Information and Communication Technology

Grade 9
Reading Book

Educational Publications Department

The National Anthem of Sri Lanka

Sri Lanka Matha
Apa Sri Lanka Namo Namo Namo Namo Matha
Sundara siri barinee, surendi athi sobamana Lanka
Dhanya dhanaya neka mal palaturu piri jaya bhoomiya ramya
Apa hata sepa siri setha sadana jeewanaye matha
Piliganu mena apa bhakthi pooja Namo Namo Matha
Apa Sri Lanka Namo Namo Namo Namo Matha
Oba we apa vidya
 Obamaya apa sathya
Oba we apa shakthi
 Apa hada thula bhakthi
Oba apa aloke
 Apage anuprane
Oba apa jeevana we
Apa mukthiya oba we
Nava jeevana demine, nithina apa pubudukaran matha
Gnana veerya vadawamina regena yanu mana jaya bhoomi kara
Eka mavakage daru kela bevina
Yamu yamu vee nopama
Prema vada sema bheda durerada
Namo, Namo Matha
Apa Sri Lanka Namo Namo Namo Namo Matha

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ආනන්ද සමරකෝන්

ஒரு தாய் மக்கள் நாமாவோம்
ஒன்றே நாம் வாழும் இல்லம்
நன்றே உடலில் ஓடும்
ஒன்றே நம் குருதி நிறம்

அதனால் சகோதரர் நாமாவோம்
ஒன்றாய் வாழும் வளரும் நாம்
நன்றாய் இவ் இல்லினிலே
நலமே வாழ்தல் வேண்டுமன்றோ

யாவரும் அன்பு கருணையுடன்
ஒற்றுமை சிறக்க வாழ்ந்திடுதல்
பொன்னும் மணியும் முத்துமல்ல - அதுவே
யான்று மழியாச் செல்வமன்றோ.

ஆனந்த சமரக்கோன்
கவிதையின் பெயர்ப்பு.

Being innovative, changing with right knowledge
Be a light to the country as well as to the world.

Message from the Hon. Minister of Education

The past two decades have been significant in the world history due to changes that took place in technology. The present students face a lot of new challenges along with the rapid development of Information Technology, communication and other related fields. The manner of career opportunities are liable to change specifically in the near future. In such an environment, with a new technological and intellectual society, thousands of innovative career opportunities would be created. To win those challenges, it is the responsibility of the Sri Lankan Government and myself, as the Minister of Education, to empower you all.

This book is a product of free education. Your aim must be to use this book properly and acquire the necessary knowledge out of it. The government in turn is able to provide free textbooks to you, as a result of the commitment and labour of your parents and elders.

Since we have understood that the education is crucial in deciding the future of a country, the government has taken steps to change curriculum to suit the rapid changes of the technological world. Hence, you have to dedicate yourselves to become productive citizens. I believe that the knowledge this book provides will suffice your aim.

It is your duty to give a proper value to the money spent by the government on your education. Also you should understand that education determines your future. Make sure that you reach the optimum social stratum through education.

I congratulate you to enjoy the benefits of free education and bloom as an honoured citizen who takes the name of Sri Lanka to the world.

Akila Viraj Kariyawasam
Minister of Education

Foreword

The educational objectives of the contemporary world are becoming more complex along with the economic, social, cultural and technological development. The learning and teaching process too is changing in relation to human experiences, technological differences, research and new indices. Therefore, it is required to produce the textbook by including subject related information according to the objectives in the syllabus in order to maintain the teaching process by organizing learning experiences that suit to the learner needs. The textbook is not merely a learning tool for the learner. It is a blessing that contributes to obtain a higher education along with a development of conduct and attitudes, to develop values and to obtain learning experiences.

The government in its realization of the concept of free education has offered you all the textbooks from grades 1-11. I would like to remind you that you should make the maximum use of these textbooks and protect them well. I sincerely hope that this textbook would assist you to obtain the expertise to become a virtuous citizen with a complete personality who would be a valuable asset to the country.

I would like to bestow my sincere thanks on the members of the editorial and writer boards as well as on the staff of the Educational Publications Department who have strived to offer this textbook to you.

W. M. Jayantha Wickramanayaka,
Commissioner General of Educational Publications,
Educational Publications Department,
Isurupaya,
Battaramulla.
2019.04.10

We are grateful if you can send us your comments to feedbackicttextbook@gmail.com regarding the contents of this series of books on Information and Communication Technology and your suggestions to develop the creativity of students.

Board of Editors

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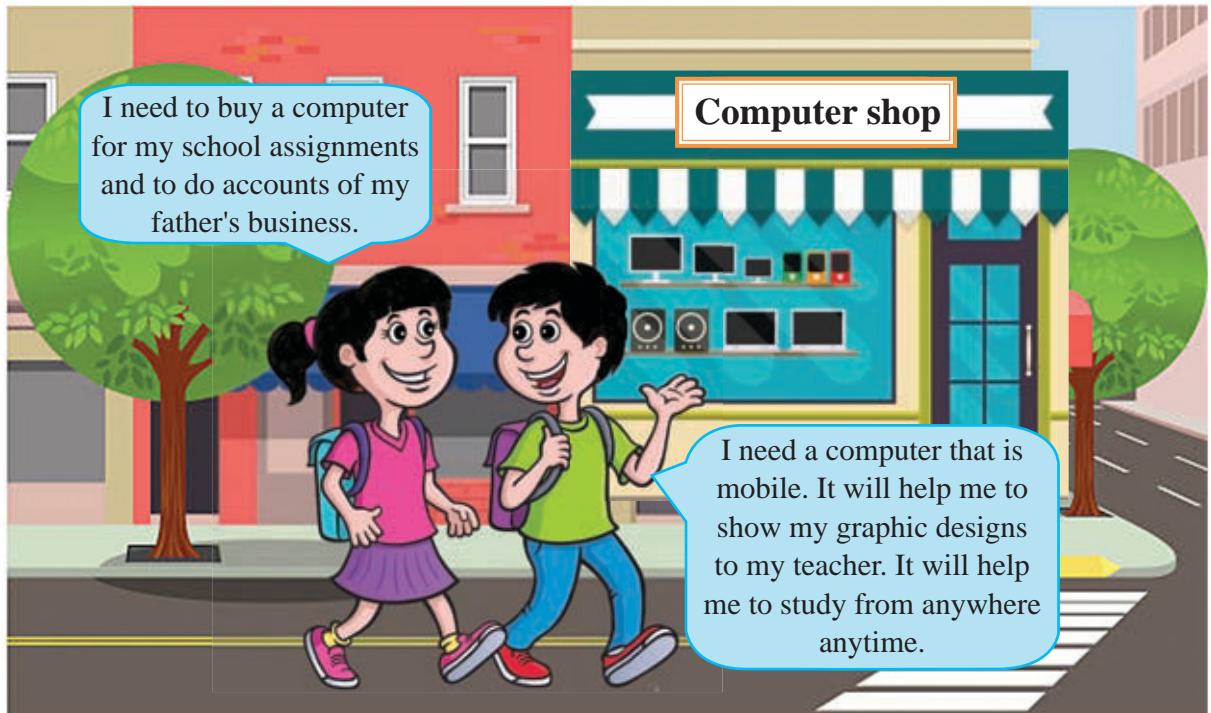
1 Preparation of Computer Specifications

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 user*s 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.

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*.

Optical disk

Microphone

Monitor/ Display

Printer

Hard disk drive

Flash drive

Speakers
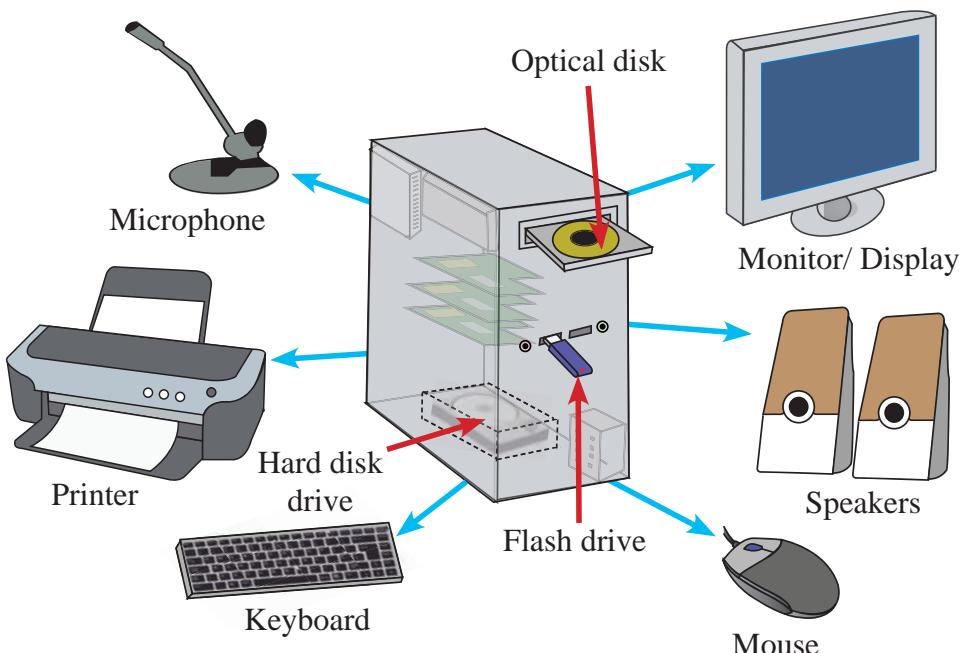
Keyboard

Mouse

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 an 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.
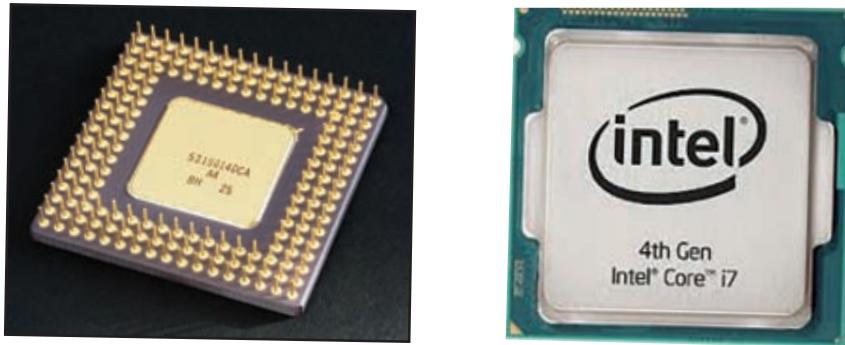
1.5.1 The processor

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.
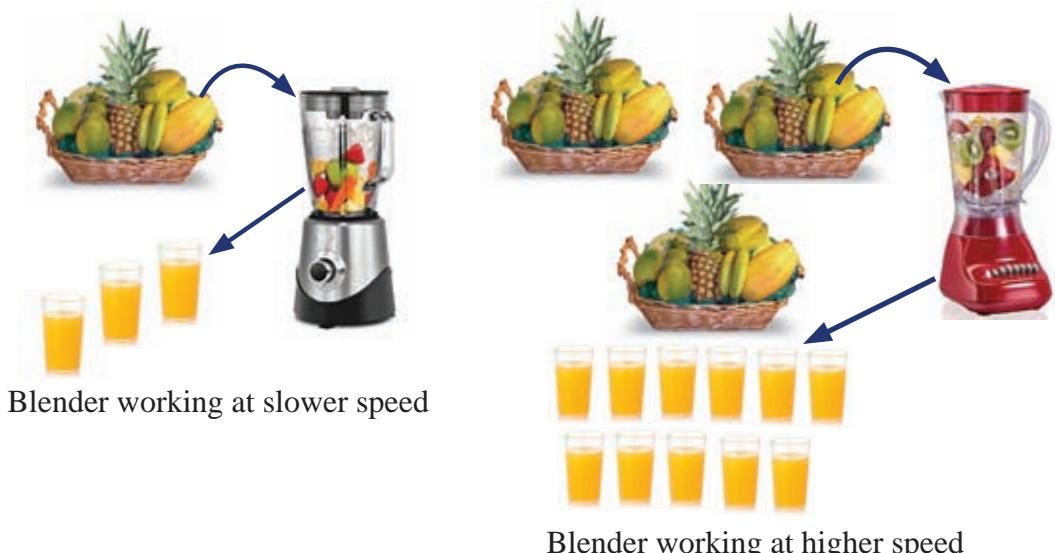
The side that connects to the mother board

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 is 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 execute per second.

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

1000 MHz = 1 GHz

Processor manufacturers

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

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	*Pentium I, II, III, IV*	
Dual Core	*Dual Core/Core 2 Duo*	
Quad Core	*Core i3, i5, i7, i9*	

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).

40 page exercise book

1 TB hard disk

160 page exercise book
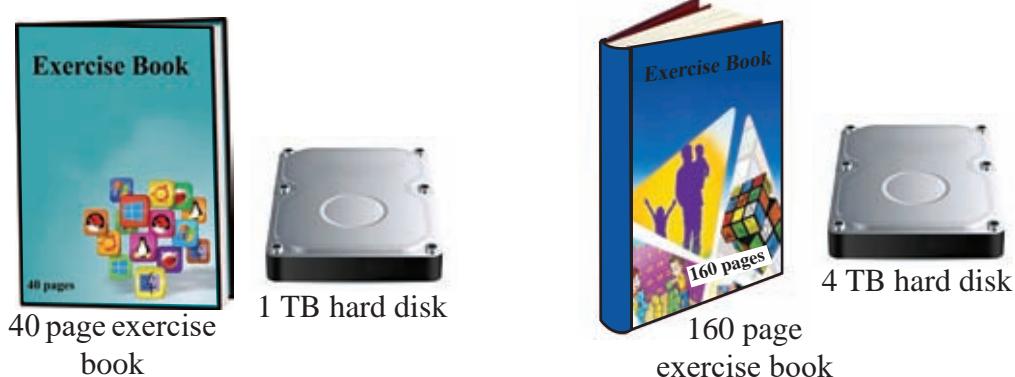
4 TB hard disk

Figure 1.8 : An analogy for hard disk capacities

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).

19 inch
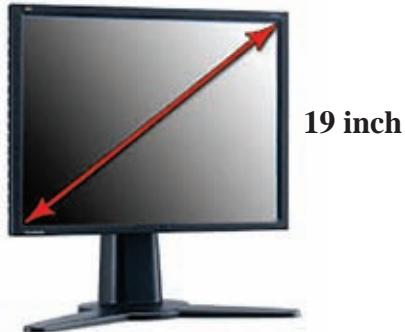
Figure. 1.9 : Monitor Size

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

LCD /LED monitor

CRT 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

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

Figure 1.13 : VGA card

separate video memory and a processor. Separate VGA cards are useful for playing computer games.

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.

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.
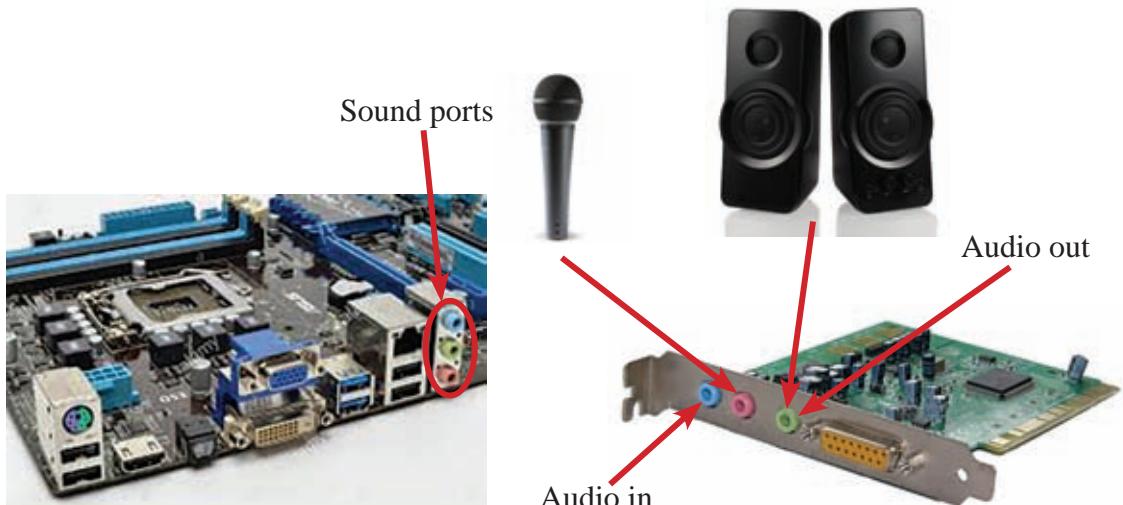
Figure 1.15 : Built in sound card on mother board

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)

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.
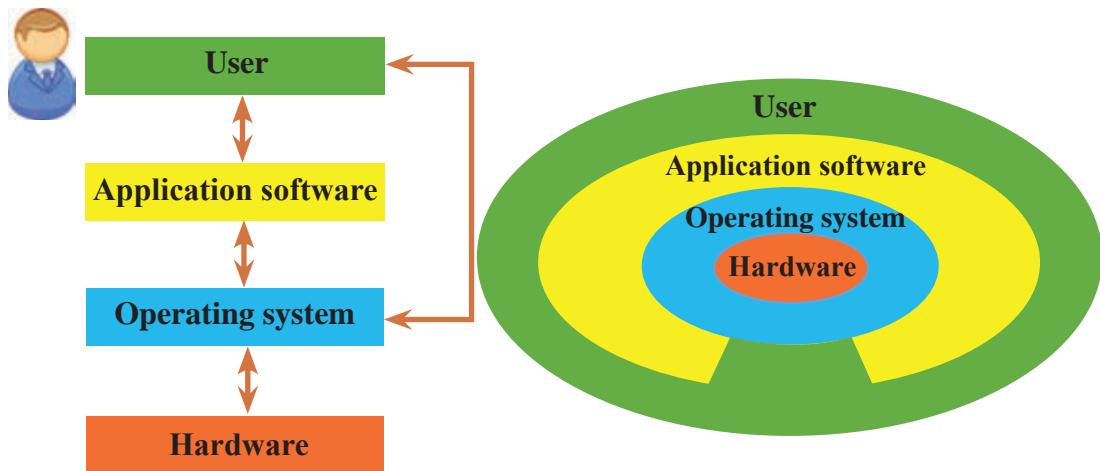
Figure 1.17 : Hardware, software and user

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 assurers 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

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)

Network port

USB Port
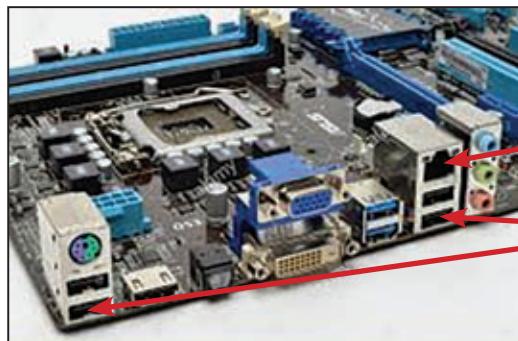
Figure 1.18

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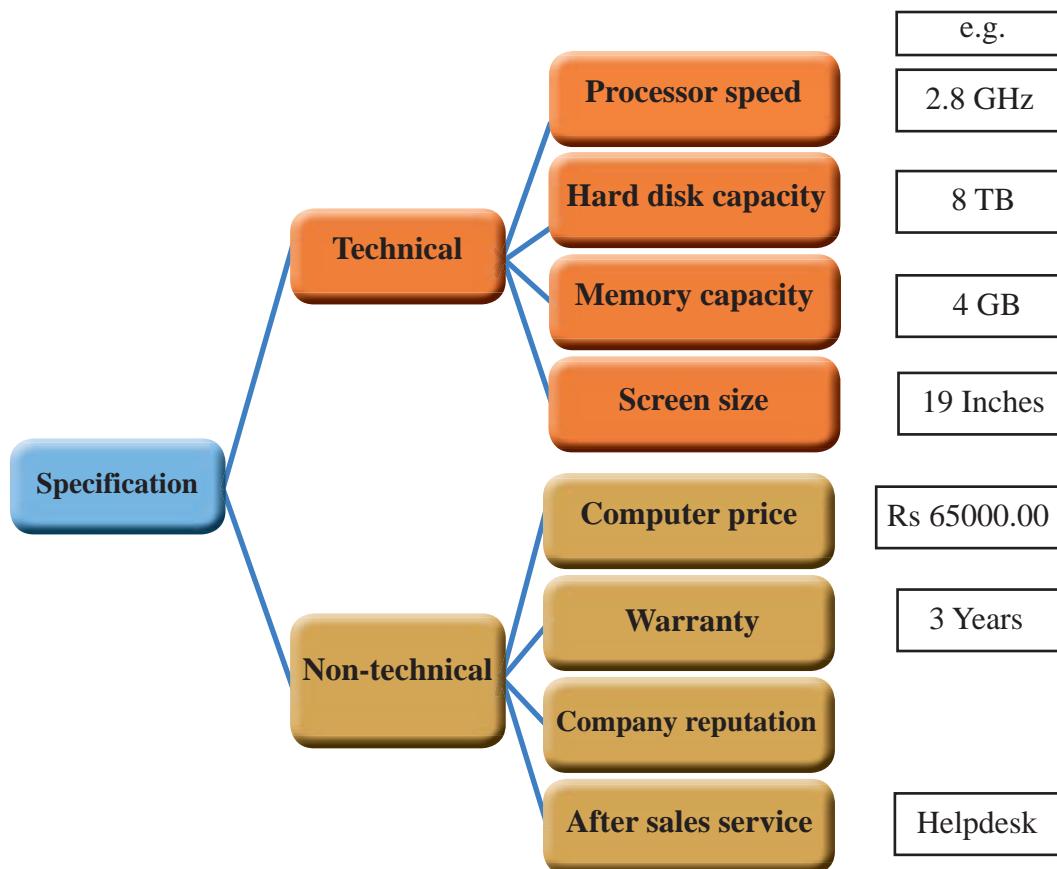
Figure 1.19 : Technical and non-technical specifications to be considered in purchasing a computer

