COMPUTER SCIENCE

8

Based on Single National Curriculum 2022

Punjab Curriculum and Textbook Board, Lahore

بِسۡمِ اللّٰہِ الرَّحۡمٰنِ الرَّحِیۡمِ

(In the Name of Allah, the Most Compassionate, the Most Merciful.)

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ONE NATION, ONE CURRICULUM

PUNJAB CURRICULUM AND TEXTBOOK BOARD, LAHORE

This textbook is based on Single National Curriculum 2022 and has been approved by the Board.

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1 Emerging Technologies

Knowledge:

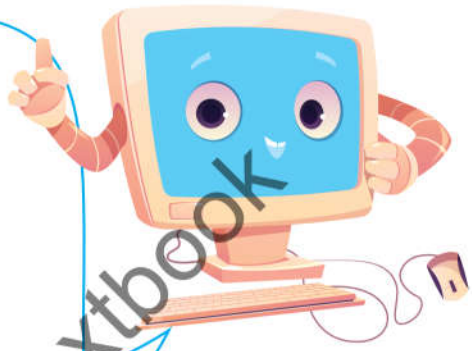
Students will be able to:

Name and explain the applications of emerging technologies in various walks of life (e.g. artificial intelligence, 5G, robotics, computer-assisted translation, 3D and holographic imaging, virtual reality, distributed applications, block-chain, and machine learning).

Skills:

Students will be able to:

Analyze emerging technologies relevant to different fields. (e.g. artificial intelligence, 5G, robotics, computer-assisted translation, 3D and holographic imaging, virtual reality, distributed applications / block-chain, and machine learning).



Emerging Technologies

New technology is generally referred to as 'Emerging Technology.' It is the advancement in the existing technology. Emerging technologies are under development technologies that will replace the current technologies in the near future. We will use them in every field of life including education, information technology, medical, transportation, communication and many more.

Do You Know?

There are websites that may be used to see and study the working of almost all technologies of the world. i.e., www.howstuffworks.com

Examples of Emerging Technologies:

You will see the emerging technologies in action in every field of life. Some of these technologies are discussed below:

Robotics

The branch of engineering that is used to manufacture intelligent machines to assist humans in different tasks is called Robotics. These intelligent machines are called Robots. They have a wide range of uses in almost all areas of life. These intelligent machines interact with their surroundings and can take a variety of actions. These machines cannot only perform various tasks without human interference, but they can also help humans perform their tasks more efficiently.

Robots are used in manufacturing, mining, logistics, healthcare, the kitchen, landmine detection, and many other areas.

We will soon see robots everywhere.

Do You Know?

The Czech word "robota" is the source of the English term "robot." It means "hard work."

Teacher Note

Students may be asked to act like a robot. They will be guided by the teachers to perform the same action e.g., to receive a book from one student and to pass it to the next student again and again. When the students get tired, bored or unable to perform the action with the same perfection, they should be told that robots have no feelings and can perform the actions for days and months with perfection.

Artificial Intelligence

Artificial intelligence (AI) is a branch of Computer Science that deals with building smart machines capable of performing tasks intelligently. These artificially intelligent machines are intelligent enough to learn from their own experiences, just like humans.

Applications of artificial intelligence include self-driving cars, expert systems, natural language processing, machine vision, chatbots, gaming, marketing, social media, navigation control, etc. Artificial intelligence will influence every field of life in the near future and will also lead towards more inventions.

Self-Driving Cars

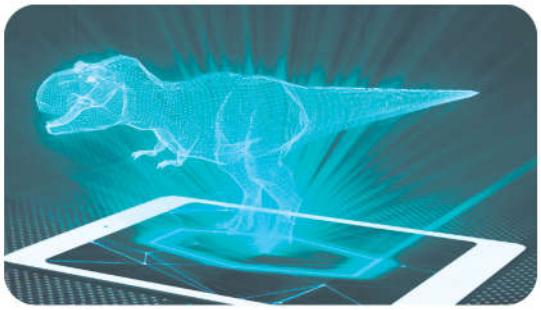
A self-driving car is also known as an autonomous vehicle (AV), driverless car, or robotic car. Self-driving cars use a variety of sensors such as thermo-graphic cameras, radar, GPS, and inertial measurement units to observe their surroundings and identify appropriate navigation paths. These cars do not need

a driver.

An example of a self-driving automobile is Google's Waymo experiment. It is almost totally autonomous.

3D Imaging

3D imaging is a technique for giving depth to an image. Simple images are created on a 2D plane, with height and width whereas, 3D imaging gives the third dimension of depth to the images also. It establishes an optical illusion of depth by capturing an item in three dimensions. Some of its applications include computed tomography (CT), 3D laser scanning, magnetic resonance imaging (MRI), 3D movies, etc.

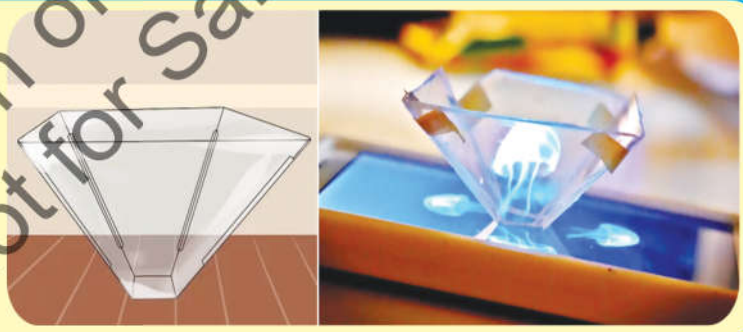


Holographic Imaging

A 3D hologram is a 3D projection of a 3D recorded image that matches almost exactly with the original object. You do not need to use 3D glasses to see this image. 3D holographic imaging is commonly used in meetings, exhibitions, education, military mapping, medical, art, product presentations, museums, and many more.

Do You Know?

You can create holograms by using simple mobile and a piece of glass or plastic cut and joined at the angle of 45 degree? You may practice it at home.



Virtual Reality

The use of computer technology to create a virtual environment that can be viewed through virtual reality headsets is known as Virtual Reality or VR. It is a computer-generated imitation of the real world where people can interact in an apparently real or physical way.

The users can interact and explore the virtual environment. Reality is experienced by the users through their senses. This virtual reality is produced by a VR headset. It is mostly used for training, entertainment, in the auto industry, education, healthcare, architecture, training, tourism, and more.

Do You Know?

You can use your cell phone for Virtual Reality Visualisation. Search for a VR application in your mobile or download it from Google Play store. Now you only need a VR Headset which is not costly. Just put your cell phone in a VR Headset and start experiencing the ultimate fun of Virtual Reality.

Augmented Reality

Unlike virtual reality, augmented reality manages to merge digital and three-dimensional (3D) components with an individual's perception of the real world. It aims to change the perception by utilising video, infographics, photos, sound, and other features.

Do You Know?

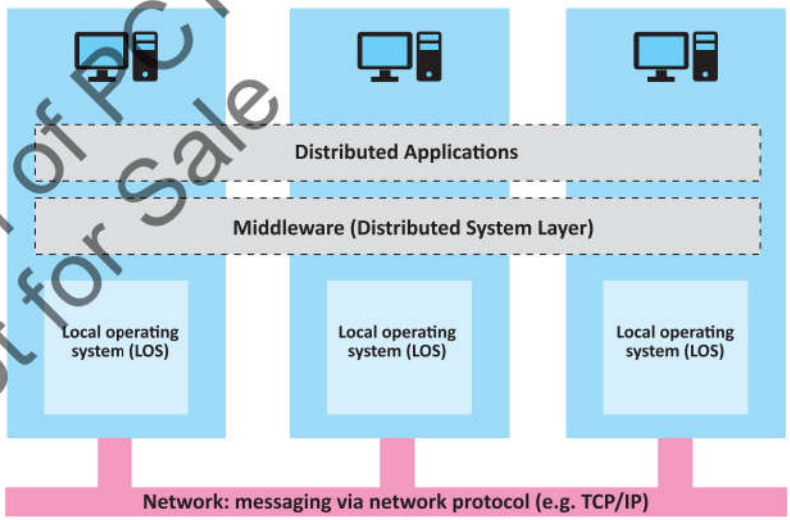
The number of AR application cases is rapidly expanding. The AR industry is anticipated to be valued more than $18 billion in 2023.

Augmented reality is now used in various industries including gaming, medical field training, public safety, education, and other types of entertainment.

Distributed Applications

Distributed applications are those that operate simultaneously on several different computers. These systems operate on the network and communicate with each other to complete a specific task.

The internet is a very famous example of a distributed system. The sharing of information amongst numerous different computer systems located in various locations is made possible by the internet.



Blockchain

Blockchain is a method of storing data in blocks that makes it difficult or even impossible to change the data or hack it. Blocks create a chain because each one has information about the block before it, hence strengthening the links in the chain. The transaction or file recorded cannot be modified.

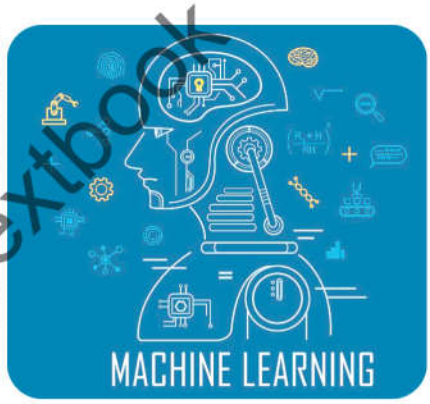
Blockchain technology is used to innovate games, secure healthcare data, provide transparency for the

business, financial services, market trends, and data-driven research. Blockchain technology is also the backbone of all Cryptocurrencies.

