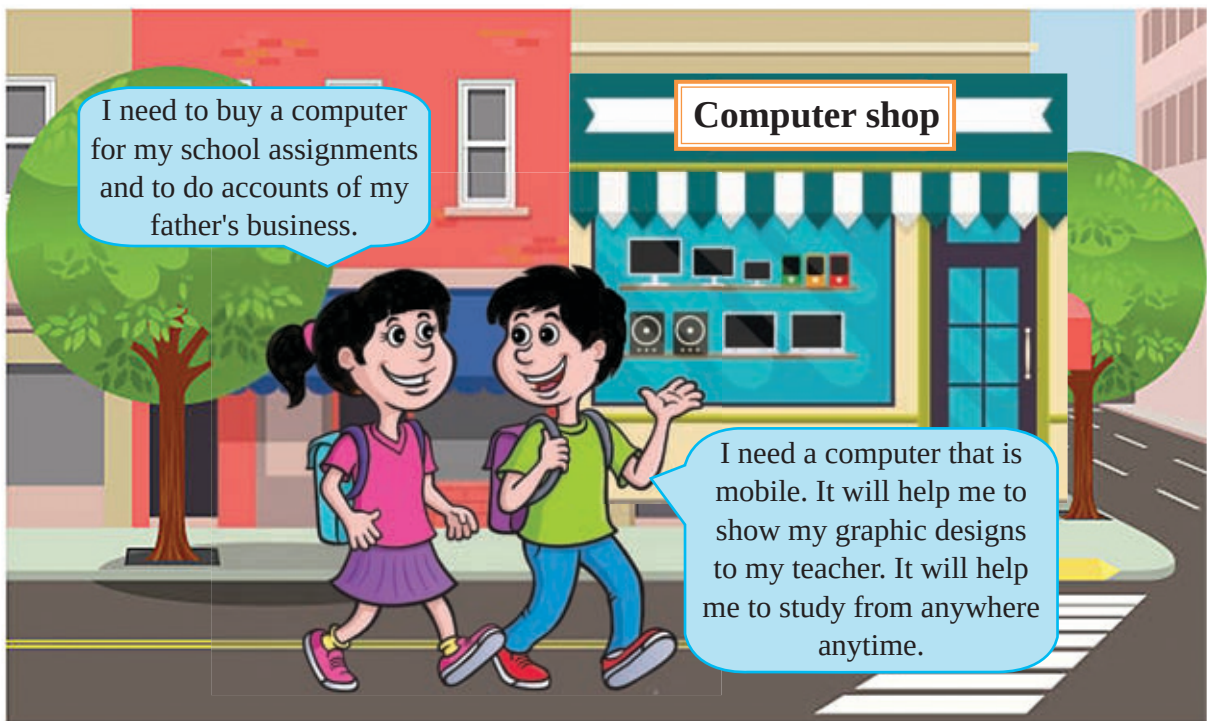


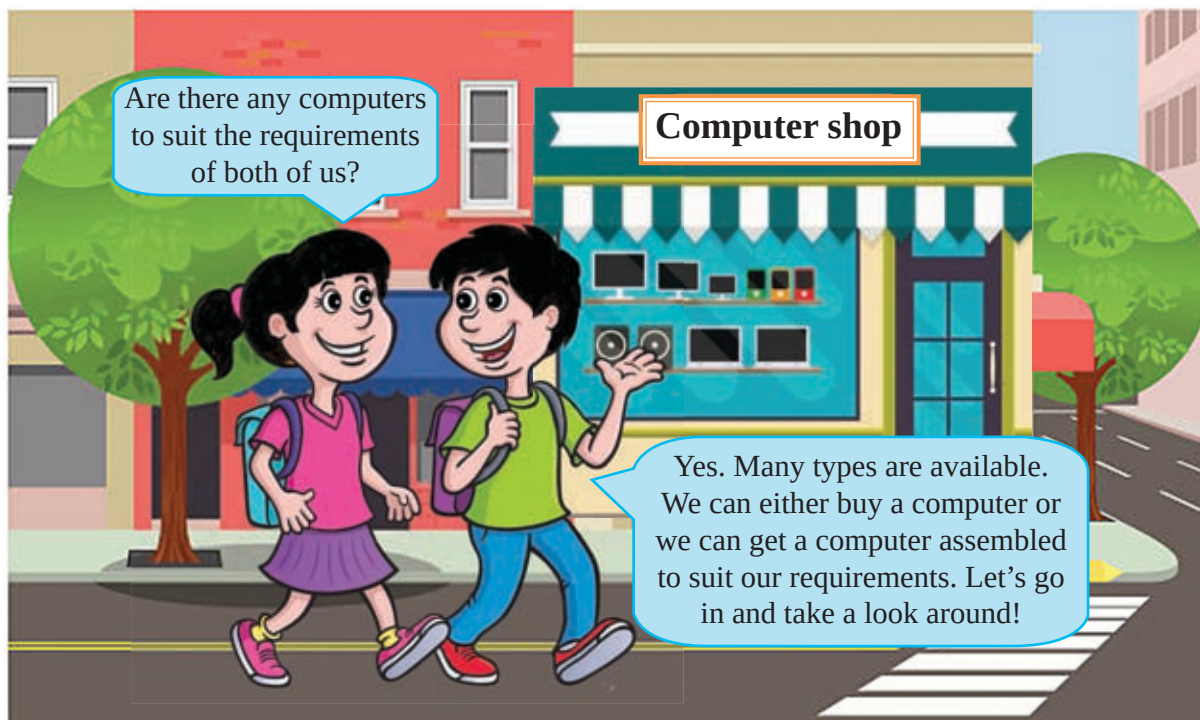
1

Preparation of Computer Specifications

This chapter will cover the following:

- Computers and peripheral devices
- Selection of devices for the user requirement
- Creating computer specifications
- Non-technical factors to be considered in purchasing a computer





1.1 Identifying the user

The one who uses a computer is generally referred to as a *user*. Different users working in different areas in Information and Communication Technologies have different designations. The following table shows a few such examples;

Table 1.1 : Types of users and their work

User name	Task
Programmer	Develops computer programs
Network Administrator	Manages and maintains computer networks
System Analyst	Designs information systems
Software Engineer	Develops software
Computer Application Assistant	Uses office application packages for office related tasks
Web Developer	Develops and maintains websites

The sixth chapter presents you a further study on the user.



Note - Users can be classified into mainly two categories: *system users* and *end users*. *End user* uses the software maintained by the *Systems User*.

1.2 Selection of a computer to suit user requirements

User requirements relate to tasks that are carried out by using a computer. The following Figure 1.1 provides examples for user requirements.



Figure 1.1 : Some examples for user requirements

A computer to suit user requirements can be selected from those available in the market (Figure 1.2), or a computer can be assembled to suit user requirements. Computers can be classified according to their nature and use as follows;

- **Non - portable computers**

Server computers, workstations, desktop computers and all-in-one computers, are all operated using the main electricity power supply. These computers are large in size and relatively heavy. Therefore, they are installed and used in places like houses, schools or offices.

- **Computers for mobile use**

Laptops, notebooks, tablet computers and a smart phones can be considered for mobile use. They operated with re-chargeable batteries. Therefore, they can be used when traveling in buses, trains, aeroplanes or from any convenient place.



Figure 1.2 : Examples for types of computers that are available in the market



Refer to workbook for Activity 1.1.



Important - The following are useful in learning more about computers.

- Printed or electronic commercial advertisements on computers
- Magazines and newspapers about computers
- Websites providing information on computers
- Obtaining information from an expert in computers
- Visiting the computer shops and gathering information

1.3 Computer peripheral devices

What are peripheral devices?

Input devices are used to feed data and instructions into a computer. *Storage devices* are used to store data. *Output devices* are used to provide the information processed with the input data. Accordingly, input, storage and output devices are called *peripheral devices*.

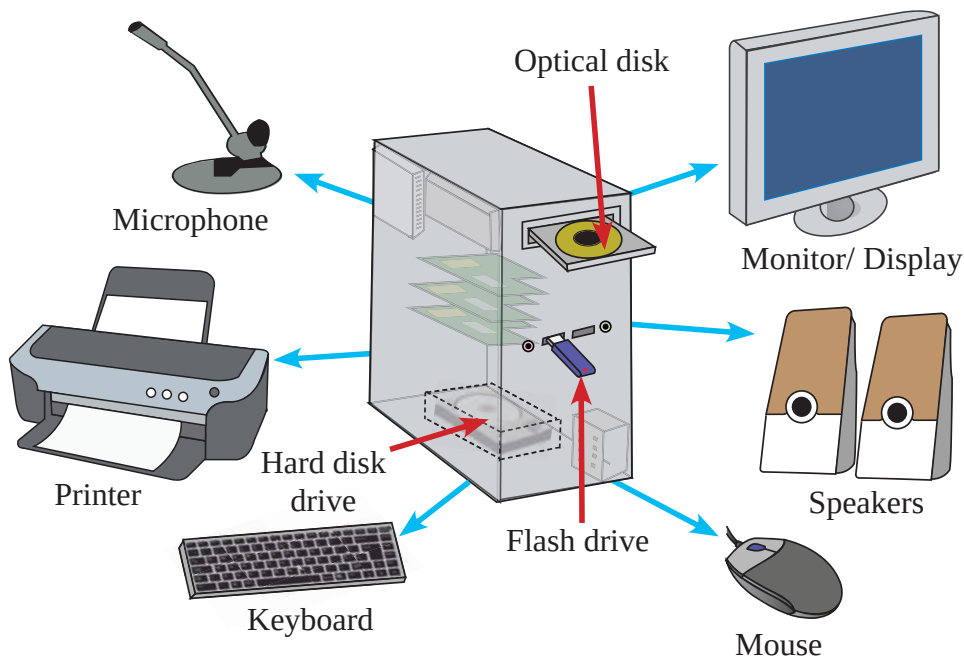


Figure 1.3 : Computer peripheral devices

The peripheral devices shown in Figure 1.3 above are classified in Table 1.2 as *input*, *output* and *storage*.

Table 1.2 : Peripheral devices

Input	Output	Storage
Keyboard	Monitor	Hard disk drive
Mouse	Printer	Optical disk drive
Microphone	Speaker	Flash drive
Touch screen		Magnetic tape drive



Note - The touch screen can be used to input data as well as to display information. Hence, it can be used as an input and output device.



Refer to workbook for Activity 1.2.

1.4 Computer specifications

What are computer specifications?

Before purchasing an item, it is important to be aware of the value and the quality of the item. Specifications are generally about the common features of an item.

For example, length, width and paper thickness, etc. determine quality of an exercise book. Basic specifications for an exercise book are as shown.

Basic specifications for an exercise book

Length	: 210 mm
Width	: 148 mm
Number of pages	: 40
Thickness of paper	: 60 GSM
Type	: Single ruled

Similar to the specification of a book, a computer also has its specification.

Specifications to suit different user requirements

Consider a situation where two students use two types of books for different purposes. For example, a square ruled exercise book for *mathematics* and a large size drawing book for *art*. Specifications for the two types mentioned above are as follows:

Specifications for an exercise book

Length	: 210 mm
Width	: 148 mm
Number of pages	: 200
Thickness of paper	: 60 GSM
Type	: Square ruled

Specifications for a drawing book

Length	: 300 mm
Width	: 210 mm
Number of pages	: 20
Thickness of paper	: 70 GSM
Type	: Blank

Different specifications for different purposes may result in price differences as well.

The specifications change according to user requirements in the above example. Similarly depending on the use of a computer its specifications also differs.

1.5 Specifications of computers and peripheral devices

The following shows some important factors of computer specifications;



Important - One can generally assure the quality of an item through its specifications.

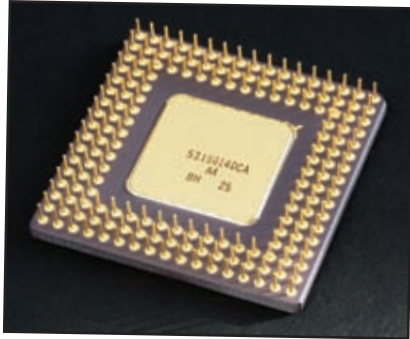
1.5.1 The processor

Humans are considered the most intelligent among all living beings. The brain (Figure 1.4) helps man to make decisions for actions taken. The brain also has the ability to swiftly respond to all sensations.



Figure 1.4 : the human brain

Much as the brain is most important for humans, the processor (Central Processing Unit) (Figure 1.5) is the most important part of a computer. The processor processes data swiftly. As such, the processor is considered the "Brain" of the computer.



The side that connects to the mother board



View from above

Figure. 1.5 : Central Processing Unit

Speed of the processor

A machine functions at a slower speed takes a longer time to complete a task while a machine functions at a higher speed takes a shorter or a lesser time to complete a task. Therefore, the amounts of work that could be carried out using these machines during a unit time differs.



Blender working at slower speed



Blender working at higher speed

Figure 1.6 : Preparation of fruit juice using blenders with different speeds

Figure 1.6 shows two blenders working simultaneously. The blender working at higher speed processes a larger quantity of fruit juice per unit time. A machine working at a higher speed provides better results.

The performance of a computer depends on the speed of the processor. A processor running at high speed is able to process more data during a unit time. That is, the performance of the computer increases. Then the software can be run faster. Therefore, when selecting a processor, it is advisable to select one with a greater speed.

The speed of the processor is measured by the number of instructions executed per second.



Important - The speed of a computer is determined by the number of instructions executed per second.

The speed is measured in Hertz (units such as MHz or GHz).

$$1000 \text{ MHz} = 1 \text{ GHz}$$

Processor manufacturers

Several processor manufacturing companies, Apple, Intel and AMD (Advanced Micro Devices) exist.



Figure 1.7 : Different processors

Types of processors

Generally, the number of processors in a central processing unit is used to classify the Central Processing Unit. The following table shows examples of some Intel Central Processing Units with multiple processor units.

Table 1.3 : Types of processors

No. of CPUs	Type
1	Single Core
2	Dual Core
4	Quad Core



When the number of processors in a central processing unit increases its capacity also increases. Table 1.4 shows examples for Intel processors.

Table 1.4 : Different processors and their names

Type	Name	Examples
Single Core	<i>Pentium I, II, III, IV</i>	
Dual Core	<i>Dual Core/Core 2 Duo</i>	
Quad Core	<i>Core i3, i5, i7, i9</i>	



Refer to workbook for Activity 1.3.

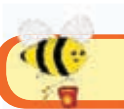
1.5.2 Hard disk

The hard disk provides permanent storage space for storing data and to installing all software. The hard disk is the main secondary storage device in a computer.

For example, an exercise book with 160 pages provide more writing space than a book with 40 pages. Similarly, more data can be stored in a hard disk with a greater storage capacity. (see figure 1.8).



Figure 1.8 : An analogy for hard disk capacities



Refer to workbook for Activity 1.4.

1.5.3 The monitor display

The main output device of a computer is its monitor display. Most often, a user interacts with a computer via its monitor/ display.

Monitor size

For examples, a wall clock is larger than a wrist watch. Time is easily seen on a wall clock because of its size. Similarly, larger monitors have better visibility.



A larger monitor size is useful in viewing a larger picture. The monitor size is measured in terms of its diagonal length in inches. (Figure 1.9).



Figure. 1.9 : Monitor Size

Monitor technology

Monitors can be classified into the following types according to the technology used by them:

- CRT (Cathode Ray Tube) Monitor
- LCD (Liquid Crystal Display) Monitor
- LED (Light Emitting Diode) Monitor



Fig.1.10 : CRT and LCD /LED monitor

CRT monitors consume more electricity than the other two types. Further they are heavier and occupy more space due to its size. Hence, light weight LED and LCD monitors which consume less electricity are commonly used today. (See figure 1.10).

1.5.4 Main memory

Let us consider a shelf which is used to keep books and bags when entering a library (See figure 1.11). Students who enter the library keep their school bags in compartments. They takes their bags as they leave the library.

In a similar manners data and instructions are stored temporarily in the main memory (See figure 1.12) when the computer functions. A bigger rack for storage in a library can hold more school bags. Similarly, a higher capacity in the main memory stores more data and instructions. Therefore, a computer with a higher main memory capacity is better.



Figure 1.11 : Rack for school bags



Figure 1.12 : Random Access Memory (RAM) card act as the main memory



Important - The capacity of the main memory is measured in units of bits. (Mega Bite (MB) or Giga Bite (GB) etc).

$$1024 \text{ MB} = 1 \text{ GB}$$



Refer to workbook for activity 1.5.

1.5.5 Video Graphic Adapter (VGA)

The Monitor is the main output device of a computer. The output is fed to the monitor via the Video Graphic Adapter (VGA). There are two types of Video Graphic Adapter (VGAs). On board VGA is fixed to the mother board and Separate VGAs card can be fixed to mother board manually. The separate VGA card has a separate video memory and a processor. Separate VGA cards are useful for playing computer games.



Figure 1.13 : VGA card

Modern computers use DV1 or HDMI ports instead of VGA port (See Figure 1.14).



Figure 1.14 : Types of video ports

When HDMI cables are connected to a computer, a television screen or multi media projector, both sound and video signals are transmitted. When a VGA is used for the same purpose, only images are transmitted and a separate cable is required for sound.

1.5.6 Sound cards

Many computer are widely used for entertainment today. A sound card is required for listening to music and recording audio. A microphone connected to the sound card can be used to record (input) sounds while a speaker connected to the sound card can be used to play (output) sounds.

Most computers have the sound card built into the motherboard (See figure 1.15). A user can also connect external sound card to the computer if necessary.

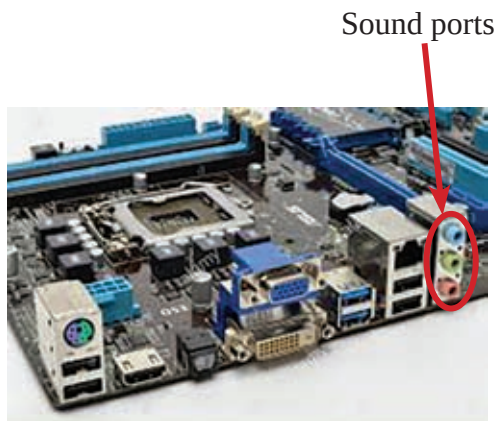


Figure 1.15 : Built in sound card on motherboard

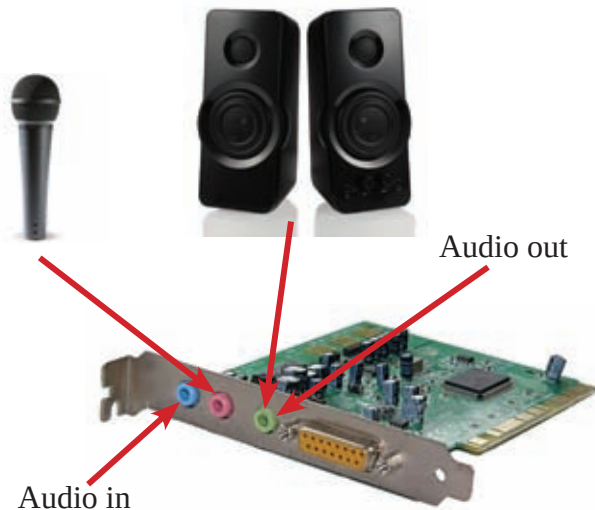


Figure 1.16 : External sound card

The ports of a sound cards use standard colour scheme for identification purpose.

- Light green - Audio out (to connect speaker or headphone)
- Light pink - Mic in (to connect microphone)
- Light blue - Line in (to feed sound with external devices)

1.5.7 Pre-Installed software

An operating system provides the interface between the user and the hardware. The operating system is essential to run application software. Once the operating system is installed in a computer, the necessary application software can be installed.