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	1st, 2nd, 3rd, 4th 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?
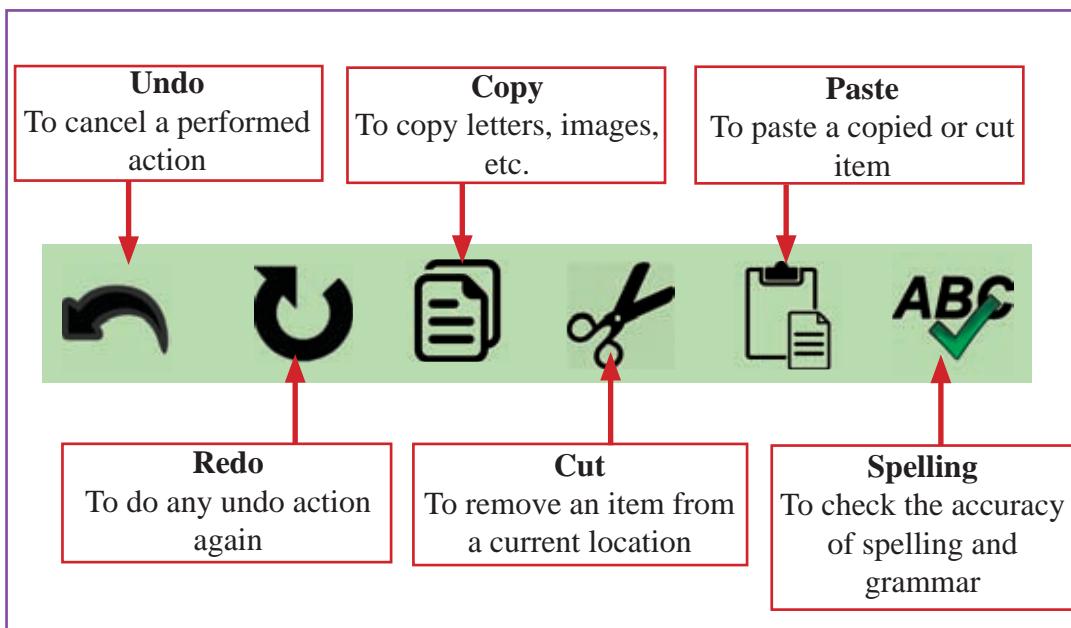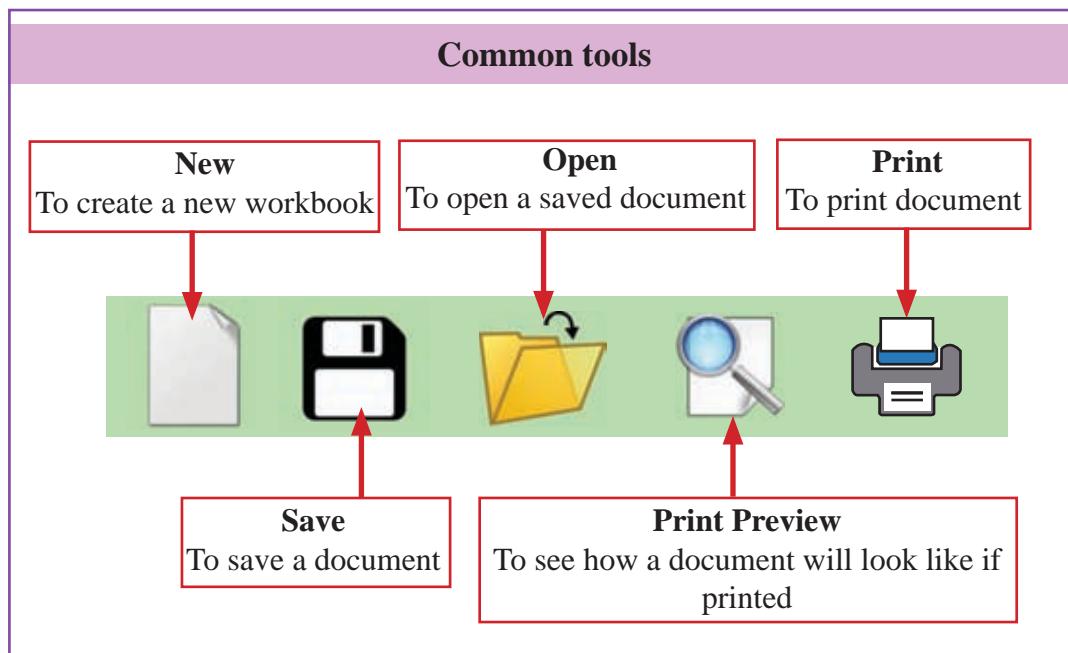
A spreadsheet means an electronic version of the paper based accounting sheets used by accountants in the past.

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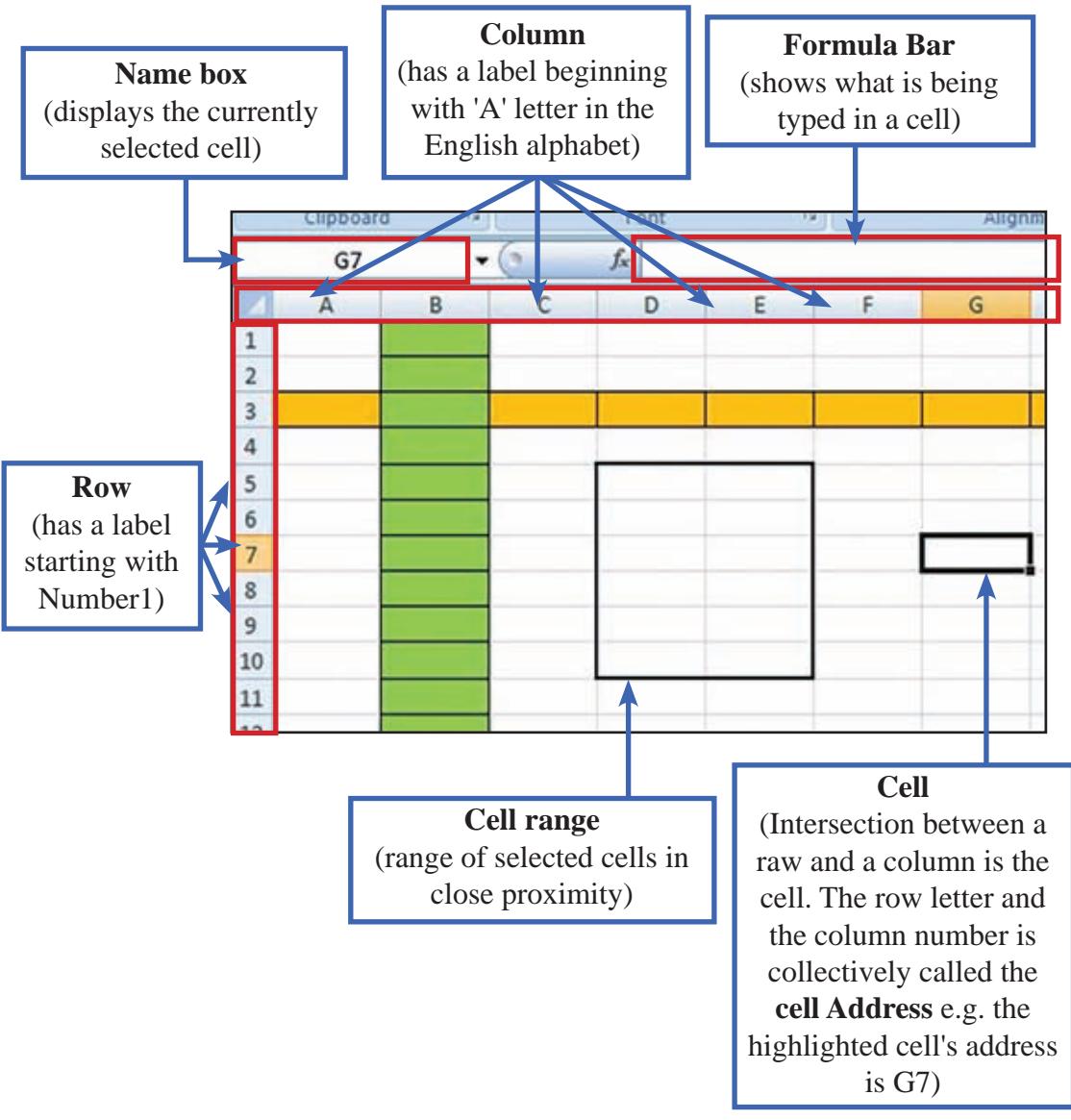
In electronic spreadsheets, *workbooks* can be used for document creation. A workbook may contain multiple *worksheets*.

Spreadsheet features

Let us learn about the functions provided in spreadsheet package.

Common tools
New — To create a new workbook **Open** — To open a saved document **Print** — To print document

Save
To save a document

Print Preview
To see how a document will look like if printed

Undo
To cancel a performed action

Copy
To copy letters, images, etc.

Paste
To paste a copied or cut item

Redo
To do any undo action again

Cut
To remove an item from a current location

Spelling
To check the accuracy of spelling and grammar

Special features of a spreadsheet

Name box
(displays the currently selected cell)

Column
(has a label beginning with 'A' letter in the English alphabet)

Formula Bar
(shows what is being typed in a cell)

Clipboard   Font   Alignm

G7   fx

A   B   C   D   E   F   G

1
2
3
4
5
6
7
8
9
10
11

Row
(has a label starting with Number1)

Cell range
(range of selected cells in close proximity)

Cell
(Intersection between a raw and a column is the cell. The row letter and the column number is collectively called the **cell Address** e.g. the highlighted cell's address is G7)

Cell formatting tools

Size
(changes size of letters)
heading,
sub-heading and
normal letters)

Bold
To make letters darker than normal

Color
To add colours to letters

Italic
To make letters slanted

Borders
To apply boarders

Font
| Font | 12 |

B *I* U | Fill | A | Borders |
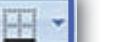
Font
- *0* Times New Roman
- *0* Cambria
- *0* Nirmala UI
- ℡ තර්සබාමප්එියස

Underline
To have line beneath the letters

Fill colour
To change cell background colour

Alignment and positioning tools

Merge and Center
(to combine multiple adjacent cells to single larger cell and align center.)
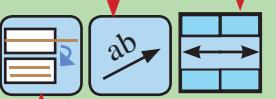
Left align
(aligns left)

Right align
(aligns right)

Middle
(aligns to the middle)

Orientation
(changes text direction)

Centre align
(aligns to middle)

Top
(top align)

Bottom
(bottom align)

Wrap Text
(To make all content visible within a cell)

Number tools

Currency	Percentage	Increase and decrease decimals

General ▼

Number `12` → Numbers - e.g. 10, 25, 100, ...

Currency → Money - e.g. Rs. / $ / ¥ - 10.00

Accounting → Lines up currency symbols and decimal points in a column / $ / ¥ - 10.00

Short Date → Short date - e.g. 02 /25/2018 (MM / DD / YYYY)

Long Date → Detailed date - e.g. Tuesday, February 25, 2018

Time → Time - e.g. 1:30 p.m., 10:00 a.m.

Percentage `%` → Percentage - e.g. 23% , 45%, 75%

Fraction $\frac{1}{2}$ → As fractions - e.g. 2/9, 4/5

Scientific 10^2 → 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

To find the highest value in cell range

Sum **Average** **Max** **Min**

To find the average of cell range

To find the lowest value in a cell range

Charts

Can be used to display spreadsheet date graphically.

Column graph

Pie chart
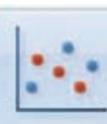
Area chart

Other charts

Column Line Pie Bar Area Scatter Other Charts

Line chart

Bar chart

Scatter chart

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 raw '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.
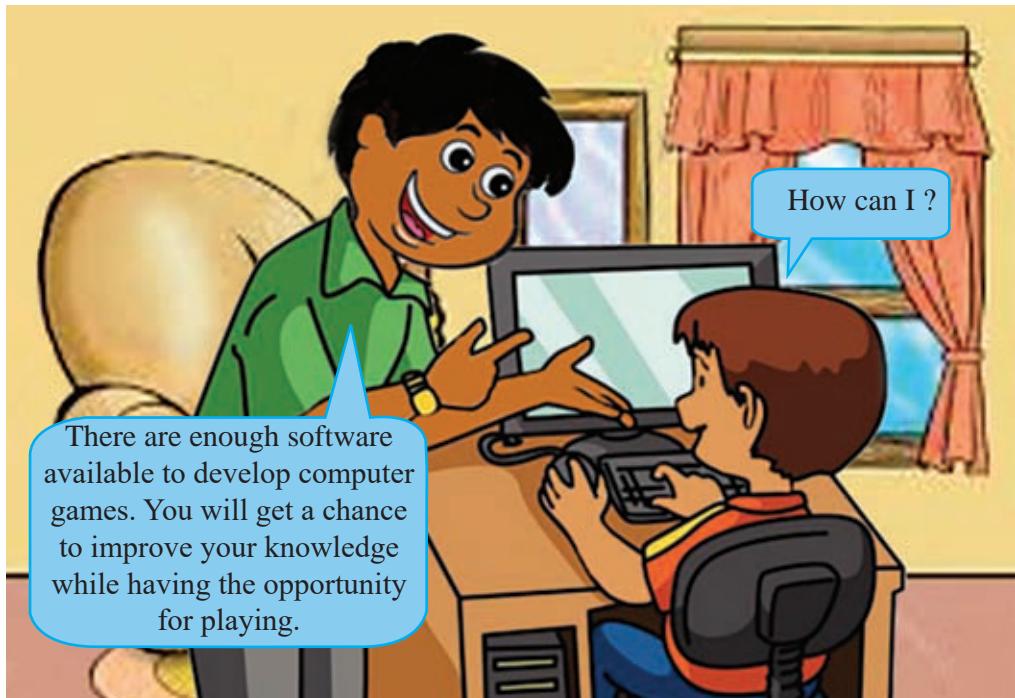
3 Programming

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.

I love computer games.

Games are not bad. But it's better to develop your own games.

How can I ?

There are enough software available to develop computer games. You will get a chance to improve your knowledge while having the opportunity for playing.
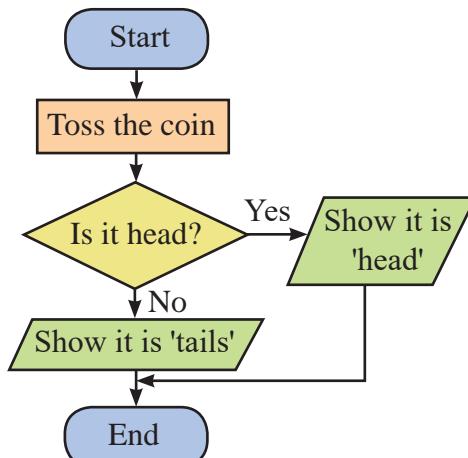
3.1 Simple selection

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.
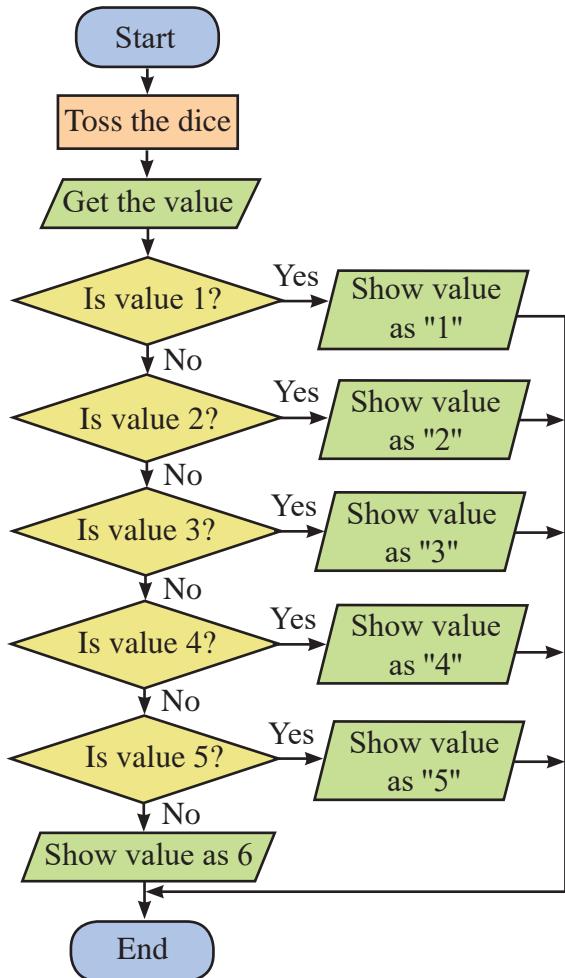
Refer to workbook for Activity 3.1.

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

Flowchart 2 : Getting value from a tossed dice

Scratch program 2

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.
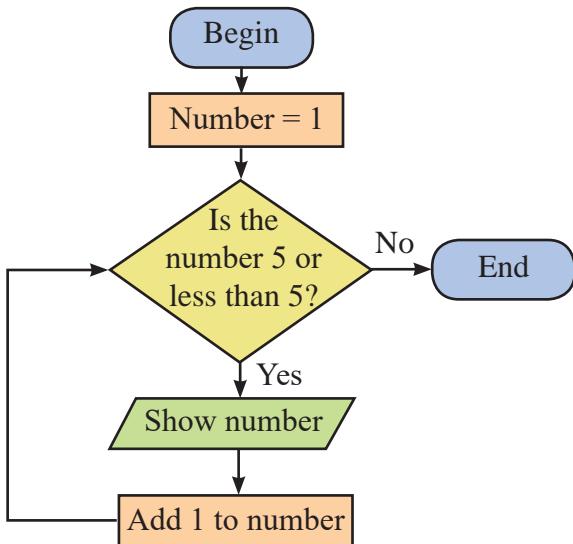
Control structure with repetition

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 fill.

