Troubleshooting and maintenance of computer

There are two basic types of troubles we experience when we work with the computer.



First, let us study what hardware problems are.

To identify problems related to hardware, it is essential to identify ports used for connections.

1	PS/2 port 	For keyboard/ mouse
2	VGA port	For monitor with VGA connection
3	DVI port 	For monitor with DVI connection

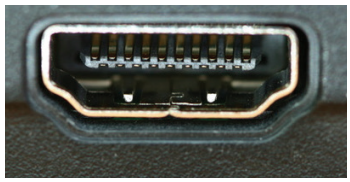
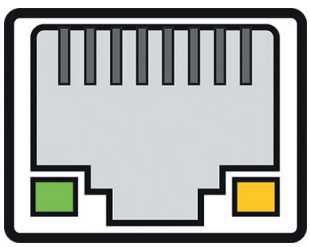
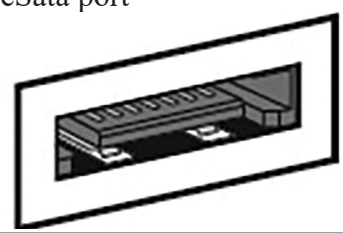
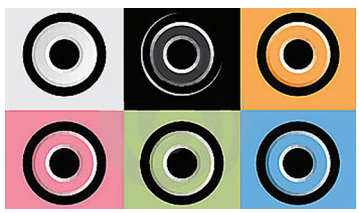
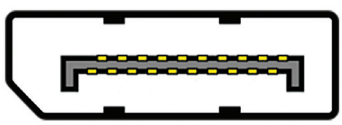
4	HDMI port 	HDMI is used to connect a television set instead of the monitor. Cables that are connected to this port can input and output both audio and video.
5	USB port	For all devices with USB type connections
6	RJ45 Ethernet port 	For networking
7	eSata port 	For external storage devices
8	HD Audio port 	For high quality sound
9	Display port 	To provide higher performance in connecting digital display devices when compared to VGA and DVI ports

Figure 2.2 : Ports in a computer

In addition to the ports in figure 2.2, there are other ports in desktop, laptop, tab computers and mobile telephones. Let us identify those ports which are shown in figure 2.3.

Parallel port	This was mostly used for printer connection. However, the modern printers use USB cables. Therefore, modern computers do not come with this port.
Micro USB port	Connects smart devices such as mobile phones, MP players, photo printers and digital cameras.
SD card reader	For SD cards. Usually found in laptop and tab computers.

Figure 2.3 : Ports in a computer

We learnt about several ports used to connect devices to the computer. This knowledge is essential for troubleshooting of computers. Let us now explore troubleshooting and possible solutions.

2.2.1 Troubleshooting hardware problems

Examples for hardware problems

- The computer does not function.
- The keyboard does not work.
- The mouse does not work.
- The monitor does not display.
- The speakers do not function.
- Network connections does not work.

Problem 01: The computer does not function when the power button is pressed.

Danger!

For activities connected with this unit, electricity has to be used. Be cautious! Do the activities under the direct supervision of the teacher.

In checking the power supply, first disconnect the main power supply.

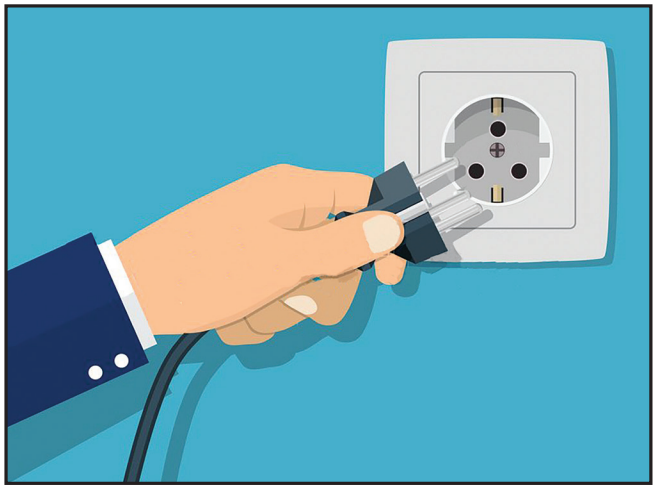
Let us look into the possible solutions;

Solution 01 :

Examine whether the cables connecting the computer and the main port supplying electricity are well connected.

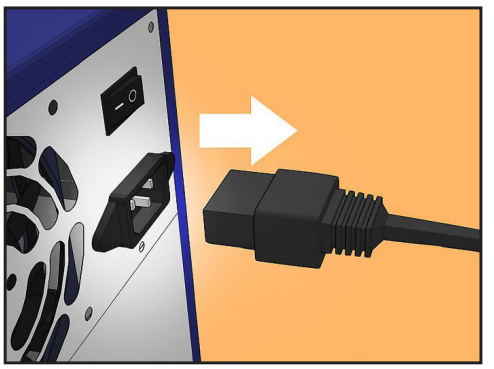
Power supply to the computer may be direct from a wall socket or through a UPS.

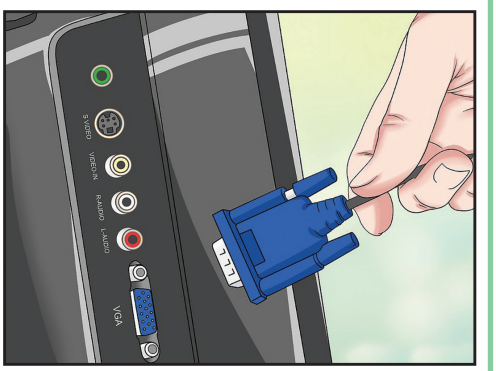
Step 1 Disconnect power supply from the wall socket.



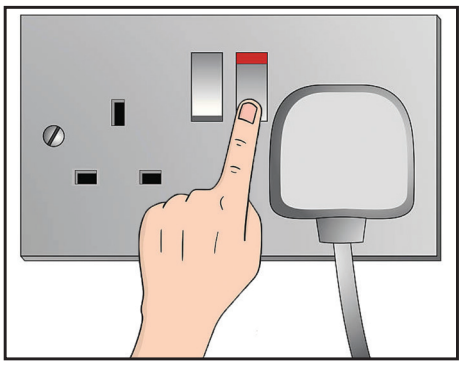
Step 2 Check whether the plug to the UPS is properly connected. Check whether the cable to the computer from the UPS is connected properly. If they are not connected, connect them properly.

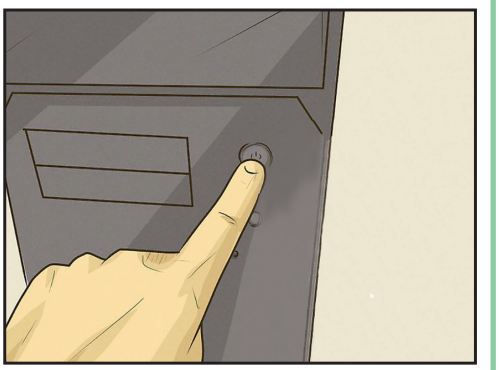
Step 3 Check whether the cables connecting the computer and the monitor to the UPS are connected properly. Sometimes, a system unit may be used to supply power for the screen. In such a situation, check both ends of the cables and fix properly if connection is loose.





Step 4 If all the above items are connected properly, power on the UPS from the main supply.



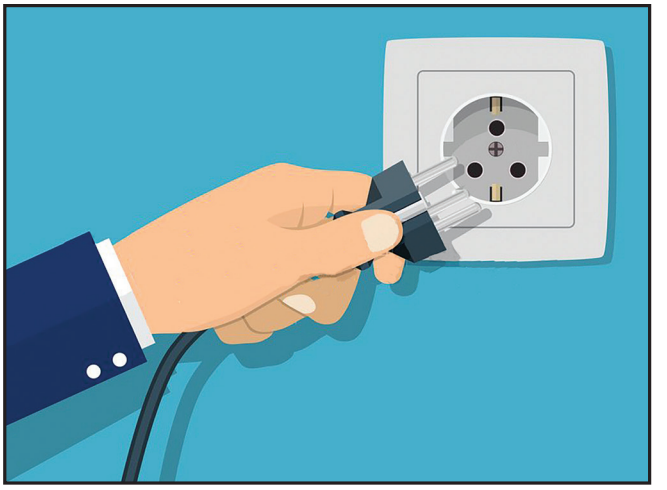


Step 5 Next, switch on the computer. It is most likely to get started. If it does not, seek technical assistance.

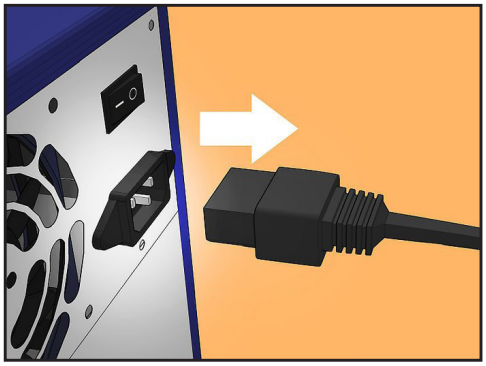
Solution 02 :

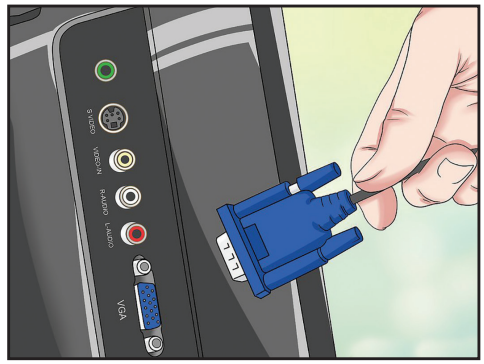
If the power supply is direct from the main supply, follow the steps below;

Step 1 Disconnect power supply from the connection on the wall socket.

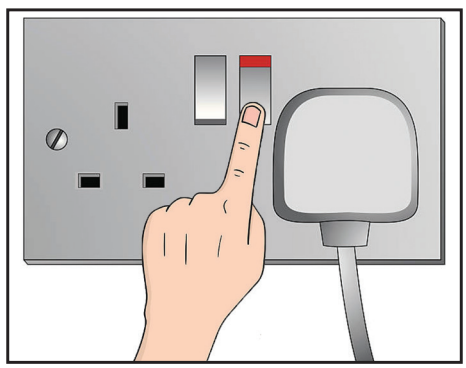


Step 2 Examine the power cables and the cables connecting the computer and the screen. If they are not properly connected, connect them correctly.





Step 3 Once all cables are connected, plug the power cable.



Step 4 After that, switch on the computer. Most likely, the computer will start. Otherwise seek technical assistance.

Problem 02 : The keyboard or the mouse does not function.

Solution 01 : Restart the computer. Check whether the keyboard or the mouse is activated. In most cases, they are likely to. If not, carry out the following.

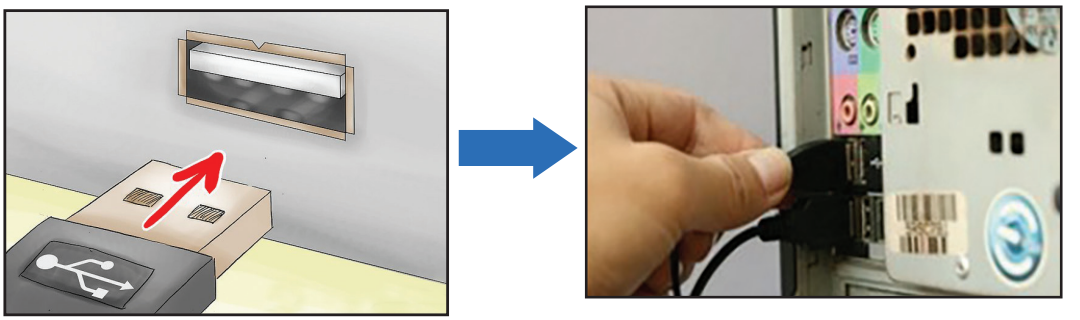
Solution 02 :

Step 1 Shut down the computer.