Activity

Students are required to search for at least five Cryptocurrencies on the internet which are being used these days. They will also list their current exchange rate with USD.

Machine Learning



Machine learning is a branch of artificial intelligence that enables a system to learn and improve itself from its experience without any user interference. Machine learning deals with the development of computer programs that can access data (training data) and use it to learn for themselves.

A real-world example of machine learning can be image recognition. It can be used to indicate if an x-ray is cancerous or not, give a name to a face in a photo, and recognise handwriting. Some other applications include data analysis, social media services, email filtering, online customer support, search engine, and online fraud detection.

5G

The abbreviation 5G is used to refer to the Fifth Generation of Cellular Technology. An estimate of its data transfer rate is 20 Gbps. In comparison to earlier generations, it is much faster, more flexible, and has less data transfer delays. Although 5G is already available in specific areas of some countries, it will be used far more in the coming years.

The applications of 5G technology include autonomous vehicles, video games, smart farming, the medical field, operations, the defence industry, and many more industries.

Computer Assisted Translation

Using software programs to translate written and spoken texts from one language to another is known as Computer Assisted Translation. The translation that is conducted using a software program enables a human translator to work more quickly and precisely. It is called CAT for short.

It speeds up lengthy translations, reduces errors, is affordable, and is widely used. Language Service Providers (LSPs), translation and localisation companies, independent translators, multilingual workers, etc. frequently use Computer Assisted Translation tools.

Google Translator is an example of Computer Assisted Translation.

Glossary

assist	an act of giving help	autonomous	independent, able to control itself
interference	the act of getting involved in	multilingual	ability to speak different languages
capable	ability to do something	assisted	to give support, to help
inertial	related to inertia, a property of matter	simultaneously	at the same time

LET'S HAVE A LOOK

- Emerging technologies are under development technologies that will replace the current technologies in the near future.
- A self-driving car is also known as an autonomous vehicle (AV), driver-less car, or robotic car.
- Virtual Reality or VR is a computer-generated imitation of the real-world where people can interact in an apparently real or physical way.
- Blockchain is a method of storing data that makes it difficult or even impossible to change the data or hack it.
- Machine Learning is a branch of Artificial Intelligence that enables a system to learn and improve itself from its experience without any user interference.
- The abbreviation 5G is used to refer to the Fifth Generation of cellular technology.
- Using software programs to translate written and spoken texts from one language to another is known as Computer Assisted Translation (CAT).

Exercise

A. Multiple Choice Questions: Tick the correct answer.

1. _____ is generally referred to as 'Emerging Technology.'
   a. Discontinued development b. New technology
   c. Best technology d. None of these
2. Which of the following is not an example of an emerging technology?
   a. Virtual Reality b. Blockchain c. Robotics d. 3G
3. _____ technology is a computer-generated imitation of the real-world where people can interact in an apparently real or physical way.
   a. VR b. AR c. CR d. all of these
4. _____ applications are those which operate simultaneously on several different computers.
   a. Embedded b. Virtual c. Distributed d. None of these

5. In a blockchain system, the transaction or file recorded cannot be_____.
   a. opened **b.** read **c.** saved **d.** modified
6. The estimated data rate of 5G technology is _____.
   a. 10Gbps **b.** 15Gbps **c.** 20Gbps **d.** 25Gbps
7. _____ is a branch of Artificial Intelligence that enables a system to learn and improve itself from its experience without any user interference.
   a. Blockchain **b.** Machine Learning **c.** Virtual Reality **d.** None of these
8. Chatbot is an example of:
   a. Virtual Reality **b.** Augmented Reality **c.** Robotics **d.** Artificial Intelligence
9. CAT is also known as:
   a. Computer Assisted Transaction **b.** Computer Authorised Translation
   c. Computer Assisted Translation **d.** Computer Application Translation
10. A self-driving car is also known as:
    a. Autonomous vehicle **b.** Driverless car **c.** Robotic car **d.** All of these

B. Write 'T' for True and 'F' for False in the boxes

1. Absolute technology is generally referred to as 'Emerging Technology.' ☐
2. A self-driving car, also known as an manual vehicle. ☐
3. Virtual Reality or VR is a technology that creates a natural environment. ☐
4. Robotics is replacing human efforts. ☐
5. Virtual Reality is a 2D image. ☐
6. Virtual Reality is the same as Augmented Reality. ☐
7. Machine Learning is a system that improves itself with experience. ☐

C. Answer the following short questions:

1. What is meant by augmented reality?
2. What are some of the applications of AI?
3. What is holographic imaging?
4. What are the primary difficulties in robotics?
5. What are the other names used for self-driving cars?
6. State the applications of 3D imaging.
7. Which device is used to experience virtual reality?

8. What is the main purpose of using Computer Assisted translation?
9. How can you create a hologram at home?
10. What makes 5G better than previous ones?

D. Answer the following long questions:

1. Write a note on blockchain.
2. What are the differences between Virtual Reality and Augmented Reality?

Learning Activities

Activity 1: (Research and Present)

- Divide the students into two groups.
- Name both groups as Group A and B respectively.
- Ask each group to research about various emerging technologies of their choice and present features, applications, advantages, and disadvantages.

Activity 2: (Mapping)

- Divide the students into suitable pairs.
- Ask each pair to open Google Maps on their computer/smartphone.
- Ask them to type their home address in the search bar and click Search.
- Ask them to click Get Directions and type the school's address in the starting directions bar and click Search.
- Ask them to look at the map (or satellite view) and check if that's the route of you getting to school.

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Answers

A: Tick the correct option.

1	b	2	d	3	b	4	c	5	d
6	c	7	b	8	d	9	c	10	d

B: True and False

1	F	2	F	3	T	4	T	5	F
6	F	7	T						

2 Data Communication and Computer Networks

Knowledge:

Students will be able to:

- Describe and differentiate between the types of computer networks:
  - o LAN
  - o MAN
  - o WAN
  - o VPN
- Explain the types of physical transmission media, and their uses:
  - o Guided (Twisted Pair, Coaxial, Fiber Optics)
  - o Unguided (wifi and lifi).
- Explain the types of wireless/wire transmission media, and their uses:
  - o Cellular Communication
  - o Satellite Communication
  - o Global Positioning System
  - o Bluetooth
- Explain the concept of
  - o IoT (Internet of Things)
  - o Embedded Systems
  - o Edge Computing
  - o Data Analytics

Skills:

Students will be able to:

- o Apply knowledge of networks to identify types of transm relevant to a specific environment.

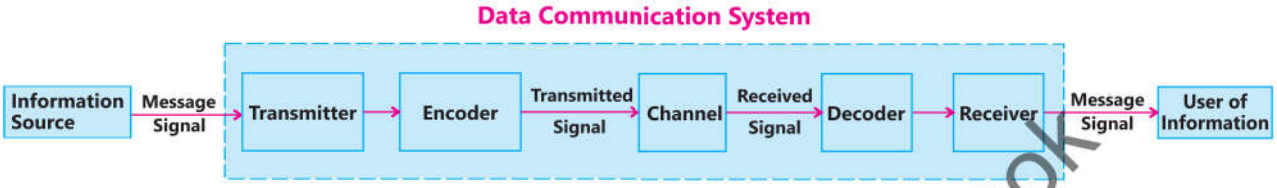
Data Communication

The process of sending and receiving data electronically from one location to the other is called Data Communication. Data is transferred using some wired or wireless media.

Components of Data Communication:

Following are the main components of data communication system:

- Message
- Sender
- Receiver
- Transmission Media
- Encoders and Decoders



Message:

A message is the data to be sent. It may be text, image, audio, video, or a combination of these. For example, if you send a picture on WhatsApp to your friend, this picture is a message.

Sender:

A computer or a device that sends a message is called a Sender. It may be a computer, mobile phone, camera, or anything that can send a message over a network.

Receiver:

A computer or a device that receives messages is called a Receiver. Again, it may be a computer, mobile phone, fax machine, or anything that can receive the message.

Transmission Media

It is the path on which a message travels from the sender to the receiver. It may be through wired or wireless media.

Encoders and Decoders

Encoders are the devices that convert digital signals into a form that can travel over wired or wireless media on the sender's side. Decoders receive these converted signals on the receiving side and convert them again into the digital form that can be stored and processed on computers or on other devices.

Communication Media

The path on which data is sent or received over a network is known as Communication Media. There are two main categories of transmission media i.e. wired (physical) and wireless media.

Physical Transmission Media

A physical medium in data communications is the physical path over which a signal transmits. It is also called Guided Media or Bounded Media. Different types of transmission media are used as communication channels. The common types of these physical media are as under:

1. Twisted Pair Cable

Twisted pair cable is a type of physical media that is commonly used. It is made by twisting two separate insulated wires together that run parallel to one another. Each twisted pair wire consists of two separate insulated copper wires that are twisted together to reduce transmission noise.

A twisted pair cable is less expensive as compared to other transmission media. It is a lightweight cable and easy to install.