Flowchart 4 : Filling a tank with water
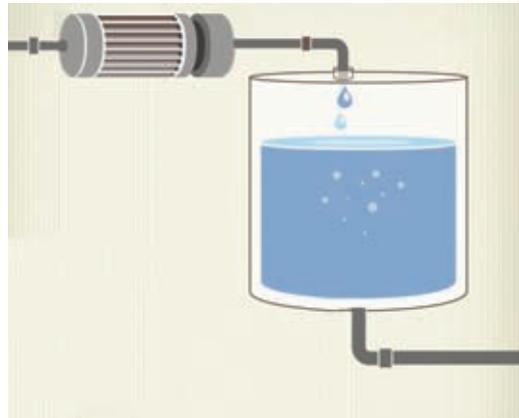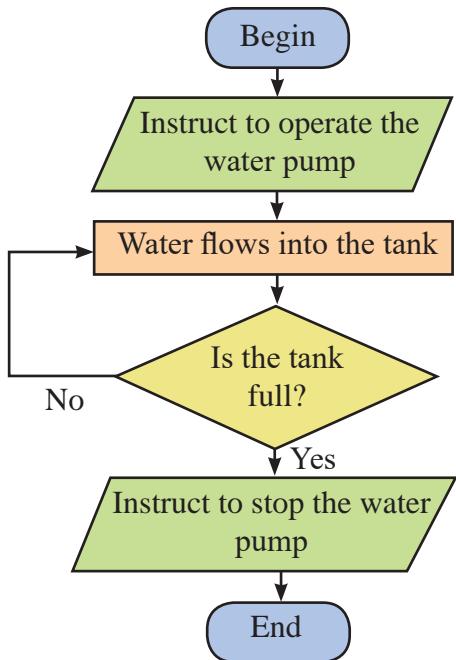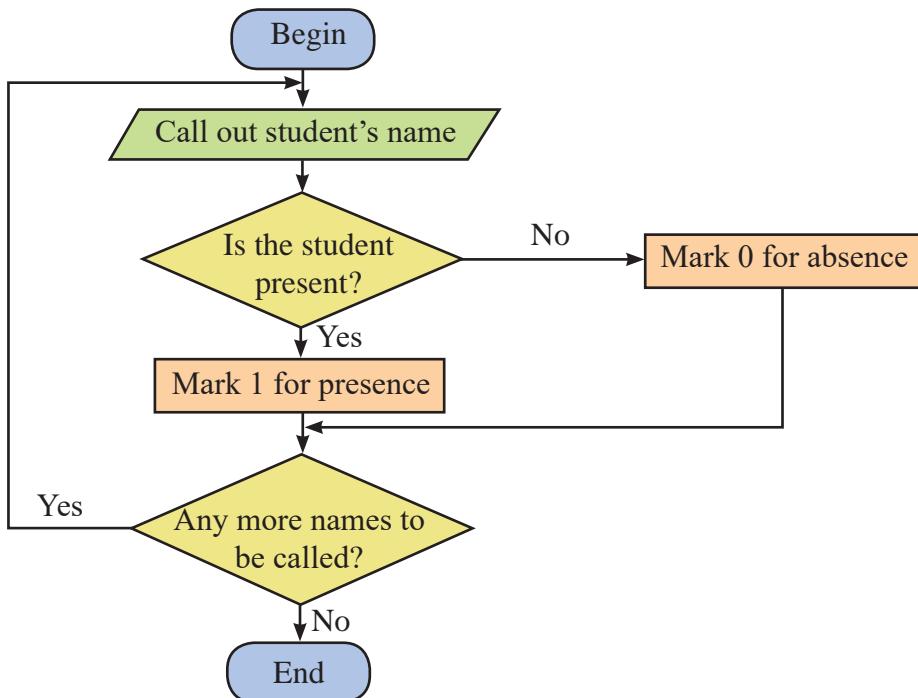
Figure 3.1 : A water pump filling a tank

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
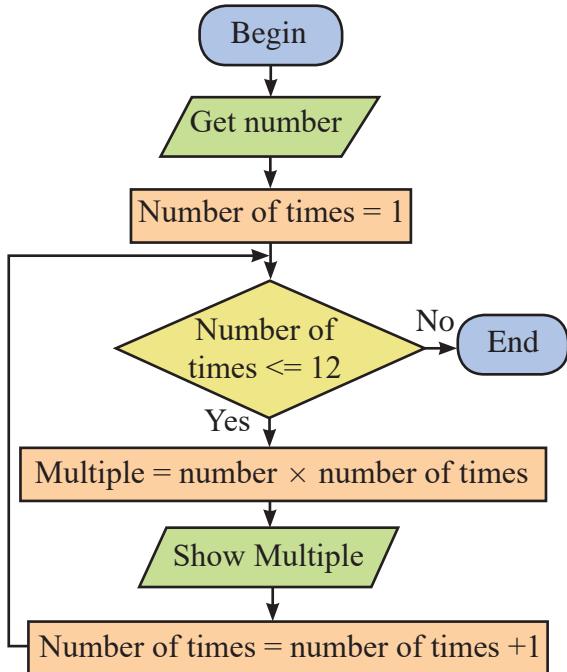
Repetition type	Example
Repetition with definite number of times The slot to place number of times for repetition repeat 10 Place for the instructions for repetition	 Scratch program 3 Displaying numbers 1 - 10 in 10 seconds
Repeating till a given condition is satisfied The slot to place the condition for repetition repeat until Place for the instructions for repetition	 Scratch program 4 Displaying all positive integers 1 - 5
Repeating infinite number of times forever Instructions for repetition	 Scratch program 5 Displaying all positive integers from 1

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
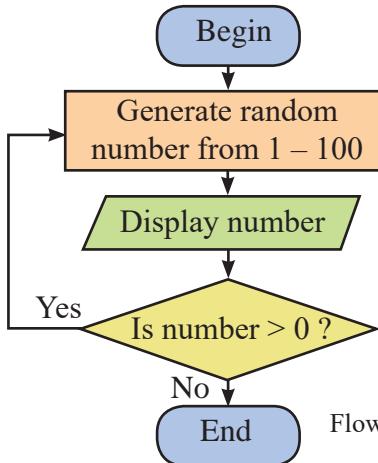
Scratch program 6

Flowchart 6

Example 2 | Displaying random number from 1 to 100, an infinite number of times
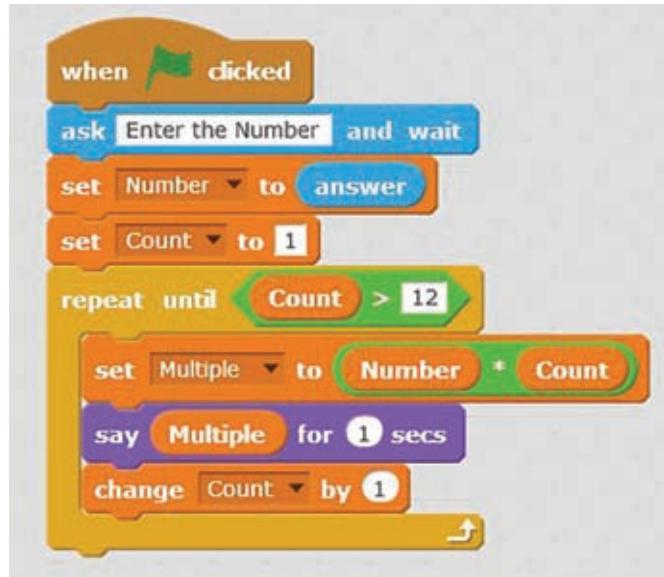
Scratch program 7

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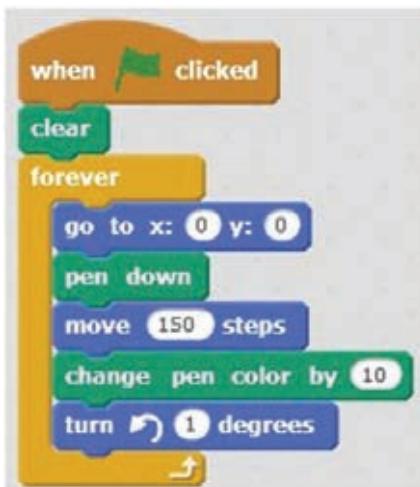
Example 3 Display the first multiples up to 12 of given number.

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
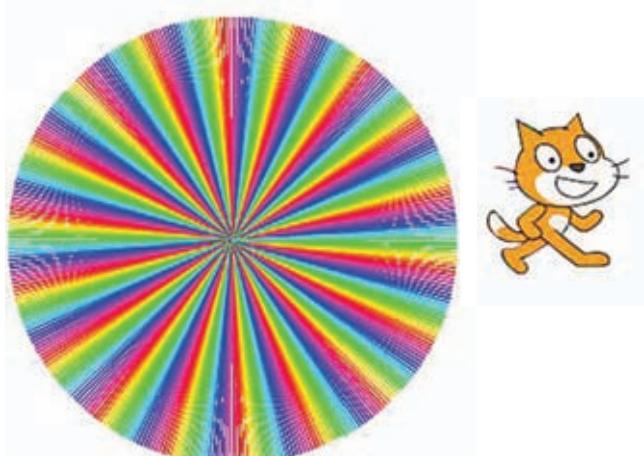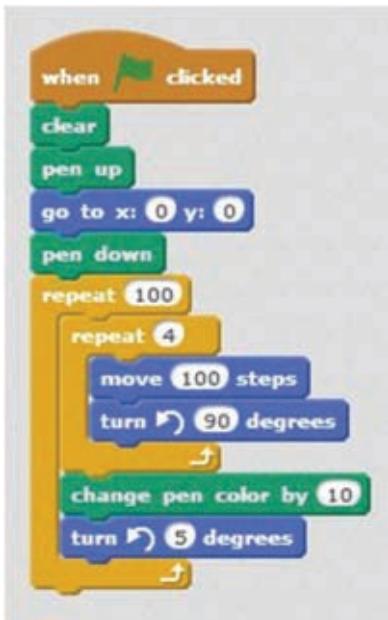
Figure 3.2 : The multi-coloured circle

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
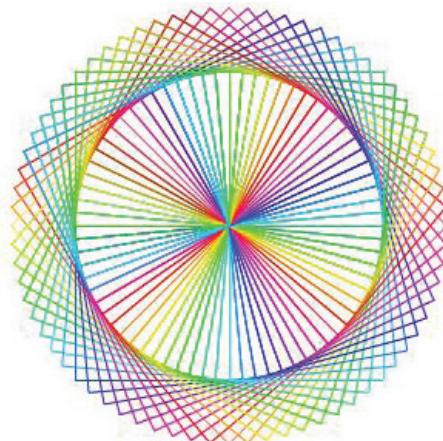
Figure 3.3

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.
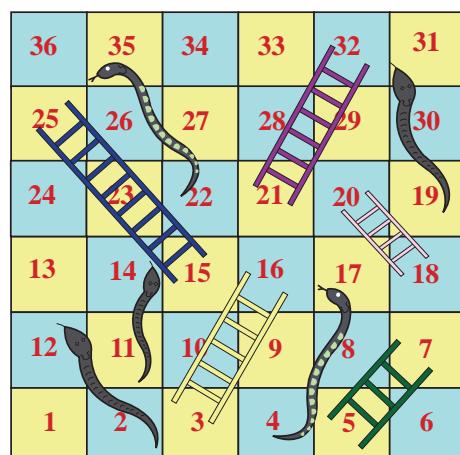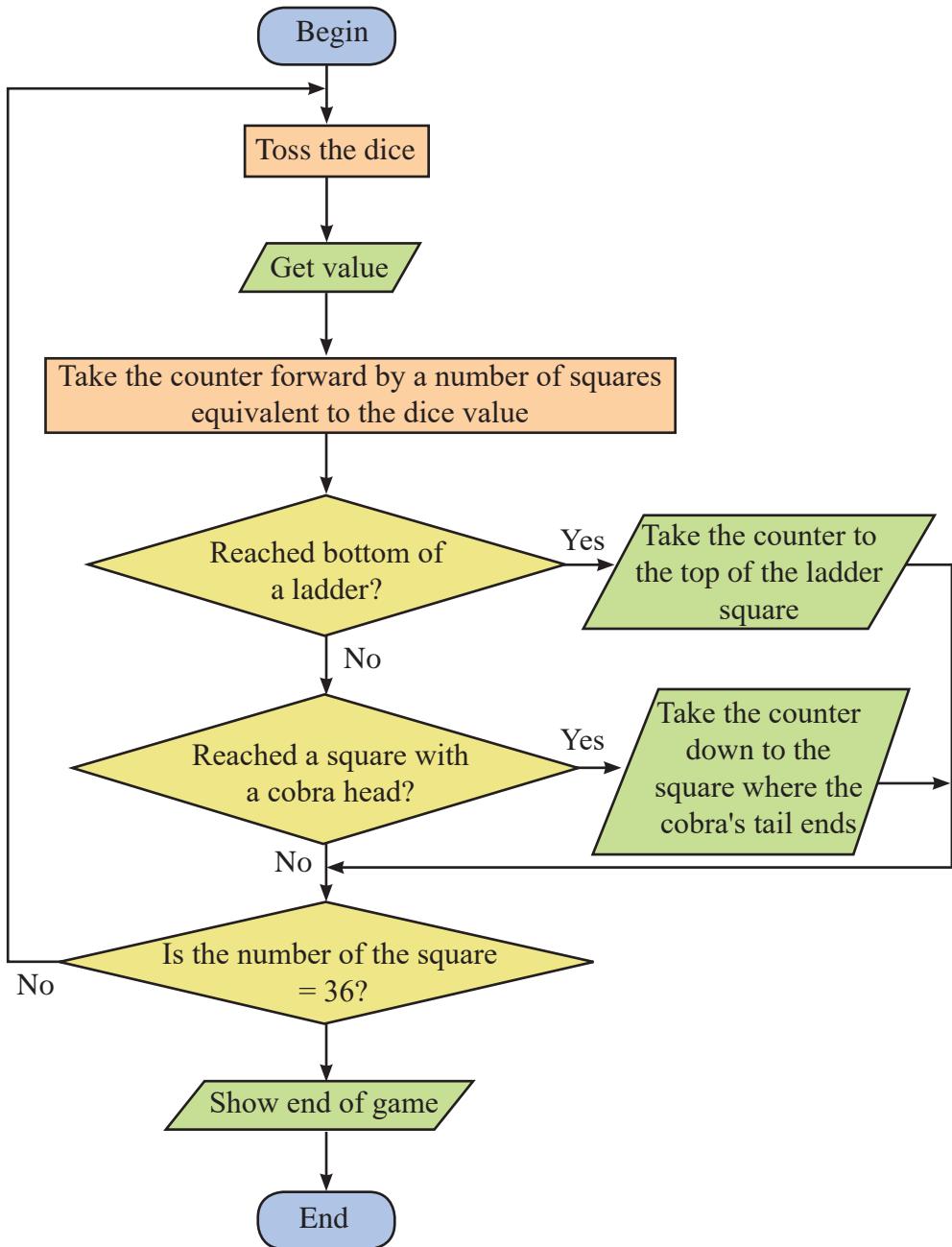
Figure 3.4 : Snakes and Ladders

```
                    ┌─────────┐
                    │  Begin  │
                    └────┬────┘
                         │
        ┌────────────────▼────────────────┐
        │        ┌─────────────────┐
        │        │  Toss the dice  │
        │        └────────┬────────┘
        │                 │
        │          ╱──────▼──────╲
        │         │  Get value   ╱
        │          ╲────────────╱
        │                 │
        │   ┌─────────────▼─────────────┐
        │   │ Take the counter forward  │
        │   │ by a number of squares    │
        │   │ equivalent to the dice    │
        │   │ value                     │
        │   └─────────────┬─────────────┘
        │                 │
        │            ◇────▼────◇          Yes    ╱────────────────╲
        │          Reached bottom of ───────────▶ Take the counter to
        │            a ladder?                    the top of the ladder
        │            ◇─────────◇                  square
        │                 │ No                    ╲────────────────╱
        │            ◇────▼────◇          Yes    ╱────────────────╲
        │          Reached a square ─────────────▶ Take the counter
        │          with a cobra head?              down to the square
        │            ◇─────────◇                   where the cobra's
        │                 │ No                     tail ends
        │            ◇────▼────◇                   ╲──────────────╱
        │    No    Is the number of
        └───────── the square = 36?
                    ◇─────────◇
                         │
                  ╱──────▼──────╲
                 │ Show end of game ╱
                  ╲────────────────╱
                         │
                    ┌────▼────┐
                    │   End   │
                    └─────────┘
```

Flowchart 8 : Snakes and ladders game

```
when [flag] clicked
set Number of the square to 0
set Value to 0
repeat until < Number of the square > 36 > or < Number of the square = 36 >
    say Toss the dice for 2 secs
    ask What is the value? and wait
    set Value to answer
    set Number of the square to (Number of the square + Value)
    say (join Value Move the counter forward) for 4 secs
    ask Did it land at the bottom of a ladder? and wait
    if < answer = Yes > then
        say Move the counter up to the top
        ask What is the number of the ladder of the square? and wait
        set Number of the square to answer
    else
        ask Did the counter land on the head of a snake? and wait
        if < answer = Yes > then
            say Slide down to the bottom of the snake
            ask What is the number of the square? and wait
            set Number of the squares to answer
say Game is over for 2 secs
```

Scratch program 11

Refer to workbook for Activities 3.2 and 3.3.

3.7 Programming with arrays
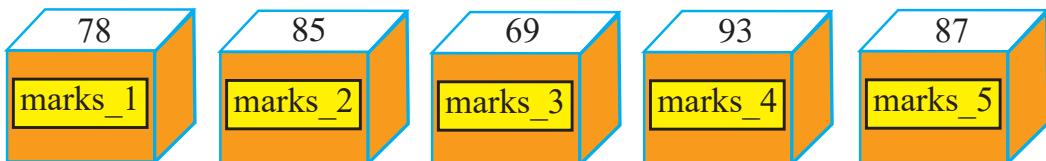
What is an array?

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.

78	85	69	93	87
marks_1	marks_2	marks_3	marks_4	marks_5

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'
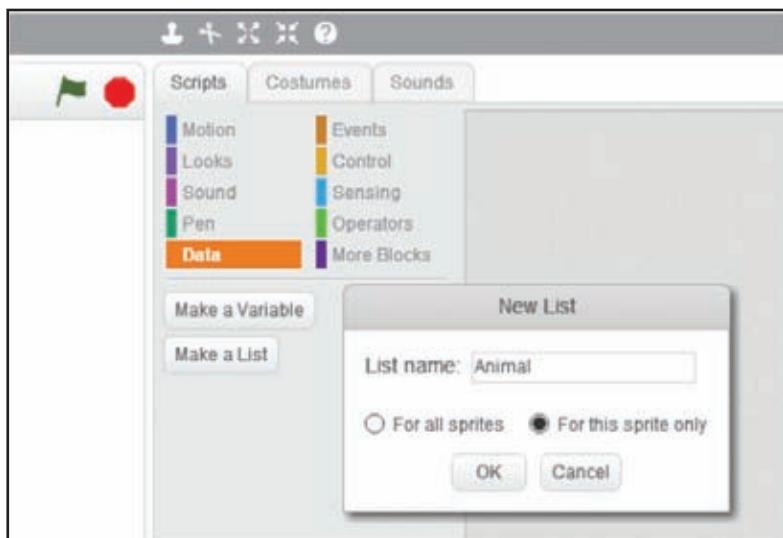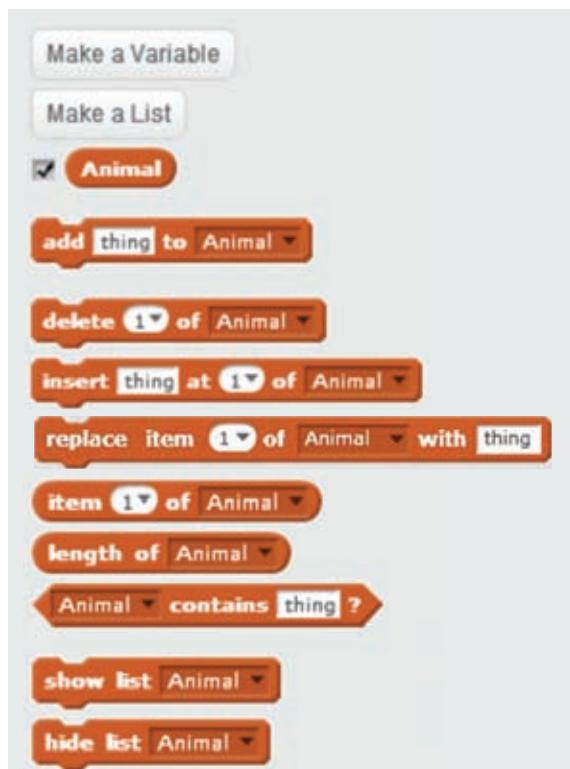
Figure 3.4 : Building up an array in Scratch
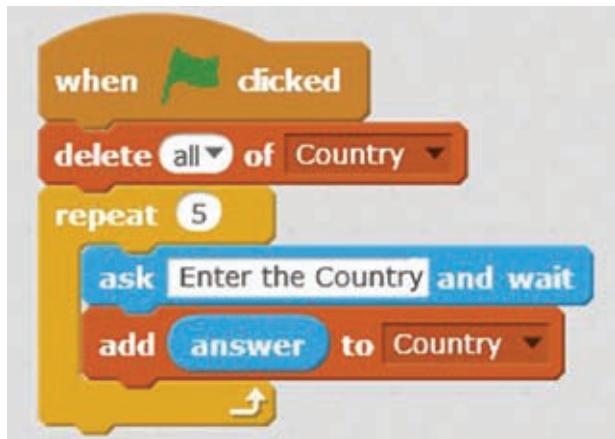
After following the steps above, instructions blocks for Animal array appear as shown below;

Scratch program 12

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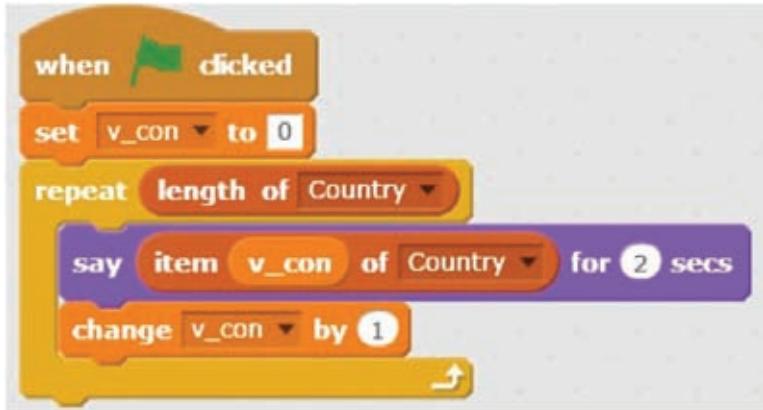
For example, after building an array named 'Country' to enter the names of five countries, the following code can be used to enter items to it.