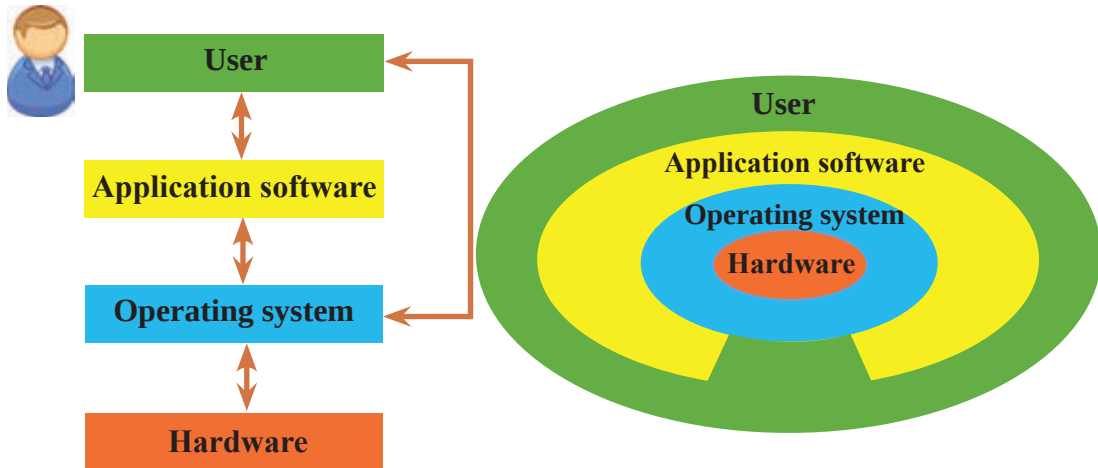


Figure 1.17 : Hardware, software and user

Free and open source operating systems such as Linux, Ubuntu can be obtained free of charge. Licensed operating systems such as Windows 8, Windows 10 to purchase. A trial version of an operating systems such as trail version of Windows 10 can be used only for a limited period. Required application software depends on the requirement of the user.

In buying a desktop computer or a laptop computer it is important to check whether an operating system has been pre-installed. Most often only DOS or LINUX computer systems are pre-installed. A computer with licensed software installed is more expensive than a computer with a free and open source operating system.

1.6 Non-technical features to be considered in purchasing a computer

Non-technical specifications such as manufacturer, type of book and price are considered in purchasing an exercise book. This applies to the purchase of a computer as well. Therefore, in purchasing a computer, non-technical specification must also be considered.

1.6.1 Warranty

Warranty is an important factor to be considered when purchasing a computer. Warranty given by the vendor and the manufacturer assures to cover the defects for a certain period. Customer can get this warranty in many different ways.

a. Manufacturer warranty

The warranty which is given by the manufacturing company is known as the manufacturer warranty. If the device malfunctions during the warranty period, it is either repaired or replaced with a new one.



b. Extended warranty

Extended warranty is a prolonged warranty given to customers in addition to the standard warranty. Customer needs bearing additional cost for extended warranty.



c. On-site warranty

If a customer obtains an on-site warranty, technicians from the respective company visit the place of work to repair the product. They generally maintain, replace faulty parts and examine the operations of the machine.

There is a standard warranty when purchasing a computer. but, the warranty for the parts of the computer may differ from the standard.



For instance, a laptop computer with standard warranty for 3 years, may have only one year warranty for the battery.

1.6.2 Price

The price of a computer can vary according to the customer requirements.

e.g.

1. The price of a computer is rather high with a high speed processor.
2. A computer with a large monitor is comparatively high in price.
3. Price is low of a computer with a lesser memory capacity.
4. A computer inclusive high capacity hard disk drive is high in price.

It is advisable to compare prices to suit one's requirements from different places and select the computer with the lowest price.



Refer to workbook for Activities 1.6 and 1.7



Important - It is not advisable to purchase a computer considering only its price.

1.6.3 Services after-sale

Computer sales centers provide the following after-sales services to customers;

1. Technical advice
2. Technical assistance
3. Telephone, e-mail and website information (i.e. contact information) of the vendor

It is advisable for a user to consider the given information in purchasing a computer. Customer needs preparing specifications first. Then, a computer must be bought from a vendor with a reputed name and must be from a recognized manufacturer.



Refer to workbook for Activity 1.8

1.6.4 Ports and network connections

Ports are used to connect the peripheral devices to a computer. A user may select peripheral devices to suit one's requirements. However, the computer should have the necessary ports to connect them. A few such ports are given below;

a. Universal Serial Bus (USB)

The USB is the most widely used port to connect peripheral devices to the computer. Therefore, it is essential to have several USB ports.

Some peripheral devices that can be connected via USB Port;

- Printer
- Keyboard
- Mouse
- Scanner
- External hard disk
- External DVD drive
- Digital camera
- Web camera
- Bar code reader
- Memory card
- Pen drive



Refer to workbook for Activity 1.9

b. Network ports/RJ45 connector

The computer uses RJ45 connector to connect to a network. (See Figure 1.18)

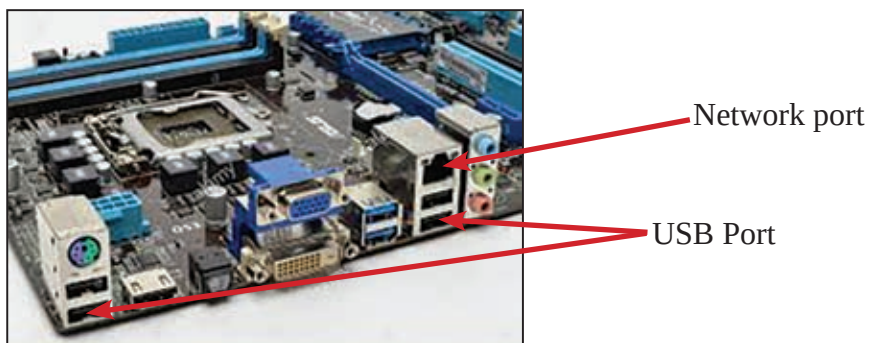


Figure 1.18

c. Bluetooth and Wi-Fi facilities

Bluetooth and Wi-Fi facilities provide cable free (i.e. wireless) network connections to computers. (See Figure 1.19)



Given below are a few basic specifications in purchasing a computer;

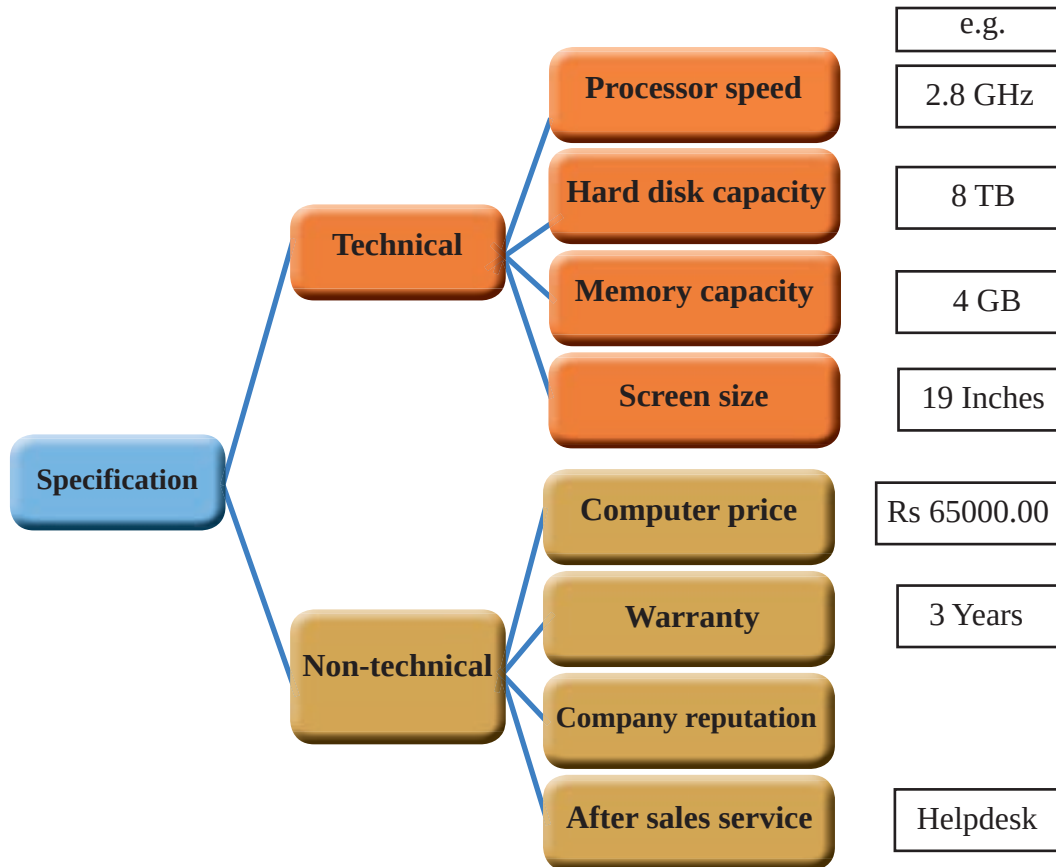


Figure 1.19 : Technical and non-technical specifications to be considered in purchasing a computer



Refer to workbook for Activity 1.10

Important factors of technical specifications

Central processing Unit	Type	Single Core/ Dual Core/ Quad Core
	Speed	2.8/ 3.0/ 3.2/ 3.4 GHz
Main memory	Capacity	512 MB/ 1GB/ 2GB/ 4GB/ 8GB
	Generation	1 st , 2 nd , 3 rd , 4 th etc.
Hard disk	Capacity	500 GB, 750 GB, 1 TB, 2 TB, 4 TB
Monitor	Size	17", 19", 21"
	Type	CRT/ LCD/ LED
Video Graphic Adapter	Type	VGA/ DVI/ HDMI
Sound card	Type	Onboard, Separate



Refer to workbook for Activity 1.11

Summary

- Several types of computers are available to suit user requirements;
 - Server
 - Workstation
 - Desktop
 - All-in-one
 - Laptop
 - Notebook
 - Tablet
 - Smart phone
- Computer peripheral devices are input, output and storage devices.
- Specification is a detailed description of a material with respect to its quality or quantity.

- Basic specifications for a computer and peripheral devices are:
 - Processor type and speed
 - Random Access Memory (RAM) capacity
 - Hard disk capacity
 - Monitor size and technology
 - Video Graphic Adapter and sound
- Other non-technical factors to be considered in purchasing a computer;
 - Warranty
 - Pre-installed software
 - After-sales services



2

Electronic Spreadsheets

This chapter will cover the following:

- What spreadsheets are
- Special features of a spreadsheet
 - Workbook, worksheets, cells, columns, rows
 - Name boxes
 - Functions, formulas
 - Data selection
 - Graphs

2.1 What are spreadsheets?

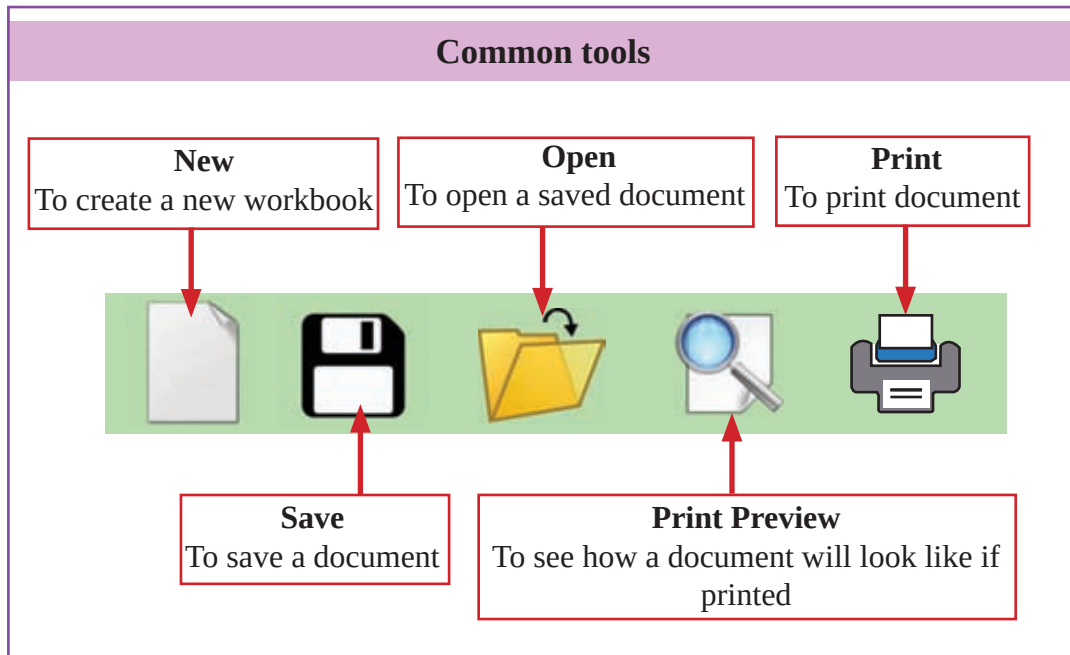
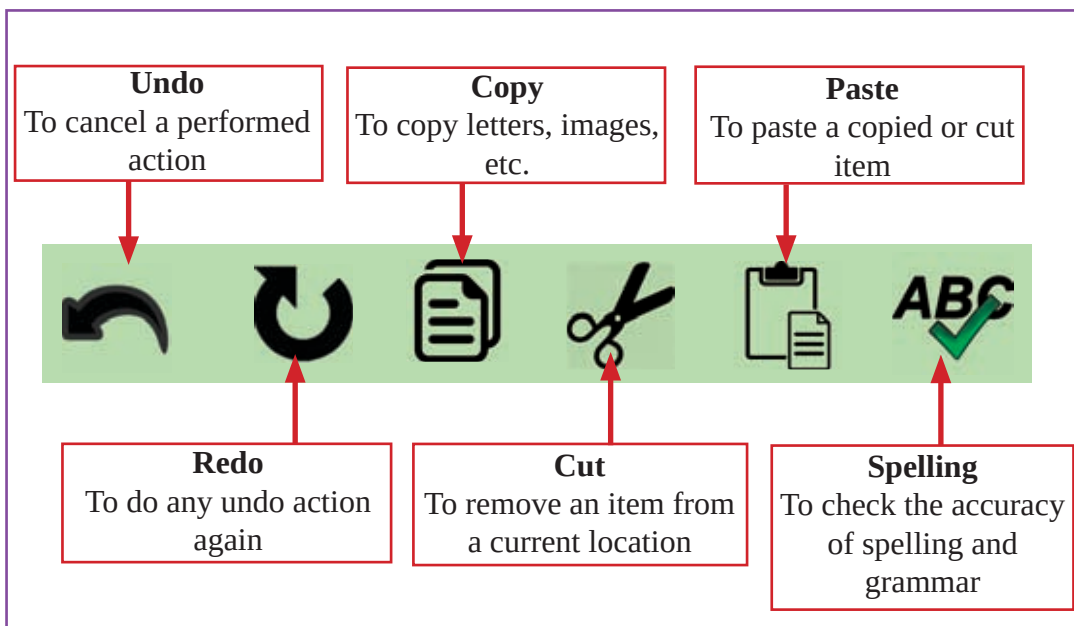
A spreadsheet means an electronic version of the paper based accounting sheets used by accountants in the past.

An electronic spreadsheet is an interactive computer application for organization, analysis and storage of data in a tabular form. Data are entered in cells of a table and the spreadsheet provides the facility of functions, formulas, sorting and charting.

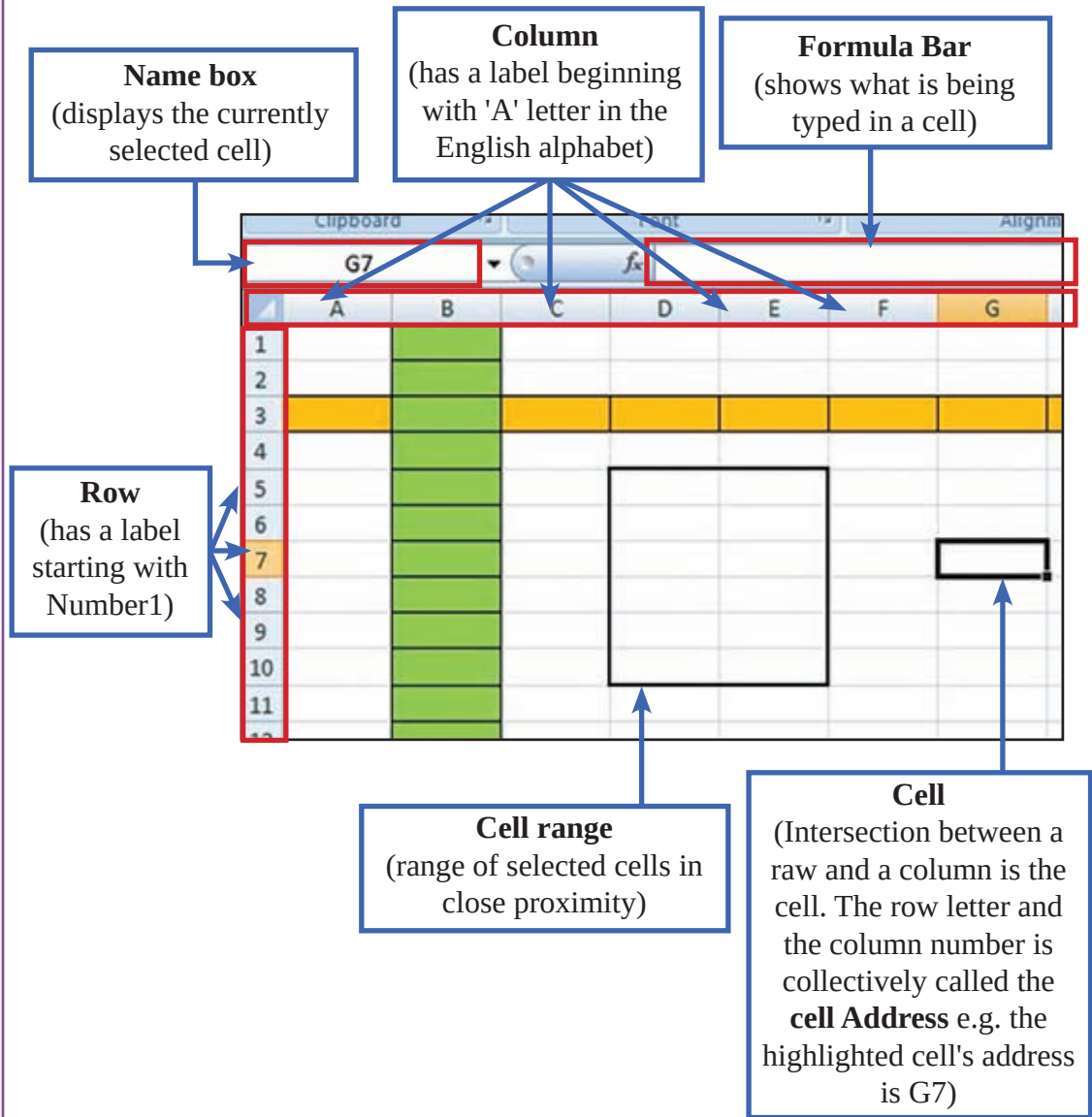
In electronic spreadsheets, *workbooks* can be used for document creation. A workbook may contain multiple *worksheets*.