Advantages of Twisted Pair Cable

- It is relatively easy to implement and terminate.
- It is less expensive.
- Performs best in short distances.
- It is low in weight.
- It is flexible to use.
- It is easy to connect.
- Suitable for data and voice infrastructure

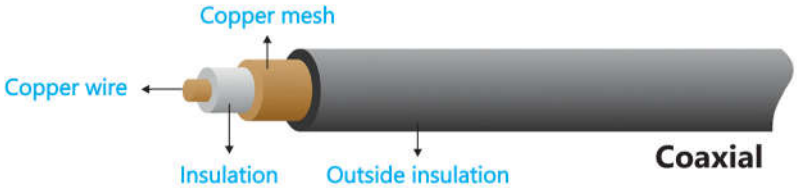
Disadvantages of Twisted Pair Cable

- Attenuation (the degradation of signal over distance) is very high.
- It provides poor security and is relatively easy to tap.
- They could break easily because they are thin.
- Low durability (must be maintained regularly).
- Susceptible to electromagnetic interference (EMI).

Coaxial Cable

Coaxial cable consists of a single copper wire surrounded by at least three layers.

- An insulating material
- A woven or braided meta
- A plastic outer coating



It has a higher data transmission rate as compared to a twisted pair cable. Coaxial cable is frequently used in cable television (CATV) network cabling because it can be cabled over larger distances than twisted-pair cable.

Advantages of Coaxial Cable

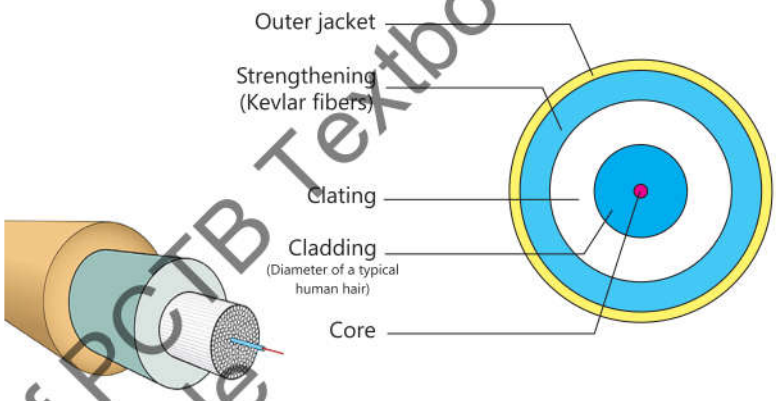
- Data can be transmitted at high speed.
- It has enhanced shielding as compared to twisted pair cable.
- It provides advanced bandwidth.

Disadvantages of Coaxial Cable

- It is more expensive compared to a twisted pair cable.
- Any fault in the cable causes the failure of the entire network.

Fiber Optic Cable

A fiber-optic cable's core is made up of many small, light-transmitting glass, plastic or silica fibers. The core of fiber optic is the innermost layer. This core is encased in a shield that protects the strands from intrusion. The plastic coating protects the optical fibres from the effects of electromagnetic interference, heat, and cold.



Advantages of Fiber Optic Cable:

- It provides more bandwidth.
- It carries the data in the form of light. This allows the fiber optic cable to convey the signals at a higher rate.
- It transports the data at longer distances.
- It is more reliable as it is resistant to any temperature changes.
- It is thinner and lighter in weight so it can withstand more pull pressure.
- It is less prone to noise.

Disadvantages of Fiber Optic Cable:

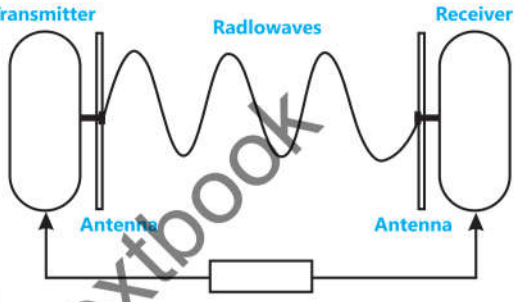
- Fiber optic cables are costly.
- They require extensive maintenance.
- It is difficult to connect them with other devices.
- They are easily breakable.
- Installation is difficult because of its delicate nature.

Unguided Media

An unguided transmission media transmits electromagnetic waves or signals without using any physical medium. It is also known as wireless transmission. There are three main categories of unguided media as follows:

• Radio Waves Transmission

The electromagnetic waves that travel through open space in all directions are known as Radio Waves. These low-frequency electromagnetic waves range from '3 kHz to 1GHz'. As radio waves have a low frequency, they can pass through objects like walls, allowing you to receive signals even when you are within a structure.



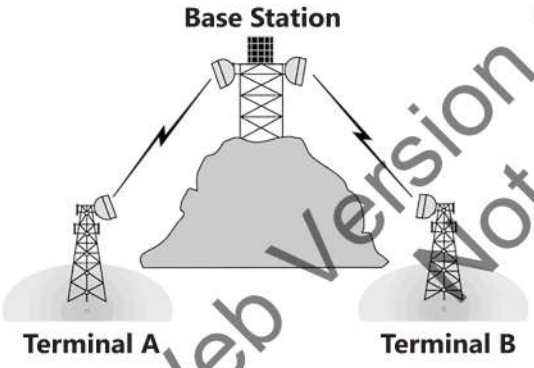
Do You Know?

Hertz is the unit of frequency. It is written as Hz.

Examples of radio waves include FM radio, cordless phones, and television.

• Microwaves Transmission

Microwaves are electromagnetic waves that have frequencies between '1 and 300 GHz.' Microwaves only travel in a straight line. The communication between two endpoints and lines of sight becomes much easier to establish once the transmission medium is facing each other.



Some examples of the areas where microwaves are used include radio navigation systems, point-to-point communication systems on the surface of the Earth, sensor systems, satellite communications, deep space radio communications, and mobile phone communications.

Do You Know?

Number of waves passing through an area per unit time is called frequency.

• Infrared Waves Transmission

A wireless method used for communication over short distances is infrared transmission. The infrared spectrum has frequencies between 300 GHz and 400 THz. Due to its high frequency, infrared transmission cannot pass through the walls.

Some examples of the areas where infrared waves are used include TV remote control usage, data transfer between two mobile phones, data transfer between a computer and cell phone, etc.

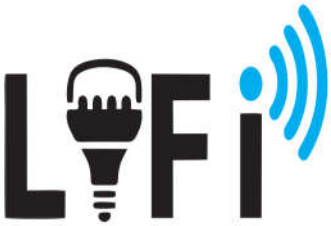

Television


Infrared Radiations


Remote

Wi-Fi (Wireless Fidelity)

A Wi-Fi network is simply an internet connection that is shared with multiple devices in a home or business via a wireless router. The router is connected directly to the internet and acts as a hub to broadcast the internet signals to all your Wi-Fi-enabled devices. It provides you the flexibility to stay connected to the internet if you are within your network coverage area.



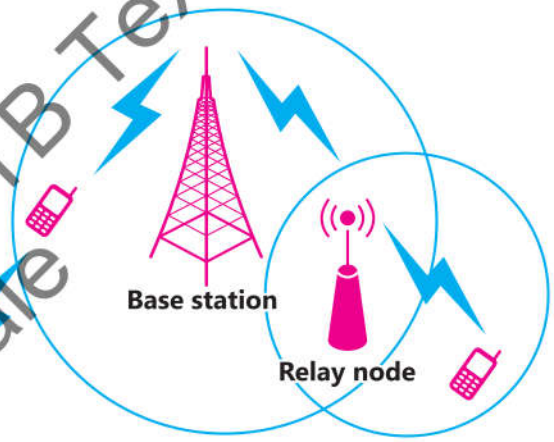
Li-Fi (Light Fidelity)

Li-Fi is a wireless optical networking technology that uses LEDs for data transmission. In simpler words, Li-Fi is a light-based Wi-Fi that uses light instead of radio waves to transmit information. Li-Fi transmission speeds can go over 100 Gb per second which is 14 times faster than the world's fastest Wi-Fi.

Wireless Transmission Services

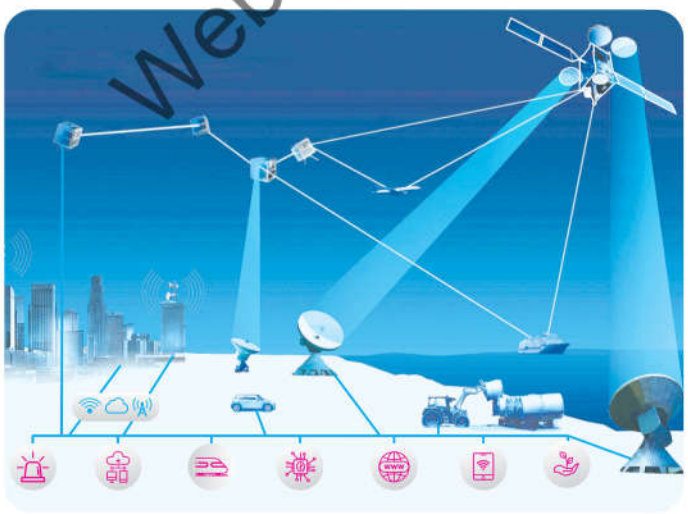
These wireless communication services allow us to send voice, data, movies, photos, and other types of content using air as a medium. It includes:

- Cellular Communication
- Satellite Communication
- Global Positioning System
- Bluetooth



Cellular Communication

A cellular network is a radio network distributed over a vast area through hexagonal cells. Each cell in this network includes a fixed location transceiver known as the base station. These cells together provide coverage of mobile phones over larger geographical areas.