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.
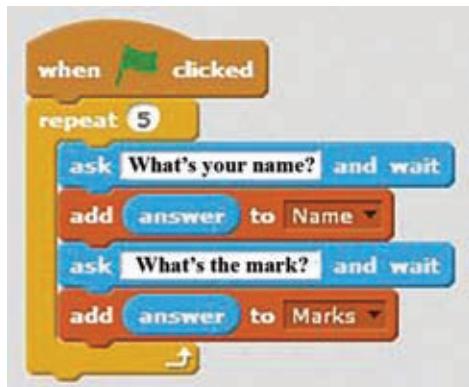
Scratch program 14

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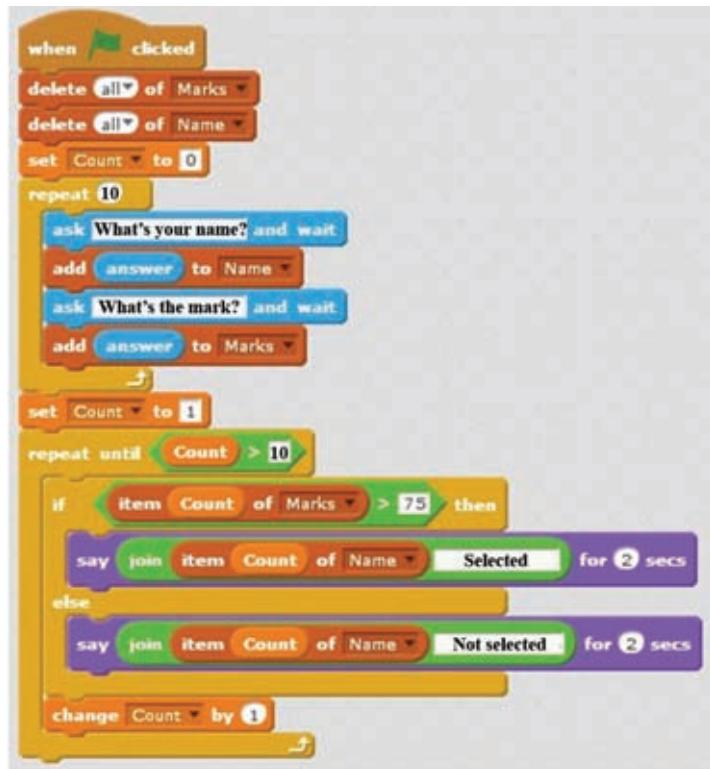
> Note - An array is termed a list in Scratch programming.

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.
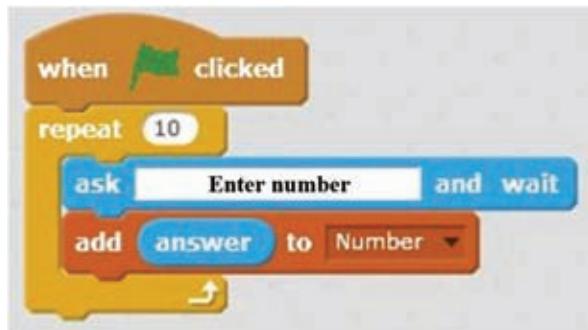
Scratch program 17

3.8 Programming with problem analysis

Dividing a problem into sections makes it easier to solve.
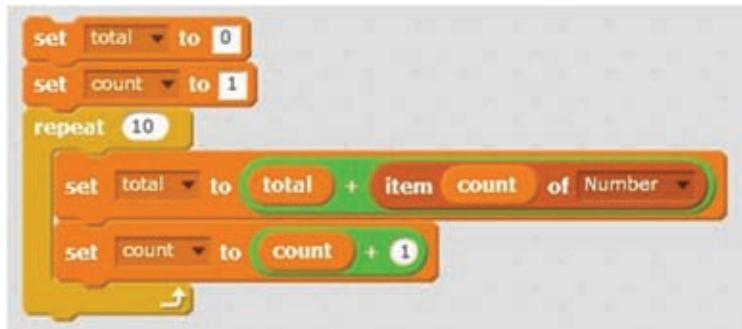
For example, Let us consider finding the average of ten numbers. This problem can be divided into sections as shown below;

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
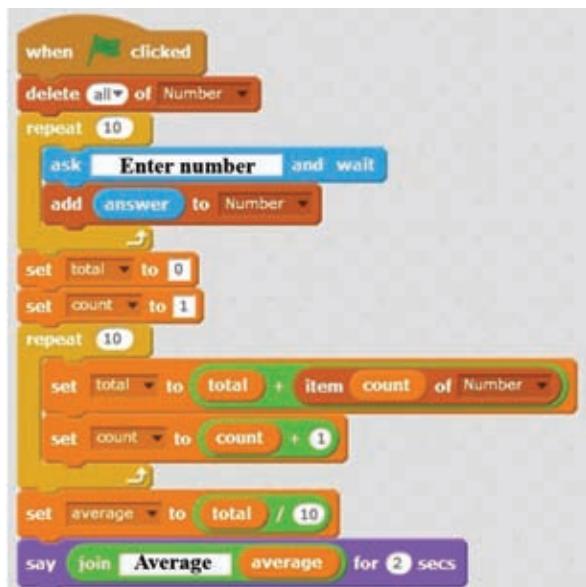
Scratch program 20

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

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.
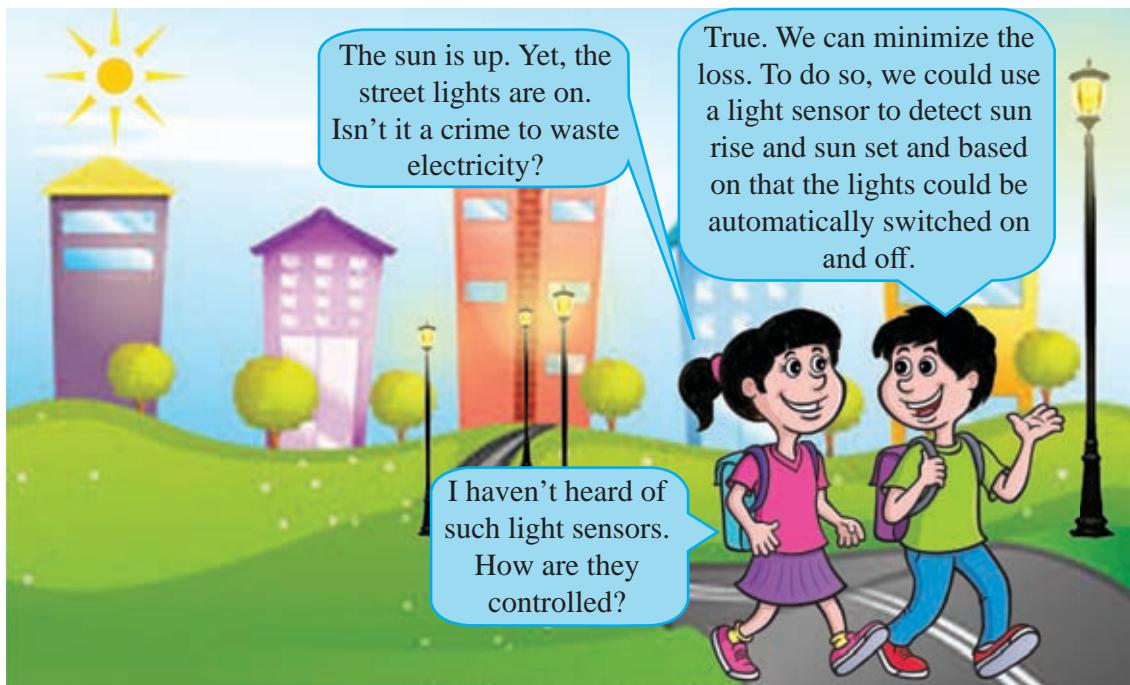
4 Use of Microcontrollers

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

There are sensors to measure things like soil conditions, temperature and environmental conditions and many such. Specialized computer programs could be used to control them.
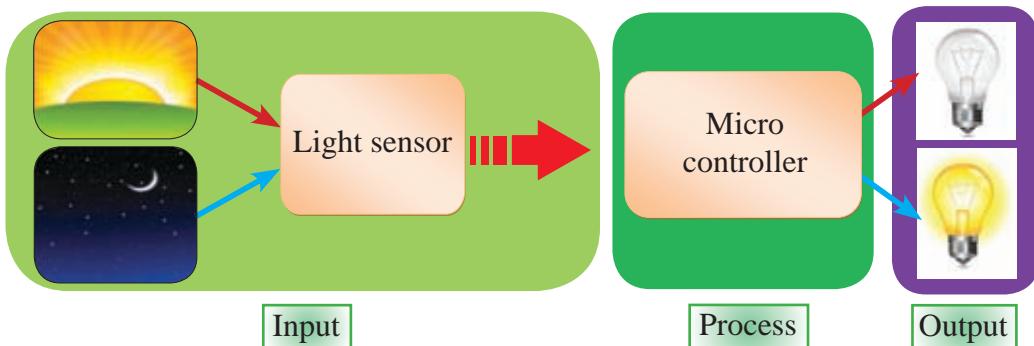
Use of sensors to identify environmental changes

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.

Input or collect data ➡ Process data ➡ 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;

Input   Process   Output

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

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.ardino.cc,
www.raspberry.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
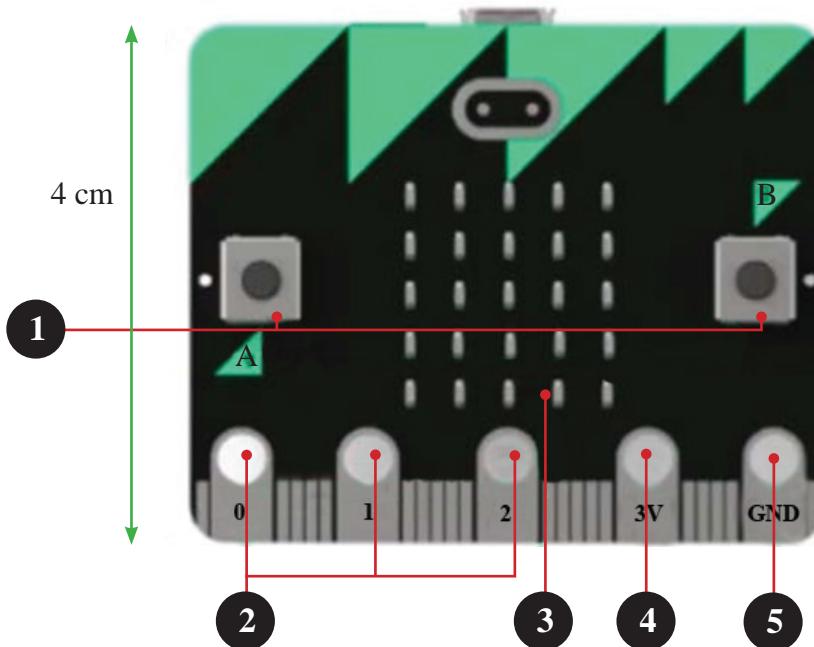
Figure 4.1 : Front view of micro:bit module

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
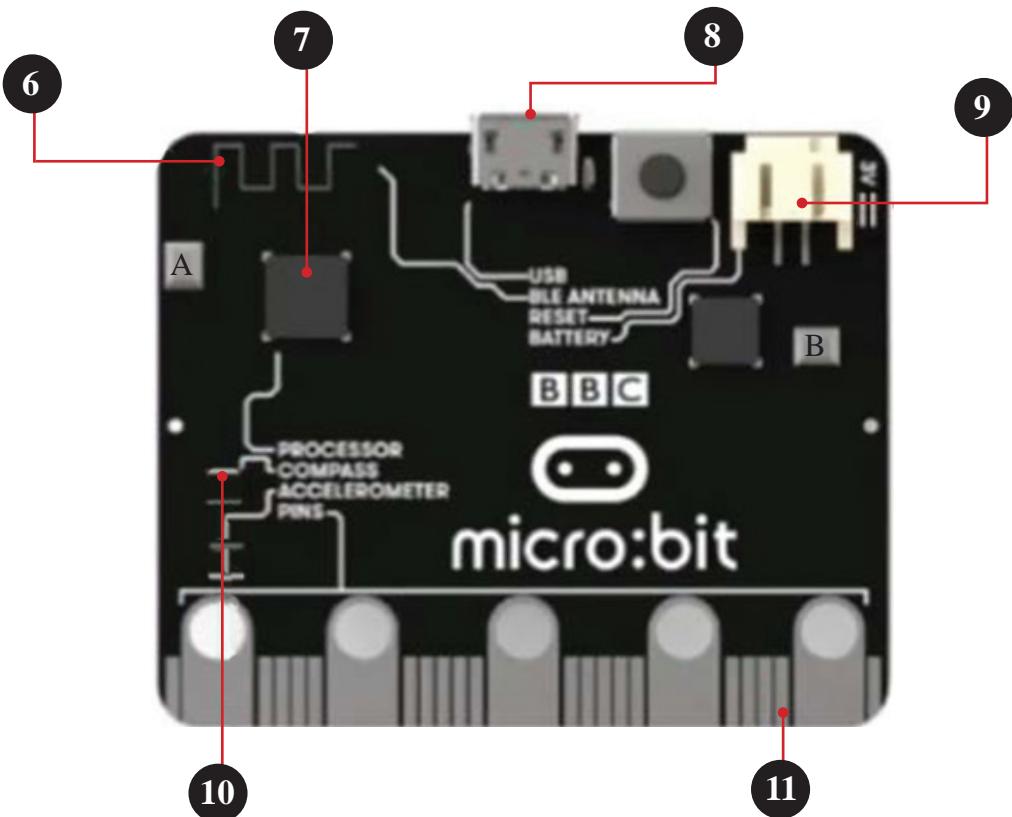
Figure 4.2 : Rear view of micro:bit microcontroller module

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;

Computer   Micro USB cable   Micro:bit module

Figure 4.3 : Connecting micro:bit module

When connected, the computer shows it as a storage unit.
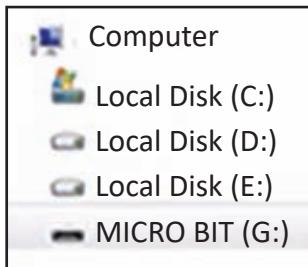
Figure 4.4 : Micro:bit shown as a storage unit

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.
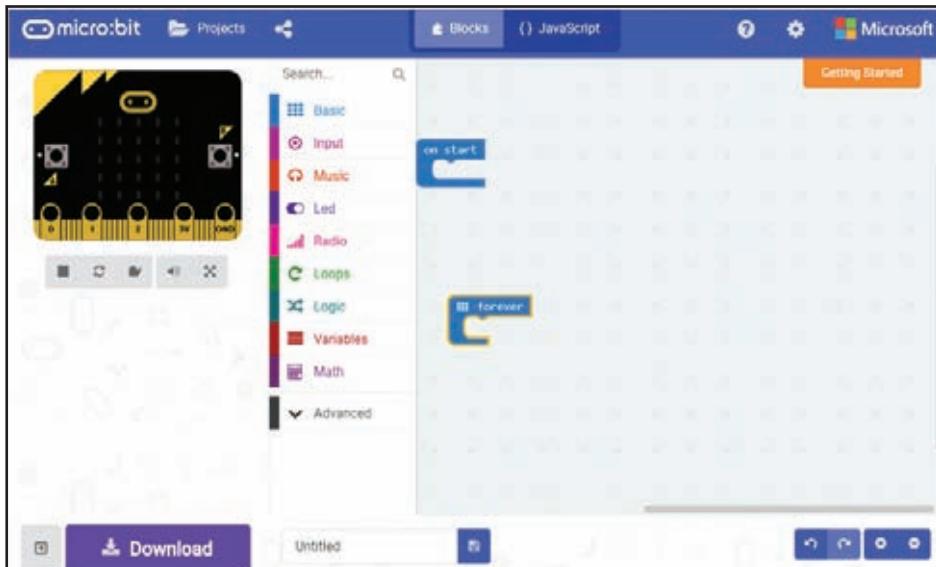
Figure 4.5 : Micro:bit coding

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;
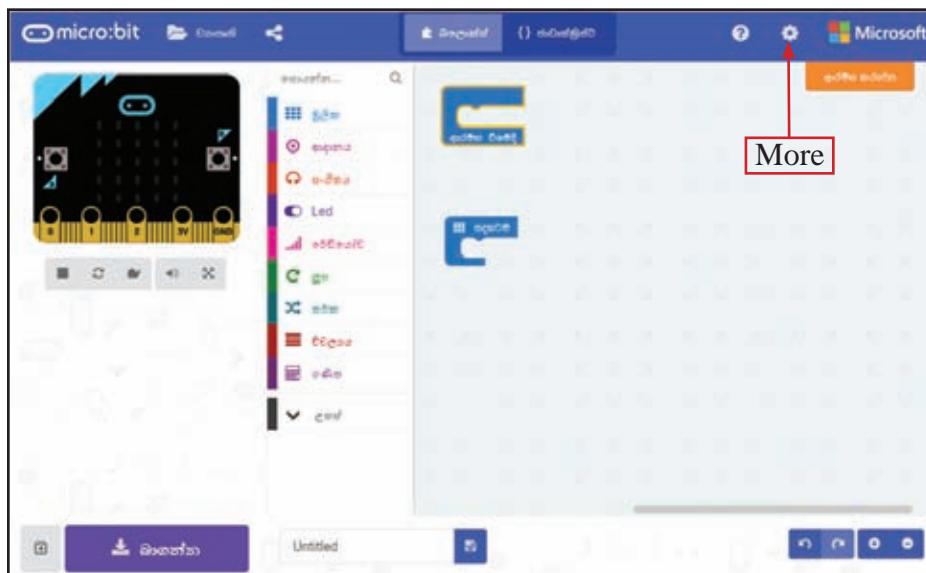
Figure 4.6 : Micro:bit code in Sinhala

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.
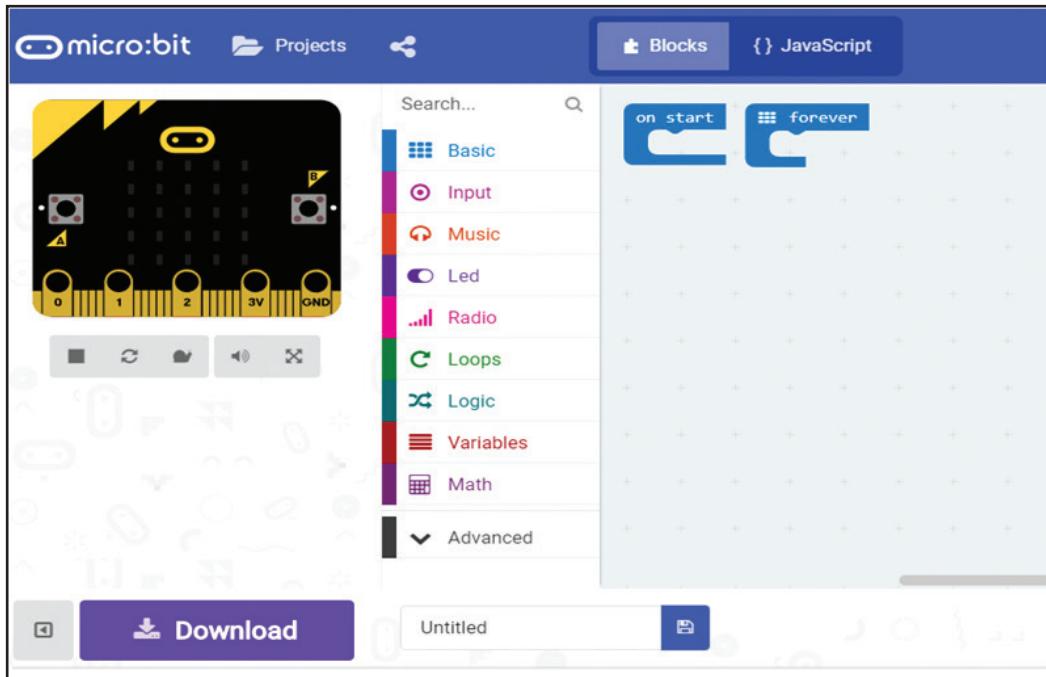
Figure 4.7 : Starting a new project in micro:bit

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.
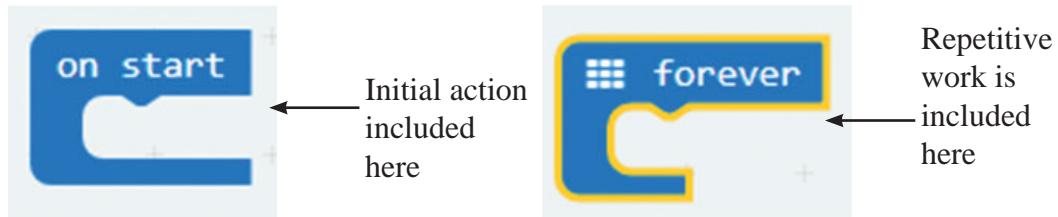
Figure 4.8 : Blocks inside the code editor