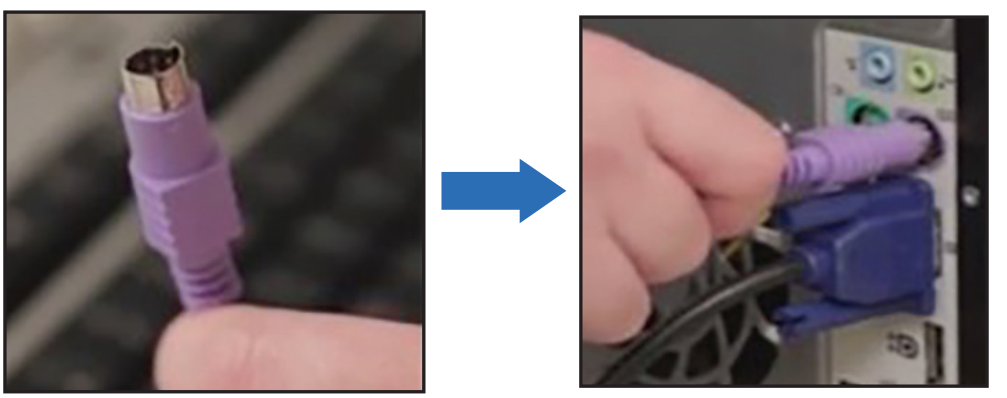
Step 2 Follow the steps below to connect the keyboard and the mouse with respective ports.

There are two types of mice. They are USB and PS/2. (old type)

i. If the mouse has a USB port, connect it firmly to the port as shown in the illustration.



ii. If the keyboard and the mouse have a PS/2 ports (old type), connect them with the PS/2 ports, properly.



Restart the computer after proper connection. The mouse and the keyboard most likely, would work. Otherwise connect another keyboard and mouse to test whether the fault is with the keyboard and mouse. If they too do not work, seek technical assistance.

Problem 03: The monitor does not function.

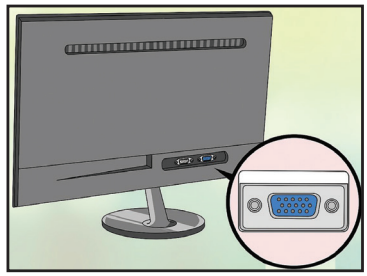
Solution :

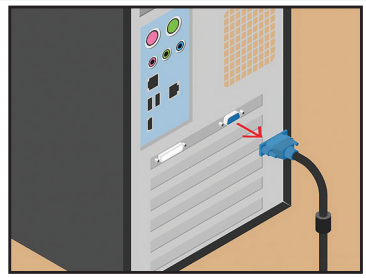
Step 1 Check whether the power button of the monitor is switched on. If not, switch on. If it does not work yet, perform the following steps.

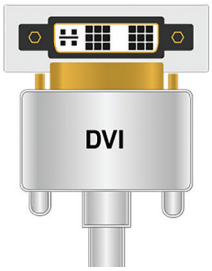
Step 2 Restart the computer. The monitor should work upon restart. Otherwise, perform the following steps.

Step 3 The cables connecting the port may be VGA, DVI, HDMI or display port. They may not be connected properly. Check the connections as shown in the illustrations below;

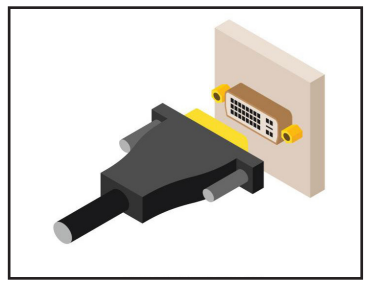
VGA



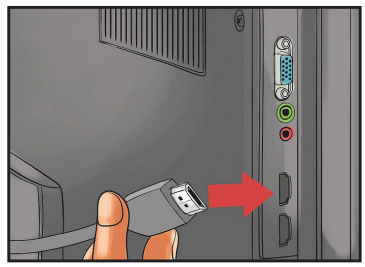




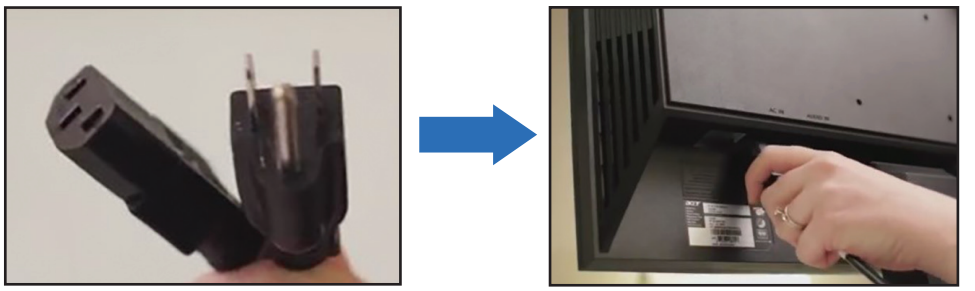
DVI



HDMI



Step 4 Check the connectivity of the power supply cable to the monitor as shown in the following picture. If not, connect them properly.



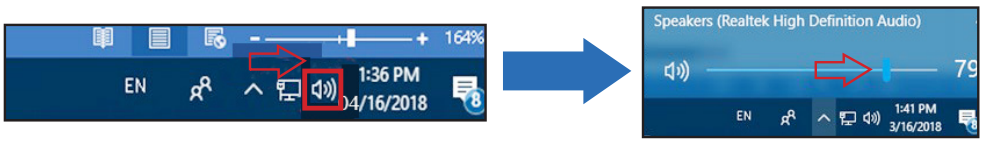
Step 5 If you follow the above mentioned steps correctly, the monitor will function properly when you restart the computer. Otherwise, test with another monitor to check whether the problem is with the monitor. If it still does not work, seek for technical assistance.

Problem 04: Faulty speakers

Solution :

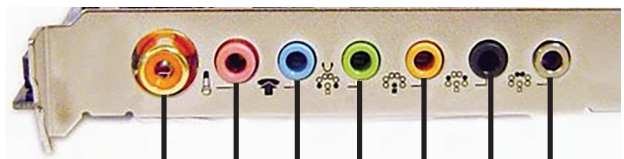
Step 1 Check the speakers by increasing the volume to a higher level. If there is no sound still, perform the following steps;

Step 2 To check whether the volume is minimized by the operating system, check the sound icon in the task bar at the bottom right hand of the computer. Check whether sound has been minimized or muted. Double click on the speaker icon and move the slider up and down to test sound. If it does not work, go to step 3.



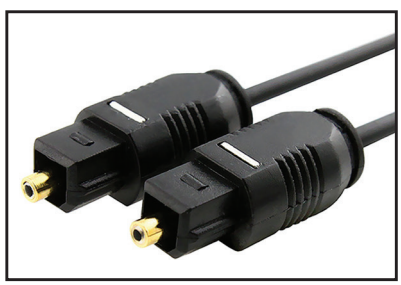
Step 3

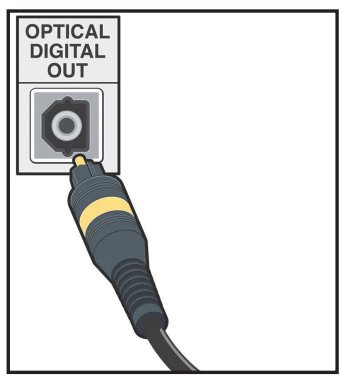
The cables that connect the computer and the speakers vary according to the technology used in the speakers. If HD Audio technology is available in your computer, check whether the cables are connected as shown in the picture. If not, connect them as shown.



Digit Out
Microphone In
Analog Line in
Front Left/Right & Headphone
Center/Sub-woofer
Surround Left/Right
Surround Back Left/Right

If your sound system has optical digital audio technology, you need only one cable to connect. Connect cables correctly to the port as shown below;





Step 4 Most sound systems require separate power supply. There is a cable attached to the speaker for this purpose. Check whether this cable is connected to a port for power. Otherwise, connect the cable for power supply.

Step 5 Follow all the steps specified above and restart the computer. Sound is most likely to work. Otherwise, check whether the fault is with speakers of your computer. Connect another set of speakers to the computer. If the trouble continues, proceed with the following steps;

Step 6 If the audio device driver is not properly installed, it has to be installed correctly. Seek assistance from your teacher for that.

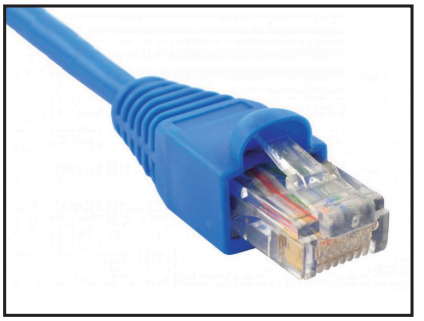
Step 7 If all the steps described above fail to work, seek technical assistance.

Problem 05: Network connection failure.

Note - A computer gets connected to a computer network with the RJ45 connector, via the network switch. There is an Ethernet port in the computer for this purpose.

Solution :

Step 1 Check with the illustrations below to see if the connection is proper. Otherwise, reconnect properly. If it is connected properly, the ethernet window flashes a small green light.



RJ45 Connector

Computer interface

Step 2 If the computer does not get connected to the network, right click on the computer icon at the bottom right of the task bar. This will give a menu for "Troubleshoot problems." Click on this. The operating system will fix the problem and connect to the network.

Note - In addition to network cables, there may be other settings to be set up. Permission for these settings has to be gained through a network administrator account. Therefore, you will need the assistance of your teacher to change such settings.

2.2.2 Software problems

There are two types of software problems as shown in the figure 2.4.

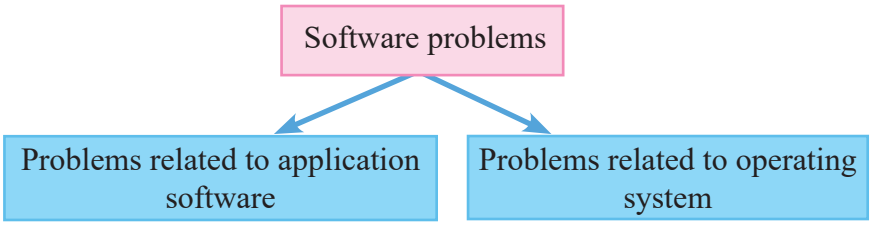


Figure 2.4 : Software problems

Application software

Application software is a computer program that is designed to perform specific tasks.

e.g. - Word processing software (e.g. - MS Word)
Spreadsheet software (e.g. - MS Excel)
Web browser (e.g. - Firefox, Chrome)
Image editing software (e.g. - Paint)

Troubleshooting application software problems

The following some example for application software problems;

- Does not run
- No response, even though it is open
- Inability to see the interface
- Takes long time to load and is slow
- Does not respond to user commands
- Indicates incorrect functioning

Solution 01 :

The simplest solution is to close the application software and reopen. If this does not work, follow the below steps.

Solution 02 :

Find out if the software is compatible with the specification of the computer and with the installed operating system. Software compatibility is the feature of software components or systems which allows to function together. A software

which is compatible with one computer environment may not be compatible to another. For instance, some software that are compatible with Windows operating system do not work with Mac operating system. Therefore, check whether the software is compatible with the computer's operating system. If software is compatible go to the next step.

Solution 03 :

Check whether the software is licensed. Further, check whether the trial period of software is expired. Unlicensed software or software with expired trial period can cause problems. Otherwise, proceed to the next step.

Solution 04 :

Try 'Repair' option of the application software. Restart the computer and reopen the application software.

Solution 05 :

Uninstall the problematic software from the computer and reinstall the same software. You will need assistance from the teacher for the 4th and 5th solutions.