Satellite Communication

Satellite Communication System is an important type of wireless communication. Satellite Communication Networks provide worldwide coverage.

Satellite Communication Systems offer different services like telecommunication (by using Satellite Phones), positioning and navigation (by using GPS), broadcasting, internet, etc. Satellite Communication Systems are necessary for mobile, television transmission, and other wireless services.

Global Positioning System (GPS)

GPS is a subcategory of satellite communication. It is primarily used in applications for positioning, navigation, monitoring, and surveying with the help of dedicated GPS receivers and satellites. It is now used in many applications where mobility is needed. GPS receivers are also available in mobile phones.

Do You Know?

In 1996, GPS was first made available in automobiles. Its initial applications were used for military purposes.

Bluetooth

Bluetooth is another important low-range wireless communication system. It provides data, voice, and audio transmission with a transmission range of 10 meters. Bluetooth devices are present in almost all smartphones, tablets, and laptops. They are compatible with cameras, audio equipment, wireless Bluetooth receivers, and other devices.

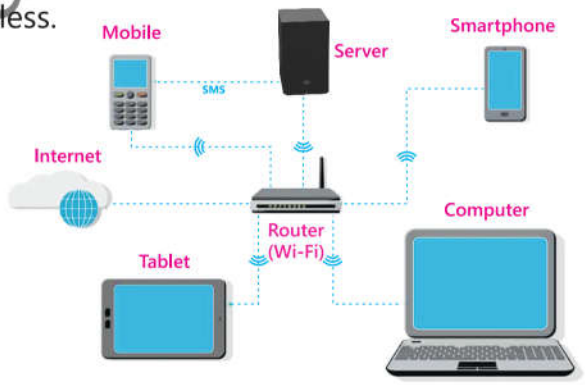
Computer Networks

A computer network is a system that connects two or more devices for sharing and transmitting information. These devices include everything from a mobile phone to a server and may be connected using physical wires or wireless.

Different types of networks are as follows:

Local Area Network (LAN)

In this type of network, two or more computers and devices are connected within a small area, for example, in a room, office building, or a campus. LANs are the best choice for networking in a small geographic area.



Either you have a home network with two or more computers, or you are at your school where more than 20 computers are connected to each other, you are on a LAN.

LAN may use cables or wireless media. WLAN is another name for wireless local area network.

Advantages

- It does not cost a lot of money.
- Data is saved centrally.
- The rate of data transfer is high.
- Central management of resources and software is possible.
- The entire LAN is simple to operate and easy to control.

- The addition of systems to the network is very easy.

Disadvantages

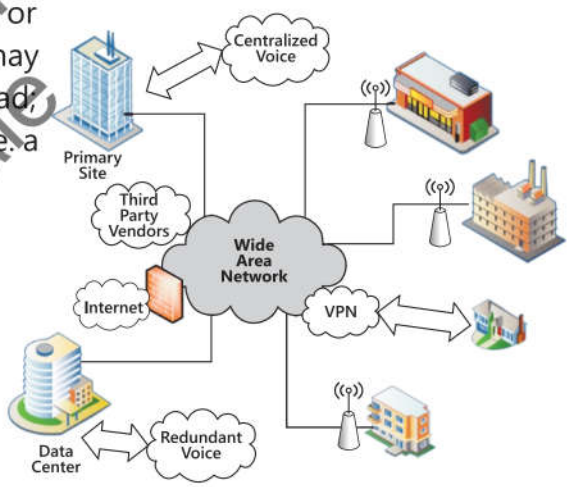
- It covers limited geographic area.
- It is easier for a virus to spread.
- Extremely high maintenance is required.
- The failure of the central device may fail the whole network.
- Extensive cabling may be required.

Devices Used in LAN

In LAN, we use network interface cards, wireless cards, network switches, bridges, and routers etc.

Wide Area Network (WAN)

A wide area network spans a large geographic area, such as an entire city, region, or even an entire country or all over the world. WAN connections often involve two or more relatively distant LANs. For example, a WAN may connect an office in Lahore with an office in Faisalabad; it is the geographic distance that makes a network, i.e. a WAN. Internet is the world's largest WAN.



Advantages

- It covers large geographical area.
- It provides more privacy to its users.
- The communication on WAN is simple.
- Its IT infrastructure is centralised

Disadvantages

- It has slower speed than LAN.
- Its maintenance is extremely complex.
- The setup cost of WAN is very high.
- It is not a reliable network.
- High-performance devices are needed.

Devices Used in WAN

PSTN (Public Switched Telephone Network) or satellite links are communication devices

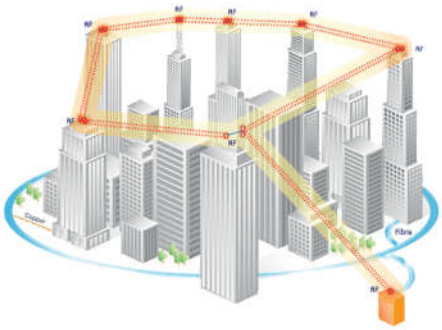
used for WAN. Long-distance transmission causes greater noise and inaccuracy in WANs than in LANs. Different devices like routers, gateways, manageable switches, modems, and network interface cards are used in WAN.

DIFFERENCE BETWEEN LAN and WAN

LAN	WAN
1. LAN is restricted to a small geographical area. It links devices within a building or group of buildings.	1. WAN covers greater distances and operates worldwide.
2. LAN operates at a faster speed, more than WAN.	2. WAN is slower than LAN in terms of speed.
3. LAN is privately owned.	3. WAN ownership might be either public or private.
4. LANs are less expensive than WANs.	4. WAN is more expensive than LAN.
5. Data transfers more quickly through LAN.	5. WAN transmits data at a slower rate than LAN.

Metropolitan Area Network (MAN)

A metropolitan area network connects the local area networks in a city or town. A MAN is a network that is smaller than a typical WAN but larger than a LAN. The best-known examples of MAN include Television cable network, Cable Internet, etc.



Advantages

- It offers greater security than a WAN.
- It is larger than LAN and covers the area of a city.
- MAN uses fewer resources than WAN since it is less expensive to implement than WAN.

Disadvantages

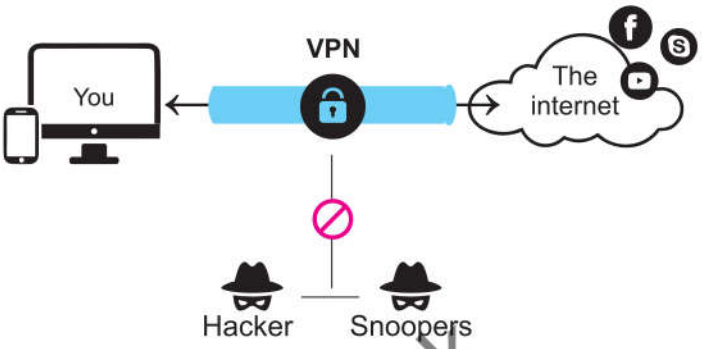
- For a MAN connection from one location to another, more cable is needed.
- When compared to LAN, the data rate is slow.
- Making a system secure against hackers is challenging.
- Managing the extensive network is challenging.
- It is more expensive than LAN.

Devices Used in MAN:

Peripheral devices, modems, and wire/cable are utilized to transmit data over MAN. It might involve LANs establishing phone connections and radio waves to link to other LANs.

Virtual Private Network (VPN)

A virtual private network, or VPN, is a secured connection over the Internet from a device to a network. This secured connection ensures that sensitive data is safely transmitted. It prevents unauthorised people from interfering with traffic and allows the user to conduct work remotely. VPN technology is widely used in corporate environments.



The Internet of Things (IoT)

A network of interconnected computing devices is known as the Internet of Things. These devices include people or things. It is frequently referred to by the acronym IoT.

Any other living thing or artificial product that can be given an IP address and communicate data across a network can be considered an item in the internet of things. Some of its examples include:

- A person with a heart monitor implant.
- A farm animal with a biochip transistor/receiver.
- A vehicle with sensors built in to alert the driver when the tyre pressure is low.

Do You Know?
By 2027, there are expected to be 41 billion IoT devices.

Examples of Internet of Things (IoT)

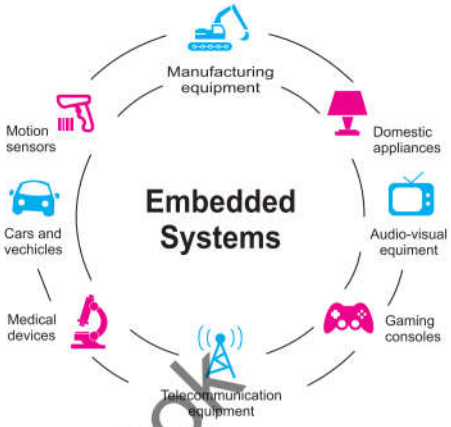
- Connected appliances
- Smart home security systems
- Autonomous farming equipment
- Wearable health monitors
- Smart factory equipment
- Wireless inventory trackers
- Biometric cyber security scanners

Embedded Computers

A dedicated computer system that is an essential component of a bigger machine or system is known as an Embedded Computer or Embedded PC. An embedded computer typically has a specific purpose only. These computer systems are commonly used in industries,

vehicles, traffic control systems, etc.