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:

show number `0`	To display a number
show leds	To create different patterns using 25 LEDs
show icon	To select LED pattern
show string `"Hello!"`	To display typing contents
forever	
pause (ms) `100`	To give an interval in milliseconds for an action
on start	
clear screen	To erase displayed data
show arrow `North`	To display an array
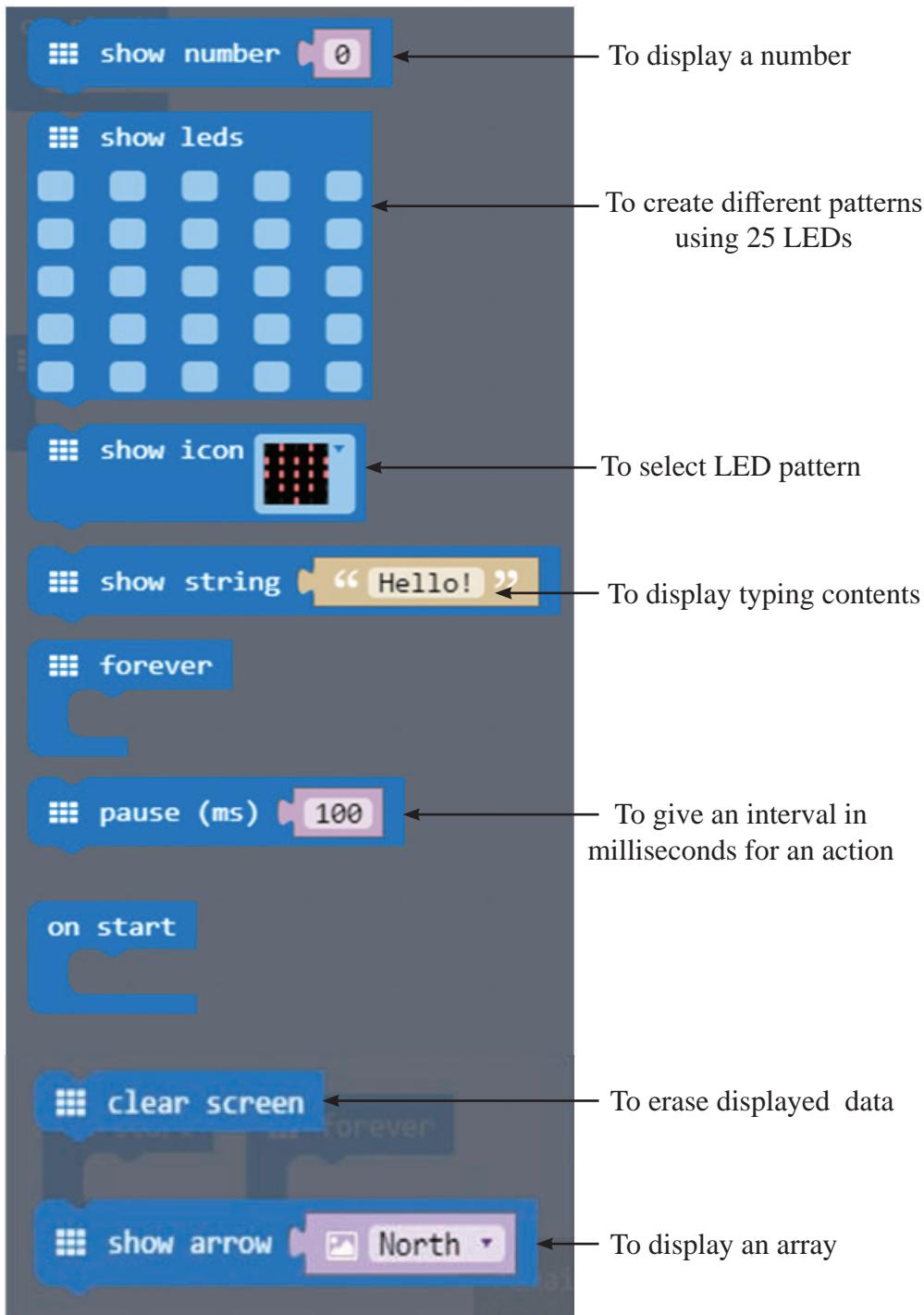
Figure 4.10 : Features in basic menu

The input menu above provides the following blocks:

	To specify actions for buttons A and B
on button A pressed	
on shake	Specify actions for a shaking or motion
on pin P0 pressed	To specify actions for pins PO, P1 and P2
button A is pressed	
pin P0 is pressed	
acceleration (mg) x	To display accelerometer data
light level	To display light sensor data
compass heading (°)	Displays compass direction data
temperature (°C)	Displays temperature sensor data

Figure 4.11 : Features in input menu

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

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.

Digital pins

Mini USB

1

Power regulator

2

3

DC power

ATMEGA328p microcontroller

6

7

4

Power pins

5

Analog pins
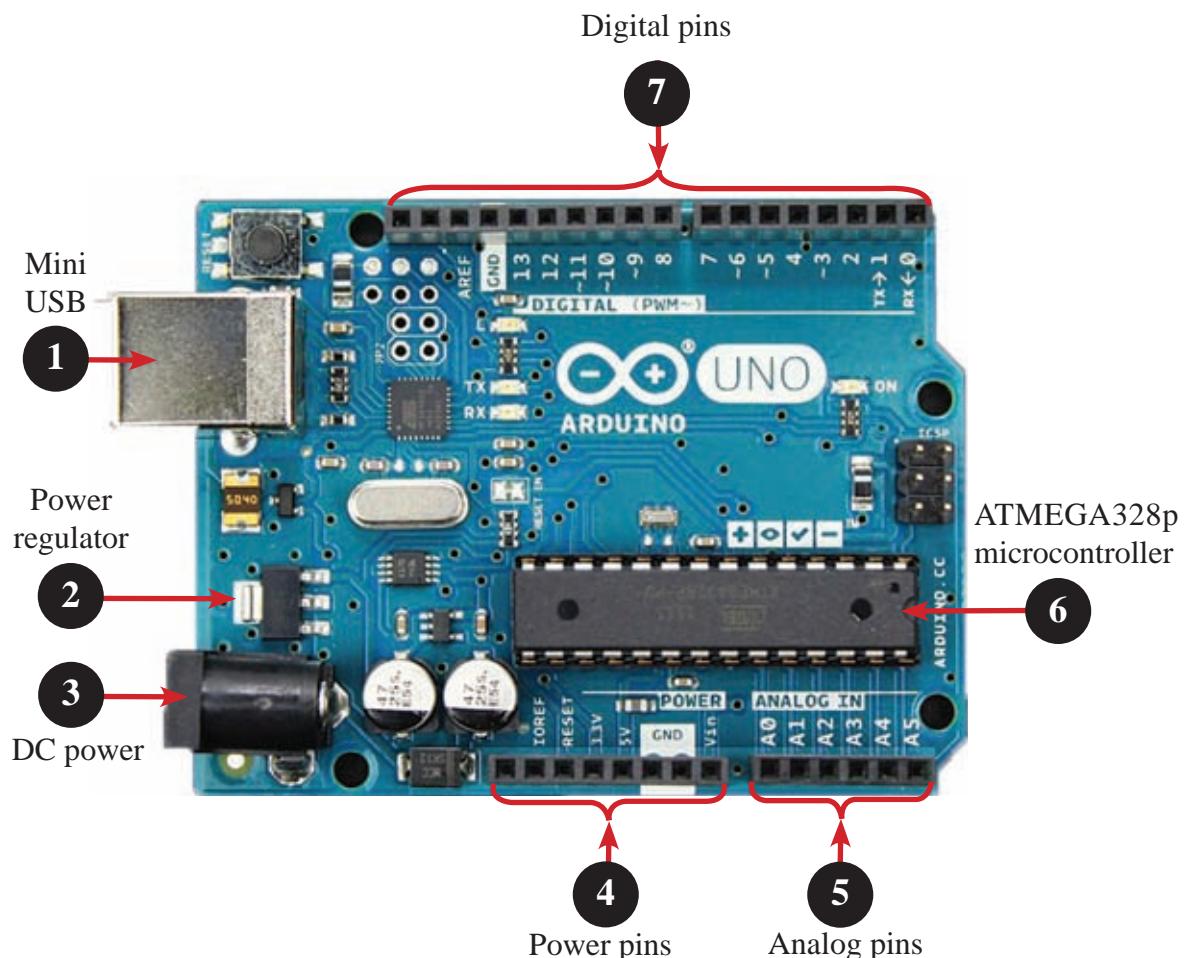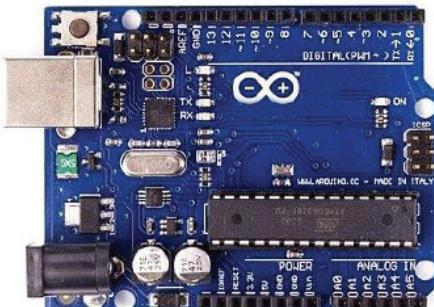
Figure 4.12 : Arduino board
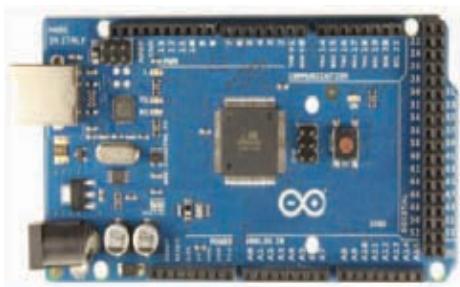
Table 4.1 : Components on the Arduino board

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.
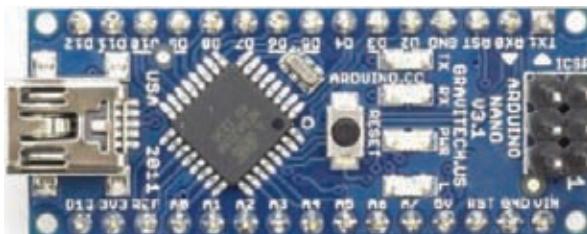
A few Arduino boards used today are shown below;
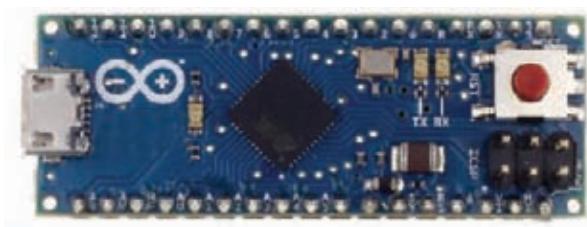
Arduino Uno board

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.
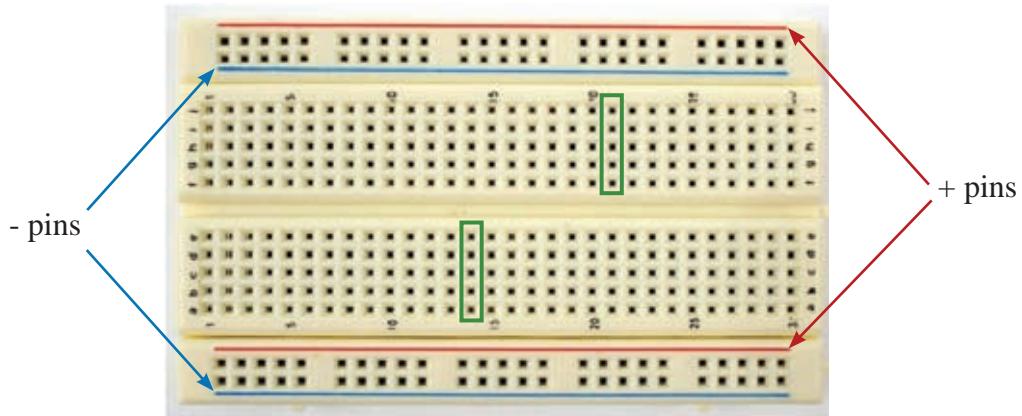
1. Bread-board

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 colured 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.
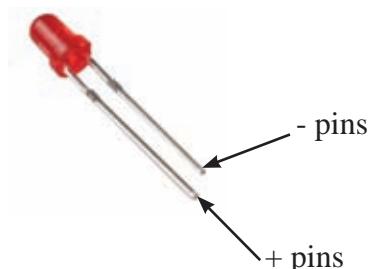
Figure 4.14 : A Light Emitting Diode

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).
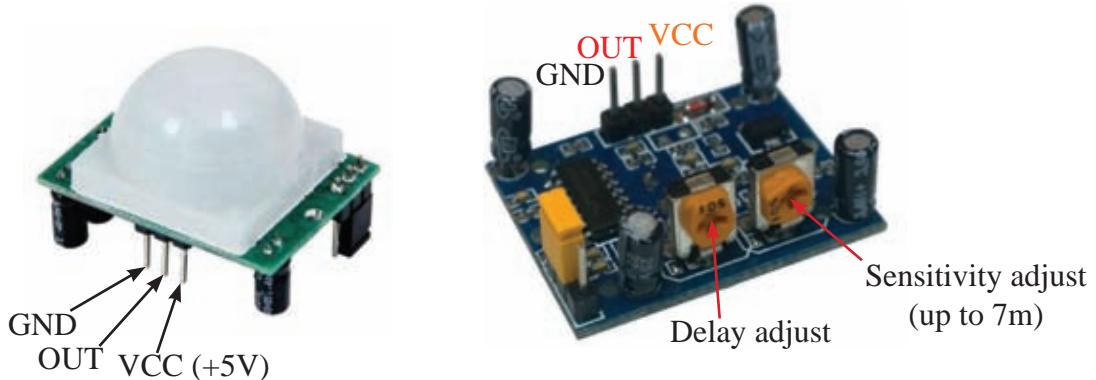
Figure 4.15 : Front and rear views of PIR Sensor

- 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).
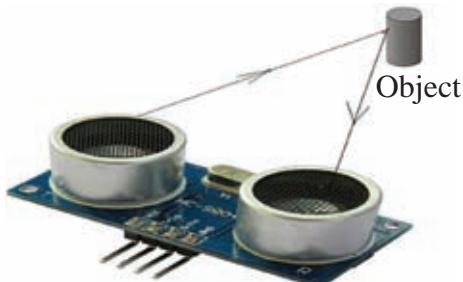
Figure 4.16 : How an ultrasonic sensor works

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

Ultrasonic waves

Echo
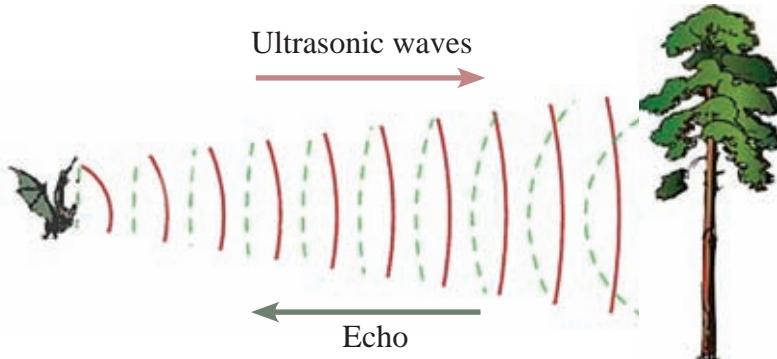
Figure 4.17 : An example similar to the ultrasonic sensor functions

The pins on the Ultrasonic sensor are as shown below.

VCC (5V)
TRIGGER (5V)

GND
Echo Pin
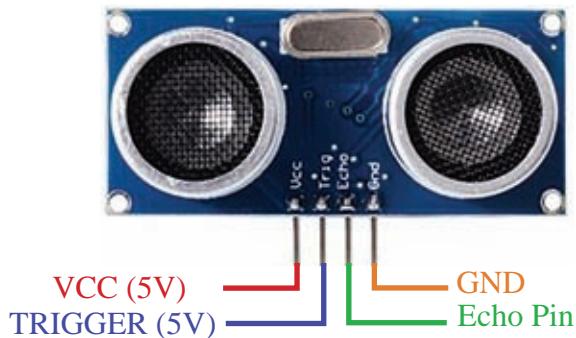
Figure 4.18 : Pins on the ultrasonic sensor

- 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.
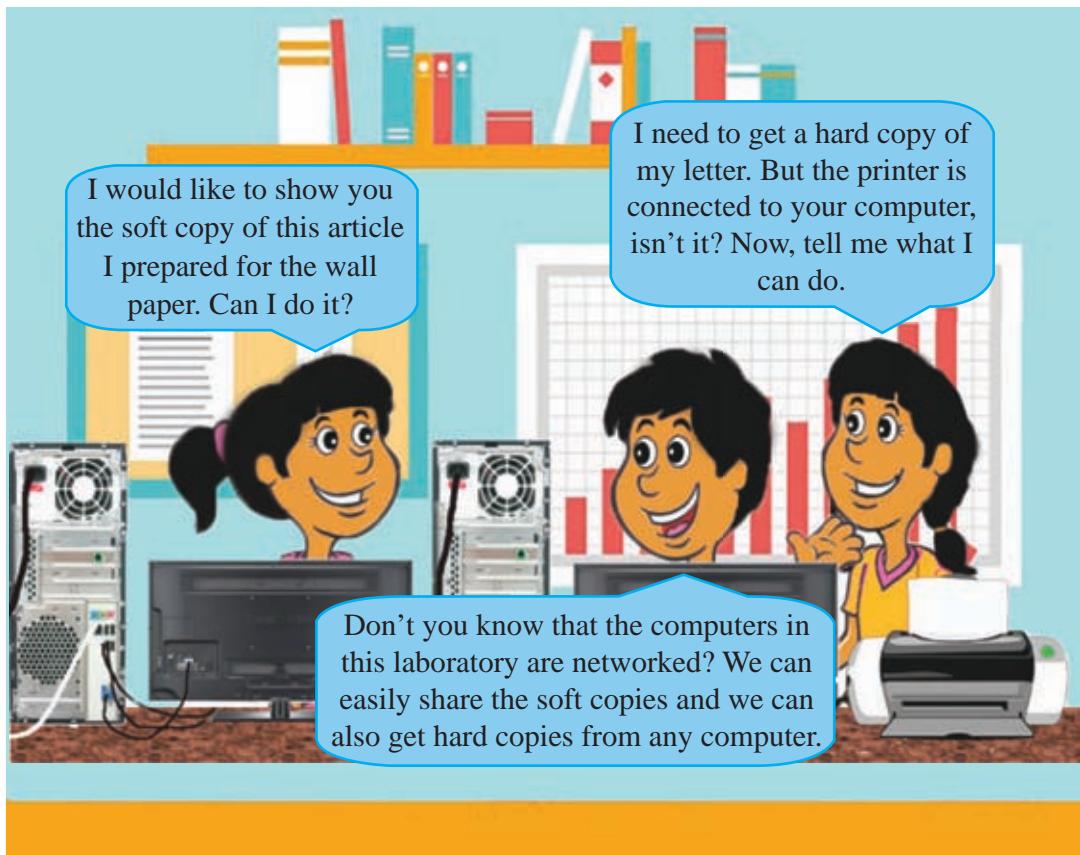
5 Computer Networks