2.2 Spreadsheet features

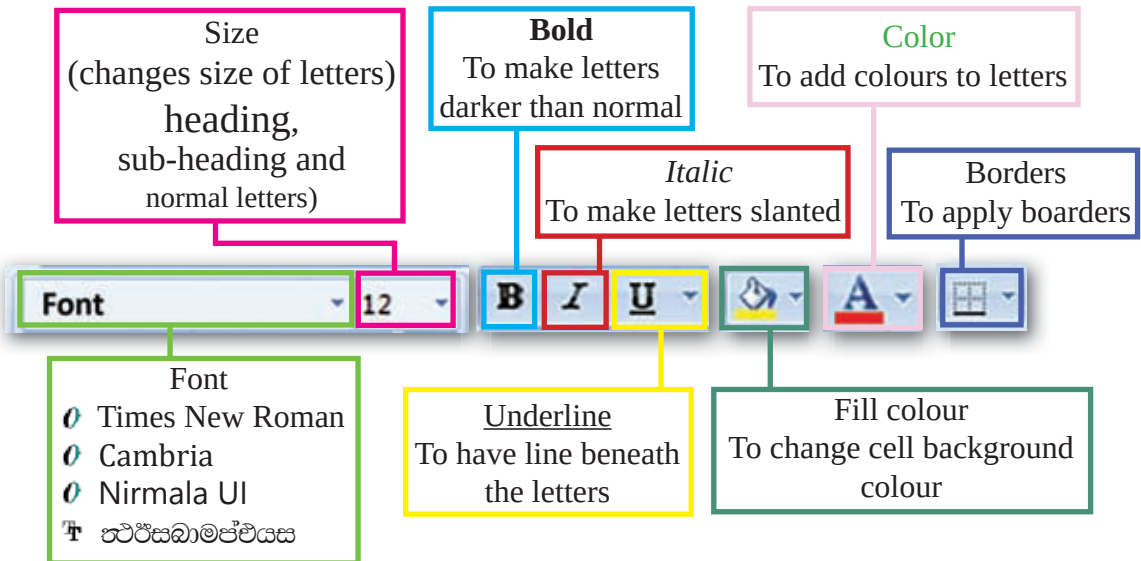
Let us learn about the functions provided in spreadsheet package.



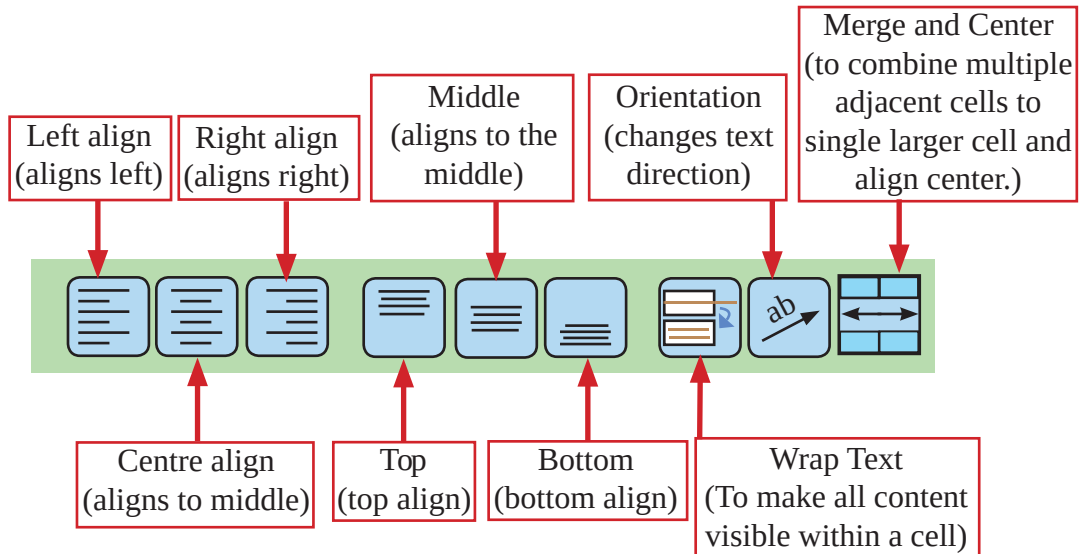
Special features of a spreadsheet



Cell formatting tools



Alignment and positioning tools



Number tools

Diagram illustrating the Number tools available in Excel, categorized by the Number format dropdown menu.

Number tools available in the ribbon:

- Currency** (Icon: Money bag)
- Percentage** (Icon: %)
- Increase and decrease decimals** (Icon: Left and right arrows with decimal places)

Number format dropdown menu options:

- General** (Dropdown arrow)
- Number** (Icon: 12) - Numbers - e.g. 10, 25, 100, ...
- Currency** (Icon: Money bag) - Money - e.g. Rs. / \$ / ¥ - 10.00
- Accounting** (Icon: Calculator) - Lines up currency symbols and decimal points in a column / \$ / ¥ - 10.00
- Short Date** (Icon: Calendar) - Short date - e.g. 02 / 25 / 2018 (MM / DD / YYYY)
- Long Date** (Icon: Calendar) - Detailed date - e.g. Tuesday, February 25, 2018
- Time** (Icon: Clock) - Time - e.g. 1:30 p.m., 10:00 a.m.
- Percentage** (Icon: %) - Percentage - e.g. 23% , 45%, 75%
- Fraction** (Icon: 1/2) - As fractions - e.g. 2/9, 4/5
- Scientific** (Icon: 10²) - In scientific notation - e.g. 5677=5.68E+03

Symbols used in spreadsheet formula

Used before a
formula or function

=

+

Subtract

-

Divide

/

Add

Multiply

Function

To find the total of a range
of cells

Sum

To find the highest value
in cell range

Max

To find the average of cell
range

Average

To find the lowest
value in a cell range

Min

Charts

Can be used to display spreadsheet data graphically.

Column graph



Column

Pie chart



Pie

Area chart



Area

Other charts



Other
Charts

Line chart



Bar chart



Scatter chart





Refer to workbook for Activities from 2.1 to 2.10.

Summary

- A spreadsheet is a document containing rows and columns where functions and formulas could be used for computations and where sorting and charting of data is possible.
- A cell is a specific location defined by the intersection of a row and a column.
- An individual cell is identified by starting with column name 'A' and row 'number 1'.
- New, Open, Print, Print Preview, Re-do, Undo, Cut, Copy, Paste and Spell check are common tools used in spreadsheets.
- Computations are done using functions/formulas.
- SUM, AVERAGE, MAX, MIN etc. are some basic functions that are available.
- Bar charts, column charts, line charts, pie-charts, etc. could be used for analysis of data.

3

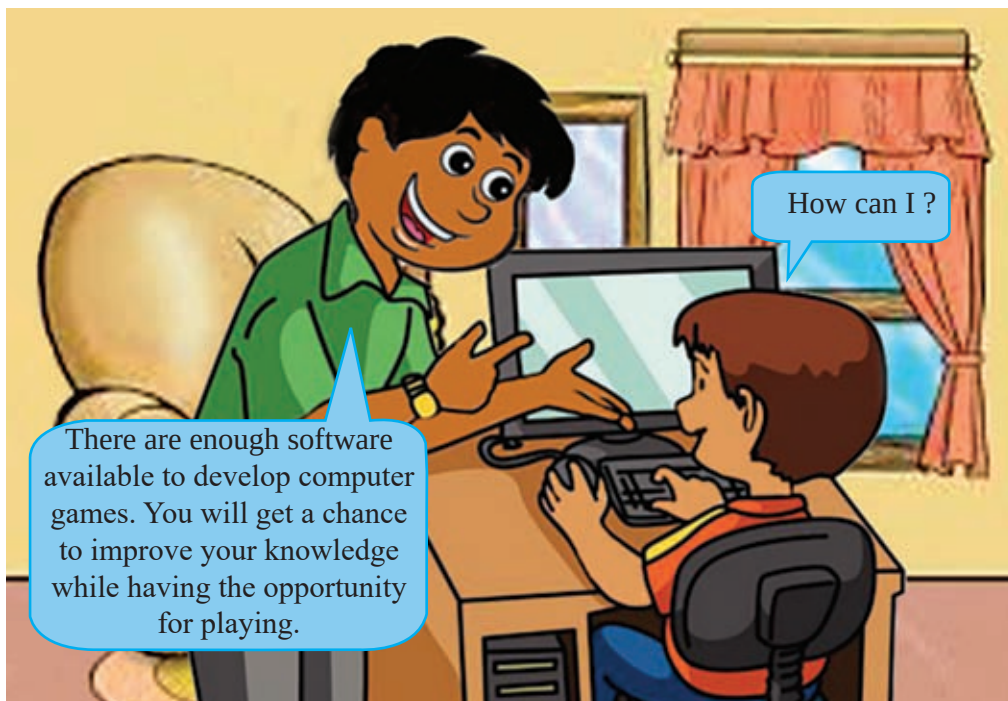
Programming

This chapter will cover the following:

- Multi-condition selection control structures
- Use of flowcharts to solve problems with many conditions
- Repetition control structures
- Use of flow charts to solve problems with repetition procedures
- Development of Scratch program using selection and repetition control structures
- Solutions with flow charts having nested loops
- Arrays and their usage

Download Scratch software from <http://www.scratch.mit.edu> as mentioned in Information Communication Technology Reading book of Grade 7.



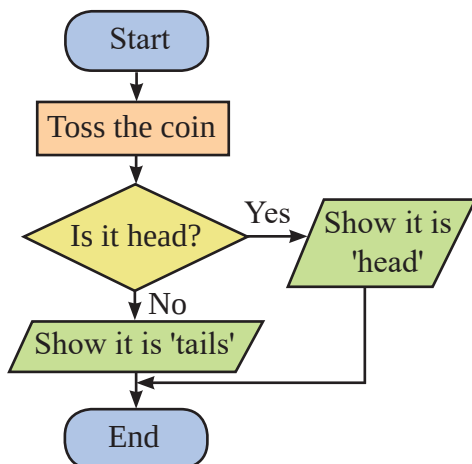


3.1 Simple selection

You learnt in programming chapter of Grade 8, ICT textbook that a simple selection is selecting one option out of two given options under a certain condition. For example, one such choice is the selection of “head” or “tail” with the toss of a coin.



Head and tail of a coin



Flowchart 1 : Getting “head” or “tail” of a coin



Scratch program 1

Simple selection has one condition with two options. A selection is made out of the two conditions. If the condition is true, one option is selected and if not, the other option gets selected.

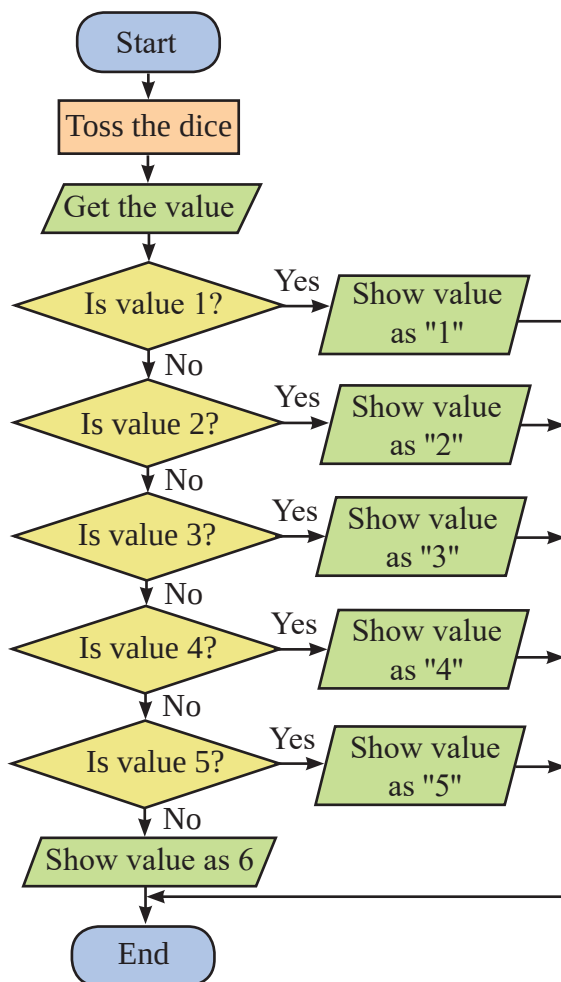


Refer to workbook for Activity 3.1.

3.2 Selection out of many options

Selection out of many options is about selecting one out of more than two options.

Example Tossing a dice for values of 1 to 6



Scratch program 2

Flowchart 2 : Getting value from a tossed dice

In the above, a number will be displayed if one of the five conditions is satisfied or if non of the five conditions is satisfied.

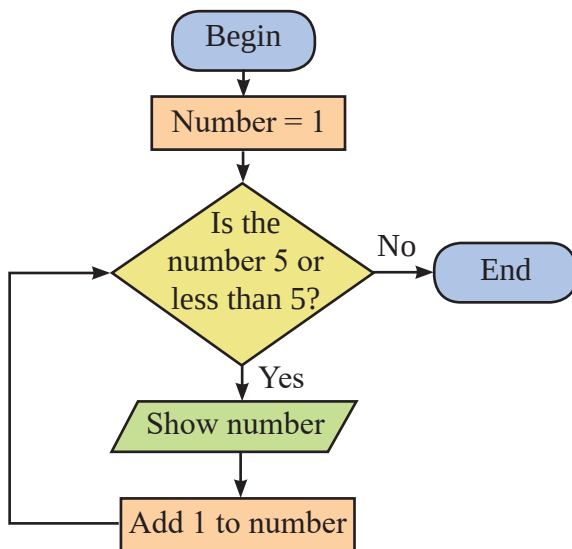
3.3 Control structure with repetition

Repetition is about an action getting repeated again and again.

With repetition, both beginning and end is based on a condition.



Example 1 Displaying numbers 1 - 5



Flowchart 3 : Display numbers 1 - 5

In this flowchart the condition is, “Is the number equals 5 or less than 5”?

At the beginning, condition is checked and since the condition is true, the repetitive work commences.

Once the number is shown, 1 is added to it and the condition is checked again.

When the number exceeds five, condition is not satisfied and the repetition ends.

Example 2 Consider a water pump filling water into a tank. The pump is operated until the tank becomes full.

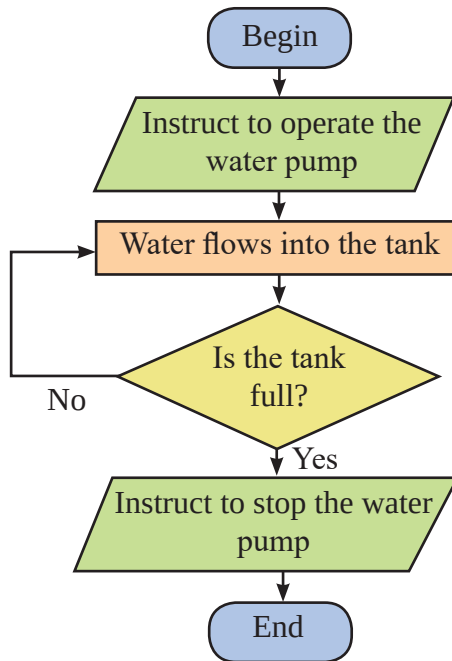
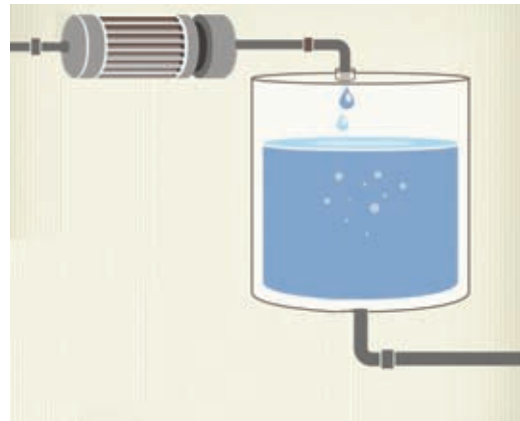
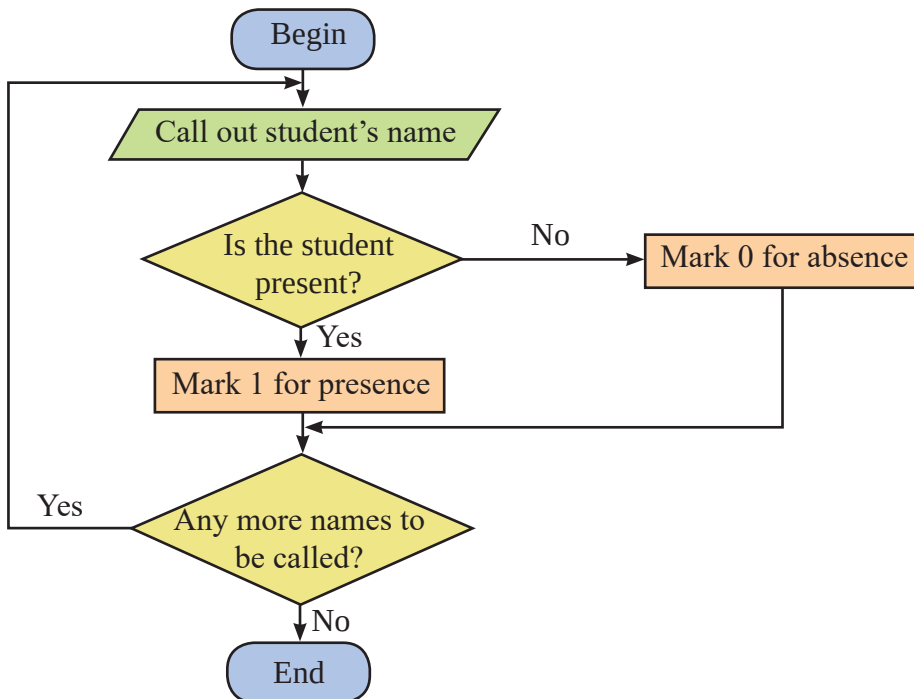


Figure 3.1 : A water pump filling a tank

Flowchart 4 : Filling a tank with water

Example 3 Consider marking attendance of students. If the student is present, the register is marked with 1. If student is absent it is marked with 0.