Embedded Systems



An embedded system is a microprocessor-based computer hardware system with software that is used to perform a specific function, either as a separate system or as a part of a large system. Examples of embedded systems include digital cameras, smart watches, MP3 players, appliances such as refrigerators, washing machines, microwave ovens, etc.

Edge Computing

The word edge in computing means geographic distribution. Edge computing is a computing model in which we focus on bringing computing devices and sources of data as closely as possible to improve response times and save bandwidth. Edge computing refers to architecture rather than a specific technology. In this way, we can minimise the number of long-distance communication costs.

Following are some applications of Edge Computing:

- autonomous vehicles
- remote monitoring of assets in the oil and gas industry
- predictive maintenance
- in-hospital patient monitoring
- cloud gaming
- traffic management

Data Analytics

Data analytics is the science of analysing raw data to make assumptions about that information. Many of the techniques and processes of data analytics have been devised or used as automated procedures and algorithms that work over raw data for human consumption.

Data analytics:

- help a business optimise its performance.
- help individuals and organisations to organise data
- typy examine raw data for insights and trends.

Glossary

convey	transport or carry to place	bandwidth	maximum amount of data transmitted in a given amount of time.
delicate	easily broken or damaged	hexagonal	having six sides and six angles
susceptible	Likely to be influenced by something	withstand	remain undamaged or unaffected

LET'S HAVE A LOOK

- A physical medium in data communications is the physical path over which a signal transmits. It is also called Guided Media or Bounded Media.
- Twisted pair cable is made by twisting two separate insulated wires together that run parallel to one another.
- The electromagnetic waves that travel through open space in all directions are known as Radio Waves.
- Coaxial cable is frequently used in cable television (CATV) network cabling because it can be cabled over larger distances than twisted-pair cable.
- The plastic coating protects the optical fibres from the effects of electromagnetic interference, heat, and cold.
- An unguided transmission transmits electromagnetic waves without using any physical medium. Therefore, it is also known as wireless transmission.
- A cellular network is a radio network distributed over a vast area through hexagonal cells.
- GPS is a subcategory of satellite communication.

Exercise

A. Multiple Choice Questions: Tick the correct answer.

1. Li-Fi is a wireless optical networking technology that uses ____ for data transmission.

   a. fiber optic cable **b.** coaxial cable **c.** LEDs **d.** none of these

2. The network with a small geographical area is called:

   a. LAN **b.** WAN **c.** MAN **d.** all of these

3. An unguided transmission media transmits electromagnetic waves without using any _____ medium.

   a. social **b.** physical **c.** both **d.** none of these

4. In the _____ network, computers are not physically connected.
   a. LAN **b.** WAN **c.** MAN **d.** none of these
5. _____ is a secured connection over the internet.
   a. LAN **b.** WAN **c.** VPN **d.** none of these
6. PSTN (Public Switched Telephone Network) or satellite links are _____ devices used for WAN.
   a. deleting **b.** storing **c.** communication **d.** all of these
7. _____ is a subcategory of satellite communication.
   a. Bluetooth **b.** GPS **c.** WiFi **d.** Router
8. A _____ network is an internet connection that is shared with multiple devices in a home or business via a wireless router.
   a. WiFi **b.** LiFi **c.** Router **d.** GPS
9. Wi-Fi stands for:
   a. Wired Fidelity **b.** Wired Function **c.** Wireless Fidelity **d.** none of these
10. Bluetooth is another important _____-range wireless communication system.
    a. high **b.** low **c.** mid **d.** side

B. Write 'T' for True and 'F' for False in the boxes.

1. The entire LAN is simple to operate and easy to control. ☐
2. WAN covers greater distance and operates nationwide. ☐
3. Each twisted pair wire consists of seven joined insulated copper wires. ☐
4. Bluetooth technology allows devices to communicate with each other using cables. ☐
5. An unguided transmission transmits electromagnetic waves without using any physical medium. ☐
6. Optical Fiber Cable is thinner and lighter in weight so it can withstand more pull pressure than a copper cable. ☐
7. Microwaves only travel in a straight line. ☐

C. Answer the following short questions:

1. Describe the advantages and disadvantages of the twisted pair cable.
2. What is a coaxial cable?
3. What are the basic elements of fiber optic cable?
4. What is the difference between Wi-Fi and Li-Fi?
5. Explain the terms data communication, message, encoder, and decoder.
6. Differentiate between LAN and WAN.
7. What are the characteristics of a twisted pair cable?
8. Why are computer networks necessary?
9. Do you believe the Internet of Things will become popular in the future?

D. Answer the following long questions:

1. What is a coaxial cable? Explain the advantages and disadvantages of coaxial cable.
2. Write a detailed note on wireless transmission media.
3. What is unguided media? Write its three transmission categories in detail.

Learning Activities

Activity 1: Digital Systems – Networks

- In class project: Students can individually or as groups demonstrate network or router function through posters, explanations, or acting.
- Reflection questions can include:
  - Definition and functions of domain name server (DNS)
  - Packet transmission through the internet using transmission control protocol/ internet protocol (TCP/IP).

Activity 2: Tablets of Stone

- In class project: Students can individually or as groups explore working of digital systems and protocols through presentation, role-play, diagram, flowchart

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- Chapter 9- Review - Yola. **http://agu.yolasite.com/resources/Computer_Application/Reviews/Review%20Ch%209.pdf**

Answers

A: Tick the correct option.

1	c	2	a	3	b	4	b	5	c
6	c	7	b	8	a	9	c	10	b

B: True and False

1	T	2	T	3	F	4	F	5	T
6	T	7	T						

3 Microsoft Excel

Knowledge:

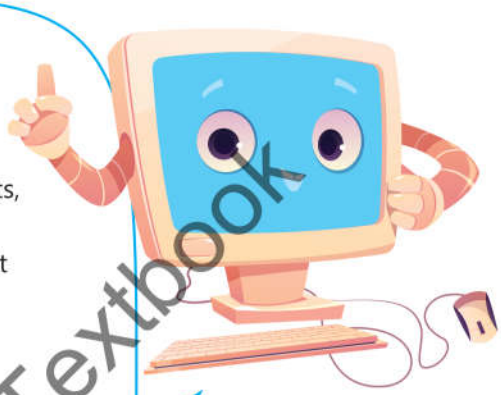
Students will be able to:

- Describe the purpose and uses of spreadsheet software.
- List different spreadsheet software e.g. Excel, Google Sheets, Open Office
- Recognise and infer spreadsheet interface to create a result card, home budget, timetable, etc.

Skills:

Students will be able to:

- Create a spreadsheet (i.e. result card, home budget, timetable, etc.) using the following tools:
- Organize data in worksheets within a workbook.
- Select a range of cells.
- Add borders.
- Increase/Decrease column width and height.
- Use simple built-in functions (e.g. sum, average, minimum, maximum).
- Create simple formulae (arithmetic operations).
- Create an appropriate chart for data presentation.



Spreadsheet

In manual systems, accountants use worksheets to keep the record of each transaction of the company. They are used to arrange, calculate, and sort data in the form of a table.

Spreadsheet Software

Software that is used to create a spreadsheet on a computer is called a Spreadsheet Software. It provides a lot more advanced facilities than manual worksheets.

There are many companies that are developing spreadsheet softwares. Some examples of spreadsheet software and their developing companies are as follows:

- Microsoft Excel by Microsoft corporation for Windows, Android, Mac OS, and iPhone Operating System
- Google Sheets by Google Corporation for online users

- Openffice by Apache
- LibreOffie, an open-source free software

Uses of Spreadsheet:

Spreadsheets are used for numerous purposes. The most common uses are as under:

- It is used to present data in rows and columns.
- It organises and stores different types of data including numbers, text, date and time, currency, accounting, scientific and any other type of data.
- It is a powerful tool for calculation and computation of data.
- Data may be represented in different formats like graphs and charts to understand data visually.
- Different types of analysis on data can be performed also.

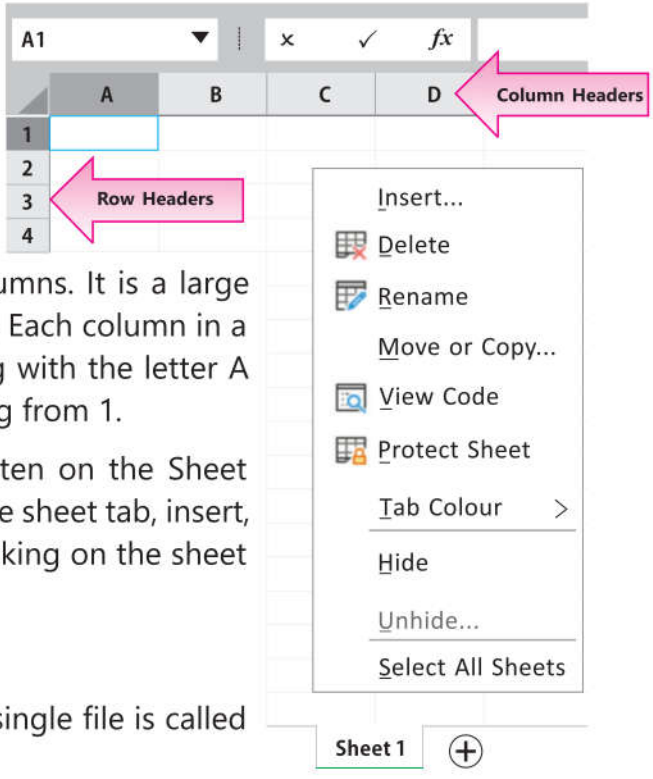
What is Microsoft Excel?