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
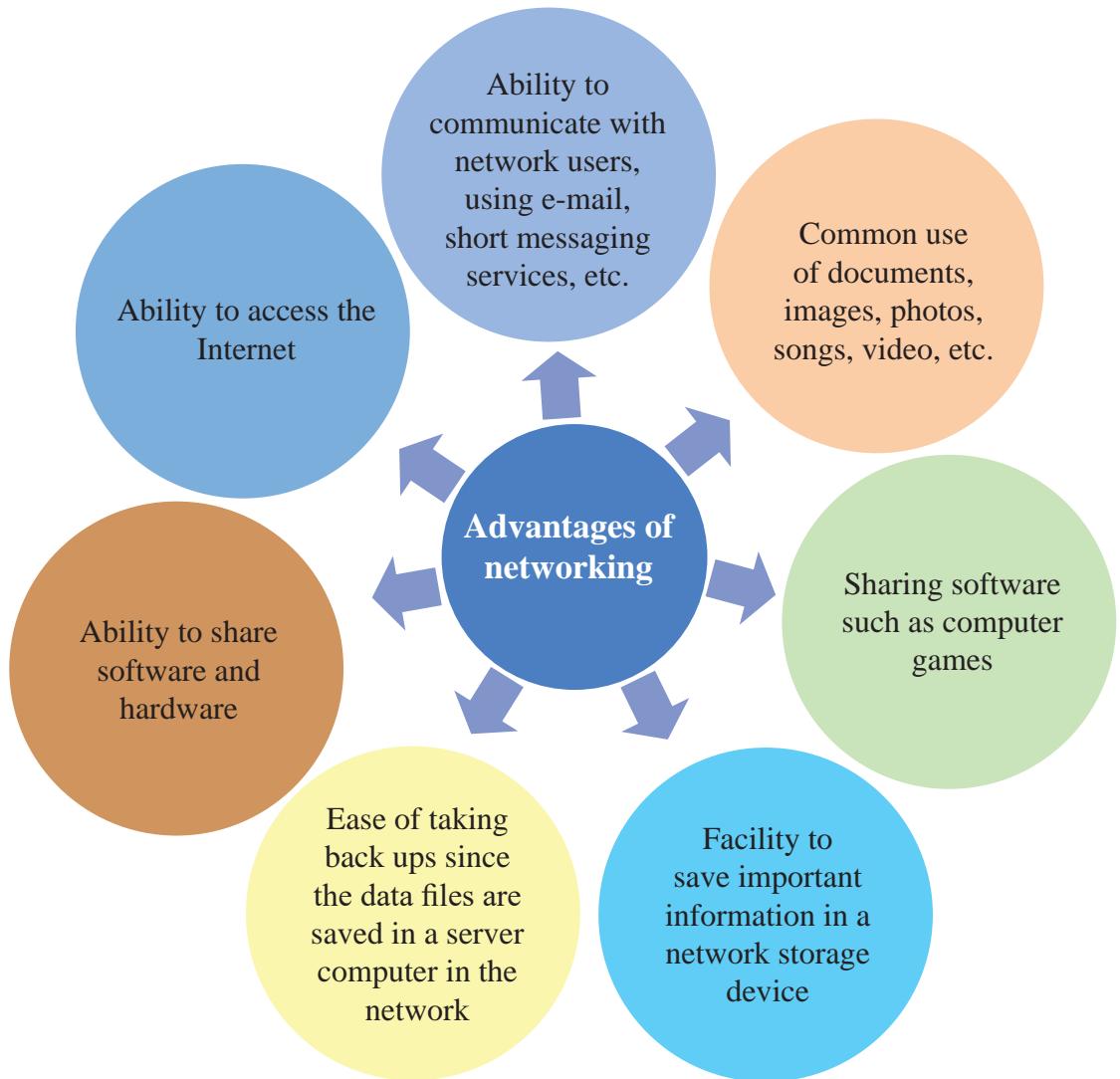
Figure 5.1 : Advantages of using computer networks

Types of network connections

Wired
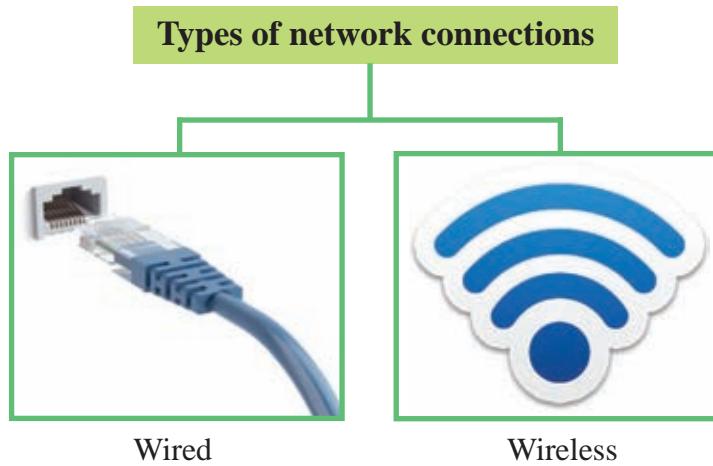
Wireless

Figure 5.2 : Types of network connections

Cabling used in wired connections

Fiber optic cables

Twisted pair cables
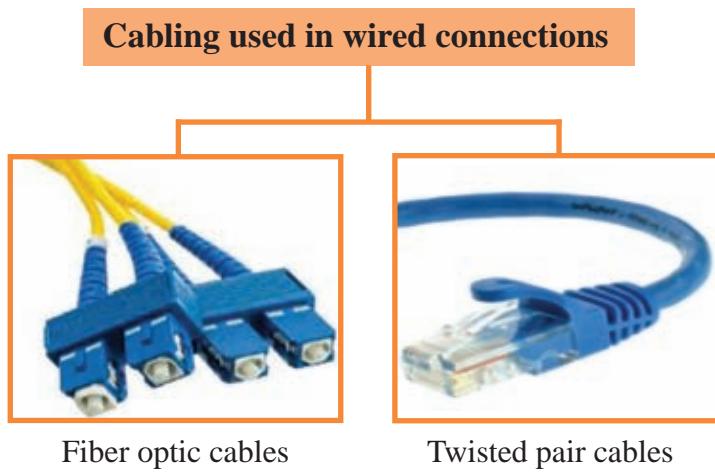
Figure 5.3 : Cabling examples

Wireless media

Infrared waves

Bluetooth

Wi-fi waves

Radio waves
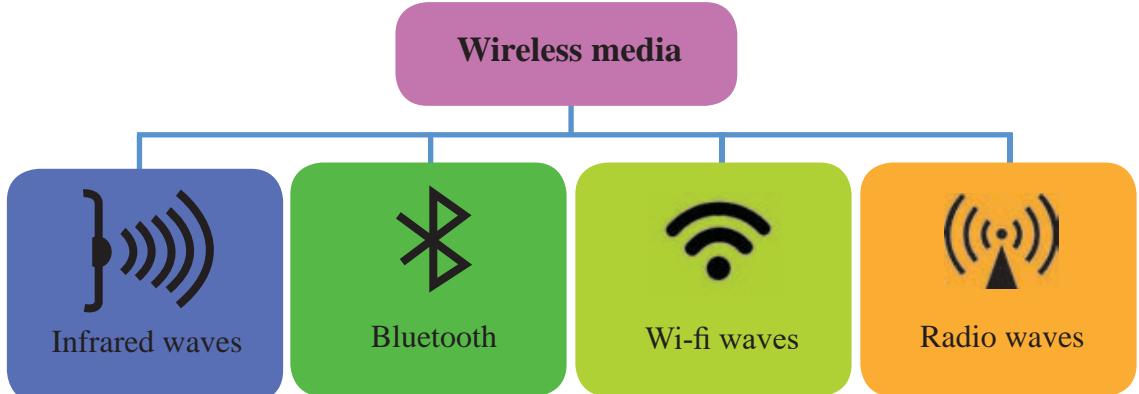
Figure 5.4 : Wireless media examples

Table 5.1 : Basic device requirements for computer networks

Basic devices of a Network	
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.	Server
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. e.g.- when printing command is given from one computer that message is sent to the relevant device i.e. the printer via switch.	Switch
Network Interface Card connects a computer to a computer network.	Network Interface Card
RJ45 connector cables	RJ45 cables

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;
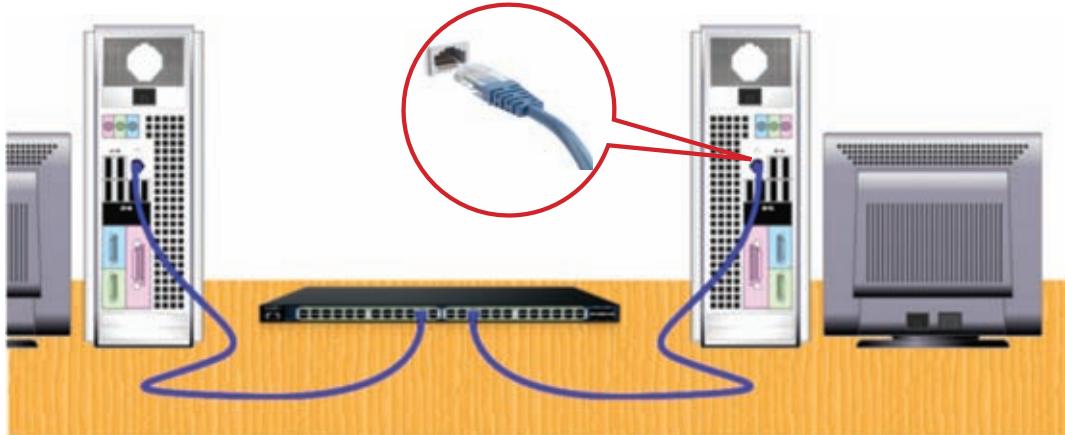
Figure 5.5 : A network involving two computers

An example of a computer network

As shown in Figure 5.6 the computers are connected to the server computer via the switch.
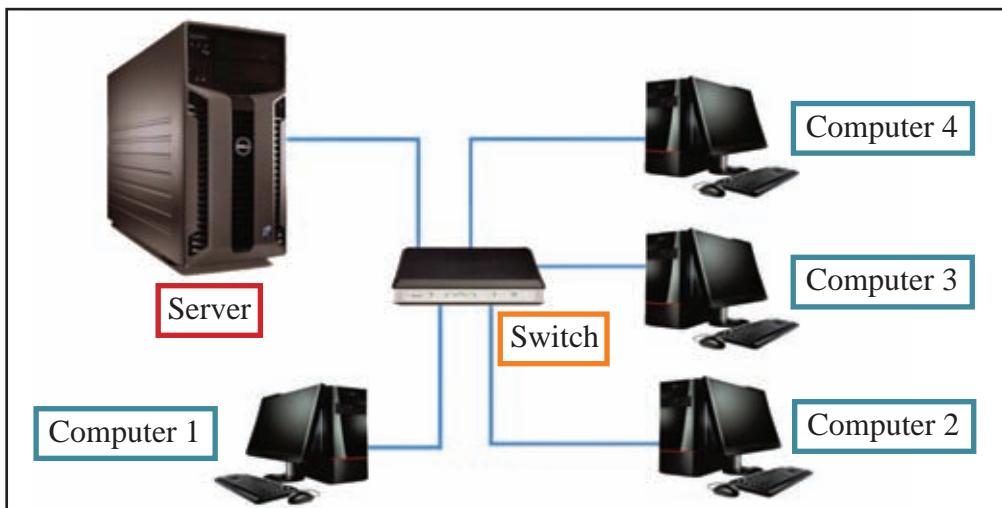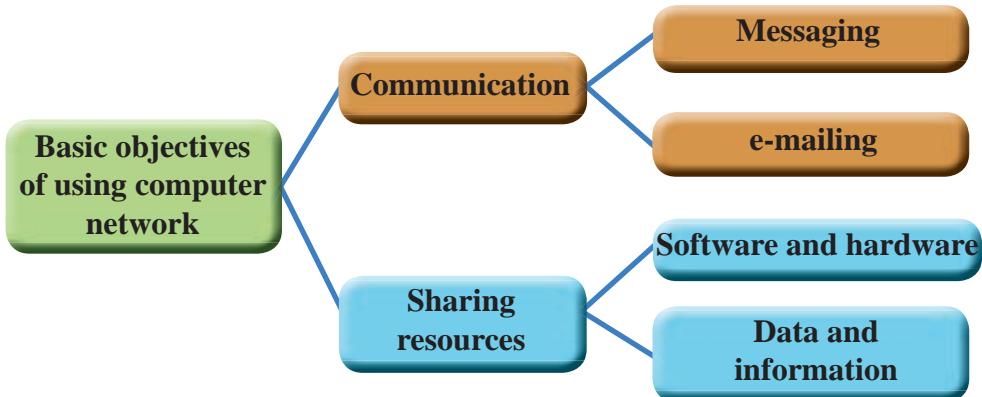
Figure 5.6 : An example of a computer network

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.
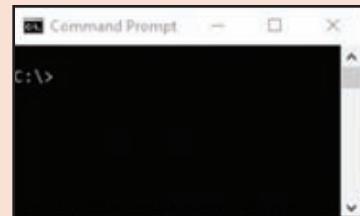
Refer to workbook for Activities 5.3 to 5.8

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.

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
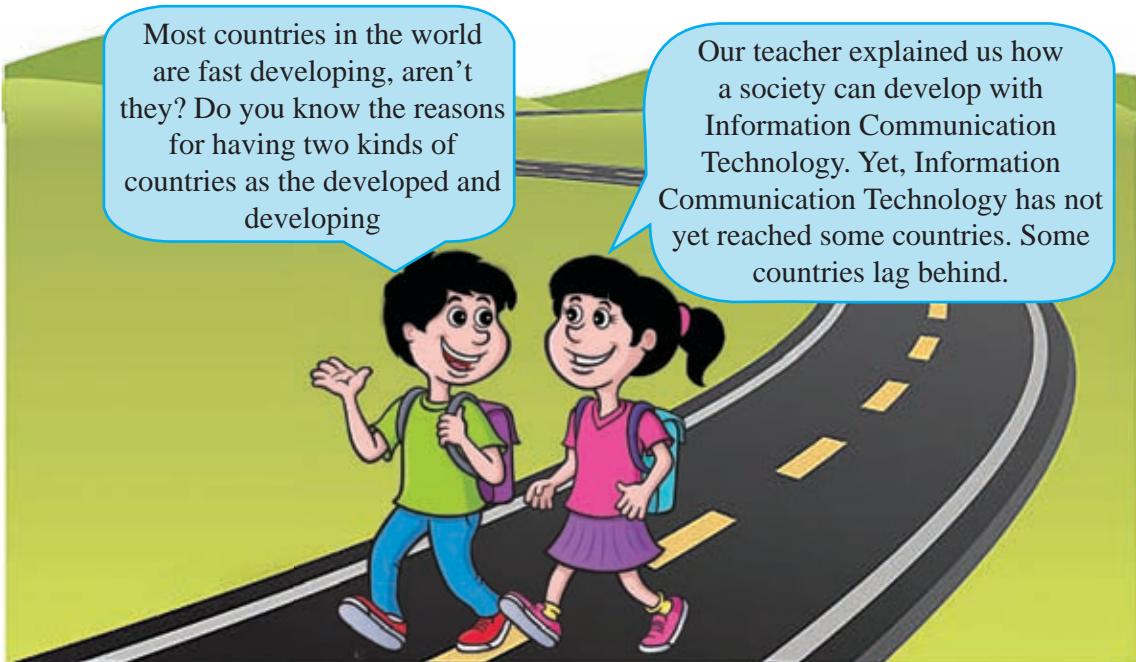
- Exchange of goods through the Internet
- Online shopping and purchasing
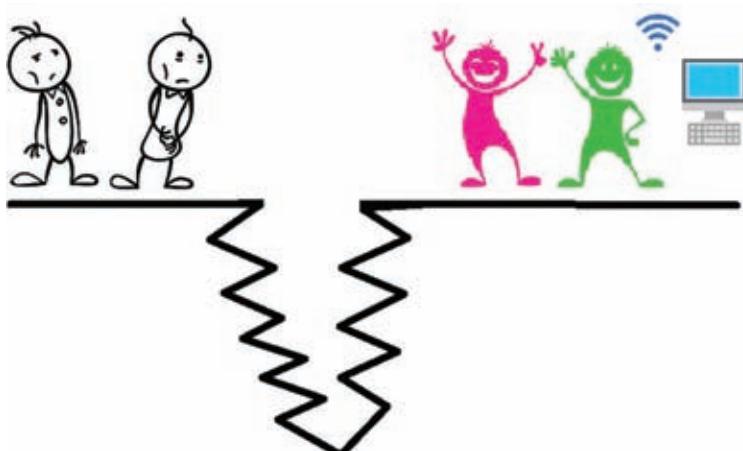
Most countries in the world are fast developing, aren't they? Do you know the reasons for having two kinds of countries as the developed and developing

Our teacher explained us how a society can develop with Information Communication Technology. Yet, Information Communication Technology has not yet reached some countries. Some countries lag behind.

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*.

Look! There's garbage everywhere. The whole environment is dirty!

Yes. of this waste, electronic waste is the most dangerous. They are not only make the environment dirty, but also harm people.

Motherboard

CDs and covers

LED display screen

Screen with a Cathode Ray Tube

Mobile phones

A few harmful electronic waste items

Printer

Cables

CFL bulbs

Electric cells

Keyboard and mouse

Figure 6.1: e-waste

Toxic poisons released from e-waste likely to harm humans

Selenium

loss of hair, nails, can cause allergies

Beryllium

lung cancer, breathing difficulties

Mercury

affects nerves, liver

Chromium

various allergies

Arsenic

cancer, nerve problems, skin diseases

Trichloroethylene

affects liver, gall bladder, infant deaths

Cadmium

Kidney weaknesses affects bone density, causes cancer

Lead

defects in brain, stomach and blood circulation

Polyvinyl Chloride

(strong gas caused when burning plastics) breathing related diseases

Barium

swelling of brain, weak muscles, damage to heart

Brominated Flame Retardants

physical weakness

Polychlorinated biphenyls

destroys liver, respiratory system, causes cancer

Dioxins and Furans

skin diseases, weak nerves, cancer

Figure 6.2 : Harmful effects of e-waste

Source: ewise.co.nz/the impact of e-waste
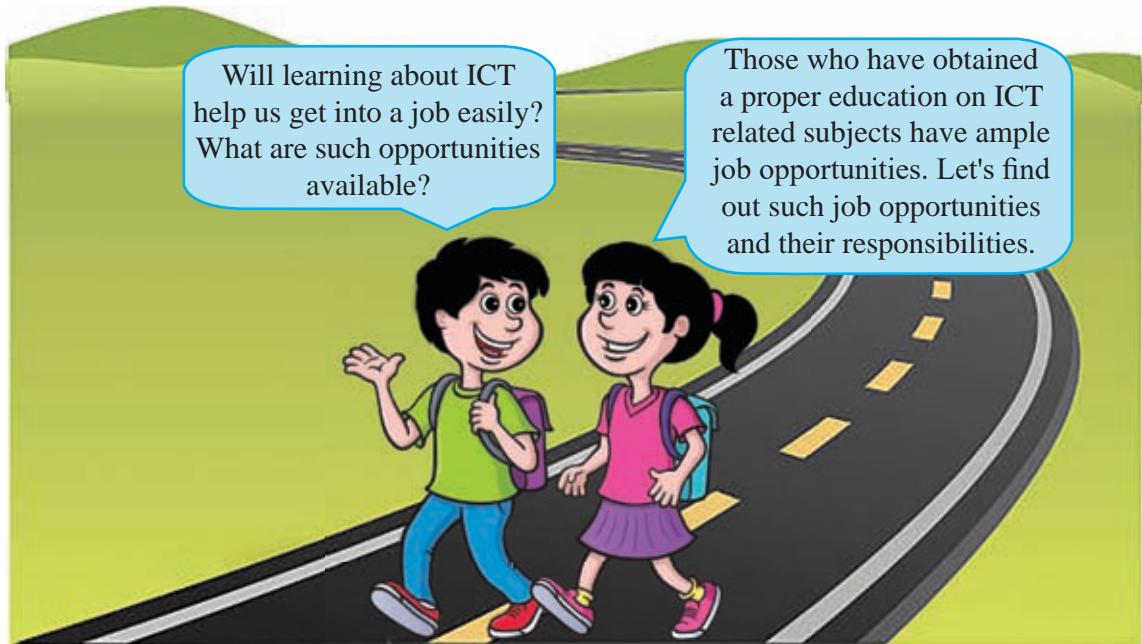
Minimizing e-waste through the 3R technique

- Minimize purchase or collection of unnecessary goods - **R**educe

- Use again and again after repairing it wherever possible - **R**euse

- Handover to suitable agencies for recycling purposes - **R**ecycle

Refer to workbook for Activities 6.3, 6.4 and 6.5.

6.2 Computer related job opportunities

Will learning about ICT help us get into a job easily? What are such opportunities available?

Those who have obtained a proper education on ICT related subjects have ample job opportunities. Let's find out such job opportunities and their responsibilities.

Software Quality Assurance Engineer	Database Administrator
Carries out tasks to assure that the software functions properly	Plans, installs configures and maintains databases

Software Engineer	Web Application Developer
Designs and develops software	Designs, develops and maintains websites

Software Architect	Graphic Designer
Designs the architecture of software, (Components and their interconnections)	Develops web pages, advertisements, magazines, banners using software

Programmer	System Analyst
Develops computer programs using programming languages	Analyses organizational needs and designs computer systems, coordinates development of software

Network Administrator	IT Consultant
Installs, configures and maintains computer network	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.