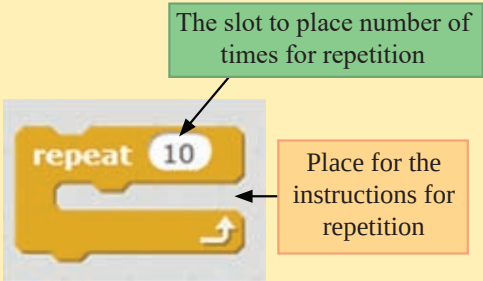
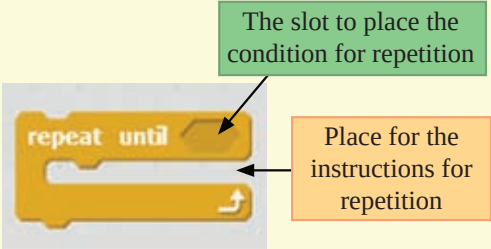
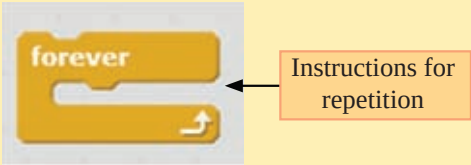


Flowchart 5 : Marking attendance register

3.4 Scratch repetition control structures

Three repetition control structures are available to build Scratch programming. They are shown below;

Table 3.1 : Repetition control structures

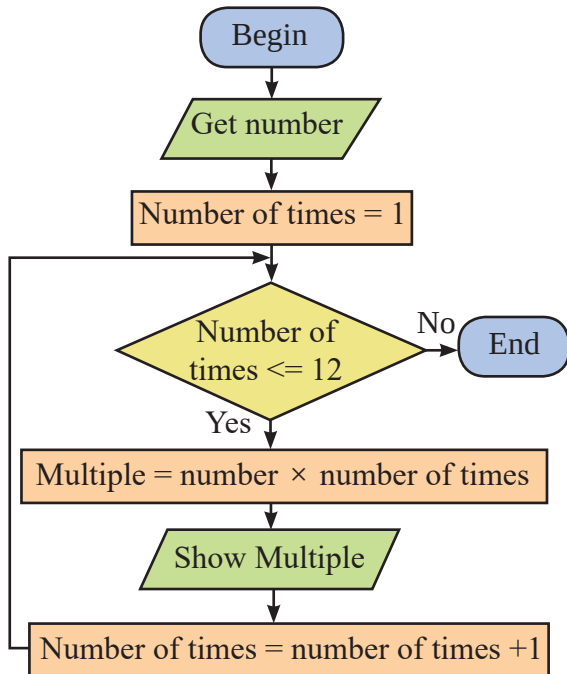
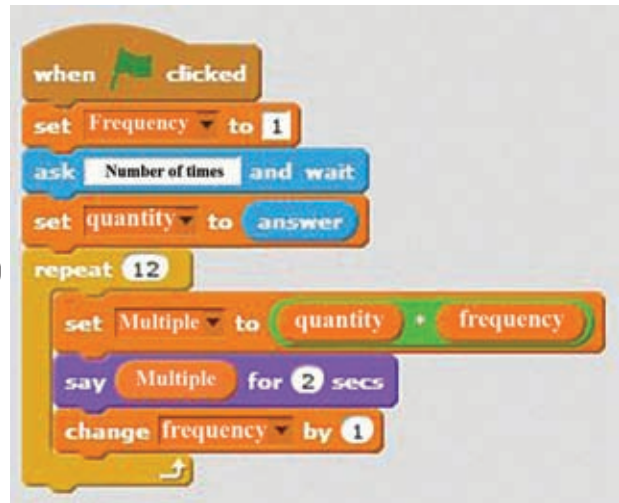
Repetition type	Example
<p>Repetition with definite number of times</p> 	 <p>Scratch program 3</p> <p>Displaying numbers 1 - 10 in 10 seconds</p>
<p>Repeating till a given condition is satisfied</p> 	 <p>Scratch program 4</p> <p>Displaying all positive integers 1 - 5</p>
<p>Repeating infinite number of times</p> 	 <p>Scratch program 5</p> <p>Displaying all positive integers from 1</p>

3.5 Developing visual programs involving repetition

Example 1 Showing the first multiples of 12 of any number.



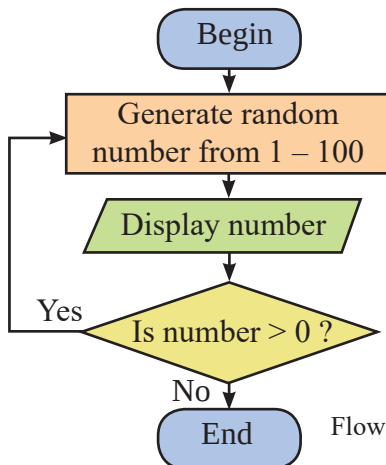
Note - For example, for number 2, the first 12 multiples are 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24 and for number 3, the first 12 multiples are 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36



Scratch program 6

Flowchart 6

Example 2 Displaying random number from 1 to 100, an infinite number of times

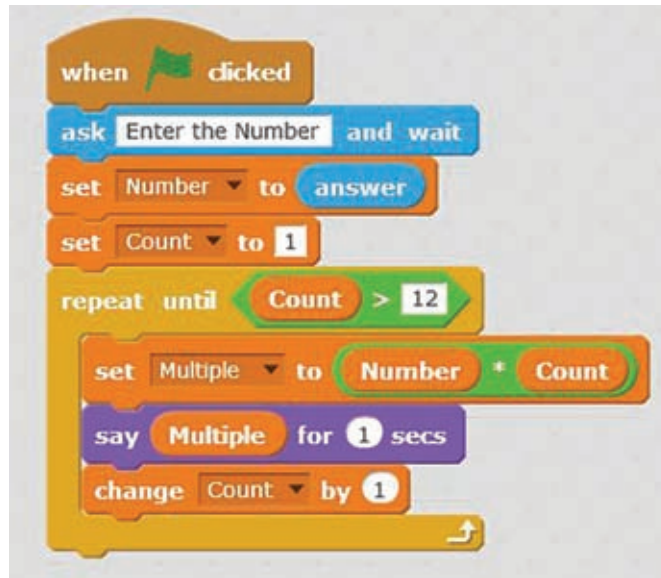


Scratch program 7

Flowchart 7 : Displaying random numbers between 1 -100

Condition in the above flowchart always remains true. It never changes to false. Therefore, continuous repetition takes place.

Example 3 Display the first multiples up to 12 of given number.



Scratch program 8

This is another program to display the same output of the flowchart 6 discussed earlier.

Example 4 Creating a multi-coloured circle using coloured lines



Scratch program 9

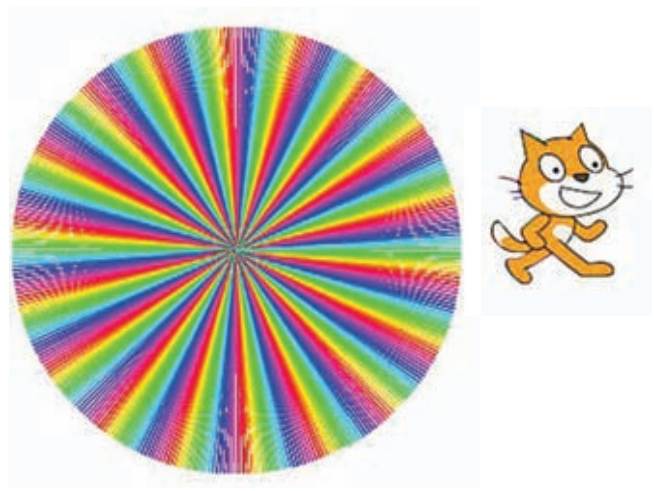


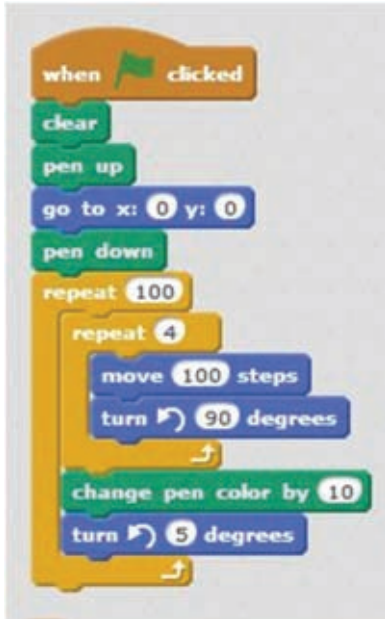
Figure 3.2 : The multi-coloured circle

3.6 Programming with nested repetition

Here, there are repetitions within repetitions.

Example 1 Repetition within a repetition

Consider the program to create the following line diagram in figure 3.3.



Scratch program 10

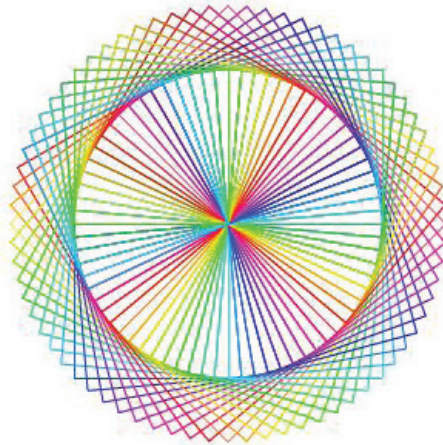


Figure 3.3

It shows repetition within repetition.

Example 2 Repetitions with selection

The flowchart and the Scratch program for a complete Snakes and ladders game is shown below. It includes repetitions with selections.

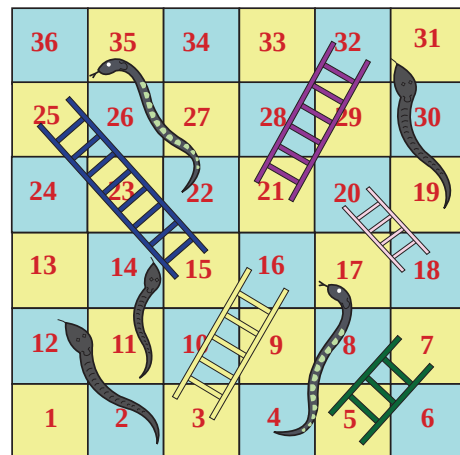
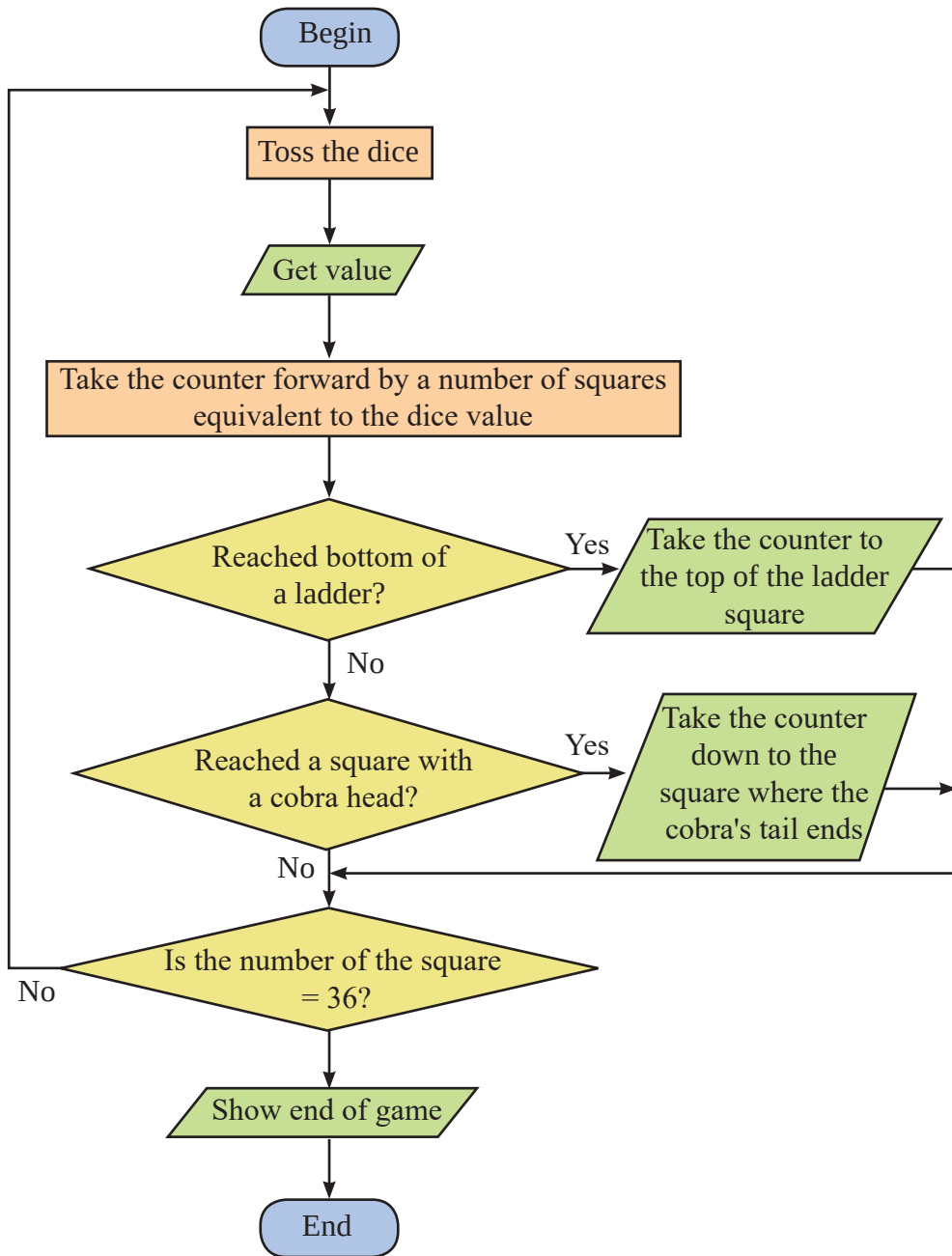


Figure 3.4 : Snakes and Ladders



Flowchart 8 : Snakes and ladders game



Scratch program 11



Refer to workbook for Activities 3.2 and 3.3.

3.7 Programming with arrays

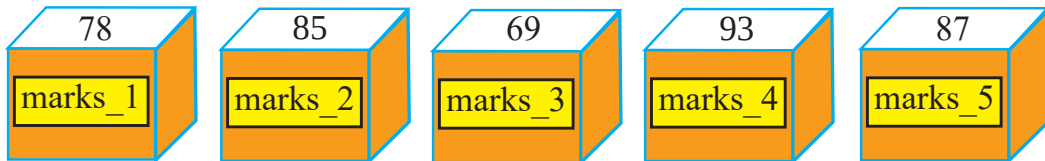
What is an array?

In Grade 7, we learnt that to store values in programming, variables are needed. We need a number of variables that is equivalent to the number of values to be stored.

For example, consider storing marks gained by a student for five question papers on general knowledge.

Five variables are required to store marks for the five question papers.

Name the variable as marks _1, marks _2, marks _3, marks _4 and marks _5. Marks earned by a student can be stored in these variables. Consider 78, 85, 69, 93, 87 to be the marks scored.



Each variable needs giving a name when variables are used to store values. This is difficult when a large number of variables are used. Further, the program become complicated and large with large number of variables. In such instances, arrays are used to get over this problem.

An array is a data structure that can store any number of items using a single variable name. By using arrays, programs become less complex and the number of instructions can be reduced.

Building up arrays

Lists are used for arrays in Scratch. Lists can be built as follows in Scratch.

e.g. - Using arrays to enter names of animals:

1. Select 'Make a List' from data
2. Give array a name
3. Select 'For this sprite only'
4. Click 'OK'

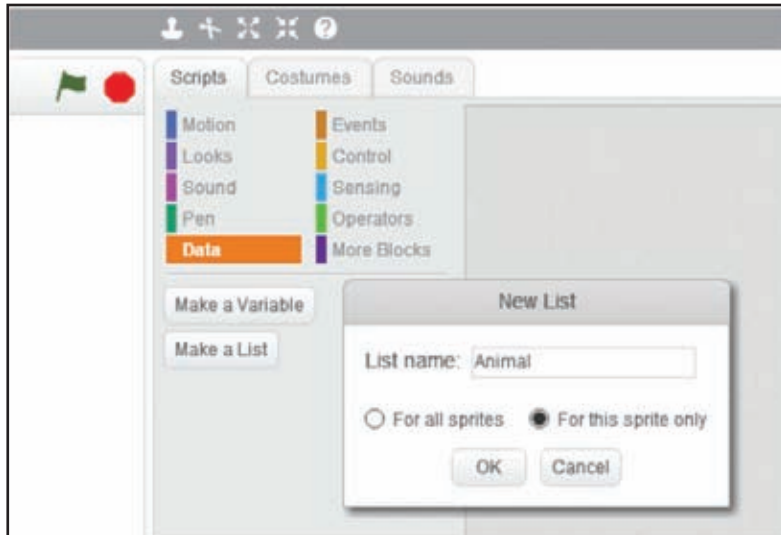


Figure 3.4 : Building up an array in Scratch

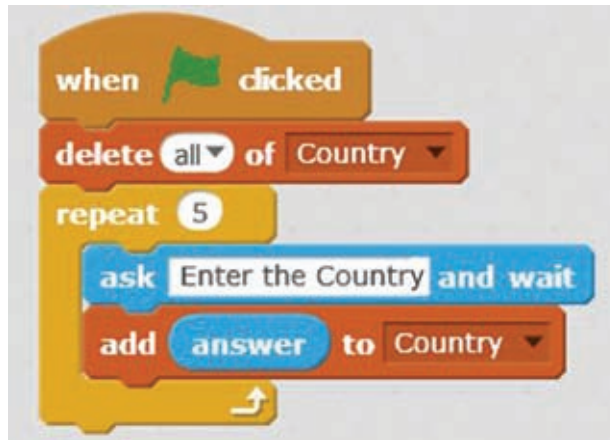
After following the steps above, instructions blocks for Animal array appear as shown below;



Scratch program 12

Assigning items into arrays

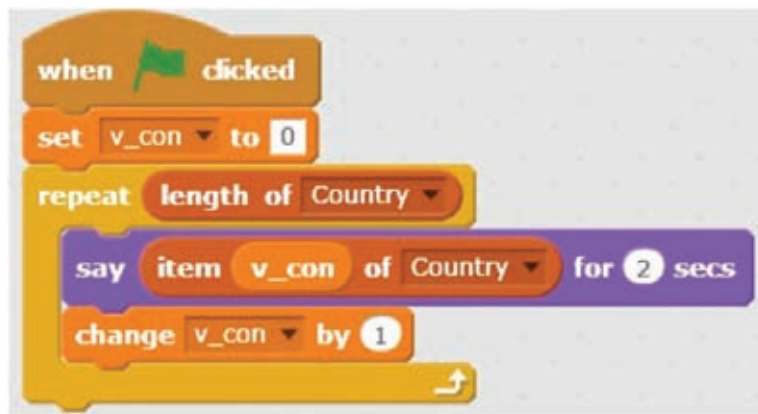
For example, after building an array named 'Country' to enter the names of five countries, the following code can be used to enter items to it.



Scratch program 13

Displaying items in an array

After entering data into an array named 'Country', the following program can be used to display its content to produce the output.



Scratch program 14

In the above program, v_con is a variable and "Country" is the name of the array.

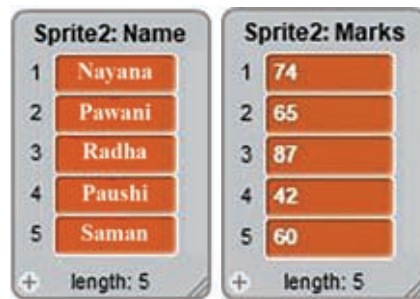
Let us consider an example where two Scratch programs to store the names and the marks of five students are processed. The first one uses multiple variables whereas the second one uses two arrays.



Scratch program 15 : Program with variables



Scratch program 16 : Program with repetition



Array with names

Array with marks

With the arrays in use, it is possible to use a repetition construct. This helps reduce the size of the program.

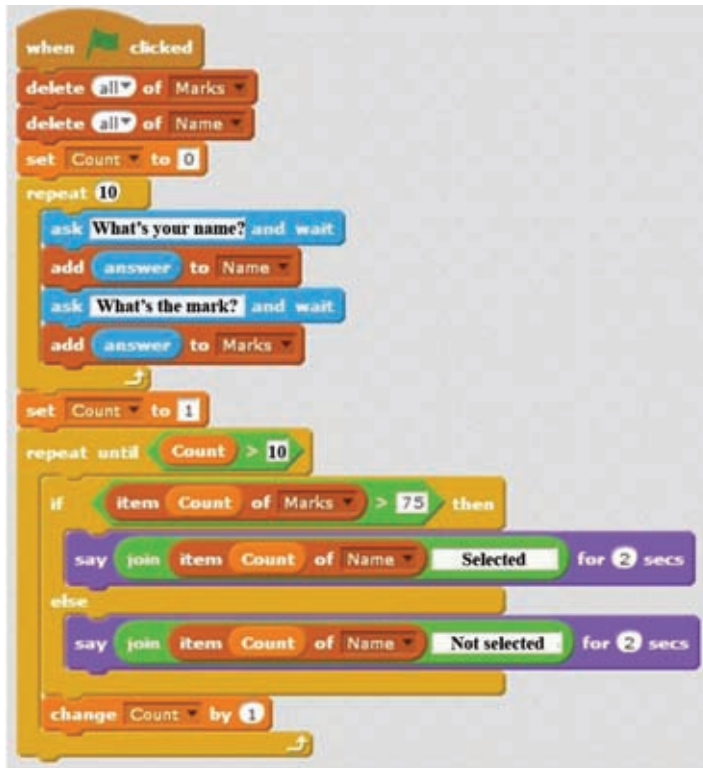


Note - An array is termed a list in Scratch programming.