Microsoft Excel is the most widely used spreadsheet software developed by Microsoft Corporation. It allows you to store, organise, and analyse different types of data. It is simple to use for common users. It also provides advanced features of statistics, mathematics, and scientific use. There are many versions of Microsoft Excel. Its 2016 version provides a lot of features that are very helpful for its users.

Do You Know?
The first software to feature a toolbar was Excel.

Basics of Microsoft Excel 2016:

Following are the basic elements of Microsoft Excel 2016.



Worksheet

A worksheet is simply a grid of rows and columns. It is a large table with 1,048,576 rows and 16,384 columns. Each column in a worksheet is identified by an alphabet starting with the letter A and each row is identified by a number, starting from 1.

The worksheet is identified by the name written on the Sheet Tab. You can change the name and colour of the sheet tab, insert, delete, move, or copy a worksheet by right clicking on the sheet tab and selecting the proper option.

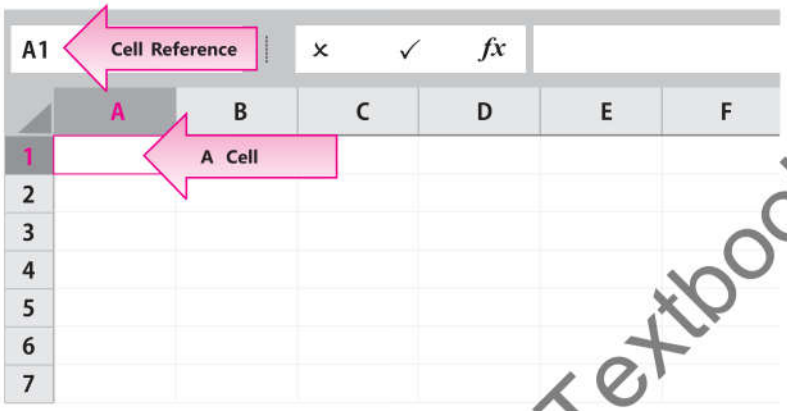
Workbook

A collection of related worksheets, saved in a single file is called

a Workbook. A workbook typically contains one or more worksheets. Each worksheet in a workbook may include similar or different data.

Cells

The intersection of row and column in a worksheet is called a Cell. Each cell is identified by its reference or address which is composed of a column head followed by a row header.

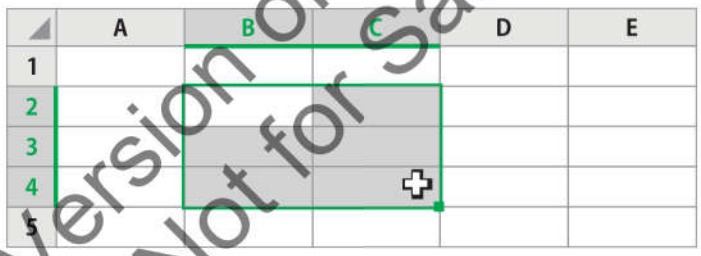


Cell Range

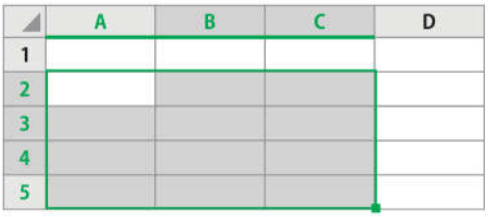
The references of adjacent cells may be denoted by cell range. It is defined by the cell reference of the first cell followed by colon (:) and then writing the reference of the last cell.

There are two methods for choosing the range of cells:

1. Click and drag cell B2 to cell C4 to choose the range B2:C4.

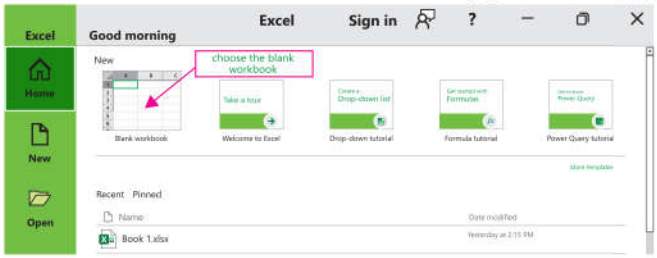


2. Click on the first cell of the range, hold down Shift Key and click on the last cell of the range. All cells between these two cells will be selected. In the following examples, the cell range is A2:C5



Excel Interface

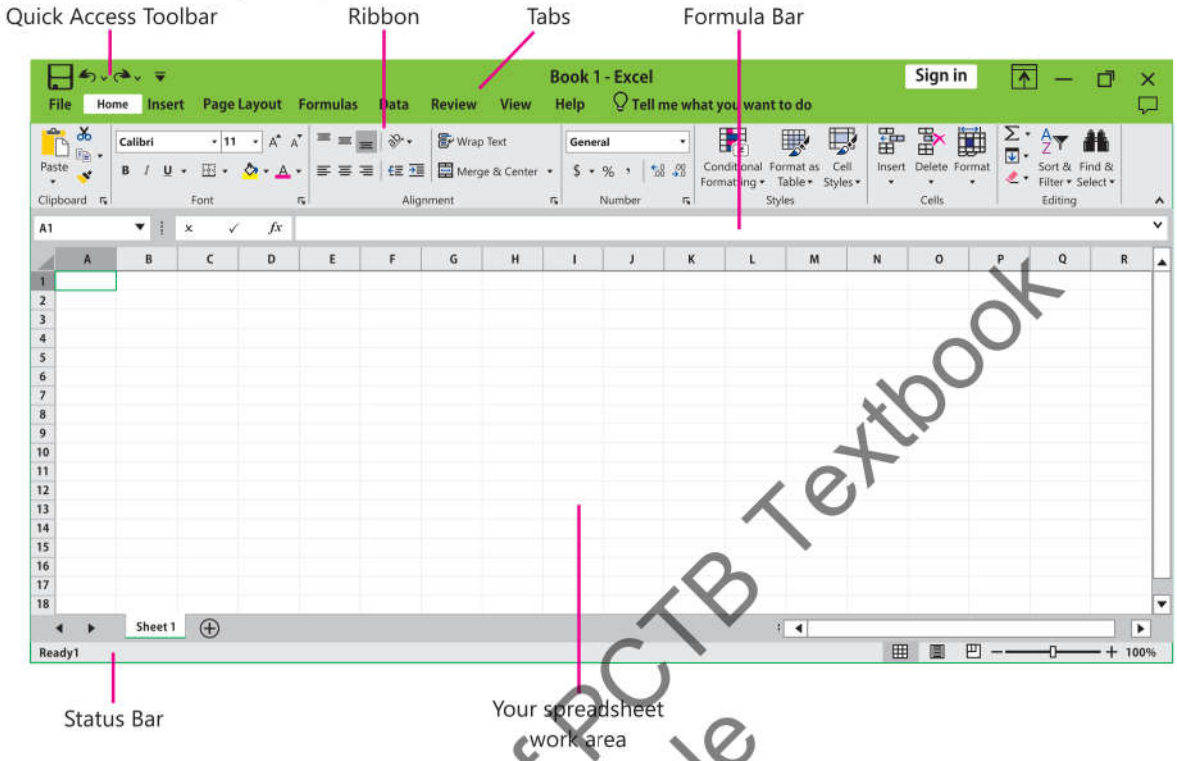
Open Excel by selecting it from the Start menu or by double-clicking the Excel 2016 desktop icon. The Excel Start Screen will appear when you first launch Excel 2016. You can view your recently opened workbooks, may create a new workbook from a template or choose to create a new blank workbook.



Locate and choose the Blank

worksheet from the Excel Start Screen to proceed to the Excel interface.

The Excel interface contains many components like Ribbon, Quick Access Toolbar, Formula Bar, Status Bar and your spreadsheet work area.



1. Quick Access Toolbar

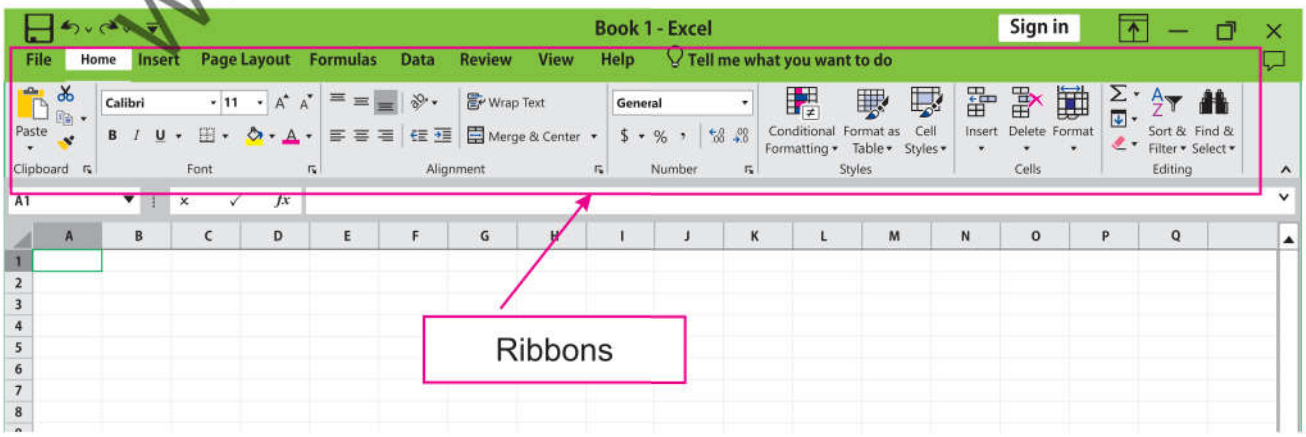
Frequently used commands of Excel are available here. You can add or delete different tools in Quick Access Toolbar.