Problem : The above problems of application software may be resolved easily. Sometimes, such problems can occur due of viruses. Let us see how to resolve such problems.

Solution :

Scan the computer using an antivirus software. Restart the computer and the application software.

Note - Computer virus is a malicious code which harms the computer system, destroys data and has the ability to replicate itself.

Problems in operating system

Some of the problems relating to operating system are;

- Slow in starting the computer
- Not being responsive to user commands due to slow processing
- Displaying a blank desktop screen

Problem 01: Slowness of computer

Note - A computer may slow down due to several staring up application programs or due to smaller space in the hard disk. To resolve this problem, logging from an administrator account is necessary. Your teacher will attend in solving these problems.

Solution :

Step 1 Close unnecessary application programs running at start up of the computer.

Step 2 Remove unnecessary files from hard disk. Use "Disk Cleanup" tool of the operating system for this purpose.

Step 3 If these solutions fail, use 'Repair' option of the operating system.

Step 4 If 'Repair' option too does not work, then reinstall the operating system.

Problem 02: Blank desktop

Note - Desktop icons may not be seen due to a problem of the operating system or operating system settings.

Solution 01 :

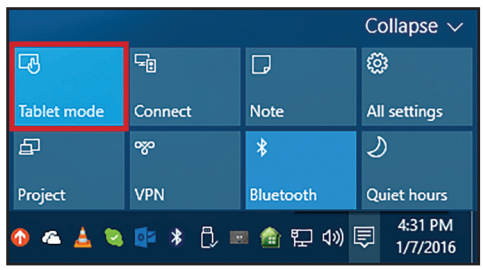
There are two modes to display the desktop in Windows 10 as;

a. Tablet mode
b. PC mode

If the mode is set to Tablet, desktop icons will not be displayed. Hence, it is necessary to follow the steps given below;

Step 1 Click on the speech button on the task bar. (On the left hand side of the time)

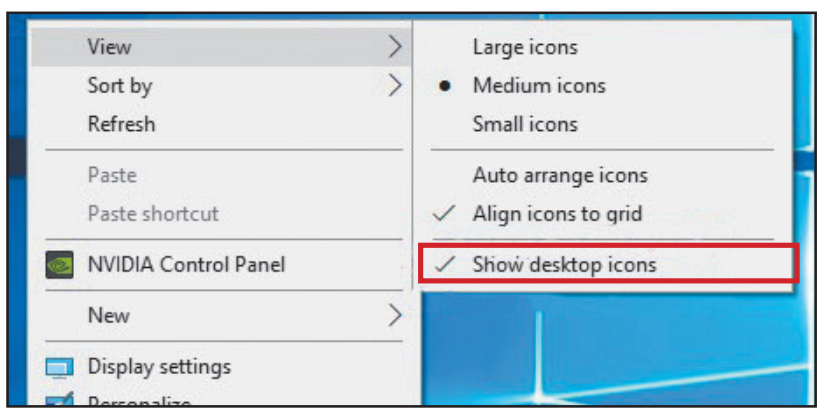
Step 2 Then, the Windows action center opens. Several rectangular tiled buttons are seen at the bottom. Click the "Tablet mode" button. This option changes tablet mode to PC mode which makes the desktop icons visible.



Solution 02 :

If icons are still not visible then, the desktop icons may be disabled. To enable them, follow the steps given below;

Step 1 Right click on the desktop. Click on the "View" menu to see the following sub menu;



Step 2 Click "Show desktop icon" in the sub menu. The symbol "√" will appear on "Show desktop icons". (Desktop icons will now appear on the screen.)

Solution 03 :

If the screen is still blank, the issue may be in the operating system. Access to administrator account is necessary with the assistance of the teacher in order to troubleshoot the issue.

Refer to workbook for Activities 2.4 and 2.5.

Summary

Operating system can be used to change the configuration and settings of a computer.

- It is important to set the date and time in a computer since the date and time is used by the operating system in saving files, searching files, sending reminders and in business correspondence.
- Countries in the world are divided into time zones according to the international standards. These time zones maintain a unique, standard time for legal, commercial and social purposes.
- Currency and their symbols should be adjusted to suit the country standards.
- There are international formats in writing numbers and currency etc.
- There are several attributes in a saved file;
  - Place where it is saved
  - Date of last modified
  - Type of file
  - Size of file
  - Date on which the file is created
  - Rights to access the file
- When a need arises to open a saved file and if the name or the place saved is forgotten, file search can be used to locate it.

- Ports are used to connect a computer to peripheral devices.
- The user may experiences two types of problems in using a computer;
  - Hardware related simple problems
  - Software related simple problems
- Troubleshooting hardware related simple problems
  - Keyboard/ mouse related problems
  - Problems with monitors
  - Problems related to speakers
  - Failure to connect to network
- Troubleshooting software related simple problems
  - Problems with Operating System
  - Problems with application software
- Computer virus is a malware (malicious software) which has the ability to cause problems the computer system, to destroy data and replicate itself.

3 Word Processing

This chapter will cover the following:

- What word processing is
- Use word processing software to;
  - Create, open, save and close a document
  - Highlight text
  - Insert files/objects
  - Insert a graph
  - Check for spelling, grammar
  - Prepare lists

Creating documents using word processing software is known as *word processing*. Word processing software is an application software that can create various types of documents. Some examples are shown in Figure 3.1 below;

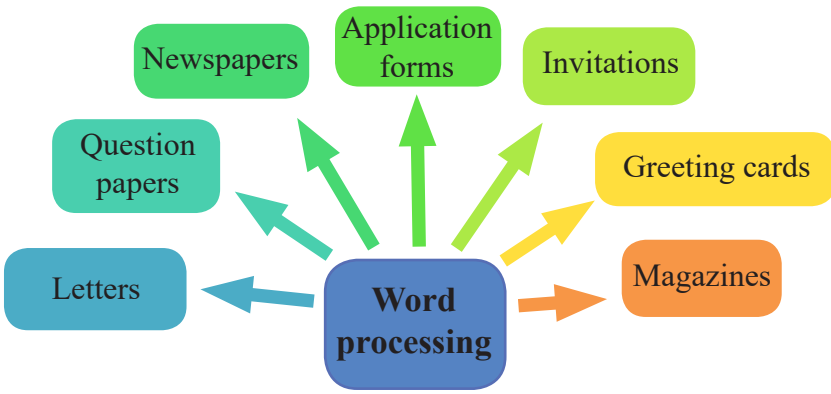
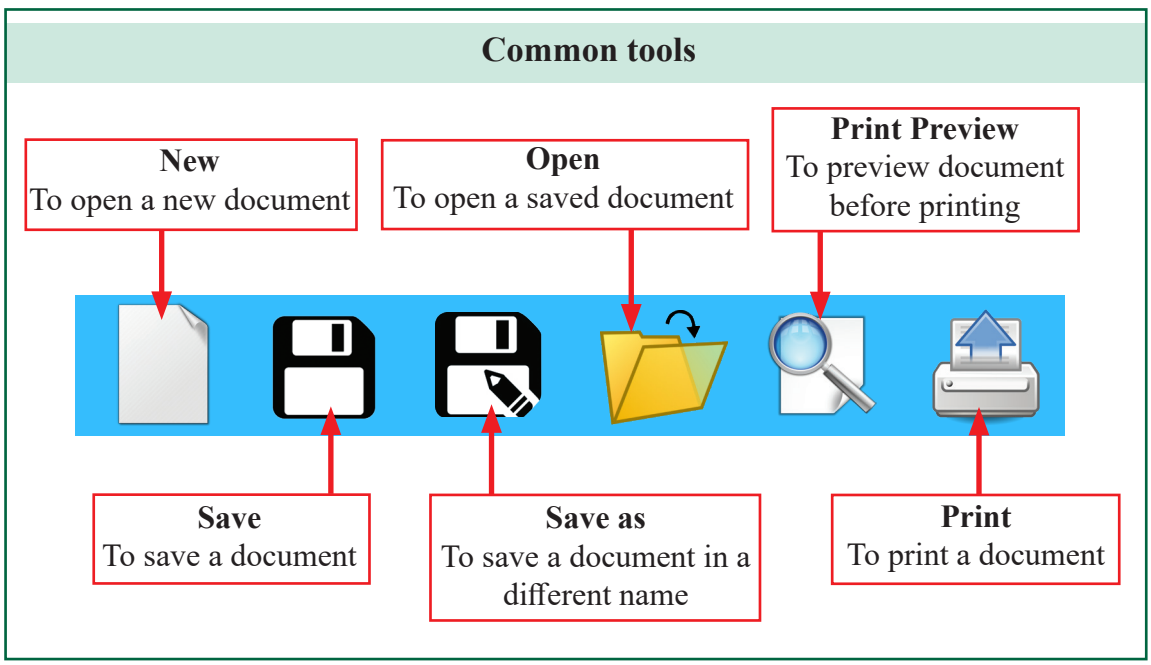
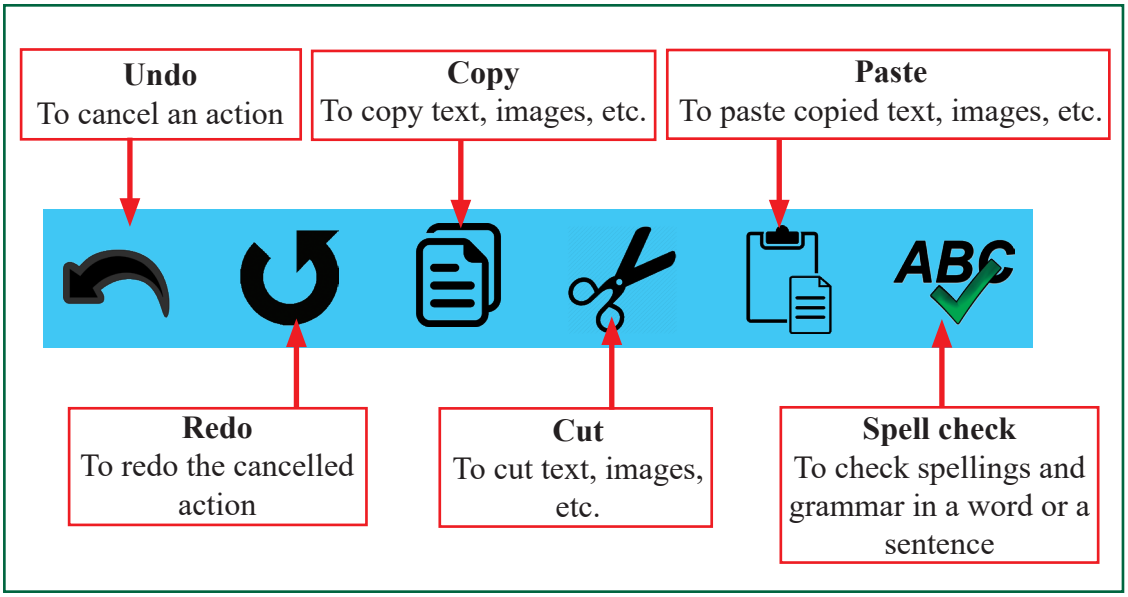