Let us consider another example;

A school conducted a competition to select students for a general knowledge contest. The principal decided to select students who gained over 15 marks for the interview.

Five students are to face the interview. In the code shown below, using two arrays named 'Name' and 'Marks' the names of students having marks greater than 75 are shown.



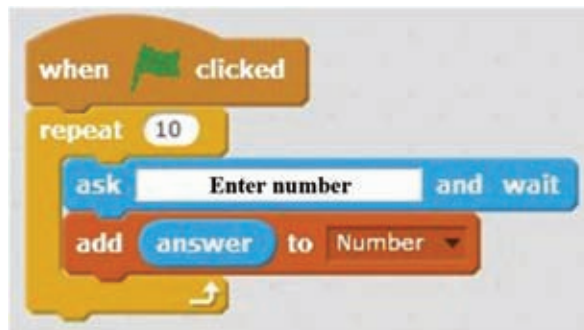
Scratch program 17

3.8 Programming with problem analysis

Dividing a problem into sections makes it easier to solve.

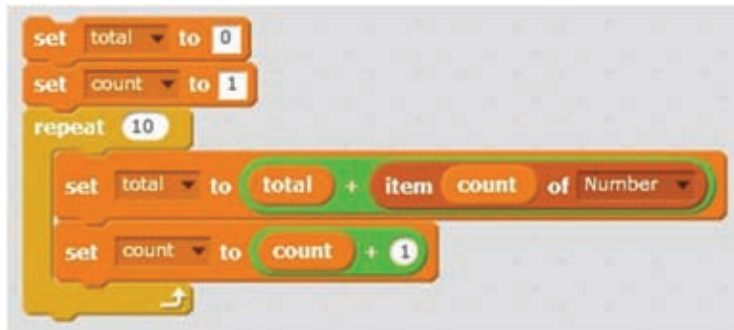
For example, Let us consider finding the average of ten numbers. This problem can be divided into sections as shown below;

1. Input ten numbers.



Scratch program 18

2. Find the total of the ten numbers



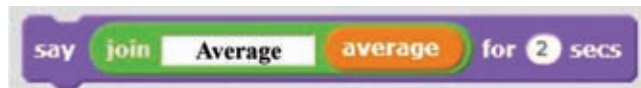
Scratch program 19

3. Divide the total by ten to find the average



Scratch program 20

4. Output average



Scratch program 21

Based on the sections written, it is possible to develop a Scratch program easily for the entire problem as follows;



Scratch program 22



Refer to workbook for Activity 3.4.

Summary

- Repetition is about repeating a statement or a set of statements.
- A condition is necessary to begin and end a repetition.
- There are Scratch repetition control structures.
- There are three repetition control structures in Scratch:
 - i. Control structure for repetition a set number of times (e.g. for 10 times)
 - ii. Control structure for repetition based on a condition
 - iii. Control structure for endless repetition
- Repetition within a repetition is called a *nested repetition*.
- There are a few nested repetition types:
 - i Repetition to satisfy a given condition
 - ii. Continuous repetition a fixed number of times
 - iii. Continuous repetition to satisfy a given condition
- An *array* is a data structure to store many items using a single name.
- Dividing a problem into smaller selections makes problem development easier.

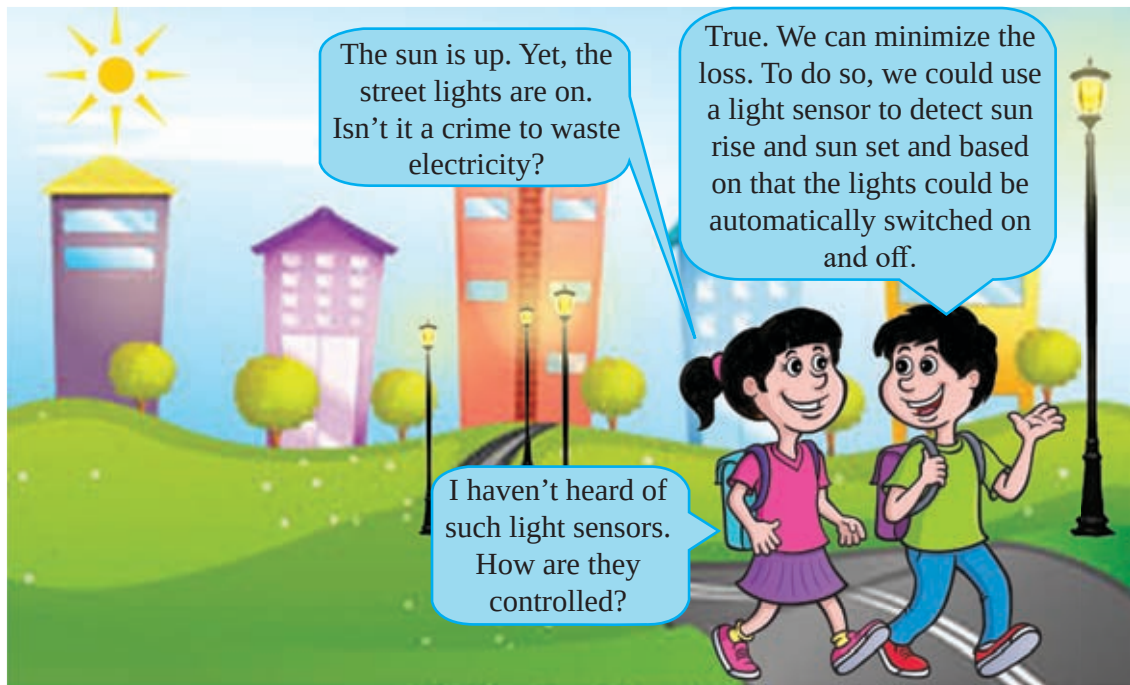
4

Use of Microcontrollers

This chapter will cover the following:

- Identifying devices that use sensors
- Introducing the control of processing and output of data collected from sensors and developing codes for the purpose.

4.1 Microcontrollers





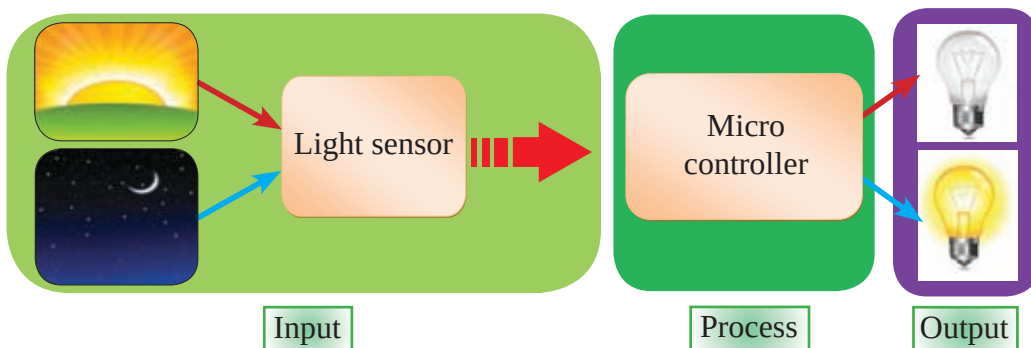
Use of sensors to identify environmental changes

To use sensors to detect environmental conditions and to set related information, they must be connected to a computer.

The basic functions of a computer are to input or collect data, process data according the given instructions and to output necessary information.



The microcontroller processes data collected from sensors according to the given instructions and releases necessary output. An example for microcontroller operation is shown below;



The microcontroller processes data gathered by the light sensors to light the bulb or to put it off. For this purpose, the microcontroller needs to be fed with program instructions in a program.



Refer to workbook for the Activity 4.1



Note - **Microcontroller**

A micro controller is actually a chip design to perform some operations according to the given instructions.



Components of microcontroller

A microcontroller consists of four basic components;

1. Central Processing Unit - CPU

This processes data into information in order to provide the output.

2. Memory

There are two types;

i. Non-volatile memory

The data in the non-volatile memory does not get erased even if there is no electricity. The program that the microcontroller should execute is stored in it.

ii. Volatile memory

Data in the volatile memory gets erased if there is no electricity. It functions as the Random Access Memory (RAM). This is used to store data as well as other results that are related when the microcontroller is at work. Data and instructions for the CPU are also held here.

3. System clock

The system clock is an electronic device. It synchronizes all components.

4. Peripheral devices

Small pins used to input data or output information belong to this category. Data is collected in both in analog and digital forms. Output is released in digital form.

Use of sensors and micro controllers

Solar lamp

This contains solar cells, sensors and microcontroller. Solar cells microcontroller and light sensors cooperate to light the lamp. The solar lamp turns on automatically with the dark and turns off when there is light. Use of such solar lamps can minimize the waste of electricity.



Washing machine

Pressing buttons, the user gives instructions to the microcontroller for the wash. The microcontroller operates accordingly.



Microwave oven

The microcontroller in the microwave oven holds the heat for a specified period and stops. The user has to instruct regarding the required temperature and the duration.



Important:

Single Board Computer (SBC)

A single-board computer has a single circuit board with memory, input, output and microcontroller.

e.g. - Raspberry pi

Single Chip Computer (SCC)

Central processing unit, input, output and memory are all built into a single integrated circuit. (IC)

e.g. - Arduino clip

4.2 Use of microcontrollers

A microcontroller based kit can be used to obtain the required outputs. A few such microcontroller based kits are shown below:

- micro:bit
- Arduino
- Raspberry pi

The following websites will help with more information about these kits;
www.microbit.co.uk
www.arduino.cc,
www.raspberrypi.org

This chapter is more about the use of Micro:bit and Arduano microcontrollers.

Micro:bit

The BBC institute has developed this microcontroller module to get inputs, process them and produce outputs. This contains a memory too. Hence this board has the basic features of a computer. Further, it contains sensors also. The architecture of the micro:bit module is as follows;

Front view of the micro:bit module

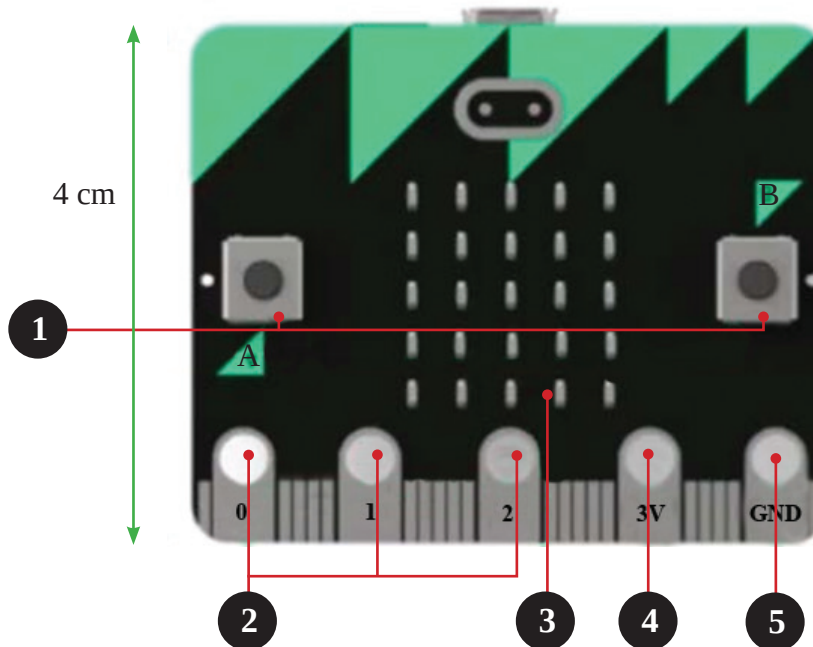


Figure 4.1 : Front view of micro:bit module

- 1 Two programmable buttons as A and B
- 2 Digital and analog input/output pins
- 3 Individually programmable LED bulbs. The LED bulbs are built into the module so additional LED bulbs are not necessary.
- 4 Port to connect power
- 5 Ground back port

Rear view of the micro:bit microcontroller module

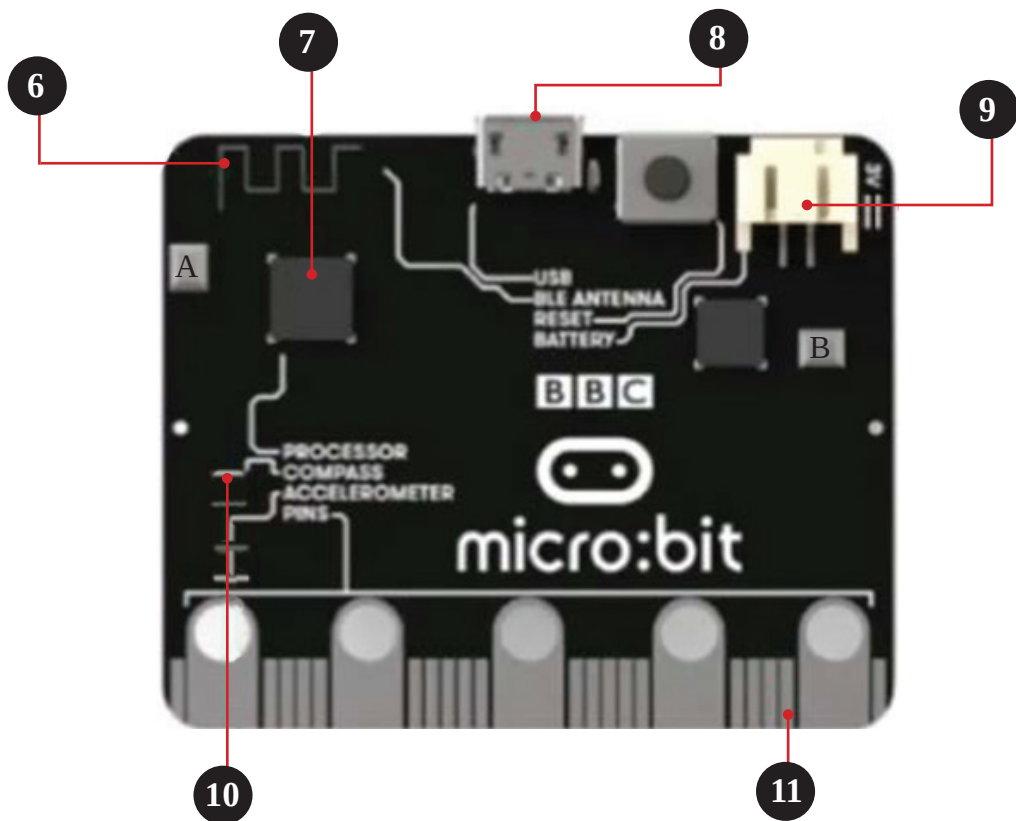


Figure 4.2 : Rear view of micro:bit microcontroller module

- 6 Bluetooth smart antenna to connect devices using bluetooth and to transmit radio waves
- 7 Central Processing Unit
- 8 Micro USB port to connect to a computer
- 9 The battery connector to connect 3V external power supply
- 10 Accelerometer and compass (The module contains a few embedded sensors)
- 11 Pin edge connector

Connecting micro:bit module to computer

The module has to be connected to the computer with a micro USB cable as shown below;

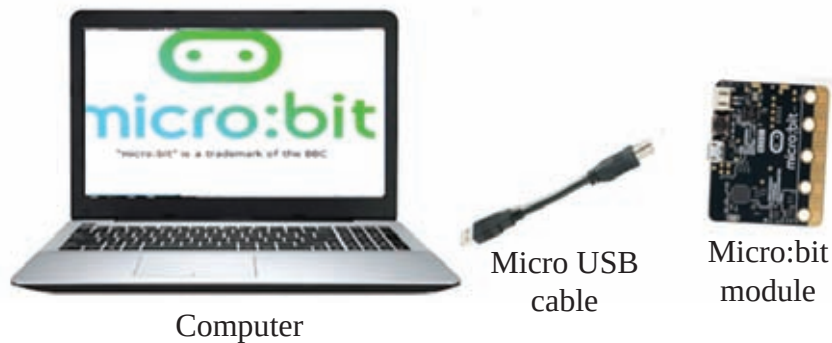


Figure 4.3 : Connecting micro:bit module

When connected, the computer shows it as a storage unit.

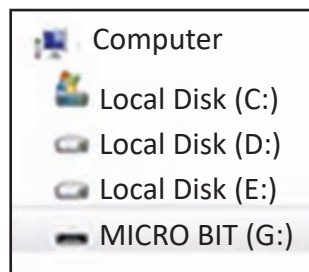


Figure 4.4 : Micro:bit shown as a storage unit

Coding the micro:bit module

Coding micro: bit module is done online. To code micro: bit module, access micro:bit code in the website www.makecode.com. This features a drag-and-drop facility to speed up programming.

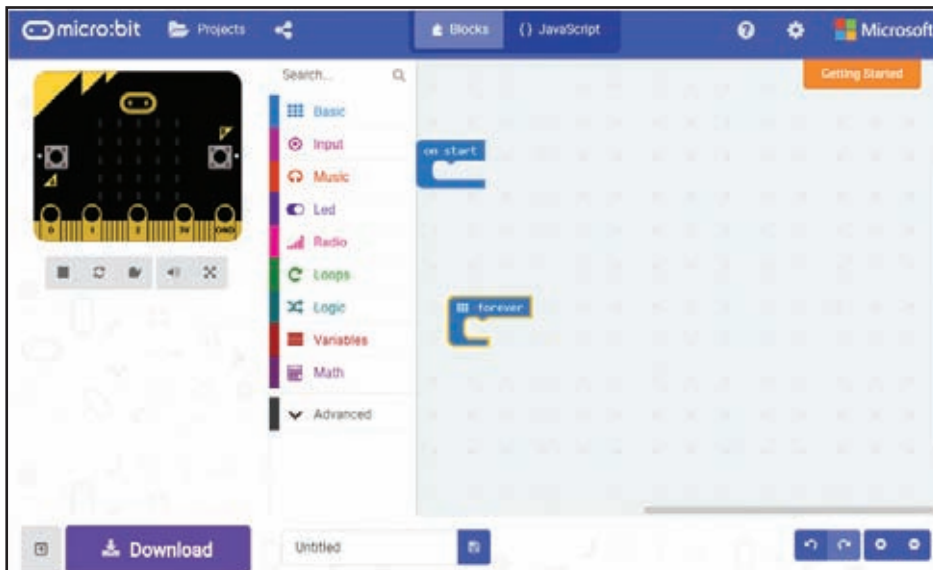


Figure 4.5 : Micro:bit coding

Therefore, it is possible for even a beginner to follow the process. A specialty in this connection is the ability to access even in Sinhala as shown below;

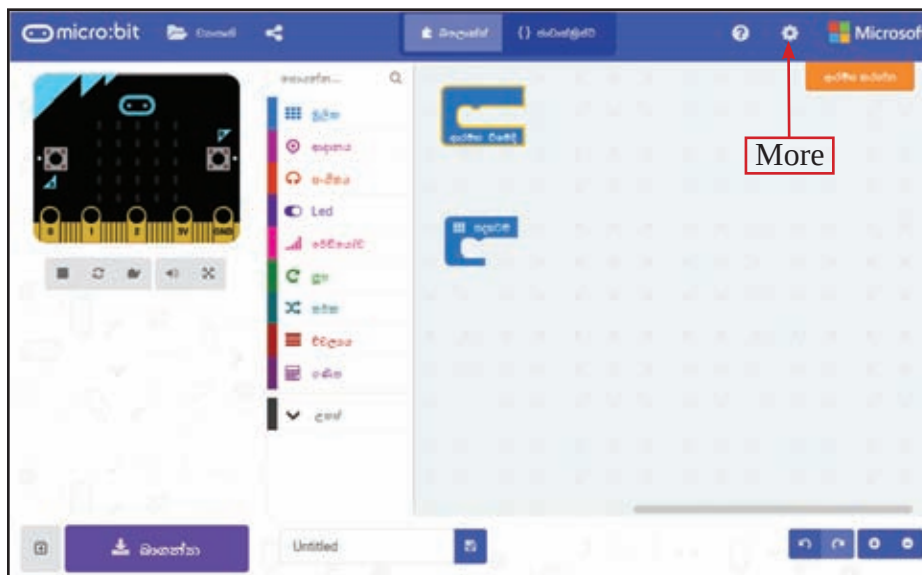


Figure 4.6 : Micro:bit code in Sinhala

To do this, the steps *More* → *Language* → *Sinhala* have to be followed.
Once the coding is done, it can be displayed in micro:bit model in Block Editor.