2. Ribbon

The ribbon contains the icons (or toolbars) for commands. These commands are grouped in different tabs based on their functionality. A brief introduction of these tabs is as under:

Ribbon Tabs

The following are some of the ribbon tabs of Excel.

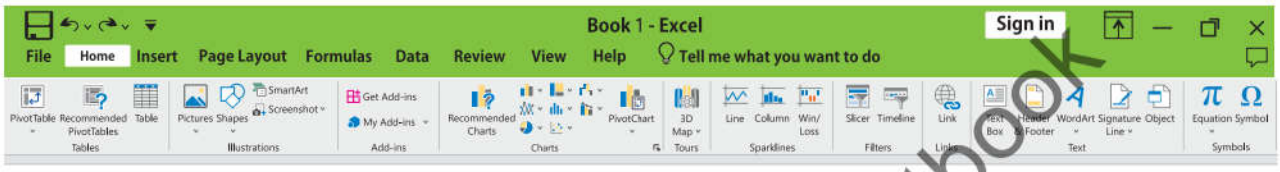


- **Home Tab**

It is used to apply formats to worksheet cells which include editing, clipboard, font, alignment, number, and cells. It is used to carry out common commands like bold, underline, copy, and paste.

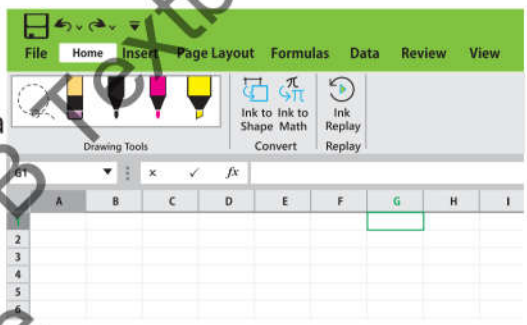
- **Insert Tab**

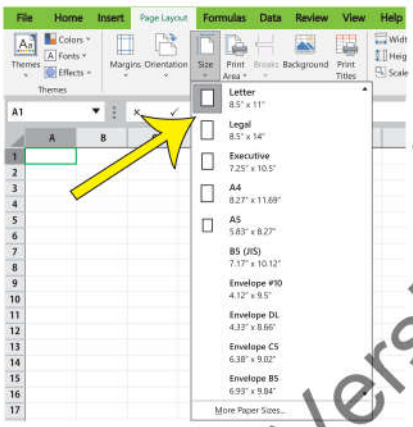
Insert Tab is used to insert different objects. These objects might include images, hyperlinks, symbols, headers, footers, etc.



- **Draw Tab**

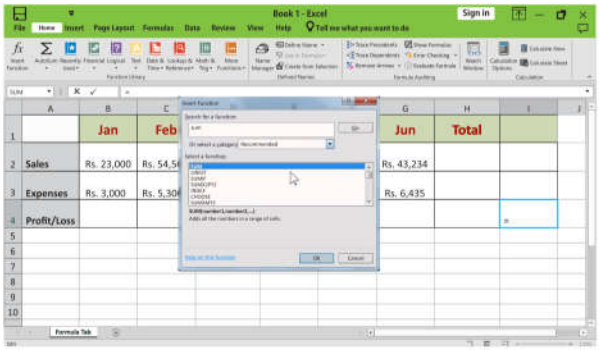
This tab lets you draw with the help of a mouse, digita pen, etc. depending on what device you are using.





- **Page Layout**

It helps in changing the appearance of the worksheet. It is done in both onscreen and printed form. It includes gridlines, margins, theme settings, etc.

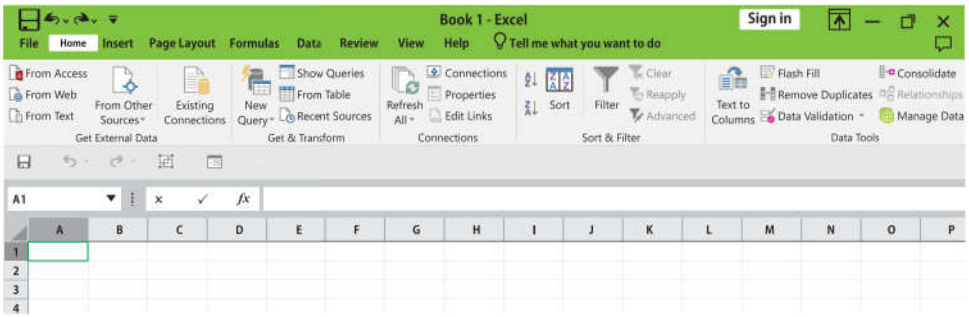


- **Formulas Tab**

Formulas Tab contains practical features for adding different calculations to the worksheet. It is used to insert functions, specify names, establish name ranges, review formulas, etc.

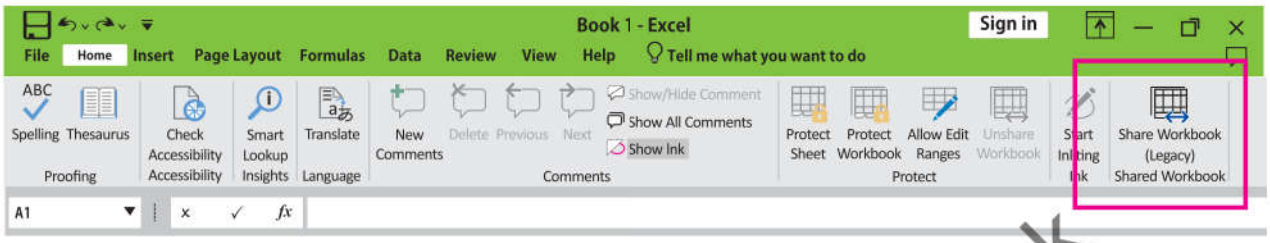
- **Data Tab**

Options for filtering, sorting, and modifying data are mostly found on the data tab.



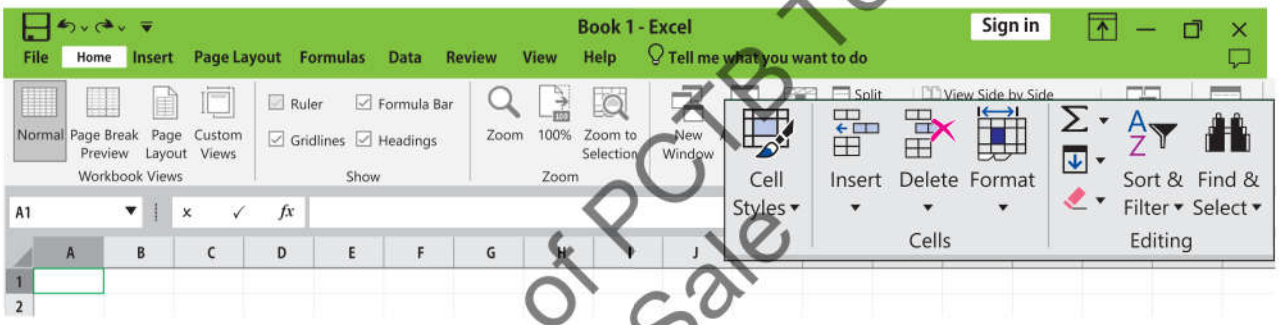
- **Review Tab**

It helps in reviewing the information like checking the spellings, translation, adding comments, etc. it also helps to protect and share the worksheet and workbook.



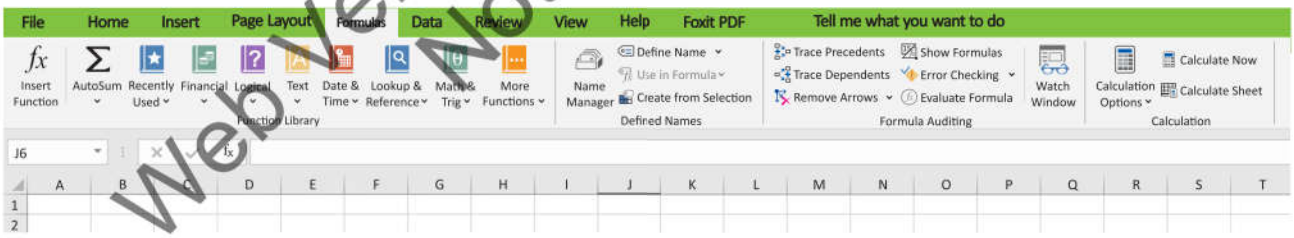
- **View Tab**

It includes commands that help in switching between the view of workbooks, freezing panes, adding macros, etc.