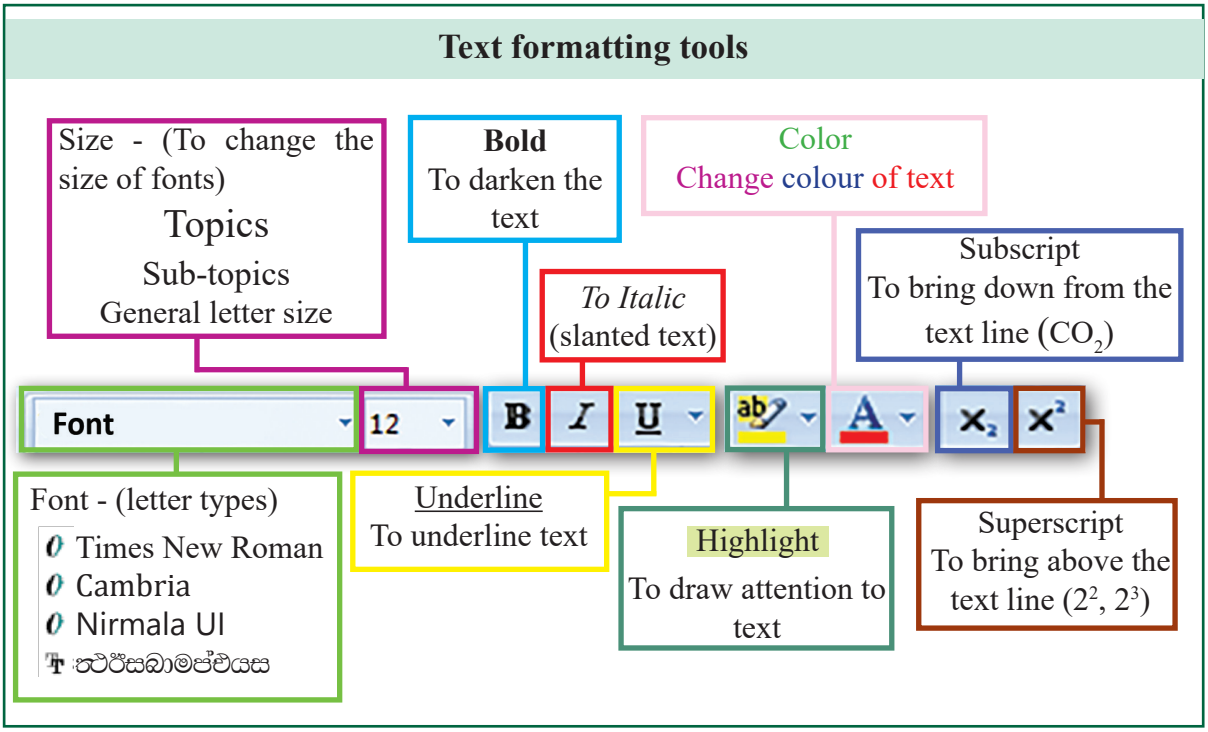
Figure 3.1 : Some documents that can be produced by using Word Processing software

There are many tools for creating documents using Word Processing software. Some of them are shown below;

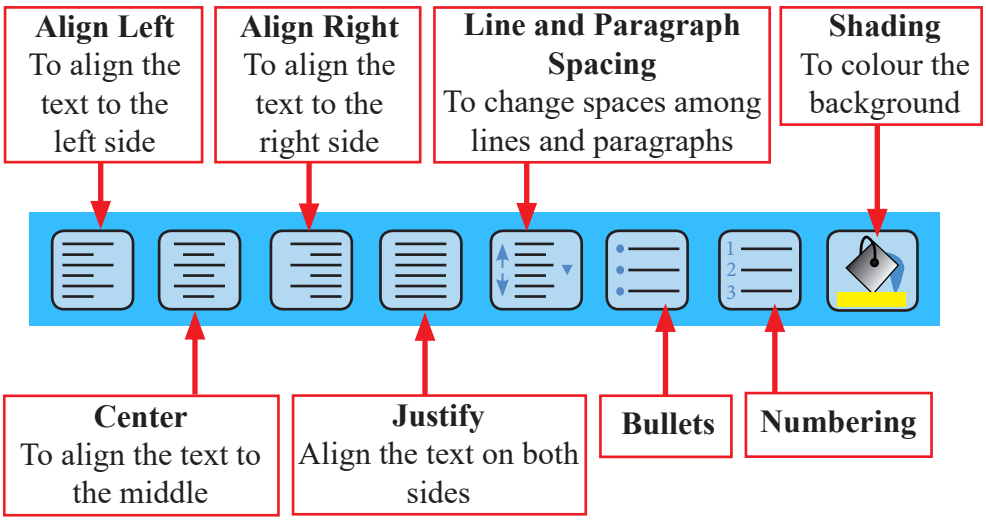




Text formatting tools

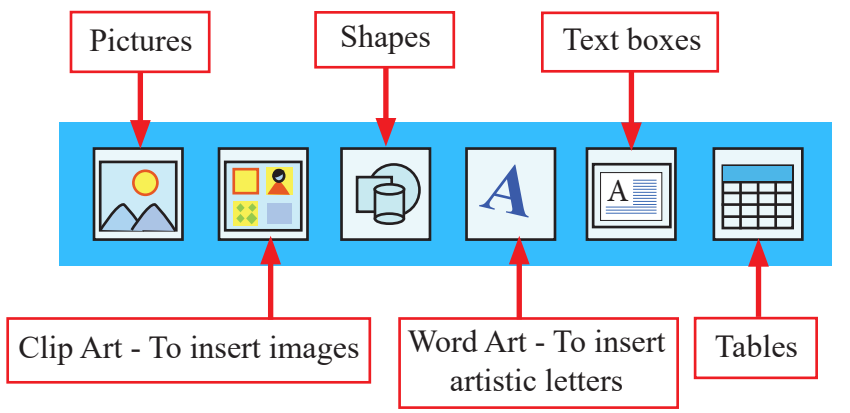


Alignment and positioning tools



Refer to workbook for Activities 3.1, 3.2, 3.3, 3.4 and 3.5

Insert objects



Refer to workbook for Activities 3.6, 3.7, 3.8, 3.9 and 3.10

Summary

- Letters, magazines, certificates, application forms and many other documents can be prepared using *Word Processing Software.*
- Commonly used tools in Word Processing are: *New, Open, Save, Print, Print preview, Redo, Undo, Cut, Copy, Paste, Spelling and grammar.*
- *Size, Color, Bold, Italic, Underline, Highlight, Font, Superscript, Subscript* etc. are tools that can be used to format letters, words and sentences, etc.
- *Left Align, Center, Right Align, Justify, Bullets, Numbering, Spacing, Shading etc. are tools* to align text in a document.
- *Pictures, Tables, Shapes, Text boxes, Clip Art* and *Word Art* are some other features that can be added to document.

4 Programming

This chapter will cover the following:

- Analyzing problems
- Control structures
- Providing solutions to day-to-day problems
- Developing programs using *sequence* and *selection* control structures
- Applications of mobile and smart devices.

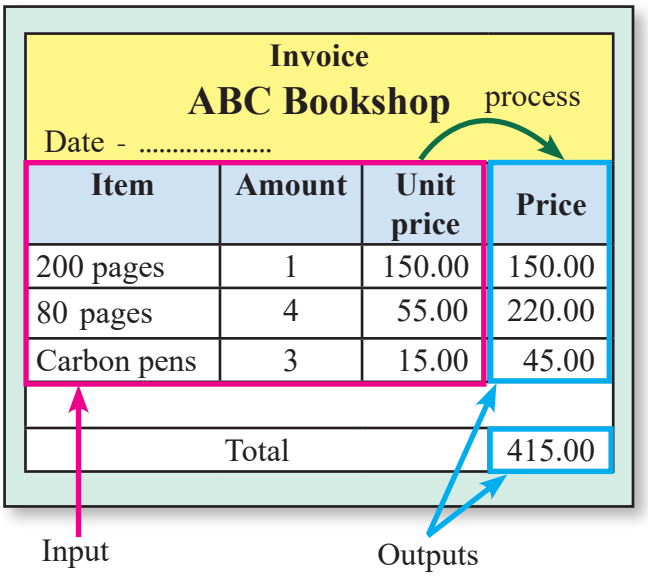
4.1 Problem analysis

Analyzing a problem involves dividing the problem into smaller segments of the problem and examine. This will make it easier to solve the problem.

For example, let us consider an invoice issued by a stationery shop.

To calculate the price (amount) of each item, number of items and unit price are required. The items required to prepare the invoice, are called **input**. Calculating the total price for each item and the value of total bill is known as **processing**. Price (amount) for each item and total bill value are known as **output**.

Hence, let us analyze the above bill and identify input, process and output.



Input : Item description, number of items, unit price

Process : For an item purchased;

Amount = number of items × unit price

Total bill = total price (amount) of all items purchased

Output : A mount to be paid

In order to develop a computer program, it is essential to identify the *inputs, process and outputs* by analyzing a problem. (see figure 4.1)

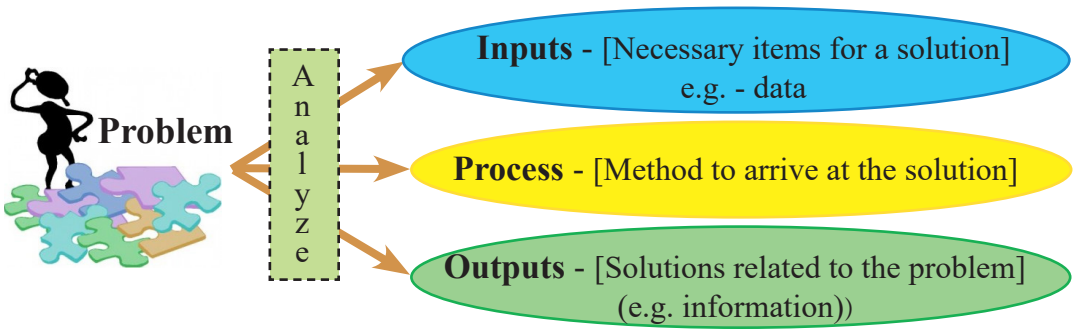


Figure 4.1 : Problem Analysis

Note - The problem needs analyzing before developing computer programs.

When analyze a problem, it is possible to identify *inputs, process and outputs*.

Example 1

Problem : Find the year of birth when a person's National Identity Card number is given.

987654321V

Input : National Identity Card number

Process : Select the first two digits in the identity card number

Output : Year of birth

Example 2

Problem : Find the cost of purchasing five pens

Input : Price of a pen

Process : Calculating cost
(total = price of a pen × 5)

Output : Total amount

Figure 4.2 : Pens

Refer to workbook for Activity 4.1.

4.2 Control structures

A control structure is a block in a program that analyses variables and chooses a direction of flow of the program.

control structures
- *1. Sequence*
- *2. Selection*
- *3. Repetition*

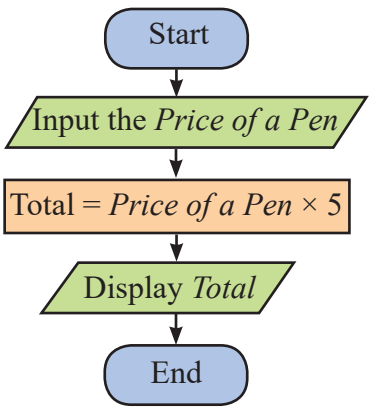
You have learnt in chapter five of Grade 7 book that there are three types of control structures as *sequence, selection* and *repetition.*

Note - In inputs and outputs are denoted by the symbol ▱ and the processes are by ▭ symbol.

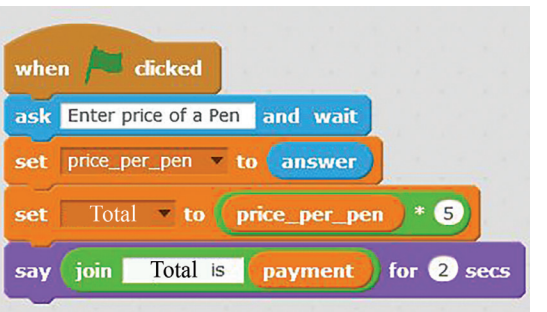
4.2.1 Sequence

If the steps are carried out one after the other from the beginning to the end in a particular consecutive order, it is called a *sequence.*

The flowchart and the Scratch program below is equivalent to the Example 2 in page 40.



Flowchart 1 : finding cost of five pens



Scratch program 1: find the cost of 5 pens when the unit price is provided

The price of the pen is shown by the *price_per_pen* variable and the amount to be paid is shown by the *Total* variable.