Practical usage of the micro:bit module

Access the website www.makecode.micro:bit.org. to get a new project with Projects → New Project. Refer figure 4.7.

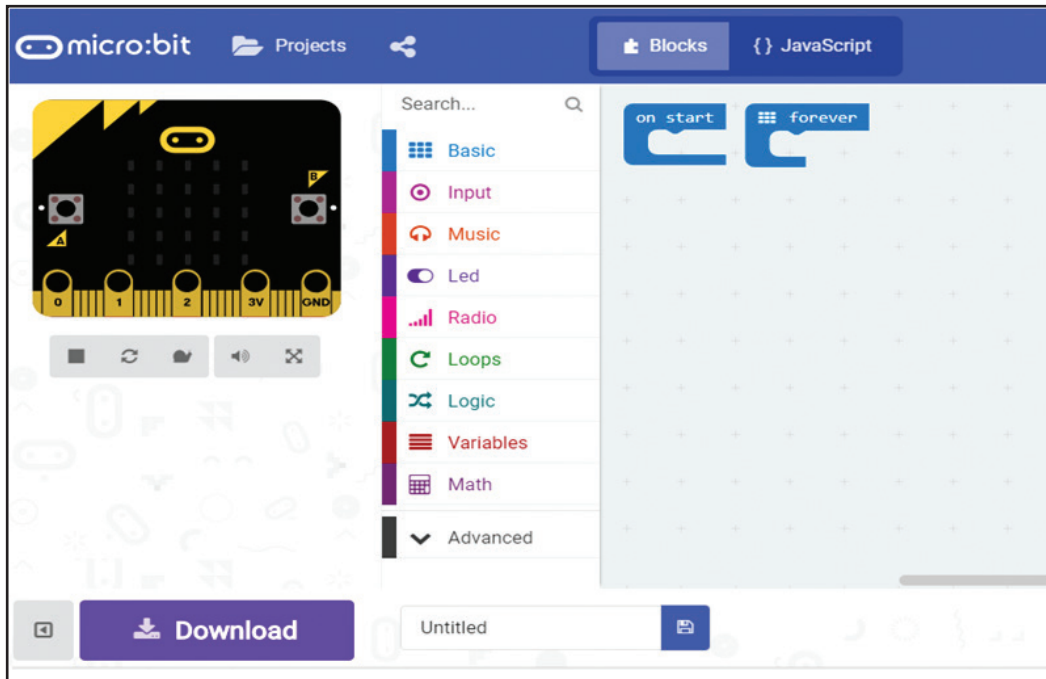


Figure 4.7 : Starting a new project in micro:bit

An image similar to figure 4.7 is shown. Click 'blocks' on it. Coding can be easily done by connecting blocks. Or else, computer programming languages like Java scripts, Python C++, etc. can be used for programming.

When starting a new project, the block editor shows two blocks as shown in Figure 4.8.

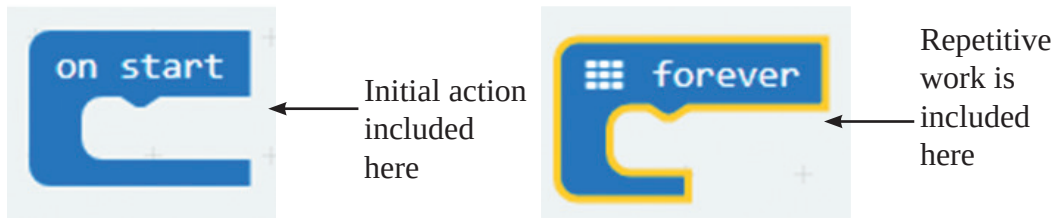


Figure 4.8 : Blocks inside the code editor

To get more block types, click on the menu in block editor (Figure 4.9).

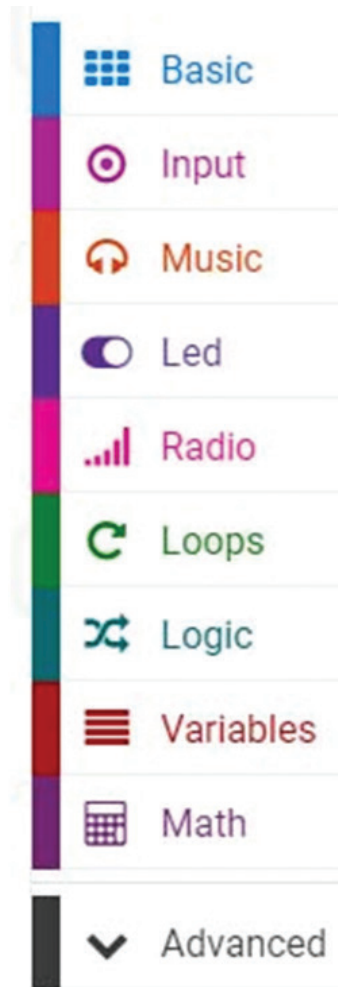


Figure 4.9 : Block editor menu

The basic menu above provides the following:

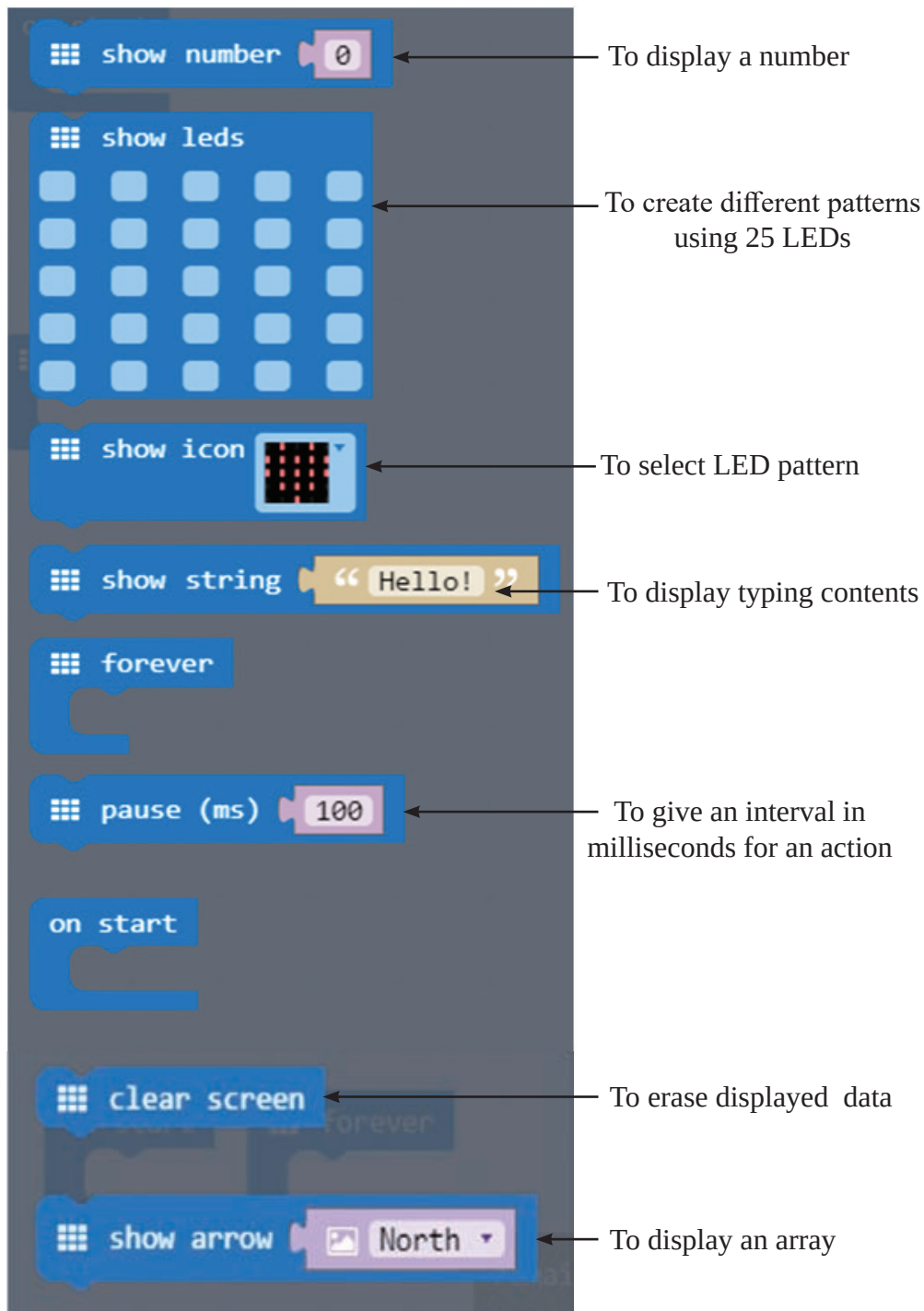


Figure 4.10 : Features in basic menu

The input menu above provides the following blocks:

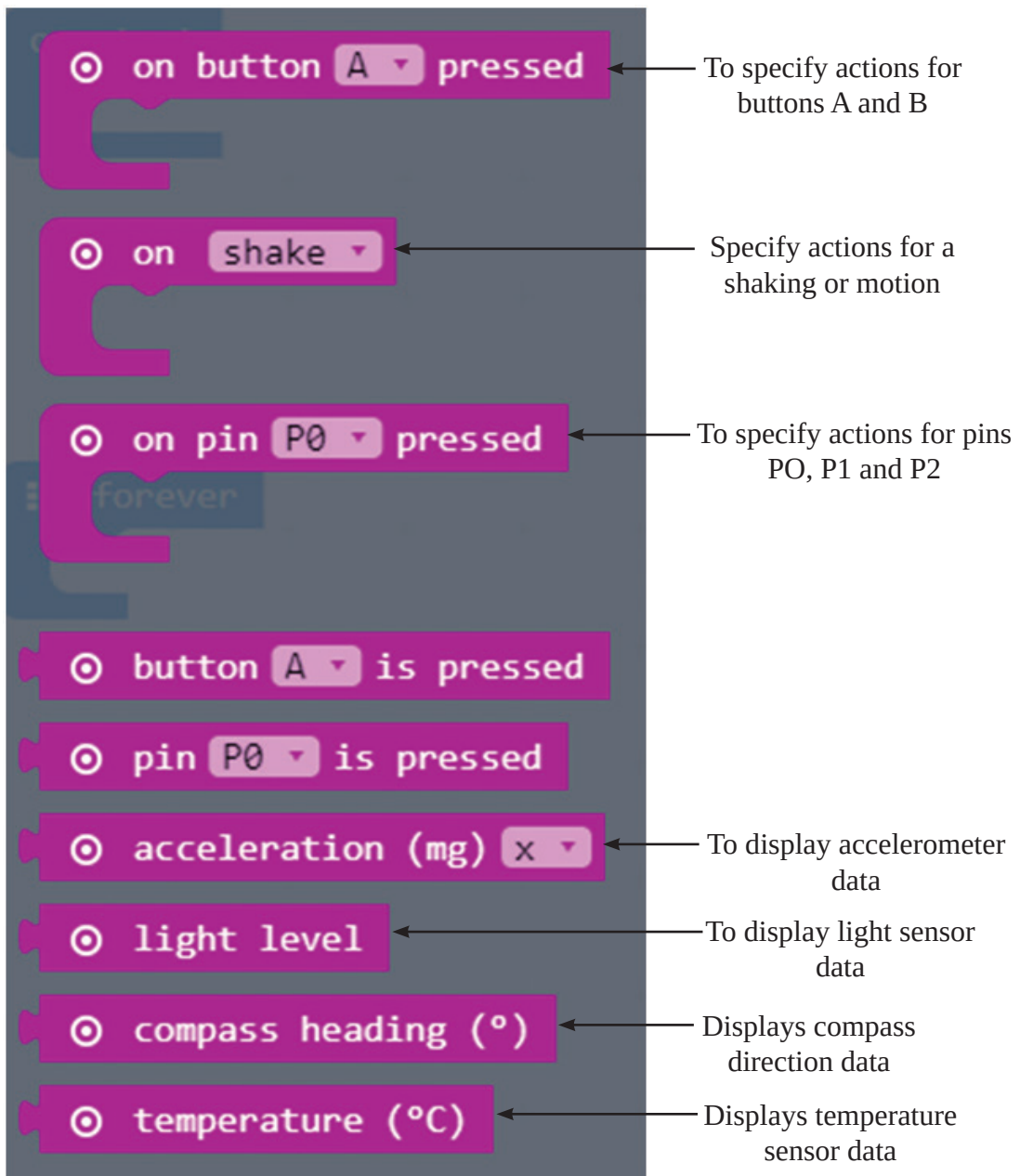


Figure 4.11 : Features in input menu

Other types available in block editor and other menus are used in the activity.



Refer to workbook for Activities 4.2 and 4.3

Arduino

Arduino is a microprocessor developed by Atmel company. It consists of the components shown below (Figure 4.12). It can receive input, process it and release output. It contains a memory as well. Therefore, this board is similar to a basic computer.

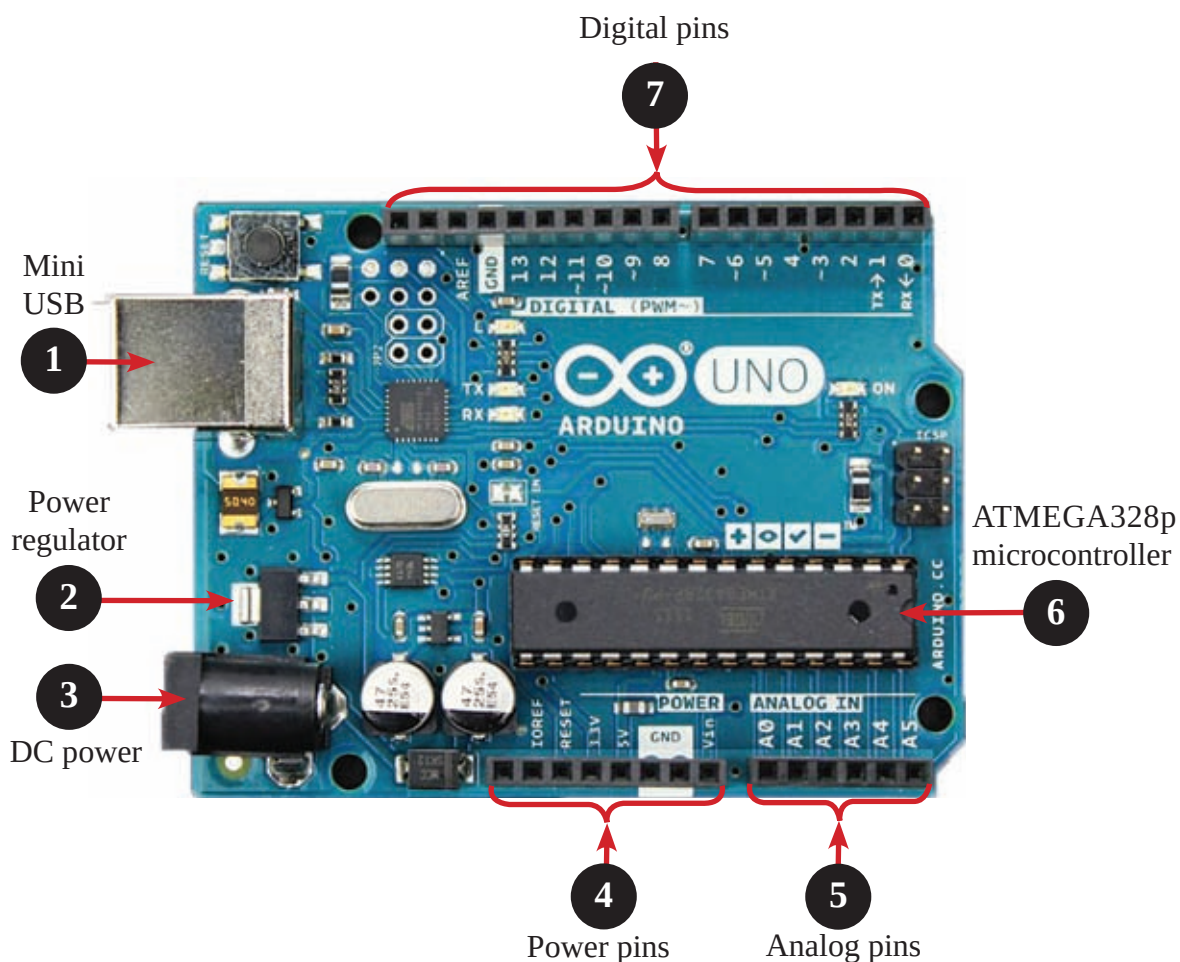
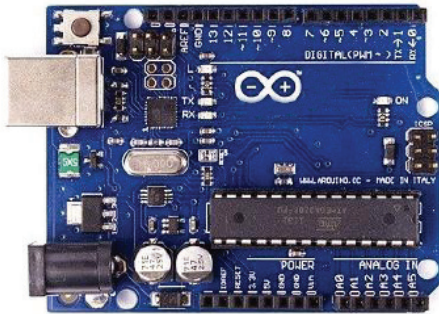


Figure 4.12 : Arduino board

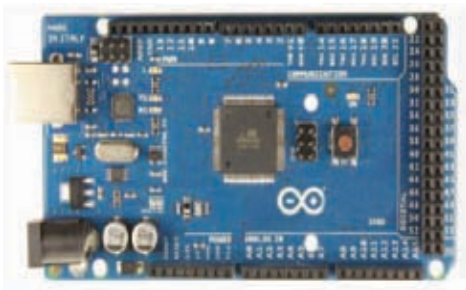
Table 4.1 : Components on the Arduino board

1	Mini USB 	Can be used to connect to a computer.
2	Electric controller 	Controls the voltage given to the Arduino board.
3	DC power supply 	When the Arduino board is connected to a computer it gets its required 5V voltage from the computer. However, when it is not the case, this port can be used to supply external power.
4	Power Pins 	These pins can be used to provide electricity from the board to an external circuit. It is also used to control some operations.
5	Analog pins 	Used to send analog inputs (e.g. sensor reading) to the board.
6	ATMEGA328p 	This is a micro controller chip in the Arduino Uno board. It is produced by Atmel company.
7	Digital pins 	Can be used to get digital inputs and to provide digital outputs.