No	English	Sinhala	Tamil
		English-Sinhala-Tamil Glossary	
1.	abstract model	වියුක්ත ආකෘතිය	கருத்தியல் மாதிரி
2.	acceptance testing	ප්‍රතිග්‍රහණ පරීක්ෂාව	ஏற்புச் சோதனை
3.	access privilege	ප්‍රවේශවීමේ වරප්‍රසාදය	அணுகல் உரிமை
4.	agile model	සුචලය ආකෘතිය	சுறுசுறுப்பு மாதிரி
5.	alternate key	විකල්ප යතුර	மாற்றுச் சாவி
6.	American Standard Code for Information Interchange (ASCII)	තොරතුරු හුවමාරුව සඳහා වූ ඇමරිකානු සම්මත කේතය	தகவல் இடைமாற்றுக்கான அமெரிக்க நியம விதிக்கோவை
7.	amplitude	විස්තාරය	வீச்சம்
8.	amplitude modulation	විස්තාර මුර්ජනාව	வீச்சப் பண்பேற்றம்
9.	analog	ප්‍රතිසම	ஒப்புமை
10.	anchor	රැඳවුම	நிலை நிறுத்தி
11.	application layer	අනුප්‍රයෝග ස්ථරය	பிரயோக அடுக்கு
12.	architecture	නිර්මිතය	கட்டமைப்பு
13.	arithmetic and logical unit (ALU)	අංක ගණිත හා තාර්කික ඒකකය	எண்கணித மற்றும் தர்க்க அலகு
14.	array	අරාව	அணி
15.	artificial intelligence	කෘතිම බුද්ධිය	செயற்கை நுண்ணறிவு
16.	Affective computing	බුද්ධිමත් සහ චිත්තවේගී පරිගණනය	நுண்ணறிவு உணர்திறன்மிக்க கணித்தல்
17.	associative law	සංඝටන න්‍යාය	கூட்டு விதி
18.	attenuation	වැහැරීම/හායනය	நொய்மை
19.	attribute	උපලැකිය /ගුණය/ උපලක්ෂණය	பண்புகள்
20.	authoring tool	සම්පාදන මෙවලම	படைப்பாக்கக் கருவி
21.	Automated Teller Machine (ATM)	ස්වයංකෘත මුදල් ගනුදෙනු යන්ත්‍රය	தானியங்கிப் பணம் கையாள் இயந்திரம்

22.	autonomous	ස්වයංපාලක/ ස්වතන්ත්‍ර/ස්වායත්ත	சுயாதீன
23.	axiom	ස්වසිද්ධිය/ප්‍රත්‍යක්ෂය	வெளிப்படை உண்மை
24.	backups	උපස්ථ	காப்பெடுத்தல்
25.	bandwidth	කලාප පළල/බඳස් පළල	பட்டை அகலம்
26.	batch processing	කාණ්ඩ සැකසුම	தொகுதி முறைவழியாக்கம்
27.	big data	මහා දත්ත	பெரிய தரவு
28.	binary	ද්වීමය	துவிதம், இருமம்
29.	binary coded decimal (BCD)	ද්වීමය කේතික දශමය	இருமக் குறிமுறை தசமம்
30.	bio-inspired computing	ජෛව ප්‍රේරිත පරිගණනය/ ජෛව අනුප්‍රේරිත පරිගණනය	உயிரியல் உள்ளீர்ப்புக் கணிப்பு
31.	bit coin	බිටු කාසි	நுண்கடன் பணம் செலுத்தல்
32.	bitwise	බිටු අනුසාරිත	பிட் வாரி
33.	bitwise logical operation	බිටු අනුසාරිත තාර්කික මෙහෙයුම්	பிட் வாரி தர்க்கச் செயற்பாடு
34.	black box testing	කාල මංජුසා පරීක්ෂාව	கறுப்புப்பெட்டிச் சோதிப்பு
35.	blogging	වෙබ් සටහනය	வலைப்பதிவிடல்
36.	boot–up	ප්‍රවේශනය	தொடங்குதல்
37.	broadcasting	විකාශනය	தொலைபரப்பல்
38.	browsing	අතිරීක්සීම	மேலோடல்
39.	bubble sort	බුබුළු තේරීම/ යා-සැසඳුම් තේරීම	குமிழி வகைப்படுத்தல்
40.	built-in	තුළබැඳි / තිළැලි	உட்பொதிந்த
41.	business process re-engineering (BPR)	ව්‍යාපාර ක්‍රියාවලියේ ප්‍රති ඉංජිනේරුකරණය	வணிக செயல்முறை மீள்கட்டமைப்பு
42.	candidate key	නිරූප්‍ය යතුර	பிரதிநிதித்துவச் சாவி
43.	cardinality	ගණනීයතාව	எண்ணளவை
44.	cathode ray tube (CRT)	කැතෝඩ් කිරණ නලය	கதோட்டுக் கதிர் குழாய்

45.	central processing unit (CPU)	මධ්‍ය සැකසුම් ඒකකය	மத்திய செயற்பாட்டு அலகு
46.	characteristics	ගති ලක්ෂණ / ස්වලක්ෂණ	சிறப்பியல்புகள்
47.	check box	සලකුණු කොටුව	சரிபார்ப்புப் பெட்டி
48.	client-server model	සේවා යෝජක-සේවා දායක ආකෘතිය	சேவைப் பயனர் மாதிரி
49.	clock	ස්පන්දකය	கடிகாரம்
50.	cloud computing	වලාකුළු පරිගණනය	மேகக் கணிமை
51.	coaxial cable	සමකේෂක කේබලය	ஓரச்சு வடம்
52.	code editor	කේත සංස්කාරක	குறிமுறை தொகுப்பி
53.	comment	විවරණය	விளக்கக் குறிப்பு
54.	commutative law	න්‍යායදේශ න්‍යාය	பரிமாற்று விதி
55.	compact disc	සුසංහිත ඩිස්කය	ஒளியியல் வட்டு
56.	compatibility	ගැළපුම්	பொருந்துகை
57.	compiler	සම්පාදකය	தொகுப்பான்
58.	component	සංරචකය	கூறு
59.	composite key	සංයුක්ත යතුර	கூட்டுச் சாவி
60.	constant	නියතය	மாறிலி
61.	content management system (CMS)	අන්තර්ගත කළමනාකරණ පද්ධතිය	உள்ளடக்க முகாமைத்துவ முறைமை
62.	context switching	සන්දර්භ සුවිච්චනය	சந்தர்ப்ப நிலைமாற்றல்
63.	contiguous allocation	යාබද විභාජනය	அடுத்தடுத்தான ஒதுக்கீடு
64.	control structure	පාලන ව්‍යූහය	கட்டுப்பாட்டுக் கட்டமைப்பு
65.	control unit (CU)	පාලන ඒකකය	கட்டுப்பாட்டலகு
66.	credit card	ණයපත	கடனட்டை
67.	customization	අභිරුචිකරණය	தனிப்பயனாக்கல்
68.	data	දත්ත	தரவு
69.	data and control bus	දත්ත සහ පාලන පථ	தரவும் கட்டுப்பாட்டுப் பாட்டையும்

70.	database management system (DBMS)	දත්ත සමුදාය කළමනාකරණ පද්ධති	தரவுத்தள முகாமைத்துவ முறைமை
71.	data definition language (DDL)	දත්ත නිර්වචන භාෂාව	தரவு வரையறை மொழி
72.	data dictionary	දත්ත ශබ්දකෝෂය	தரவு அகராதி
73.	data flow diagram	දත්ත ගැලීම් සටහන	தரவு பாய்ச்சல் வரைபடம்
74.	data flow model (DFM)	දත්ත ගැලීම් ආකෘතිය	தரவு பாய்ச்சல் மாதிரி
75.	data link layer	දත්ත සබැඳි ස්ථරය	தரவு இணைப்பு அடுக்கு
76.	data manipulating language (DML)	දත්ත හැසුරුම් බස	தரவு கையாளல் மொழி
77.	data migration	දත්ත පර්යටනය	தரவு பெயர்ச்சி
78.	debugging	නිදොස් කිරීම	வழு நீக்கல்
79.	decision support system (DSS)	තීරණ සහාය පද්ධති	தீர்மான உதவு முறைமை
80.	declarative	ප්‍රකාශාත්මක	அறிவிப்பு
81.	default values	පෙරනිමි අගය	இயல்புநிலை மதிப்பு
82.	defragmentation	ප්‍රතිඛණ්ඩනය	துணிக்கை நீக்கல்
83.	demodulation	විමුර්ජනය	பண்பிறக்கம்
84.	device	උපාංගය / උපකුමය	சாதனம்
85.	device driver	උපාංග ධාවක මෘදුකාංග	சாதனச் செலுத்தி
86.	digital	අංකිත	இலக்க முறை
87.	digital camera	අංකිත කැමරාව	இலக்கமுறைப் படக்கருவி
88.	digital economy	අංකිත ආර්ථිකය	இலக்கமுறைப் பொருளாதாரம்
89.	digitizer	සංඛ්‍යාංකකය	இலக்கமாக்கி
90.	direct implementation	සෘජුස්ථාපනය	நேரடி அமுலாக்கம்
91.	disk formatting	තැටි/ඩිසක හැඩසවි ගැන්වීම	வட்டு வடிவமைப்பு
92.	distortion	විකෘතිය	திரிபு

93.	distributive law	විසටන න්‍යාය	பங்கீட்டு விதி
94.	document flow diagram	ලේඛන ගැලීම් සටහන	ஆவணப் பாய்ச்சல் வரைபடம்
95.	domain	වසම්	ஆள்களம்
96.	domain name server (DNS)	වසම් නාම සේවාදායකය	ஆள்களப் பெயர் சேவையகம்
97.	domain name system (DNS)	වසම් නාම පද්ධතිය	ஆள்களப் பெயர் முறைமை
98.	dynamic host configuration protocol (DHCP)	ගතික ධාරක පාලන නියමාවලිය	மாறும் விருந்தோம்பி உள்ளமைவு நெறிமுறை
99.	dynamic web page	ගතික වෙබ් පිටු	இயக்குநிலை வலைப்பக்கம்
100.	e-commerce	විද්‍යුත් වාණිජ්‍යය	மின் வர்த்தகம்
101.	economical feasibility	ආර්ථික ශක්‍යතාව	பொருளாதாரச் சாத்தியப்பாடு
102.	elementary process description(EPD)	මූලික ක්‍රියාවලි විස්තරය	அடிப்படைச் செய்முறை விபரிப்பு
103.	e-market place	ඉ-වෙළඳ පොළ	இலத்திரனியல் சந்தை இடம்
104.	encryption	ගුප්ත කේතනය	மறைகுறியாக்கம்
105.	enterprise resource planning system (ERPS)	ව්‍යවසාය සම්පත් සැලසුම් පද්ධතිය	நிறுவன மூலவள திட்டமிடல் முறைமை
106.	entity	භූතාර්ථය/අභිභූතත්වය/සත්තාව	நிலைபொருள்
107.	entity identifier	භූතාර්ථ/අභිභූතත්වය හඳුන්වනය	நிலைபொருள் அடையாளங்காட்டி
108.	entity relationship(ER) diagram	භූතාර්ථ සම්බන්ධතා රූපසටහන	நிலைபொருள் உறவுமுறை அட்டவணை
109.	executable	ක්‍රියාත්මක කළ හැකි	இயக்கத்தகு
110.	executive support system (ESS)	විධායක සහාය පද්ධතිය	நிறைவேற்று உதவு முறைமை
111.	expert system	විශේෂඥ පද්ධතිය	நிபுணத்துவ முறைமை

112.	extended binary coded decimal interchange cod (EBCDIC)	විස්තෘත ද්වීමය කේතක දශම	நீடித்த துவித குறிமுறை தசம இடமாற்றக் குறி
113.	extended entity relationship (ER) diagram	විස්තෘත භූතාර්ථ සම්බන්ධතා රූප සටහන	விரிவாக்கப்பட்ட நிலைலொருள் உறவுமுறை அட்டவணை
114.	feasibility study	ශක්‍යතා අධ්‍යයනය	சாத்தியப்பாடு கற்கை
115.	feedback loop	ප්‍රතිපෝෂණ ලූපය	பின்னூட்டல் வளையம்
116.	fetch-execute cycle	ආහරණ-ක්‍රියාකරවුම් චක්‍රය	தருவிப்பு நிறைவேற்றுச் சுழற்சி
117.	fiber optic	ප්‍රකාශ තන්තු	இழை ஒளியியல்
118.	file	ගොනුව	கோப்பு
119.	file hierarchy	ගොනු ධුරාවලිය	கோப்பு படிநிலை
120.	firewall	ගිනි පවුර	தீச்சுவர்
121.	normal form	ප්‍රථම ප්‍රමත අවස්ථාව	இயல்பாக்கல் வடிவம்
122.	fixed internal hard disk	අචල අභ්‍යන්තර දෘඩ තැටි	நிலையான உள்ளக வன்தட்டு
123.	flash memory	සැණ/ ක්ෂණික මතකය	பளிச்சீட்டு நினைவகம்
124.	flash memory card	සැණ/ ක්ෂණික මතක පත	பளீச்சிட்டு நினைவக அட்டை
125.	flat file system	ඒක ගොනු පද්ධතිය	சமதளக் கோப்பு முறைமை
126.	flip-flop	පිළි-පොළ	எழு-விழு
127.	float	ඉපිලුම්/ඉපිලීම	மிதவை
128.	floppy disk	නම්‍ය තැටිය	நெகிழ் வட்டு
129.	flow chart	ගැලීම් සටහන	பாய்ச்சற் கோட்டுப்படம்
130.	folder	ගොනු බහලුම	கோப்புறை
131.	foreign key	ආගන්තුක යතුර	அந்நியச்சாவி
132.	formatting	හැඩසවි ගැන්වීම	வடிவமைத்தல்
133.	frame	රාමුව	சட்டகம்
134.	frequency modulation	සංඛ්‍යාත මූර්ජනය	அதிர்வெண் பண்பேற்றல்

135.	full adder	පූර්ණාකලකය	முழுமைக் கூட்டி
136.	function	ශ්‍රිතය / කාර්යය	சார்பு
137.	functional dependency	කාර්ය බද්ධ පරායත්තතාව	செயல் சார்புநிலை
138.	functional requirement	කාර්ය බද්ධ අවශ්‍යතාව	செயல்படு தேவை
139.	quantum computing	ක්වොන්ටම් පරිගණනය	சொட்டு கணிப்பு அடிப்படை
140.	gateway	දොරටු මඟ / වාසල් ද්වාරය /වාහල්දොර	நுழைவாயில்
141.	genetic algorithm	සහජ ඇල්ගොරිදමය	மரபணு வழிமுறை
142.	geographical information system(GIS)	භූගෝලීය තොරතුරු පද්ධතිය /මිහිතැන් තොරතුරු පද්ධතිය	புவியியல் தகவல் முறைமை
143.	graph plotter	ප්‍රස්තාර ලකුණුකරණය	படவரையி
144.	graphic tablet	චිත්‍රකඵලකය	வரைவியல் விவரமாக்கி
145.	grid computing	ජාලක පරිගණනය	கோட்டுச்சட்டகக் கணிமை
146.	guided media	නියමු මාධ්‍ය	வழிபடுத்தப்பட்ட ஊடகம்
147.	half adder	අර්ධාකලකය	அரை கூட்டி
148.	hand trace	හස්තානුරේඛනය	கைச் சுவடுகள்
149.	hard disk	දැඩි තැටිය / දෘඪ ඩිස්කය	வன்தட்டு
150.	hardware	දෘඪාංග	வன்பொருள்
151.	hexadecimal	ෂඩ් දශමය	பதினறுமம்
152.	hierarchical model	ධුරාවලි ආකෘතිය	படிநிலை மாதிரி
153.	host	සත්කාරකය	விருந்தோம்பி
154.	hub	නාභිය	குவியன்
155.	human operator	මිනිස්ක්‍රියාකරුවෝ	மனித இயக்குபவர்
156.	hybrid approach	දෙමුහුන් ප්‍රවේශය	கலப்பு அணுகல்
157.	hyperlink	අධිසම්බන්ධකය	மீ இணைப்பு
158.	Integrated circuits (IC)	අනුකලිත පරිපථ	ஒருங்கிணைந்த சுற்று
159.	icon	නිරූපකය	சிறு படம்

160.	identity	සර්වසාම්‍ය	அடையாளம்
161.	image	රූපය	படிமம்
162.	imperative	විධානාත්මක	கட்டளை
163.	incremental	වර්ධනාත්මක	ஏறுமான, அதிகரிப்பு
164.	indexed allocation	අනුක්‍රමික විභාජනය	சுட்டி ஒதுக்கீடு
165.	information	තොරතුරු	தகவல்
166.	inkjet printer	තීන්ත විදුම් මුද්‍රකය	மைத்-தாரைஅச்சுப்பொறி
167.	instant messaging	ක්ෂණික පණිවුඩ යැවීම	உடனடிச் செய்தியிடல்
168.	integrated development environment(IDE)	සමෝධානික සංවර්ධන පරිසරය	ஒருங்கிணைந்த விருத்தி சூழல்
169.	integration test	අනුකලන පරීක්ෂණය	ஒருங்கிணைந்த சோதிப்பு
170.	intelligent and emotional computing	බුද්ධිමත් සහ චිත්තවේගී පරිගණනය	நுண்ணறிவும் உணர்திறனுமிக்க கணித்தல்
171.	interface	අතුරු මුහුණ	இடைமுகம்
172.	internet service provider(ISP)	අන්තර්ජාල සේවය සපයන්නා	இணையச் சேவை வழங்குநர்
173.	interpreter	අර්ථවිනිශ්චසකය	மொழிமாற்றி
174.	interrupt	අතුරු බිඳුම	இடையூறு
175.	intranet	අන්ත:ජාලය/ අන්තෝජාල	அகவிணையம்
176.	internet of things (IoT)	**සාර්ව ද්‍රව්‍ය අන්තර්ජාලය/** සබැඳි ද්‍රව්‍ය අන්තර්ජාලය	பொருட்களின் இணையம்
177.	iteration	පුනර්කරණය	மீள் செயல்
178.	karnaugh map	කානෝ සිතියම	கானோ வரைபடம்
179.	knowledge management system(KMS)	දැනුම් කළමනාකරණ පද්ධතිය	அறிவு முகாமைத்துவ முறைமை
180.	large scale integration (LSI)	විශාල පරිමාණයේ අණුකලනය	பாரிய அளவு ஒருங்கிணைப்பு
181.	latency	පමාව/ශුප්තතාව	மறைநிலை

182.	least significant	අඩුම්වෙසෙසී	சிறும மதிப்பு
183.	legend	විස්තර පාඨය	குறி விளக்கம்
184.	life cycle of data	දත්ත ජීවන චකුය	தரவு வாழ்க்கை வட்டம்
185.	light emitting diode(LED) display	ආලෝක විමෝචක ඩයෝඩ සන්දර්ශකය	ஒளிகாலும் இருவாயித் திரை / ஒளி உமிழும் இரு முனையம்
186.	linked allocation	සබැඳි විභාජනය	இணைப்பு ஒதுக்கீடு
187.	linker	සන්ධාරකය	இணைப்பி
188.	liquid crystal display(LCD)	ද්‍රවස්ඵටික සන්දර්ශකය	திரவப்பளிங்குக் கணினித் திரை
189.	list	ලැයිස්තුව	பட்டியல்
190.	liveware	ජීවාංග	உயிர் பொருள்
191.	local publishing	ස්ථානීය ප්‍රසිද්ධ කිරීම	உள்ளக வெளியீடு
192.	local area network (LAN)	ස්ථානීය ප්‍රදේශ ජාලය	இடத்துரி வலையமைப்பு
193.	logic gate	තාර්කික ද්වාරය	தர்க்கப் படலை
194.	Logical Data Modeling(LDM)	තාර්කික දත්ත ආකෘතිකරණය	தர்க்கத் தரவு மாதிரியுருவாக்கல்
195.	logical data structure	තාර්කික දත්ත වයුහය	தர்க்கத் தரவுக் கட்டமைப்பு
196.	logical design tools	තාර්කික සැලසුම් මෙවලම්	தர்க்க வடிவமைப்புக் கருவி
197.	looping	ලූපනය	வளைய வரல்
198.	machine code	යන්ත්‍ර කේතය	இயந்திரக் குறியீடு
199.	machine-machine coexistence	යන්ත්‍ර-යන්ත්‍ර සහපැවැත්ම	இயந்திர- இயந்திர ஒருங்கிருத்தல்
200.	magnetic ink character reader(MICR)	චුම්බකීත තීන්ත අනු ලකුණු කියවනය	காந்த மை எழுத்துரு வாசிப்பான்
201.	magnetic stripe reader	චුම්බක තීරු කියවනය	காந்தப்பட்டி வாசிப்பான்
202.	magnetic tape	චුම්භක පටිය	காந்த நாடா
203.	malware	අනිෂ්ඨ මාදුකාංග	தீம்பொருள்