4.2.2 Selection

Selection decides which step(s) are executed depending on whether a condition of an algorithm is satisfied or not.

For example, consider a rainy day. If it rains students are asked to go to the library. If it does not rain, students are asked to go to the playground.

The decision box in flowcharts, is used to show the selection control structure (See Figure 4.3). If the condition is true, it is directed towards "Yes". If it is false, it is directed towards "No". The following symbol is used To indicate the decision making;

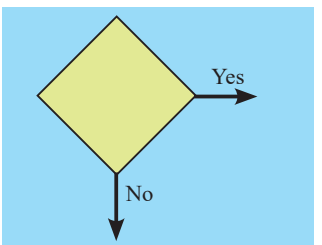
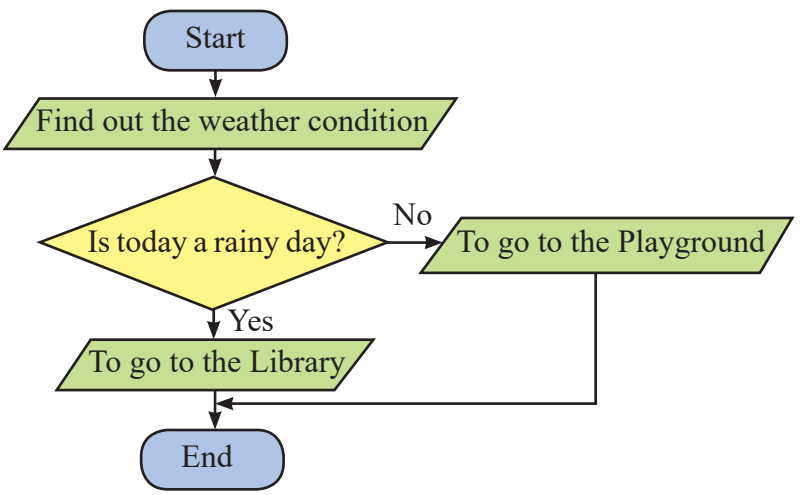


Figure 4.3 : Control structure

Figure 4.4 : Decision on whether it is a rainy day or not

Example 1 Indicate the above example in a flowchart.



Flow chart 2 : Going to the playground or the library according to the weather condition

Example 2 Making decisions when playing *Snakes and Ladders* Game

Snakes and Ladders is a popular game that can be played by an individual or by a group of players. In this game, there are number of boxes from beginning (1) to end (36). Each *ladder* and *snake* has two boxes connected at ends (Refer figure 4.5).

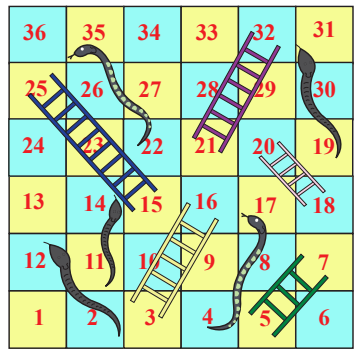
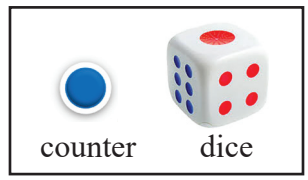


Figure 4.5 : Snakes and Ladders Board

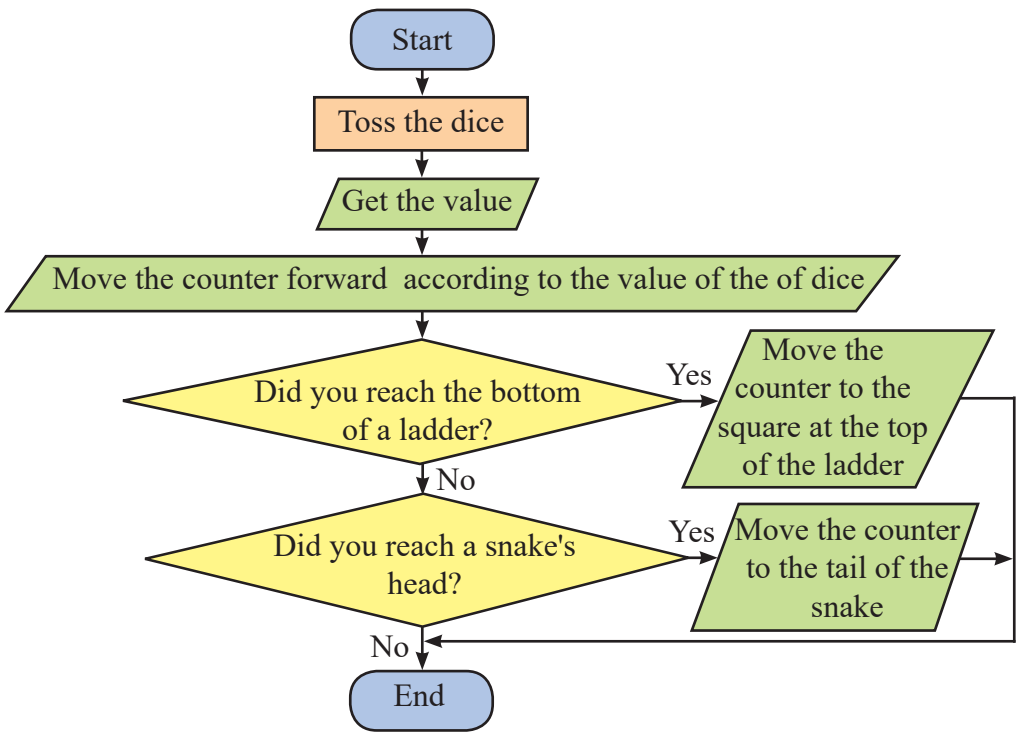
Each time the dice is tossed, the following instructions are to be followed;

1. Check the number shown on the top face of dice.
2. Shift the counter to face by the number shown on the top face of the dice.
3. If the counter reaches the bottom of a ladder, move it to reach the top of the ladder.
4. If the counter reaches the head of the snake, move down to where the tail is.



One has to follow these conditions and reach square 36 to become the winner.

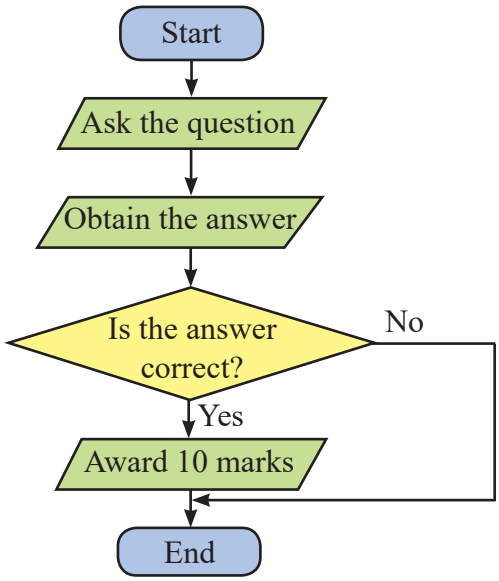
Given below is the flowchart relevant to the above example.



Flowchart 3 : Snakes and Ladders game

Example 3 Consider a scenario where 10 marks are awarded to the correct answer.

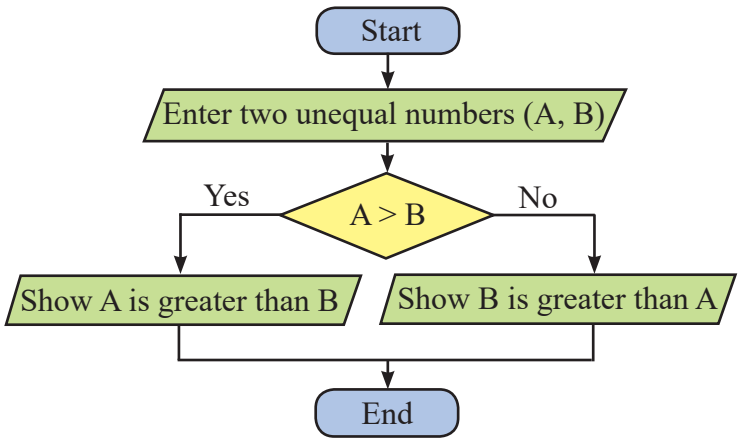
Before marks are awarded, it must be checked whether the answer is correct or wrong. If the answer is correct, 10 marks are awarded. Incorrect answers are awarded no marks. The above scenario can be represented by the following flowchart and control structures (Refer to Flowchart 4).



Flowchart 4 : Offering/Not offering marks for correct/incorrect answer

Example 4 Considering the scenario of finding the larger number from two unequal numbers.

Two numbers are given as input. Then the two numbers are compared. If the first is greater than the second, the output shows as the first number is greater. Otherwise, the output shows as the second number is greater (Refer to flowchart 5).



Flowchart 5 : Finding greater number

Refer to workbook for Activities 4.2 and 4.3

Note - You will learn about the repetition control structure in Grade 9.

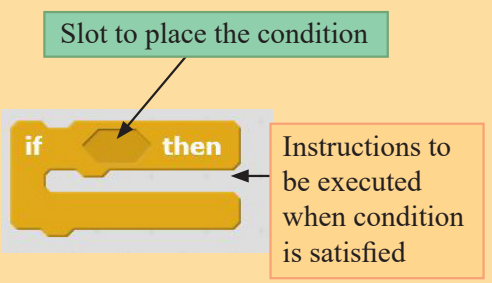
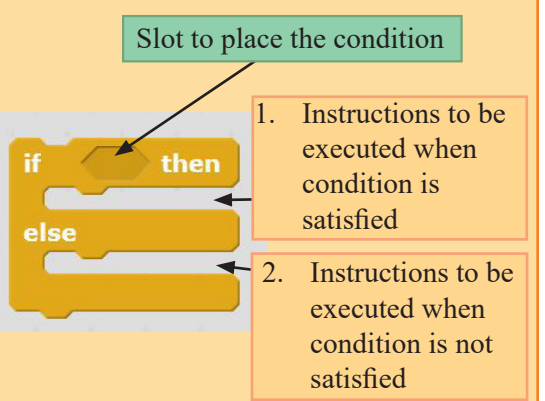
4.3 Selection control structures

Scratch is an Open Source Visual Programming Language produced to make programming easier to learn. Games, music, animations, interactive stories, etc. can be created using Scratch. Basic knowledge about Scratch was provided in the Grade 7 textbook.

Two types of selection control structures can be used in developing Scratch programs;

1. IF... THEN instructions block
2. IF... THEN... ELSE instructions block

Table 1 : Selection control structures

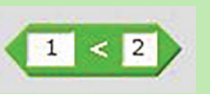
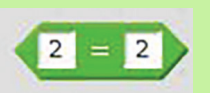
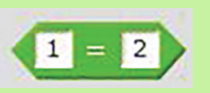
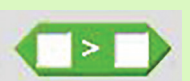
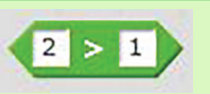
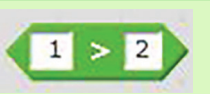
IF... THEN block	IF... THEN... ELSE... block
	
Instructions are executed only if the condition is satisfied.	The first instruction block is executed when the condition is satisfied. The second instruction block is executed when the condition is not satisfied.

Comparison blocks

There are instances where a decision has to be taken after comparing two values in programming. The decision is taken after comparing the two values; whether one value is greater/smaller/equal than other value.

Instruction blocks shown in the following table are used to compare values. These blocks output "True" or "False" after comparison.