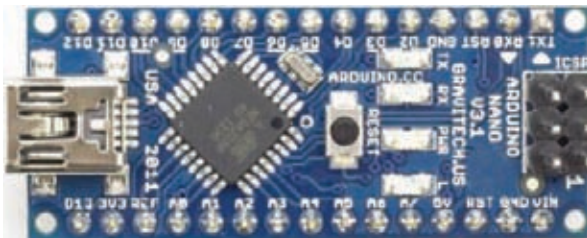
A few Arduino boards used today are shown below;



Arduino Uno board



Arduino Mega board



Arduino Nano board



Arduino Micro board

Out of the above Arduino boards, we use the Arduino Uno board for the activities in this unit.

Other peripherals connected to microcontrollers

1. Bread-board

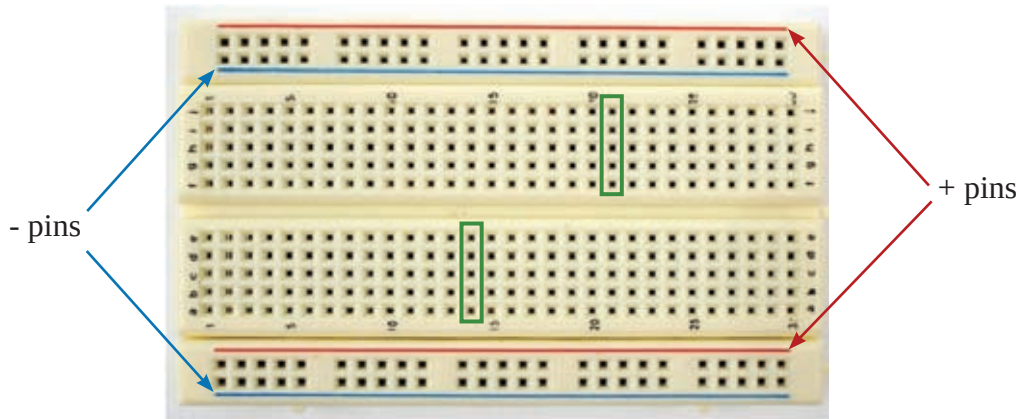


Figure 4.13 : A breadboard

Breadboards can be used to make circuits without resorting to welding to connect the circuit components.

On a breadboard;

- All holes marked (+) ve (red) are connected together.
- All holes marked (-) ve (blue) are connected together.
- As shown in Figure 4.13 holes in each green colored section are connected together.

2. Light Emitting Diode - LED

A Light Emitting Diode (Figure 4.14) emits light when electricity passes through it.

In a diode, electricity travels only in one direction.

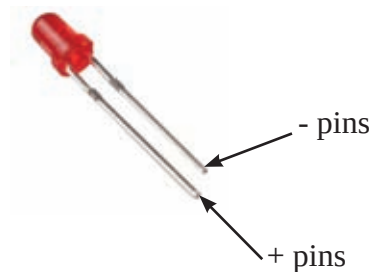


Figure 4.14 : A Light Emitting Diode

3. Sensors

A sensor is a device which detects or measures a physical property and records, indicates or otherwise responds to it.

(i) Passive Infrared Sensor (PIR) Sensor

This is an electronic sensor that measures infrared objects (e.g. humans) in its field of view and gives an output voltage accordingly (Figure 4.15).

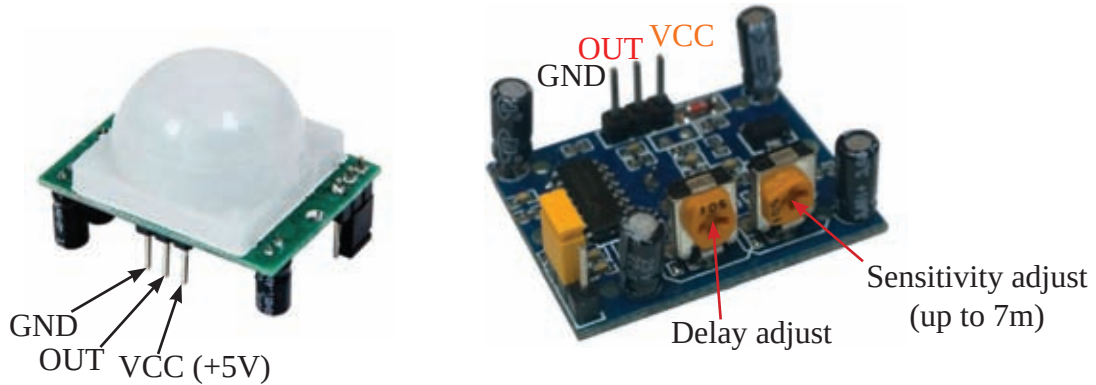


Figure 4.15 : Front and rear views of PIR Sensor

- GND : is the negative terminal
- VCC : is the positive terminal (need 5V)
- OUT : the output terminal (outputs 3.3V)

Out of the two trimpots marked colour yellow, one enables adjusting the distance covered by the sensor, while the other indicates the time delay to release the output.

(ii) Ultrasonic sensor

An ultrasonic sensor is used to estimate the distance from it to an object. This is done by ultra sound signals to the object and then interpreting the reflected signals (Figure 4.16).



Figure 4.16 : How an ultrasonic sensor works

This sensor functions in a way similar to that of a bat finding its route. (Figure 4.17).

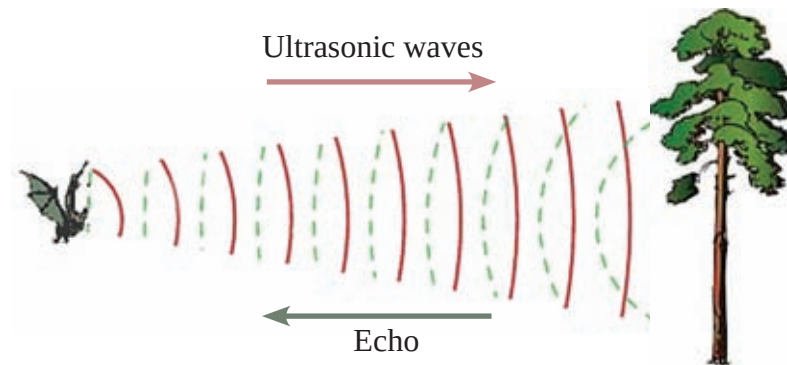


Figure 4.17 : An example similar to the ultrasonic sensor functions

The pins on the Ultrasonic sensor are as shown below.

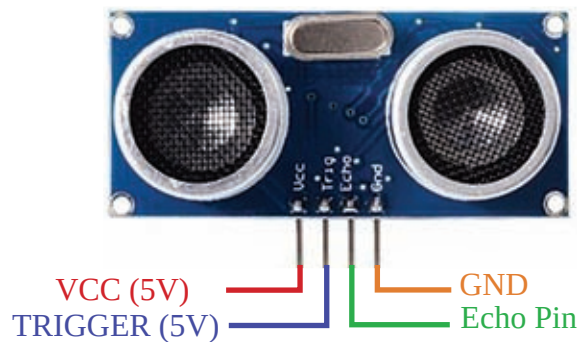


Figure 4.18 : Pins on the ultrasonic sensor

- GND : the negative terminal
- VCC : the positive terminal (5V must be supplied to it)
- TRIGGER : for input
- ECHO provides output : for output



Refer to workbook for Activities 4.4, 4.5 and 4.6

Summary

- Components of a microcontroller:
 - Central Processing Unit
 - Memory
 - System clock
 - Peripherals
- Some devices using microcontrollers:
 - Microwave ovens
 - Washing machines
 - Solar lamps
 - Traffic lights
 - Computer printers
 - Remote controllers
- Different boards containing microcontrollers (Microcontroller based kits)
 1. micro:bit
 2. Arduino
 3. Raspberry pi
- To code the above controllers must be connected to a computer. In using micro:bit, block editor helps with easy coding.

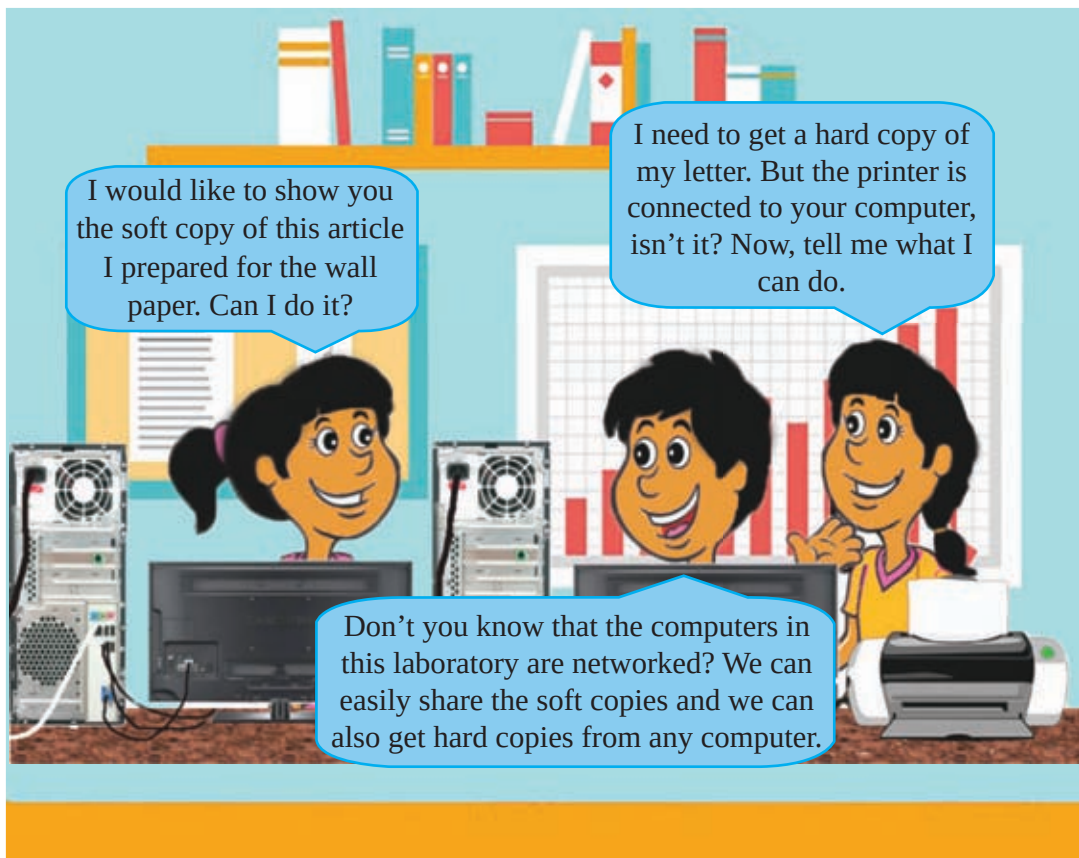
5

Computer Networks

This chapter will cover the following:

- Computer networks and their basic devices
- Communication using computer networks
- How resources can be shared in computer networks

5.1 Computer networks



A collection of computers in a school computer laboratory or an organization, etc. connected together is called a *computer network*.

Several advantages of computer networking

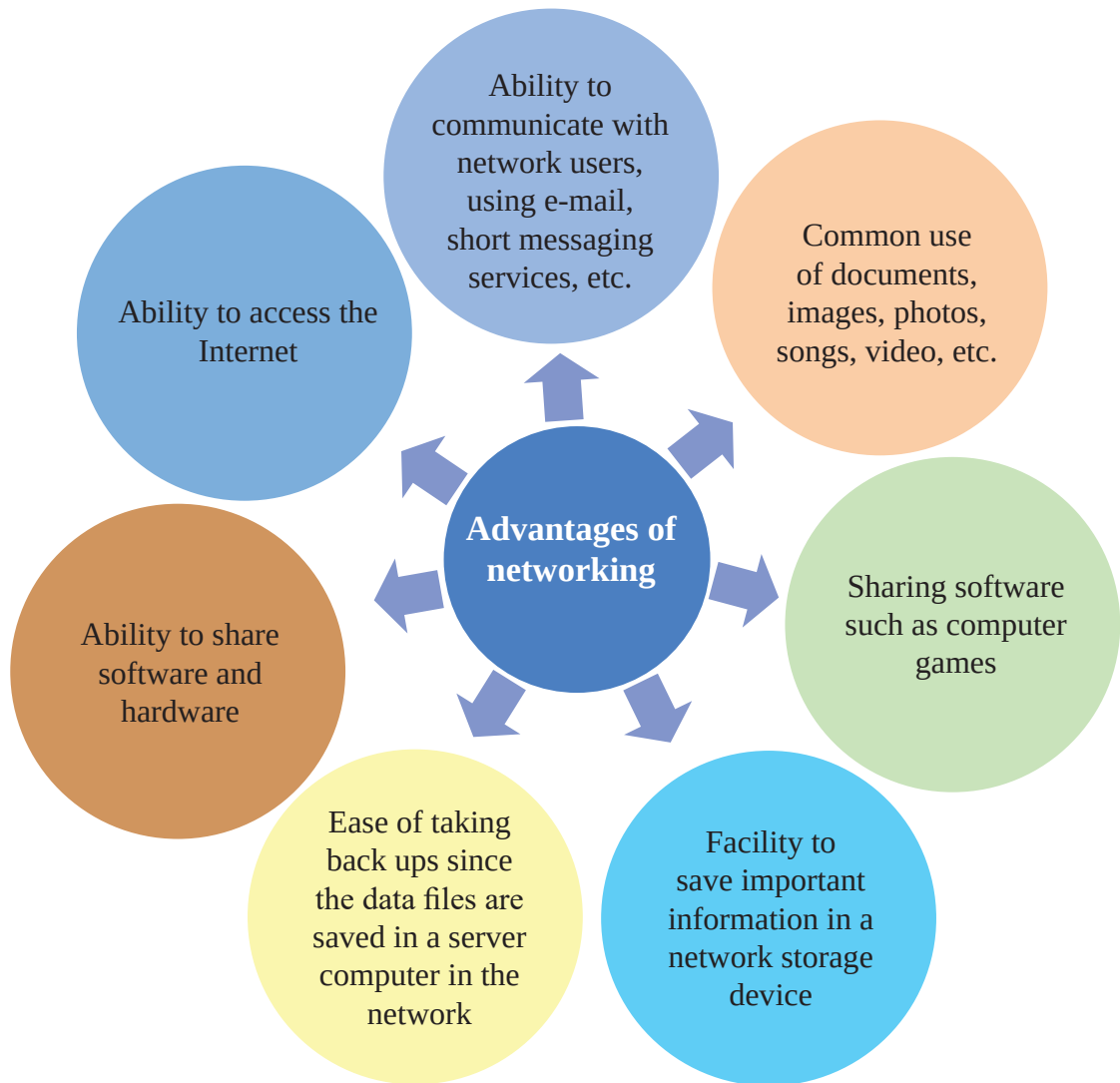


Figure 5.1 : Advantages of using computer networks

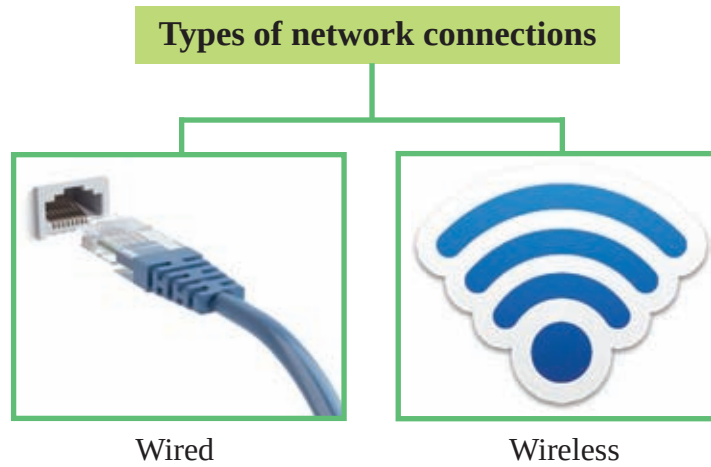


Figure 5.2 : Types of network connections

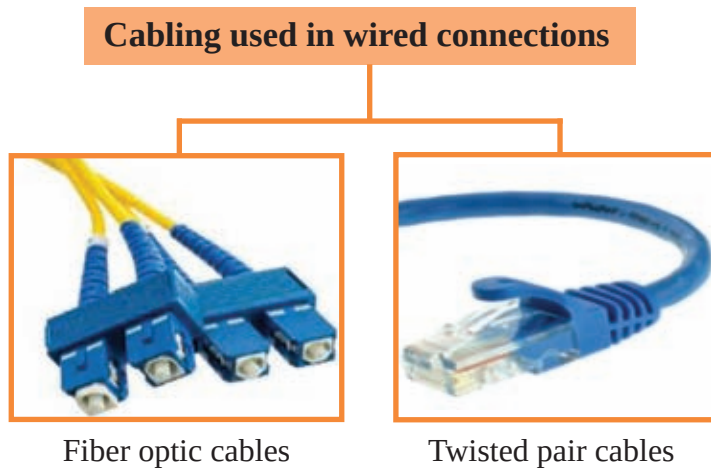


Figure 5.3 : Cabling examples

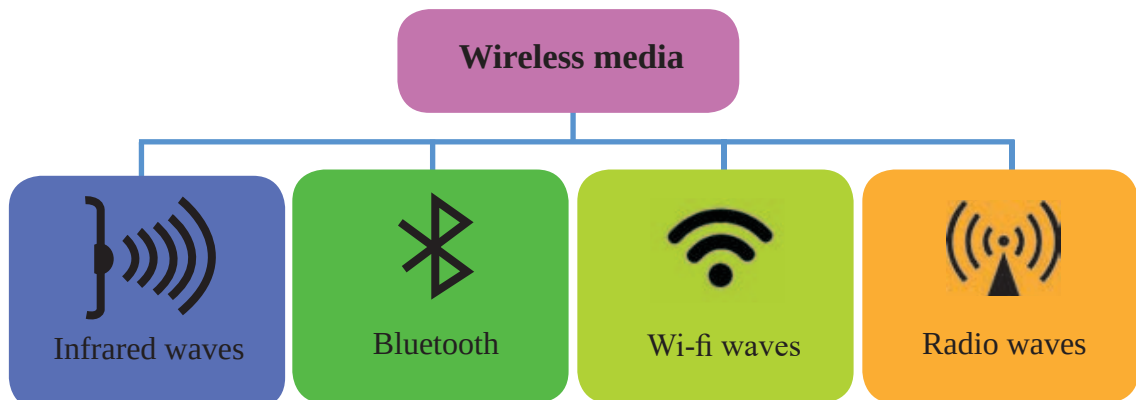


Figure 5.4 : Wireless media examples

Table 5.1 : Basic device requirements for computer networks

Basic devices of a Network	
<p>The server manages the software, the hardware, the files and communication in the network. Any ordinary computer with the necessary software installed can be used as a server.</p>	 <p>Server</p>
<p>The switch acts as the mediator between two or more computers. The switch recognizes the destination computer or the device when messages are sent from one computer to another in the network.</p> <p>e.g.- when printing command is given from one computer that message is sent to the relevant device i.e. the printer via switch.</p>	 <p>Switch</p>
<p>Network Interface Card connects a computer to a computer network.</p>	 <p>Network Interface Card</p>
<p>RJ45 connector cables</p>	 <p>RJ45 cables</p>



Note: The **router** is used to connect one network to another network or to the Internet.

The router connects your computer or the network to the Internet easily.