204.	management information system (MIS)	කළමනාකරණ තොරතුරු පද්ධතිය	முகாமைத்துவ தகவல் முறைமை
205.	man-machine coexistence	මිනිස්-යන්ත්‍ර සහපැවැත්ම	மனிதன் - இயந்திரம் ஒருங்கிருத்தல்
206.	media access control (MAC)	මාධ්‍ය ප්‍රවේශ පාලක	ஊடக அணுகல் கட்டுப்பாடு
207.	memory management unit(MMU)	මතක කළමනාකරණ ඒකකය	நினைவக முகாமைத்துவ அலகு
208.	mesh topology	බැඳි ස්ථලකය	கண்ணி இடத்தியல்
209.	microprocessor	ක්ෂුද්‍ර සකසනය	நுண்செயலி
210.	microwave	ක්ෂුද්‍ර තරංග	நுண்ணலை
211.	mini disk	කුඩා තැටිය	சிறு வட்டு
212.	mobile computing	ජංගම පරිගණනය	செல்லிடக் கணிமை
213.	mobile marketing	ජංගම අලෙවිකරණය	செல்லிடச் சந்தைப்படுத்தல்
214.	modularization	මොඩියුලකරණය	கூறு நிலையாக்கம்
215.	modulation	මූර්ජනය	பண்பேற்றம்
216.	most significant	වැඩිම වෙසෙස්	அதியுயர் மதிப்பு
217.	mother board	මවු පුවරුව	தாய்ப்பலகை
218.	multi agent systems	බහු කාරක පද්ධති	பல்முகவர் முறைமை
219.	multi user-multi task	බහු පරිශීලක - බහු කාර්යය	பற்பயனர்-பற்பணி
220.	multi-core processors	බහු හර සකසන	பல்கரு செயலி
221.	multimedia objects	බහු මාධ්‍ය වස්තු	பல்லூடக பொருள்
222.	multiplexer	බහු පථකාරකය	பல்சேர்ப்பி
223.	multiplexing	බහු පථකරණය	பல்சேர்ப்பு
224.	multiprocessing	බහු සැකසුම	பன்முறைவழியாக்கி
225.	multitasking	බහුකාර්ය කිරීම	பற்பணி
226.	multi-threading	බහු-අනුත්‍රියායනය	பல் செயல்கூறு
227.	nature inspired	ප්‍රකෘති ප්‍රේරිත පරිගණනය/	இயற்கை உள்ளீர்ப்புக்

	computing	ප්‍රකෘති අනුලේඛිත පරිගණනය	கணிப்பு
228.	nested loop	නීඩිත ලූපය	நீடித்த வளையம்
229.	network addresses translating (NAT)	ජාල යොමු පරිවර්තනය	வலையமைப்பு முகவரி பெயர்ப்பு
230.	network architecture	ජාල නිර්මිතය	வலையமைப்புக் கட்டமைப்பு
231.	network layer	ජාල ස්ථරය	வலையமைப்பு அடுக்கு
232.	network model	ජාල ආකෘතිය	வலையமைப்பு மாதிரி
233.	neural network	ස්නායුක ජාලය	நரம்பியல் வலையமைப்பு
234.	non-functional requirement	කාර්යබද්ධ නොවන අවශ්‍යතාව	செயல்சாராத் தேவைகள்
235.	normalization	ප්‍රමිතකරණය	இயல்பாக்கல்
236.	null	අභිශූන්‍ය	வெற்று
237.	object code	වස්තු කේත/	பொருள் குறி
238.	object oriented	වස්තු නැඹුරු / පාදක	பொருள் நோக்குடைய
239.	object- relational model	වස්තු-සම්බන්ධක ආකෘතිය	பொருள் உறவுநிலை மாதிரி
240.	octal	අෂ්ටමය	எண்மம்
241.	office automation system (OAS)	කාර්යාල ස්වයංකරණ පද්ධතිය	அலுவலகத் தன்னியக்க முறைமை
242.	offline	මාර්ග අපගත/ මාර්ගගත නොවන	தொடரறு நிலை
243.	one's compliment	එකෙහි අනුපූරකය	ஒன்றின் நிரப்பி
244.	online	මාර්ගගත	தொடரறா நிலை
245.	open source	විවෘත මූලාශ්‍ර	திறந்த மூலம்
246.	operational feasibility	මෙහෙයුම් ශක්‍යතාව	செயற்பாட்டுச் சாத்தியப்பாடு
247.	operator category	කාරක ප්‍රවර්ගය	செயலி வகை
248.	operator precedence	කාරක ප්‍රමුඛතා	செயலி முன்னுரிமை
249.	optical character reader (OCR)	ප්‍රකාශ අණු ලකුණු කියවනය	ஒளியியல் எழுத்துரு வாசிப்பான்

250.	optical mark reader (OMR)	ප්‍රකාශ ලකුණු කියවනය	காந்த மை எழுத்துரு வாசிப்பான்
251.	output	ප්‍රතිදානය	வெளியீடு
252.	packet switching	පොදි හුවමාරුව	பொதி மடைமாற்றல்
253.	paging	පිටුකරනය	பக்கமிடல்
254.	paradigm	සුසමාදර්ශය/ ප්‍රතිමානය/ප්‍රතිරූපය	கோட்பாட்டுச் சட்டகம்
255.	parallel implementation	සමාන්තර ස්ථාපනය	சமாந்தர அமுலாக்கம்
256.	parameter passing	පරාමිති යැවීම	பரமானக் கடத்தல்
257.	parity	සමතාව	சமநிலை
258.	password	මුර පදය	கடவுச்சொல்
259.	payment gateway	ගෙවුම් වාසල් ද්වාරය	பணக் கொடுப்பனவு நுழைவாயில்
260.	periodic refreshing	ආවර්ත ප්‍රබෝධකරණය	காலமுறை புதுப்பித்தல்
261.	peripheral device	පර්යන්ත උපාංගය / උපකුමය	புறச் சாதனம்
262.	phablet	ෆැබ්ලට්	பெப்லட்
263.	phased implementation	අවධිස්ථාපනය / පියවර ක්‍රියාත්මකකිරීම	கட்ட அமுலாக்கல்
264.	phase modulation	කලා මුර්ජනය	நிலை பண்பேற்றம்
265.	phishing	තතුබෑම	வழிப்பறித்தல்
266.	physical layer	භෞතික ස්ථරය	பௌதீக அடுக்கு
267.	physical memory	භෞතික මතකය	பௌதீக நினைவகம்
268.	pilot implementation	නියාමක ස්ථාපනය / නියාමක ක්‍රියාත්මක කිරීම	முன்னோடி அமுலாக்கல்
269.	piracy	චෞරත්වය/ ලුණ්ඨනය	களவு
270.	pirated software	චෞර/ලුණ්ඨීත මෘදුකාංග	திருட்டு மென்பொருள்
271.	plagiarism	ග්‍රන්ථ/රචනා චෞර්යය	கருத்துத் திருட்டு
272.	point to point connection	ඍජු ලක්ෂ්‍ය සම්බන්ධතාව	ஒன்றுடனொன்று இணைப்பு

273.	pointing device	දැක්වුම් උපාංගය	சுட்டி சாதனம்
274.	port	කෙවෙනිය	வாயில், துறை
275.	portable external hard disk	ජංගම/සුවහනීය බාහිර දෘඪ තැටිය	காவத்தகு புற வன்தட்டு
276.	portal	ද්වාරය/ ආමුඛද්වාරය	வலைவாசல்
277.	Point of sale (POS) machine	විකුණුම් පොල යන්ත්‍ර	விற்பனை இட இயந்திரம்
278.	postulate	උපකල්පනය	எடுகோள்
279.	power supply	විදුලි සැපයුම්/ජව සැපයුම	மின் வழங்கி
280.	presence check	තථ්‍යතා පරීක්ෂාව	இருத்தல் சரிபார்த்தல்
281.	presentation layer	සමර්පන/ඉදිරිපත් කිරීම් ස්ථරය	முன்வைப்பு அடுக்கு
282.	primary key	ප්‍රාථමික/මුල් යතුර	முதன்மைச் சாவி
283.	primitive data type	ප්‍රාථමික දත්ත වර්ගය	பூர்வீகத் தரவு வகை
284.	privacy	පෞද්ගලිකත්වය	அந்தரங்கம்
285.	private key	පෞද්ගලික යතුර	பிரத்தியேகச் சாவி
286.	process	ක්‍රියාවලිය/ක්‍රියායනය/ සැකසුම	செயல்/ முறைவழியாக்கல
287.	process control block(PCB)	ක්‍රියායන පාලන ඛණ්ඩය	செயல் கட்டுப்பாட்டுத் தொகுதி
288.	process management	ක්‍රියායන කළමනාකරණය	செயல் முகாமைத்துவம்
289.	process states	ක්‍රියායන තත්ත්ව	செயல் நிலை
290.	process transition	ක්‍රියායන සංක්‍රමණය	செயல் நிலைமாறல்
291.	product commercialization	නිෂ්පාදන වාණිජ්‍යකරණය	தயாரிப்பு வர்த்தகமயமாக்கல்
292.	product of sum (POS)	ඒකයන්ගේ ගුණිතය	கூட்டுத்தொகையின் பெருக்கம்
293.	program translator	ක්‍රමලේඛ පරිවර්තක	செய்நிரல் மொழிபெயர்ப்பான்
294.	proprietary	හිමිකම් සහිත	தனியுரிமை
295.	protocol	නියමාවලිය	நடப்பொழுங்கு

296.	prototyping	මූලාකෘතිකරණය	மூலவகை மாதிரி
297.	proxy server	නියෝජන සේවාදායකය	பதிலாள் சேவையகம்
298.	pseudo code	ව්‍යාජ කේතය	போலிக்குறி
299.	public switch telephone network (PSTN)	පොදු ස්වීච දුරකථන ජාලය	பொது ஆளியிடப்பட்ட தொலைபேசி வலையயமைப்பு
300.	public key	පොදු යතුර	பொதுச் சாவி
301.	pulse code modulation	ස්පන්ද කේත මූර්ජනය	துடிப்புக்குறி பண்பேற்றம்
302.	pulse width modulation	ස්පන්ද විතර මූර්ජනය	துடிப்பு அகலப் பண்பேற்றம்
303.	radio button	විකල්ප තේරීම	ரேடியோ பொத்தான்
304.	random access memory (RAM)	සසම්භාවී ප්‍රවේශ මතකය	தற்போக்கு அணுகல் நினைவகம்
305.	range check	පරාස පරීක්ෂාව	வீச்சு சரிபார்த்தல்
306.	rapid application development (RAD)	ශීඝ්‍ර යෙදවුම් සංවර්ධනය	துரித பிரயோக விருத்தி
307.	read only memory (ROM)	පඨන මාත්‍ර මතකය	வாசிப்பு மட்டும் நினைவகம்
308.	real time	තථ්‍ය කාලික	நிகழ்நேரம்
309.	record	උපලැකියාන	பதிவு
310.	redo	නැවත කිරීම	மீளச் செய்
311.	redundancy	සමතිරික්තතාව	மிகைமை
312.	reference model	යොමු ආකෘතිය	வலையமைப்பின் கட்டமைப்பு
313.	refreshing	පුබුදු කිරීම	புத்துயிர்ப்பித்தல்
314.	register memory	රෙජිස්තර මතකය	பதிவகம்
315.	relational	සම්බන්ධක	தொடர்பு, உறவுநிலை
316.	relational model	සම්බන්ධක ආකෘතිය	உறவுநிலை மாதிரி
317.	relational database	සම්බන්ධක දත්ත සමුදාය	உறவுநிலை தரவுத்தளம்
318.	relational instance	සම්බන්ධා නිදර්ශනය	தொடர்பு முறை எடுத்துக்காட்டு

319.	relational schema	සම්බන්ධතා පරිපාටික සටහන	தொடர்பு முறைத் திட்டம்
320.	relationship	සම්බන්ධතාවය	தொடர்புமுறை
321.	remote	දුරස්ථ	தொலை, தூர
322.	render	විදැහු	வழங்கு
323.	repeater	පුනරීකථකය	மீளி, மீட்டி
324.	repetition	පුනරුක්තිය	மீள் செயல்
325.	reset button	පුතහාරමීභ බොත්තම	மீளமைப்புப் பொத்தான்
326.	retrieve	සමුද්ධරණ	மீள்பெறு
327.	return value	පුතහාගමන අගය	திரும்பல் பெறுமானம்
328.	reverse auction	පුතිවෙන්දේසිය	எதிர்மாற்று ஏலம்
329.	ring topology	මුදු ස්ථලකය	வளைய இடத்தியல்
330.	router	මං හසුරුව	வழிப்படுத்தி, வழிச்செலுத்தி
331.	routing	මං හැසිරවීම	வழிச்செலுத்தல்
332.	scanner	සුපිරික්සකය	நுணுகு நோக்கி
333.	scheduler	නියමකරණය	ஒழுங்குபடுத்தி
334.	scope of variable	විචලය පරාසය	மாறி செயற்பரப்பு
335.	query	විමසුම	வினவல்
336.	selection	තේරීම	தெரிவு
337.	selector	වරකය	தேர்வி, தேர்ந்தெடுப்பி
338.	sensor	සංවේදකය	உணரி
339.	sequence	අනුකුමය	தொடர்
340.	sequential circuit	අනුකුමික පරිපථය	தொடர்ச் சுற்று
341.	sequential search	අනුකුමික සෙවුම	வரிசைமுறைத் தேடல்
342.	server	සේවාදායකය / අනුගුාහකය	சேவையகம்
343.	session layer	සැසි ස්ථරය	அமர்வு அடுக்கு
344.	sharable pool	හුවමාරු පුංජය	பகிரதகு பொது இடம்
345.	sign-magnitude	ලකුණුවත් පුමාණය / සංලක්ෂීත	குறியுடைய வீச்சளவு

		පරිමාණනය / අංකිත පරිමාණනය	
346.	single user-multi task	ඒක පරිශීලක-බහු කාර්යය	தனிப்பயனர்-பற்பணி
347.	single user-single task	ඒක පරිශීලක-ඒක කාර්යය	தனிப்பயனர்-தனிப்பணி
348.	smart card	සුහුරු කාඩ්පත	சூட்டிகை அட்டை
349.	smart phone	සුහුරු දුරකථනය	சூட்டிகைத் தொலைபேசி
350.	smart system	සුහුරු පද්ධතිය	சூட்டிகை முறைமை
351.	social networking	සමාජ ජාලකරණය	சமூக வலையமைப்பாக்கல்
352.	software	මෘදුකාංග	மென்பொருள்
353.	software agent	මෘදුකාංග කාරක	மென்பொருள் முகவர்
354.	sort	තේරීම	வரிசைப்படுத்து
355.	source	ප්‍රභව	மூலம்
356.	spiral model	සර්පිල ආකෘතිය	சுருளி மாதிரி
357.	spooling	එතීම	சுற்றுதல்
358.	Star topology	තාරකා ස්ථලකය	வின்மீன் இடத்தியல்
359.	stepwise refinement	පියවරාකාර පිරිපහදුව	படிமுறை நீக்கல்
360.	storage	ආචයනය	சேமிப்பு
361.	storage allocation	ආචයන විභාජනය	சேமிப்பு ஒதுக்கல்
362.	stored program concept	ආචිත ක්‍රමලේඛ සංකල්පය	சேமிக்கப்பட்ட செய்நிரல் எண்ணக்கரு
363.	structure	ව්‍යුහය	கட்டமைப்பு
364.	structure chart	ව්‍යුහ සටහන	கட்டமைப்பு வரைபு
365.	structured	ව්‍යුහගත	கட்டமைப்புடைய
366.	structured query language(SQL)	ව්‍යුහගත විමසුම් බස	கட்டமைப்பு வினவல் மொழி
367.	submit button	යොමු බොත්තම	சமர்ப்பித்தல் பொத்தான்
368.	subnet mask	උප ජාල ආවරණය	உபவலை மறைமுகம்
369.	sub-netting	උප-ජාලනය	உபவலையமைப்பு

370.	sub-program	උප-ක්‍රමලේඛය	துணைச் செய்நிரல்
371.	sum of products (SOP)	ගුණිතයන්ගේ ඓක්‍යය	பெருக்கங்களின் கூட்டுத்தொகை
372.	supply chain management	සැපයුම් දාම කළමනාකරණය	விநியோக சங்கிலித்தொடர் முகாமைத்துவம்
373.	swapping	ප්‍රතිහරණය	இடமாற்றல்
374.	switch	ස්විච්‍ය	ஆளி
375.	syntax	කාරක රීති	தொடரியல்
376.	system development life cycle(SDLC)	පද්ධති සංවර්ධන ජීවන චක්‍රය	முறைமை விருத்தி வாழ்க்கை வட்டம்
377.	table	වගුව	அட்டவணை
378.	table check constraint	වගු පරීක්ෂා සංරෝධකය	அட்டவணை சரிபார்த்தல் கட்டுப்பாடு
379.	tag	උසුලනය	ஒட்டு
380.	Technical feasibility	තාක්ෂණික ශක්‍යතාව	தொழினுட்பச் சாத்தியக் கற்கை
381.	telecommuting	දුරස්ථ සංවාදය / දුර සන්නිවේදනය	தொலைசெயல்
382.	testing strategy	පරීක්ෂණ උපක්‍රමය	பரீட்சித்தல் உபாயம்
383.	text and font	පාඨ සහ අක්ෂර	வாசகமும் எழுத்துருவும்
384.	text formatting	පාඨ හැඩසව් ගැන්වීම	வாசக வடிவமைப்பு
385.	text input	පාඨ ආදාන	வாசக உள்ளீடு
386.	normal form	ප්‍රමත අවස්ථාව	இயல்பாக்கல் வடிவம்
387.	thumbnail	සැකෙව් රූ	குறும்படம்
388.	time division modulation (TDM)	කාල බෙදුම් මූර්ජනය	நேரப் பிரிவுப் பண்பாக்கம்
389.	time sharing	කාල විභජනය	நேரப்பகிர்வு
390.	timing	කාල ගණනය	நேரக்கணிப்பு
391.	top down design	මුදුන් බිම් සැලසුම	மேலிருந்து கீழான வடிவமைப்பு

392.	touch pad	ස්පර්ශක උපධානය / පාදකය	தொடு அட்டை
393.	touch screen	ස්පර්ශක තීරය	தொடுதிரை
394.	transaction processing system(TPS)	ගනුදෙනු සැකසුම් පද්ධතිය	பரிமாற்றச் செயலாக்க முறைமை
395.	transitive dependency	සංක්‍රාන්ති පරායත්තතාව	மாறும் சார்பு நிலை
396.	transport layer	ප්‍රවාහන ස්ථරය	போக்குவரத்து அடுக்கு
397.	transport protocol	ප්‍රවාහන නියමාවලිය	போக்குவரத்து நடப்பொழுங்கு
398.	tuple	උපලැකියාන/පේළිය	பதிவு/நிரை
399.	twisted pair	ඇඹරි යුගල	முறுக்கிய சோடி
400.	two's compliment	දෙකෙහි අනුපූරකය	இரண்டின் நிரப்பி
401.	type check	ප්‍රරූප පරීක්ෂාව	வகை சரிபார்த்தல்
402.	constraint	සංරෝධනය	கட்டுப்பாடு வகை
403.	ubiquitous computing	සර්වවර්ති ආගණනය	எங்கும் வியாபித்த கணிமை
404.	undo	අහෝසි කිරීම	செயல்தவிர்
405.	unguided media	නියමු නොවන මාධ්‍ය	வழிபடுத்தப்படாத ஊடகம்
406.	uni-casting	සෘජු සම්ප්‍රේෂණය	தனிப்பரப்பல்
407.	unicode	යුනිකෝඩ්/ ඒකකේත	ஒற்றைக்குறி முறை
408.	unique constraint	අනන්‍ය සංරෝධකය	தனித்துவக் கட்டுப்பாடு
409.	unit testing	ඒකක පරීක්ෂණය	அலகுச் சோதனை
410.	universal	සාර්වත්‍ර	பொது
411.	updating	යාවත්කාලීන කිරීම	தற்காலப்படுத்தல்
412.	user	පරිශීලක	பயனர்
413.	user defined	පරිශීලක නිර්වාචිත	பயனர் வரையறை
414.	validation	වලංගු කිරීම	செல்லுபடியாக்கல்
415.	variable	විචල්‍යය	மாறி
416.	very large scale integration (VLSI)	ඉතා විශාල පරිමාණයේ අනුකලිත	மிகப் பெரியளவிலான ஒருங்கிணைப்பு

417.	video graphic adapter (VGA)	දෘශ්‍ය චිත්‍රක අනුහුරුකුරුව	காணொளி வரையி பொருத்தி
418.	virtual community	අතථ්‍ය ප්‍රජාව	மெய்நிகர் சமூகம்
419.	virtual memory	අතථ්‍ය මතකය	மெய்நிகர் நினைவகம்
420.	virtual storefront	අතථ්‍ය වෙළඳ ප්‍රදර්ශනාගාරය	மெய்நிகர் கடைமுகப்பு
421.	waterfall model	දියඇලි ආකෘතිය	நீர் வீழ்ச்சி மாதிரி
422.	wave length	තරංග ආයාමය	அலை நீளம்
423.	web portal	වෙබ් ද්වාරය	வலை வாசல்
424.	web server	වෙබ් සේවාදායකය	இணைய சேவையகம்
425.	web service provider	වෙබ් සේවා සැපයුම්කරු	இணைய சேவை வழங்குநர்
426.	white box testing	ස්වේත මංජුසා පරීක්ෂාව	வெண்பெட்டிச் சோதிப்பு
427.	world wide web (WWW)	ලෝක විසිරි වියමන	உலகளாவிய வலை
428.	uniform resource locator (URL)	ඒකාකාරී සම්පත් නිශ්චායකය	சீர்மை வள இருப்பிடங்காட்டி
429.	uniform resource identifier(URI)	ඒකාකාරී සම්පත් හඳුන්වනය	சீர்மை வள அடையாளங்காட்டி

This glossary is still being developed.