Table 2 : Comparison blocks

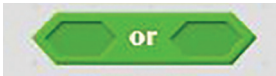
Instructions	Example	Output
Check whether the value on the left is smaller than the value of the right		True
		False
Check whether the value on the left equals to the right		True
		False
 Check whether the value on the left is greater than the one on the right		True
		False

Refer to workbook for Activity 4.4

Instruction with logical blocks

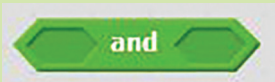
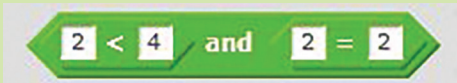
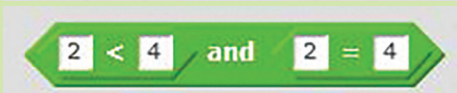
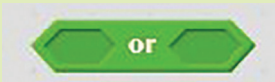
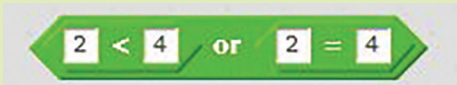
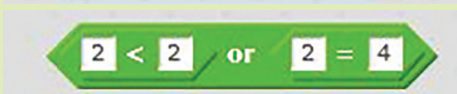
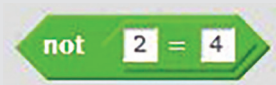
The following instruction blocks are used to combine comparison instruction blocks. There are three types of logical blocks as follows;

1. AND

2. OR 

3. NOT

Table 3 : Logical blocks

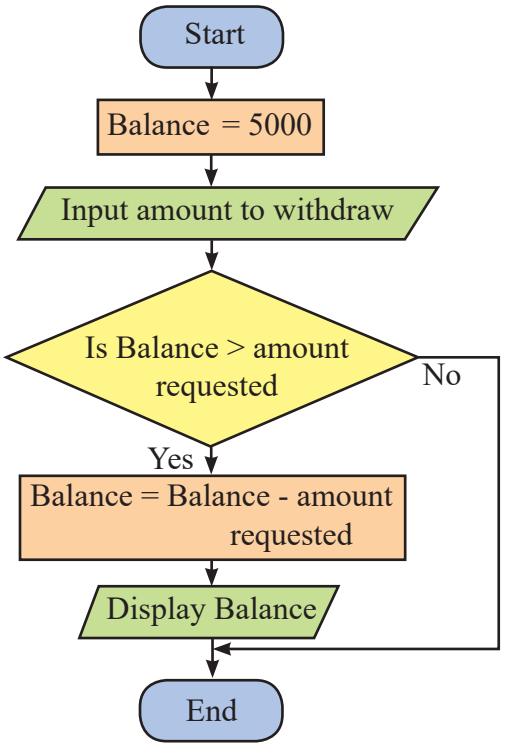
Instruction	Example	Reply
 If both expressions on left and right are true only, the output is true.	 	True False
 If both expressions on left and right are true or if only one is true, the output is true.	 	True False
If the expression is false, the output is true. If the expression is true, the output is false.		True False

Refer to workbook for Activity 4.5

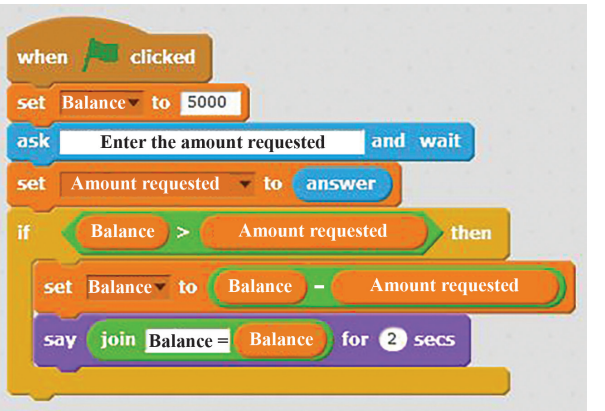
4.3.1 Developing Scratch program with selection control structure

Example 1 Display current balance after a withdrawal from an account with Rs.5000/=

In withdrawing money from an account, the current balance is first checked. Money is released only if the current balance is greater than the amount requested. The amount withdrawn is deducted from the current balance (Refer to Flowchart 6 and Scratch program 2).



Flowchart 6 : Display account balance



Scratch program 2 : Display account balance

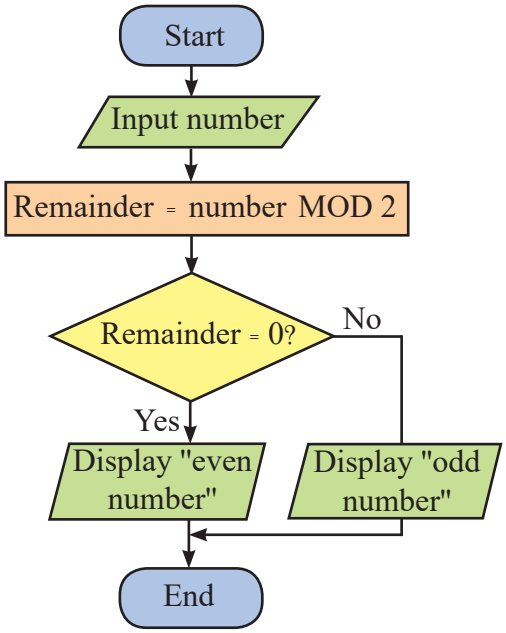
Example 2 Display whether an input number is odd or even.

Mathematical operator MOD is used to determine the remainder when a number is divided by another. For example, 13 MOD 5 is 3. When 13 is divided by 5, the remainder is 3.

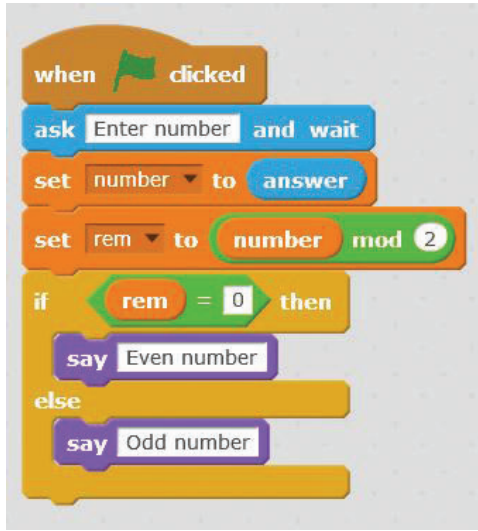
$$\begin{array}{r} 2 \\ 5\overline{)13} \\ \underline{10} \\ 3 \end{array} \leftarrow \text{remainder}$$

13 MOD 5 = 3

Accordingly, if a number is divided by 2 and the remainder equals 0, it is an even number. If the remainder is 1, it is an odd number.

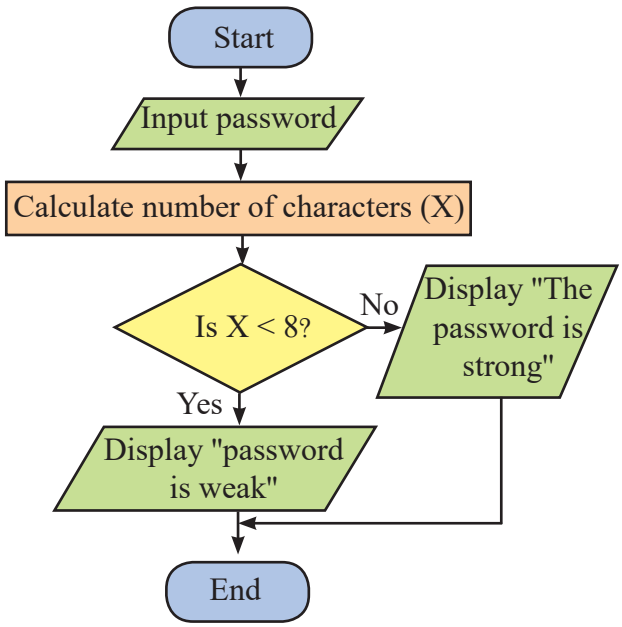


Flowchart 7 : Text whether a number is even/ odd

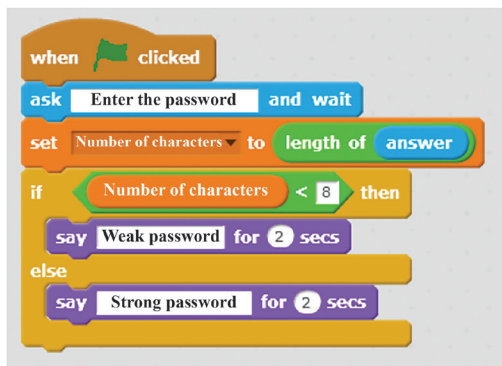


Scratch program 3 : Test whether a number is even /odd

Example 3 The number of characters in a password is one of indicators of strength. If the number of characters is less than 8, it is a weak password. If it is more than 8, it is a strong password (see Flowchart 8 and Scratch program 4).

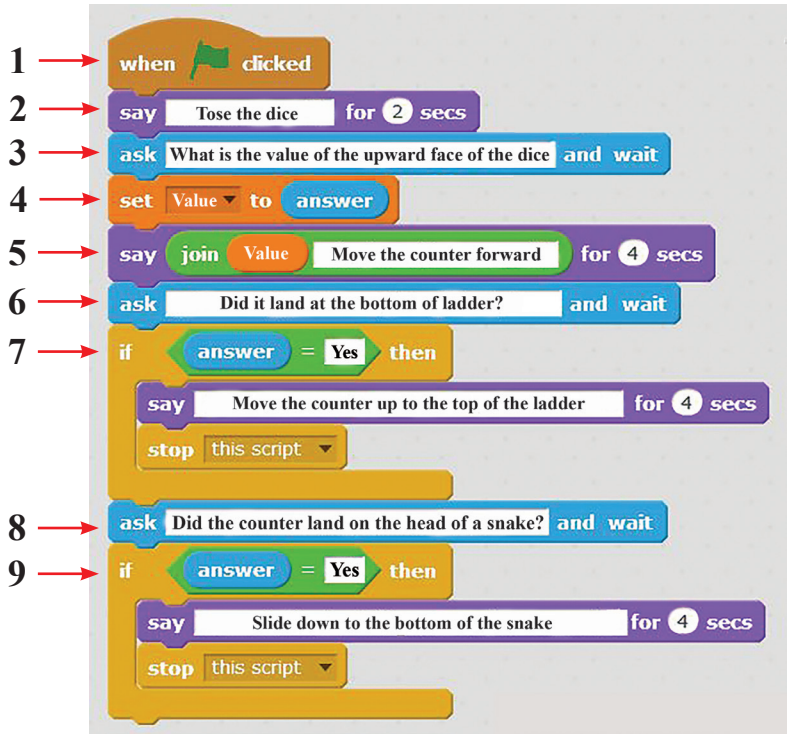


Flowchart 8 : Display whether a passwords is weak or strong



Scratch programming 4 : Display whether a password is weak or strong

The Scratch program for *Snakes and Ladders* game is given below; (Refer to Scratch programs 5)



Scratch program 5 : Snakes and Ladder game

Analysis of the program

1. Click on to start.
2. First, display "Toss the dice".
3. Ask "What is the value?" and get the answer.
4. Assign the value obtained in step 03 above to the variable.
5. Declare 4 seconds to bring the counter forward according to the value of the dice.
6. Obtain "Yes" or "No" answer for the question, "Did it land at bottom of ladder?"
7. If the answer is "Yes", then move the counter to the square at the top of the ladder.
8. Display, "Did the counter come to the head of a snake?"
9. If the answer is "Yes", then move the counter to snake's tail.

Refer to workbook for Activities in 4.6, 4.7, 4.8 and 4.9

4.3.2 Applications for mobile and smart devices

Mobile and smart devices

Various applications are available for mobile and smart devices. These applications usually carry out tasks accurately and efficiently. Each mobile and smart device is developed for a specific function and they can be used according to the user requirements (See Figure 4.6).