The following example shows a network between two computers using the devices discussed above;

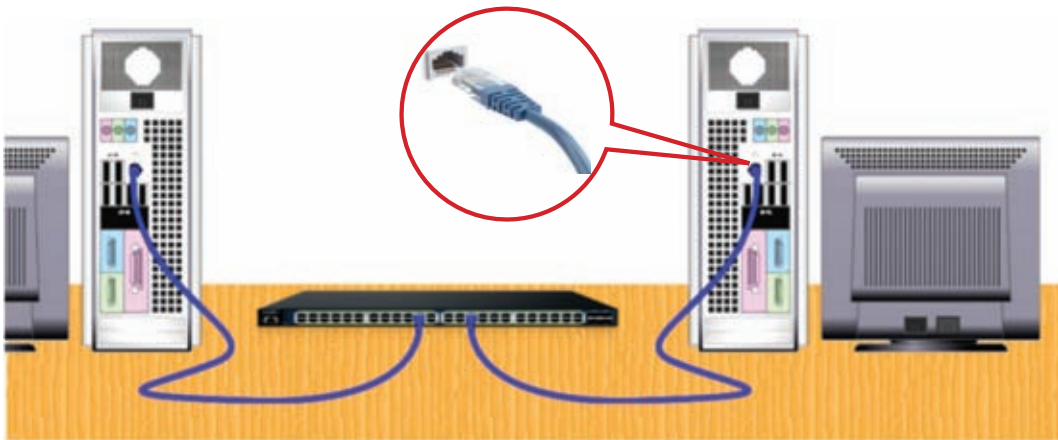


Figure 5.5 : A network involving two computers

An example of a computer network

As shown in Figure 5.6 the computers are connected to the server computer via the switch.

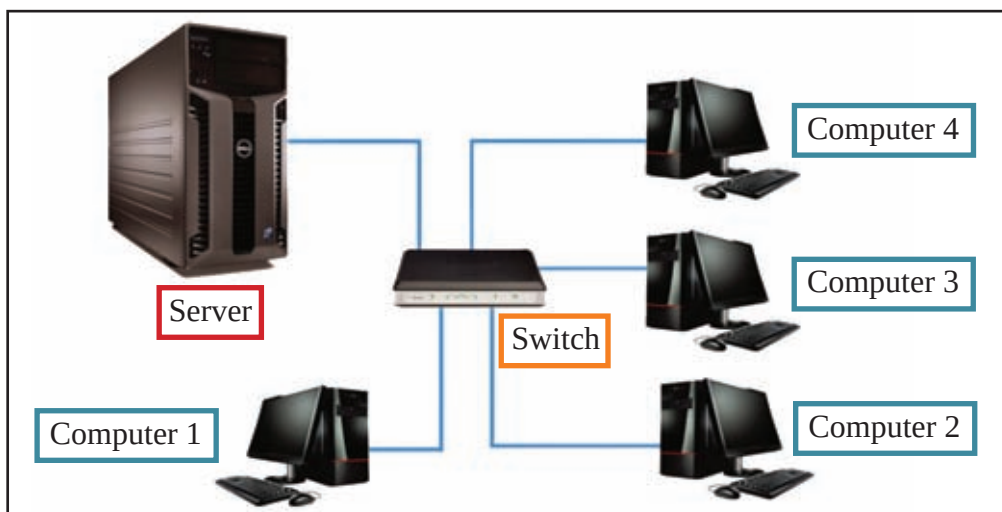


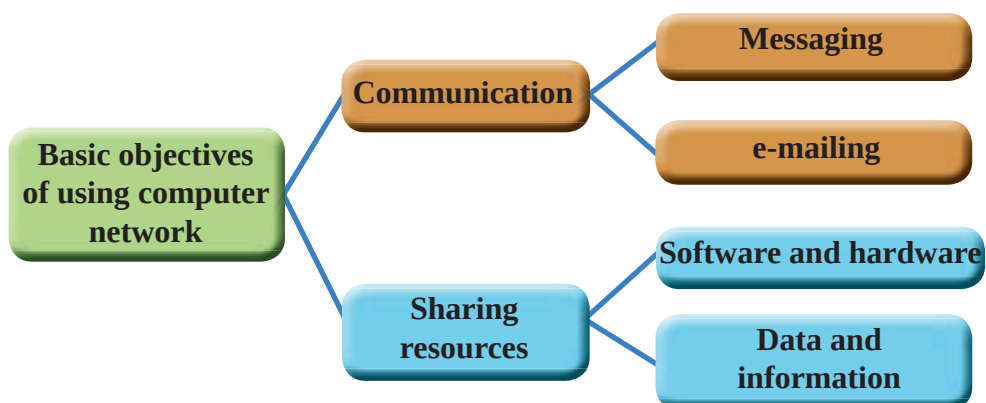
Figure 5.6 : An example of a computer network



Refer to workbook for Activities 5.1 and 5.2

5.2 Use of a computer network to share resources and for communication

Let us consider the basic objectives of computer networks.



5.2.1 Communication using a computer network

A computer network helps with easy communication among friends by messaging.

A message can be directed to many friends in the network at one time.

The Command Line Interface (CLI) can be used for this purpose.



5.2.2 Sharing resources using a computer network

e.g. 1 - Sharing hardware

When a printer is connected to the network using cables or wireless, every one in the network can use it when arrangements are made as such.



Some other devices shared in a network.



Scanner



Fax machine

Advantages of using peripherals in common

- Ability to use common hardware with several computers
- Saving money
- Saving time

e.g. 2 - Sharing software

Each stand-alone computer may need individual software licenses. This is very expensive. However, buying multiuser software licenses for a computer network is relatively low. This saves a lot of money.

e.g. 3 - Sharing data and information

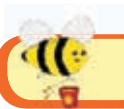
Sharing data and information helps save time, money and storage capacity while increasing the efficiency and productivity.

File folder



When a folder is shared in a network, all the files in the folder can be accessed by the users in the network.

This provides an opportunity to share images, photos, songs and videos, etc. among friends.

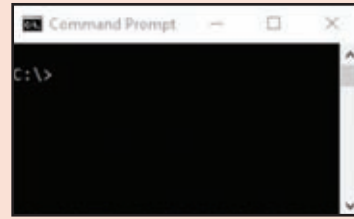


Refer to workbook for Activities 5.3 to 5.8



Note - **Command Line Interface (CLI)**

The command Line Interface is an interface that could be used to give typed commands to computer sequentially in the form of texts. Before the introduction of the Graphical User Interface, the operating system of the computer, had the command line interface. This interface can be used to send messages to the network users.



In addition, the third party software such as LAN messages, Net send GUI, POP Messenger, also could be used for network user communications.

Summary

Computer networks

- A collection of two or more computers connected to share resources is a computer network.
- Computer networking has many advantages. The basic objectives of networking are to share resources and to communications.

Computer connection types used in networking:

- Wired
- Wireless

Wired media examples;

- Optical fiber
- Twisted pair cables

Wireless media examples;

- Infrared waves
- Bluetooth
- Wi-Fi
- Radio waves

Basic device requirements for computer networking;

- Computers with Network Interface Card – NIC
- Switch
- Connection media

Server

- A computer network may have different servers to provide different services.
- The server controls management of software, hardware, files and messaging in a network.
- Any ordinary computer with relevant software installed can function as a server.

The switch

- The switch functions as a mediator to build up communication between two or more computers.
- Messages or data from one computer in the network are dispatched to the destination by the switch correctly.

Sharing resources and information

- Hardware, software, data and information can all be shared by users in a computer network.
- Messaging and e-mailing help with communication in a network.

Shared file folder

- All types of files in a file folder can be commonly used by the users in a network.

Sharing printer

- A printer connected to the network can be made available for common use by the users in the network.

Communication in a computer network

- Command Line Interface (CLI) can be used for communication among network users.

6

ICT and Society

This chapter will cover the following:

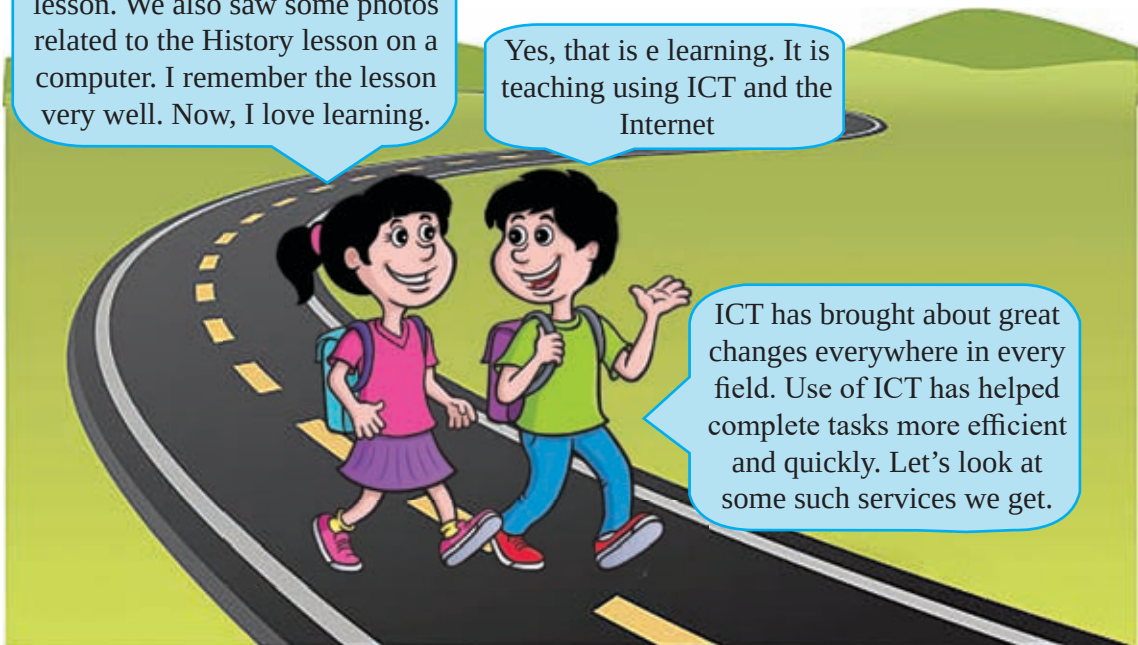
- Changes to the society brought about by Information Communication Technology.

6.1 Impact of ICT on society

The methods of teaching in our class has changed a lot. Today we saw a video during the science lesson. We also saw some photos related to the History lesson on a computer. I remember the lesson very well. Now, I love learning.

Yes, that is e learning. It is teaching using ICT and the Internet

ICT has brought about great changes everywhere in every field. Use of ICT has helped complete tasks more efficient and quickly. Let's look at some such services we get.



- Clearer explanation with pictures and video clips
- Collecting information through the Internet
- Dialogue and messaging with other schools
- The facility to learn anytime from anywhere

School e-learning



Hospital e-health



- Use of computer based modern equipment to diagnose illnesses
- Facility to store patient information to be used when necessary

- Bill payment
- Specimen forms, loan information
- Government Information Centre
- Ability to apply to State universities through the Internet
- To obtain circulars, legal services
- Information in Gazette
- The map of Sri Lanka

Public service - e-governance



e-commerce



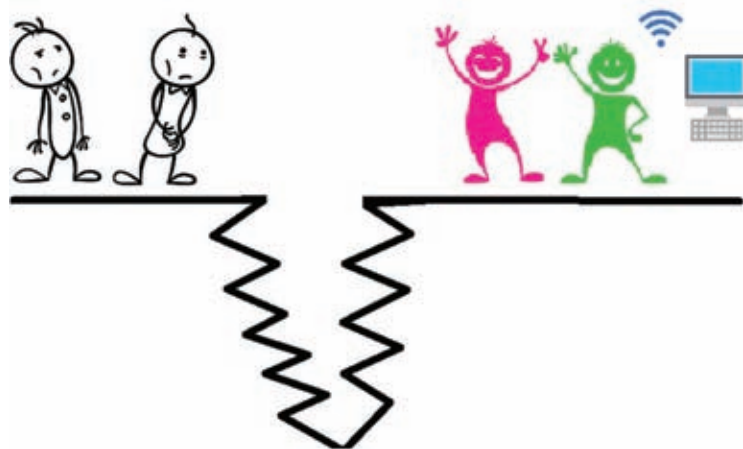
- Exchange of goods through the Internet
- Online shopping and purchasing



Refer to workbook for Activity 6.1.



Digital divide



Some societies in the world have ready access to computers and the Internet while some others do not. This gap between those who have and those who have not is known as the *digital divide*.



Refer to workbook for Activity 6.2.



Figure 6.1: e-waste

Toxic poisons released from e-waste likely to harm humans

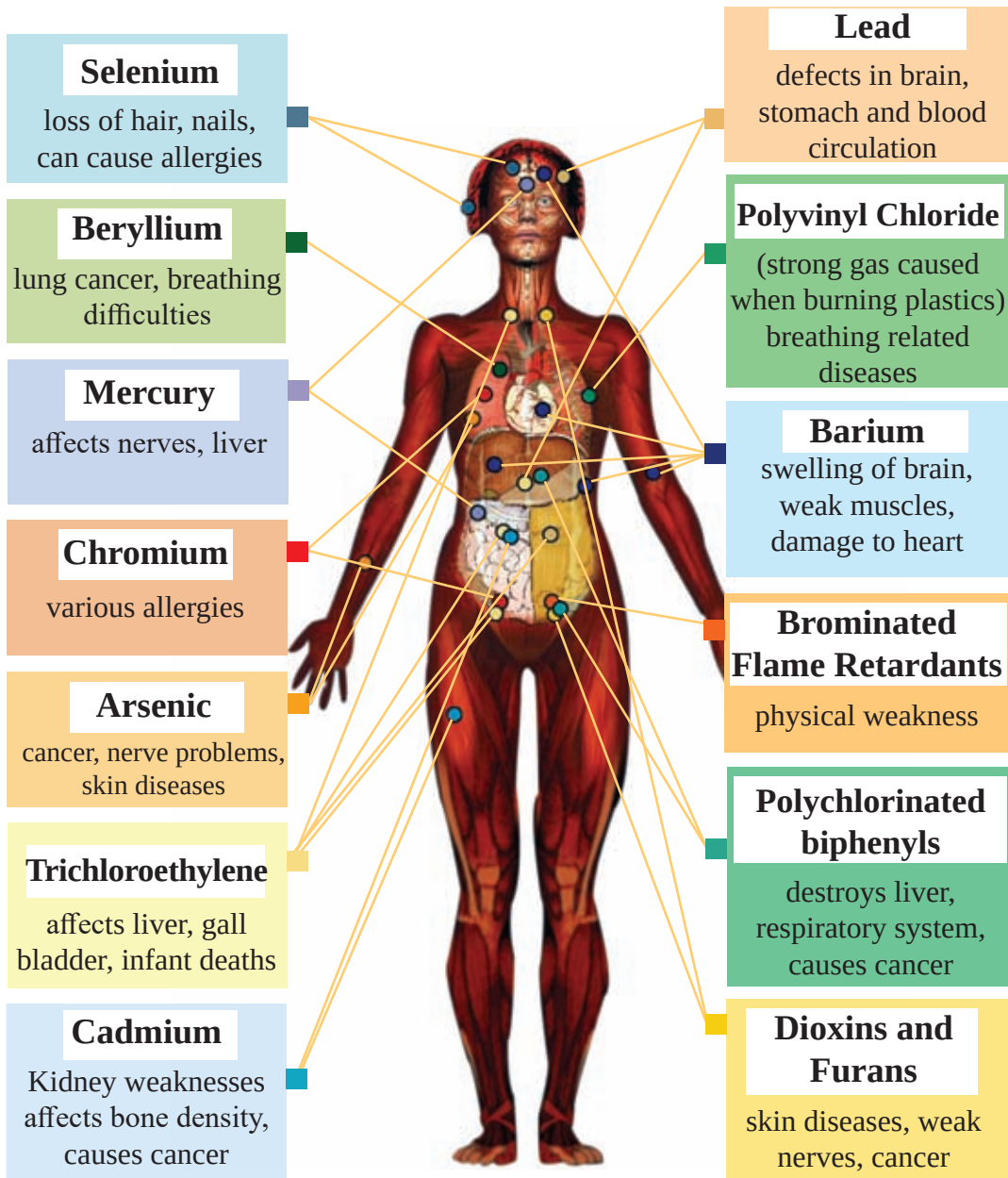


Figure 6.2 : Harmful effects of e-waste

Source: ewise.co.nz/the-impact-of-e-waste

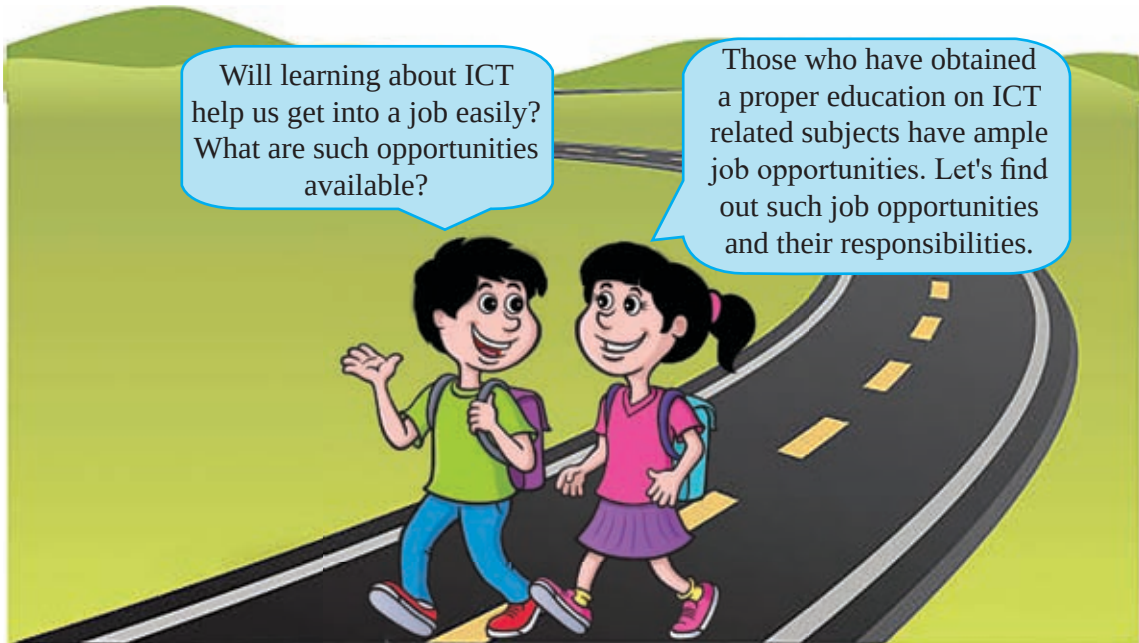
Minimizing e-waste through the 3R technique

- Minimize purchase or collection of unnecessary goods - **Reduce**
- Use again and again after repairing it wherever possible - **Reuse**
- Handover to suitable agencies for recycling purposes - **Recycle**



Refer to workbook for Activities 6.3, 6.4 and 6.5.

6.2 Computer related job opportunities



Software Quality Assurance Engineer

Carries out tasks to assure that the software functions properly

Database Administrator

Plans, installs configures and maintains databases

Software Engineer

Designs and develops software

Web Application Developer

Designs, develops and maintains websites

Software Architect

Designs the architecture of software, (Components and their interconnections)

Graphic Designer

Develops web pages, advertisements, magazines, banners using software

Programmer

Develops computer programs using programming languages

System Analyst

Analyses organizational needs and designs computer systems, coordinates development of software

Network Administrator

Installs, configures and maintains computer network

IT Consultant

Advises organizations on the matters related to information technology



Refer to workbook for Activities 6.6 and 6.7.

Summary

- The use of ICT in education, health services, commerce and the public service has resulted in increased efficiency.
- There is a "digital divide" between societies having and not having access to ICT sources.
- Improper disposal of e-waste is a threat to all living beings and environment.
- The 3R concept: Reduce, Reuse, Recycle can be used for proper disposal of e-waste.
- Many job opportunities are available in the field of ICT for qualified individuals.