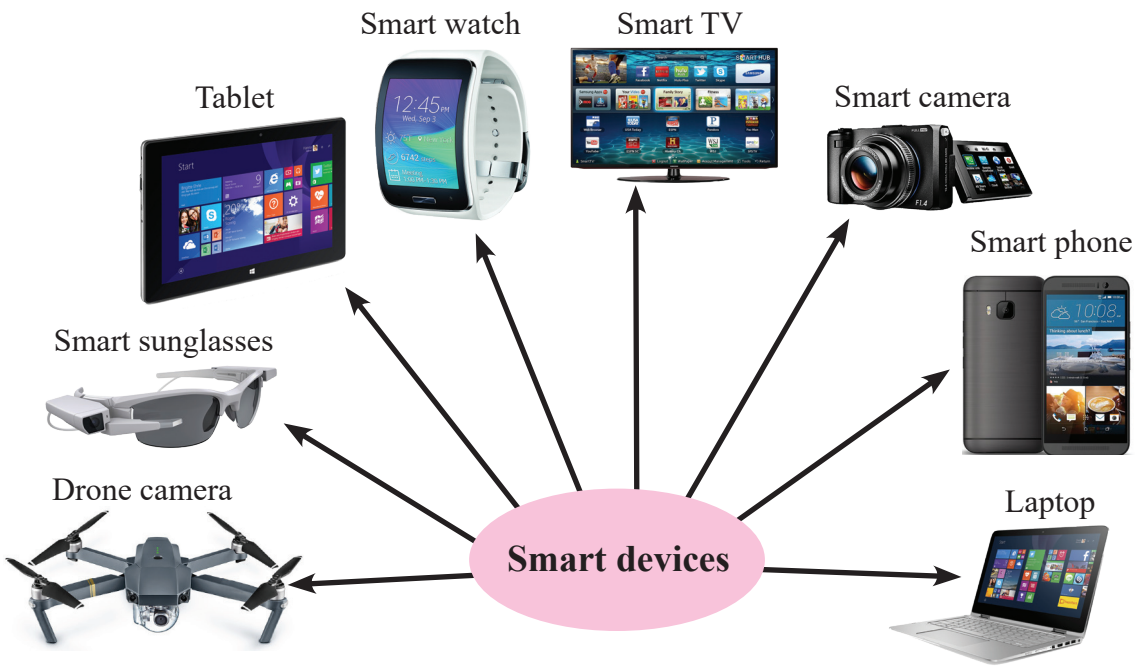


Figure 4.6 : Examples of mobile and smart devices

Tablets and laptops are widely used as general purpose machines. Other devices are meant for a specific functions. Therefore, it is necessary to determine whether the selected mobile device suits the intended purpose.

Table 4 : Smart devices and applications

Mobile device	Examples of use
Laptop computer	As a mobile device for general computer applications
Tablet computer	To surf the Internet and to take photos, etc.
Smart mobile phone	Telephone conversations, SMS and MMS messaging, taking photos, recording audio and video clips, surfing Internet, sending e-mails, etc.
Smart television	Managing and recording television programmes, e-mail and Internet
Smart camera	Taking photos, recording audio/video clips and sending them to other smart devices
Smart wristwatch	Displays time, sends SMS, sets alarm, accesses the Internet, etc.
Mobile spectacles	Watch scenery in 3D form, listen to audio, taking photos, record video clips, etc.
Drone camera	A remotely controlled, mini helicopter used to obtain aerial pictures or videos

Applications of mobile and smart devices

Many application software for mobile and smart devices are available on the Internet. Some application software can be downloaded free of charge while others have to be purchased. These downloaded software can be used after installing in the smart devices. The following shows some examples for application software for mobile and smart devices. (See Figure 4.7)

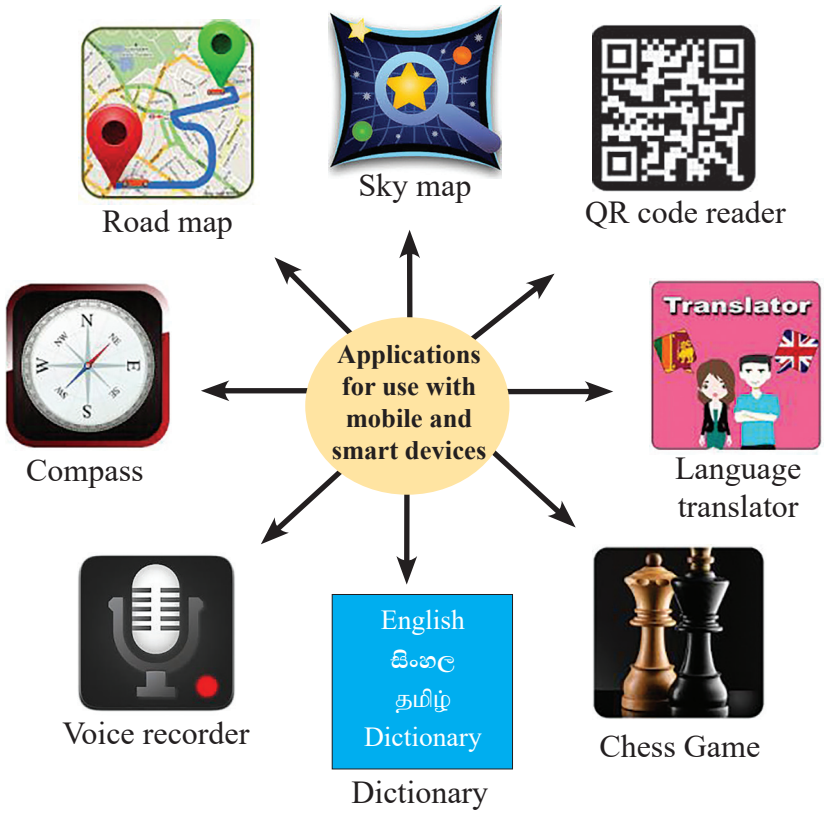


Figure 4.7 : Examples of the applications of mobile and smart devices

Table 5 : Mobile and smart devices and their uses

Smart device	Examples of use
Compass	finds the orientation
Route map	directs using GPS (finding routes), finds distance between two places, identifies traffic, etc.
Sky map	points the smart device towards a star or planet on the sky and see the details such as name, location, etc.
QR Code Reader	obtains information by scanning the QR code
Language translator	translates text in one language to another
Chess game	computer play as the opponent of Game
Sinhala dictionary	finds English term for Sinhala
Tape recorder	records and playback sound

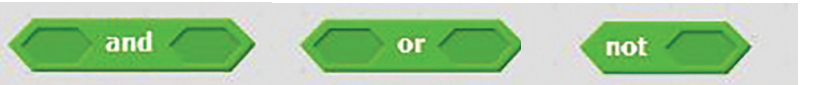
Refer to workbook for the Activity 4.10

Summary

- Computer programs are developed to accept input, process data and produce output. Generally, the algorithm is written first and then the algorithm is converted to a program.
- There are three types of control structures that can be used in an algorithm;
    1. Sequence
    2. Selection
    3. Repetition
- A sequence follows steps in the algorithm the one after the other.
- In selection, the program selects the cause of action based on whether condition is satisfied or not. Scratch programming uses "if then" and "if then else" control structures for selection.

- Scratch uses three types of comparison blocks.

- Scratch uses three types of logical blocks.



- The "Repetition" control structures, will be taught in a future lesson.

5 Physical Computing

This chapter will cover the following:

- Basic logic gates
- Use of software to identify a logic function
- Constructing simple circuits using logic gates
- Showing the functions of logic gates by using them practically

5.1 Basic logic gates

There are three basic logic gates as AND, OR and NOT.

AND Gate

Let us consider the following analogy to understand function of the AND gate.

The following diagram of a water tank in a house is to fill water without overflowing. Two valves are used to prevent water waste.

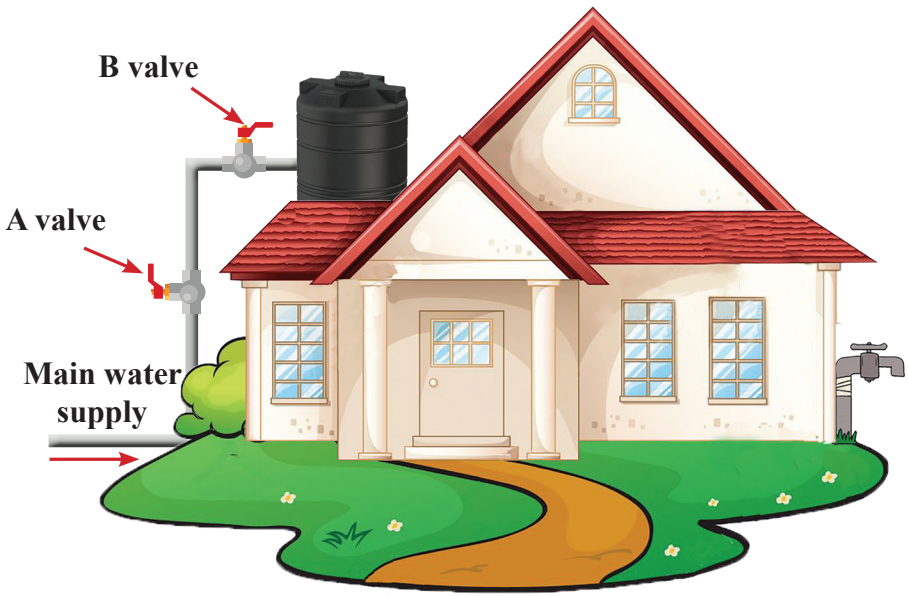


Figure 5.1 : Analogy for AND gate

The following table shows whether the tank receives water or not from the main supply based on whether the A and B valves are closed or open. (Table 5.1)

Table 5.1 : Water supply by valves A and B

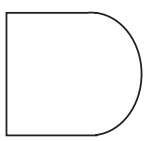
A valve	B valve	Water supply to tank
Closed	Closed	does not receive water
Closed	Open	does not receive water
Open	Closed	does not receive water
Open	Open	receives water

The following table using 1 for ‘open’ state, 0 for ‘closed' state, and 1 for ‘receives’ state and 0 for ‘does not receive’ state (See Table 5.2).

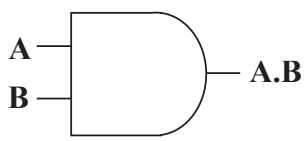
Table 5.2 : Indicating water supply by 0 and 1

A valve	B valve	Water supply to tank
0	0	0
0	1	0
1	0	0
1	1	1

The table above indicates whether the valves supply water or not. Similarly, the AND gate decides whether an electric signal is present or not. Availability of an electric signal is shown by state "1" and the unavailability is by state "0".



The standard symbol for AND Gate



When A and B are inputs

Inputs of a Gate is shown in capital letters. The output of AND gate is denoted by A.B when inputs are A and B.

The following truth table shows the function of the AND gate.

Input		Output
A	B	A.B
0	0	0
0	1	0
1	0	0
1	1	1

In order to obtain the output 1, both inputs should be 1 in an AND gate.

OR Gate

Let us consider the following analogy to understand the function of the OR gate. As shown in the illustration below, the house has a water tank in addition to the regular main water supply. The tank is to ensure uninterrupted water supply. There are two valves A and B. (See Figure 5.2)

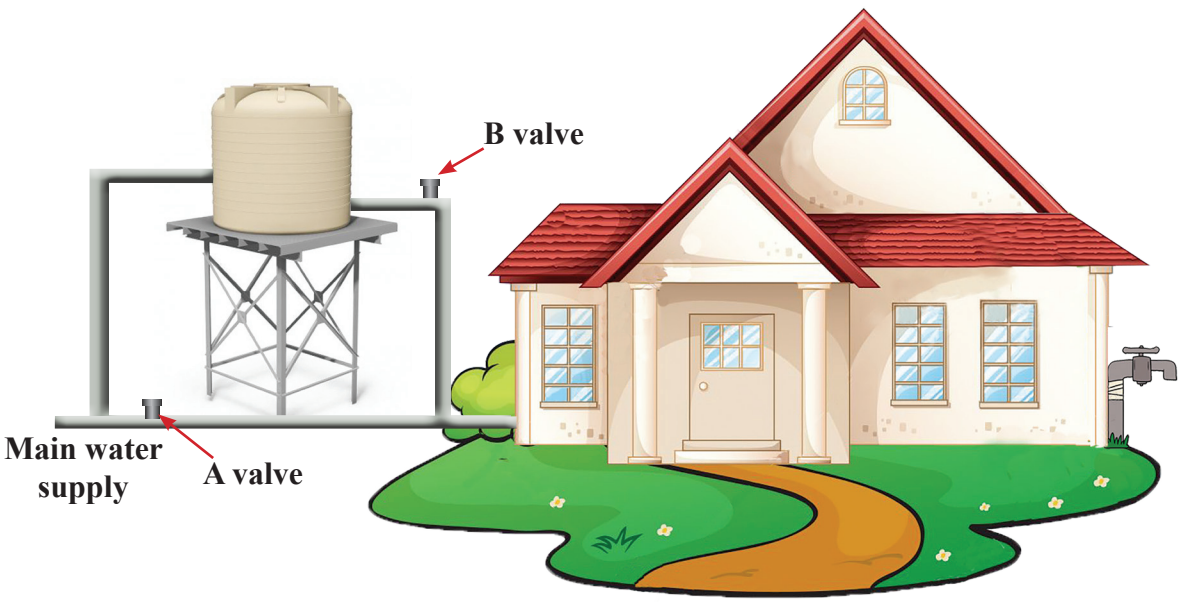


Figure 5.2 : An analogy for OR gate

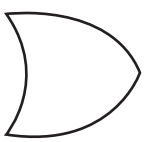
The following table shows if the house receives water or not based on whether A and B gates are open or closed.

A valve	B valve	Water supply to house
Closed	Closed	does not receive water
Closed	Open	receives water
Open	Closed	receives water
Open	Open	receives water

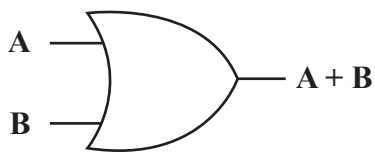
When the above table is replaced with value 1 for " open" state, 0 for closed state, 1 for receives state and '0' for "does not receive" state;

A valve	B valve	Water supply to house
0	0	0
0	1	1
1	0	1
1	1	1

The valves used in the above water tank control the supply of water to the house. Similarly OR gate controls the availability and unavailability of electric signal in a circuit. The availability of an electric signal is shown by '1' state whereas '0' state indicates the unavailability.



The standard symbol of the OR Gate



When A and B are inputs

The illustration above shows OR Gate as it appears on circuits. When A and B are inputs, output of OR gate is A+B. Truth table related to OR Gate is as follows;

A	B	A+B
0	0	0
0	1	1
1	0	1
1	1	1

Output of OR Gate is state '1' when at least one input is in '1' state.

NOT Gate

Let us consider the following analogy to understand the function of NOT gate. It shows a street with street lamps that are switched off during day time and switched on at night.

Figure 5.3 : Lighting street lamps automatically

Sunlight	Electric lamp
available	OFF
unavailable	ON

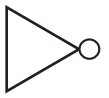
Consider state '1' as there is day light and state '0' as there is no day light. Street lamp's OFF state as 0, and 'ON' state on as 1.

Sunlight	Electric lamp
1	0
0	1

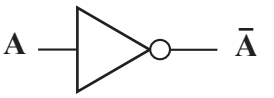
The output of the NOT gate is the opposite of its input.

Input	Output
receives day light	bulb OFF
receives no day light	bulb ON

The symbol of NOT gate is as follows;



Standard Symbol of NOT gate



When A is its input

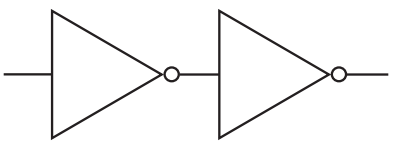
The above illustration shows a NOT gate in an electric circuit with A as input and $\overline{A}$ as output. The equivalent truth table is as follows;

A	$\overline{A}$
1	0
0	1

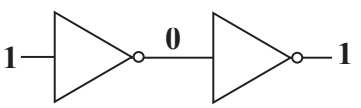
A particular voltage is shown by state1 and another voltage is shown by state '0'.

Connecting logic gates in circuits

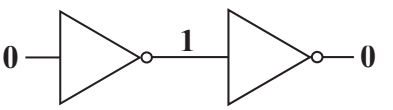
e.g.1 - Obtaining output from the circuit below where input is 1 or 0.



When input is 1

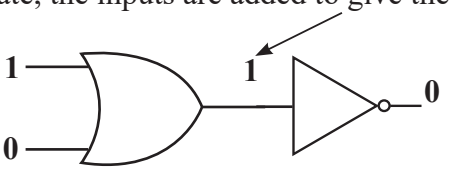


When input is 0



e.g. 2 - Obtaining the relevant output according to the input given.

In OR gate, the inputs are added to give the output (1 + 0 = 1)



Refer to workbook for Activities 5.1, 5.2, 5.3 and 5.4

Note - Logic Gates

1. The basis building block of Central Processing Unit (CPU) and other electronic devices and computers are logic gates. The basic function of the CPU uses logic gates.
2. Digital signals are used in digital computers. The significance of digital signals is that it has one value out of two, at a particular point in time (See Figure 1).

Figure 1 : Digital signal

3. Logic gates take digital inputs and provides digital outputs. The digital inputs and outputs take binary values. That means, the input and output are available only in one form of two states as 0 or 1.
4. Binary values can be represented using different methods. The most common method of representing is 0 and 1. They can also be shown represented as TRUE/ FALSE or HIGH/ LOW. In computer hardware, they are voltage values with 5V and 0V (See table 1).

Table 1 : Methods of representably binary values

1	0
HIGH	LOW
True	False
5 V (volt)	0 V

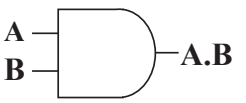
5. Computer uses AND, OR and NOT logic gates to process data. Logic gates take states 0 or1 as input and produce 0 or 1 states as output.

Summary

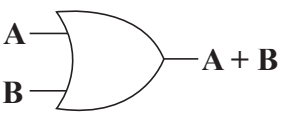
Basic logic gates

1. AND
2. OR
3. NOT

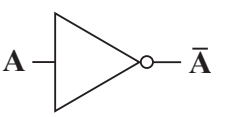
- Inputs given to those gates produce relevant output.
- Function of AND gate



- Function of OR gate



- Function of NOT gate



6 Internet

This chapter will cover the following:

- Search engines
- Use of the Internet and explore for information
- Creating web pages
- Developing websites

6.1 Search engines

Search engines can be used to find information, images, videos, etc. on the Web. (See Figure 6.1)

Examples for search engines

Figure 6.1 : A few main search engines

Use of Internet to explore information

Different methods can be used to explore the Internet for information. A few of them are as follows:

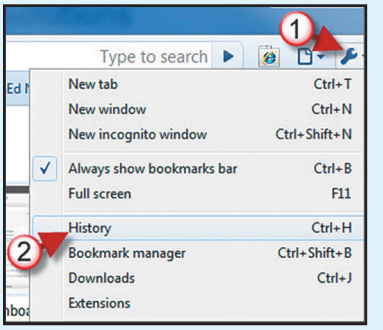
Search engines

Search engines help find websites. Typing the keyword on the "Search" box and pressing the 'Search' button, display a list of websites that are relevant to the key words.

Browsing history

Search engines save recently used web addresses.

These websites can be accessed using the 'History'.



Bookmark/Favourite

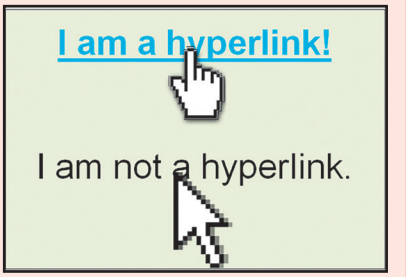
A click on bookmark/favourite helps save web addresses (URL) used often.

Saved websites as such can be seen as a list so that the required website can be accessed.

Hyperlinks

A hyperlink on web page links to another section of the same page or a different web page.

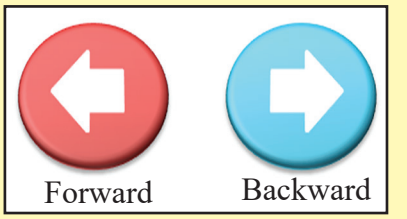
A text with a hyperlink has an underline an display in color. The mouse over a hyperlink shows icon of a hand.



Forward/ Backward

The Forward/Backward button helps navigate to a previous page or next page.

The forward/backward button appears on the top left corner of the web browser



Tabs

A number of web pages can be opened in a single window of a web browser. They are called as Tabs.

When web pages are opened as tabs, it is easy to select pages.

Refer to workbook for the Activity 6.1.

6.2 Creating a web page

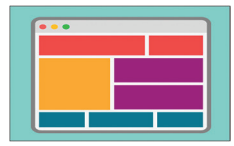
Some factors that should be considered in developing a web page are listed below;

1

- What is the goal of web site?
- Who uses it?

2

- Layout and structure of the size

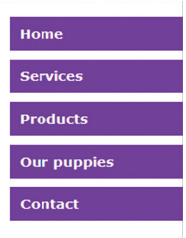


3

★ Design
- Use of colours, letters and font size
- Clarity and readability of the content

4

★ Navigation
- How does the user navigate the website?
- Navigation to other websites



5

★ Use of images
- Suits to user
- Compatible with content
- Minimal use of images

Main features necessary to create websites

Tool	
There are several tools that can be used to develop web pages.	

Software	
Examples for some software that can be used to create web pages using HTML	Notepad, NetBeans, Microsoft Visual Studio Community, Word Press, Bluefish, Eclipse

Tags/Elements
• HTML tags are used to create web pages. • A tags/element is shown with the angular brackets < >. • Most Tags have a start and an end.

A few tabs used in HTML to create a website and their functions:

<html>…</html>	Indicate that HTML is used to create the web page
<head>…</head>	Container for all head elements such as title of document.
<title>…</title>	Title of the website (not included in the web page)
<body>…</body>	To the content of the web page
<h>...</h>	headers (titles)
…	bold face text
…	italicize text
**<centre>… **	center alignment
** … **	a list with bullets
** … **	a list with numbers
** … **	bullet/ numerical list items
** **	line break
<p>	a paragraph
<img src=”….”>	Insert an image
…	create a hyperlink

<title>…</title>

7 Wonderful Benefits of | Department of Official La

Secure | https://food.ndtv.com/food-drinks/benefits-of-banana-how-

<h>...</h>

Wonderful Benefits of Banana

<img src="….">

…

<p>

Adding a banana to your daily diet has an array of benefits in your body.

Bananas helps

…

1. ***loss of weight***
2. ***keep your bowels healthy***
3. ***provide nutrients that regulate heart rhythm***
4. ***have vitamin compounds for eye health.***

…

Bananas provide a variety of vitamins and minerals:

…</ul

- Vitamin B6 - 0.5 mg.
- Manganese - 0.3 mg.
- Vitamin C - 9 mg.
- Potassium - 450 mg.
- Dietary Fibre - 3g.
- Protein - 1 g.
- Magnesium - 34 mg.

More about bananas

…

Refer to workbook for Activities 6.2, 6.3, 6.4, 6.5, 6.6 and 6.7

Summary

- Search engines are used to find information from the web sites on Internet.
- Google, Yahoo, bing, Ask, MSN are examples for search engines.
- History of the web surfing and bookmarks also help gather information.
- Hyperlinks, forward and backward buttons and tags are used to navigate among web pages and web sites.
- The goal, the users, arrangement and structure, etc. are to be considered in developing a web state.
- Tools, software, HTML tags are used in developing a web page.