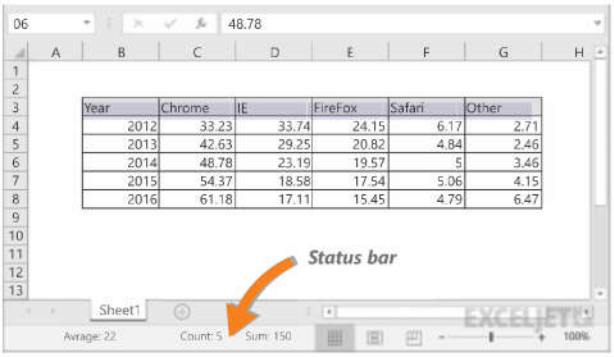
3. Formula Bar

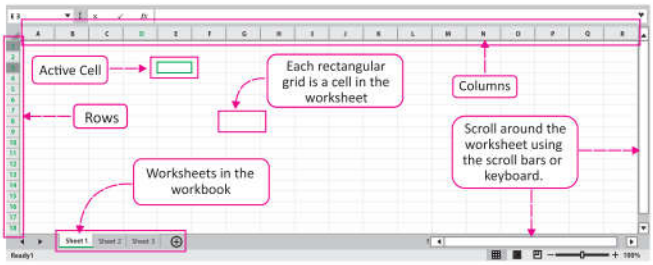
Right above the spreadsheet is the formula bar. When you enter a formula or function in the cell, it appears here in the formula bar. The result of the calculation is shown in the cell.



4. Status Bar

It is used to display information. Different function e.g. sum, count, average of the cells, etc. may be displayed in the status bar. A lot of other information may be displayed in Status bar by right clicking and choosing the options.



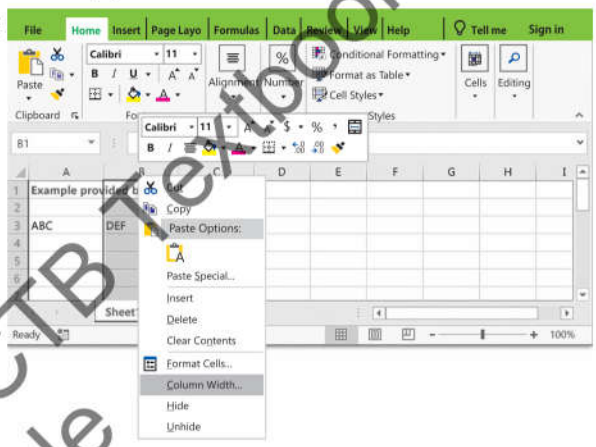


5. Spreadsheet Work Area

It is the place where the main work is done on the data in Excel.

Different Operations in Excel 2016

In Excel, you may perform many actions related to the appearance and organisation of data in worksheets. Some of them are explained here:

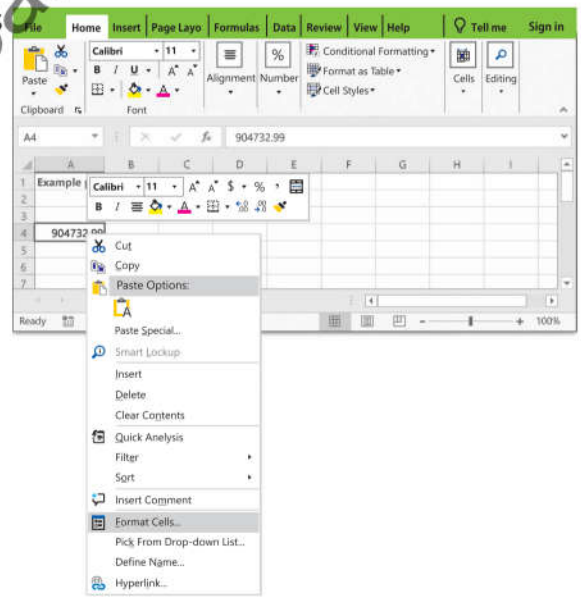


Resize Columns

1. Choose a column or a selection of columns.
2. Choose Format > Column Width from the Home menu (or Row Height).
3. Enter the column width, then click OK.

Formatting Cells

To format a cell or group of cells, follow the steps given below:



Step 1: Select the cells to be formatted and click on the Format button on Home tab.

Step 2: Click on Format Cells.

Step 3: Select the appropriate option from the Number tab like Date for displaying date, currency format for showing currency, and so on.

Step 4: In the Alignment tab, we can change the alignment of the text. Alignment refers to the placement of your text or numbers in a cell.

Step 5: You can change the font of the content of the cells by selecting the font size, font family and other formats for font specification.

Step 6: The Border tab allows you to draw different types of borders to the selected cells.

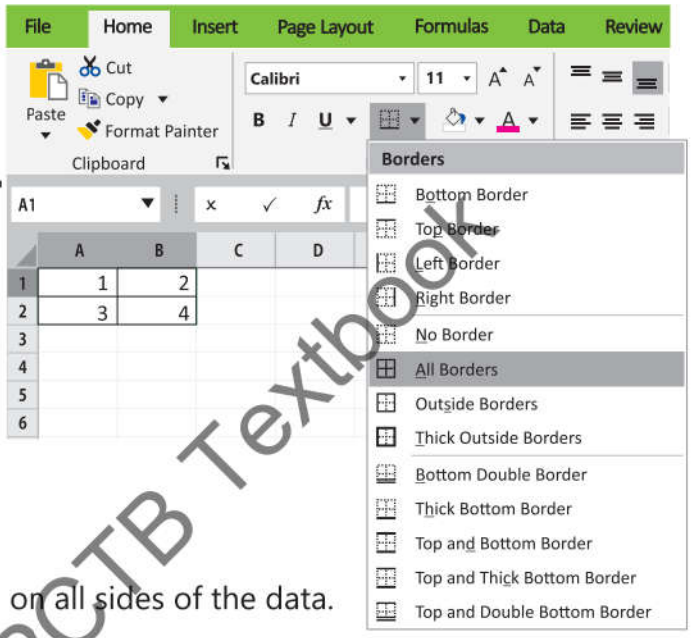
Step 7: You can apply different colours to the cells using the options available in the Fill tab.

Applying Borders:

Let us create the following sheet in Excel.

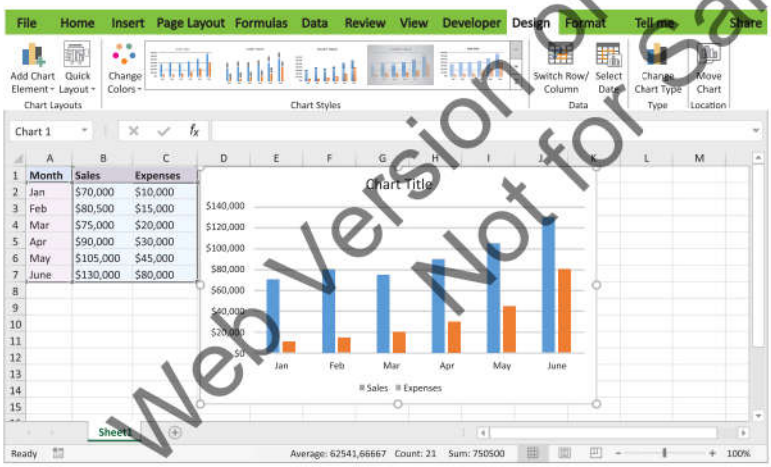
Step 1: Open MS Excel and write '1', '2', '3' and '4' in four separate cells as shown.

Step 2: Select the cells and then click on the Border icon on the Home tab. A list will appear and then click on All Borders.



We can see that a border has been created on all sides of the data.

Generating Charts



A chart is data from a worksheet that is represented visually and can be better understood than data that is only seen as numbers. It is also commonly known as a Graph. It is used for the representation or comparison of data.

We can generate charts of the data entered in a sheet. Let us create a chart for the sheet generated in the previous section.

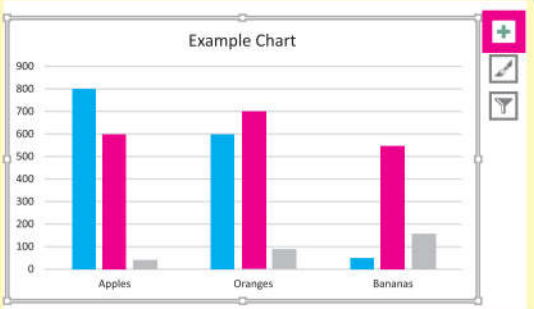
Step 1: Select the data for which the chart is to be generated. In the sheet below, select cell D11 to cell I14.

Step 2: From the Insert tab, select the Chart icon. Now click on the 2-D clustered Column chart in the list that appears.

We can see that a chart is created with different colours and legends.

Do You Know?

Legend is found on the right side of the graph or chart and is encircled by a border. The data that is graphically represented in the plot area of the chart is linked to the legend. Simply, legends are a short visual representation of the data series on the chart. The legends on Excel charts explain the data used for a chart.



After you have created the chart, a new chart tool will appear in the menu. You can use the chart tool to modify the chart's properties as you wish.

Formulas in Excel

To perform mathematical computations, an Excel formula is used. It is an expression that calculates a cell's value.

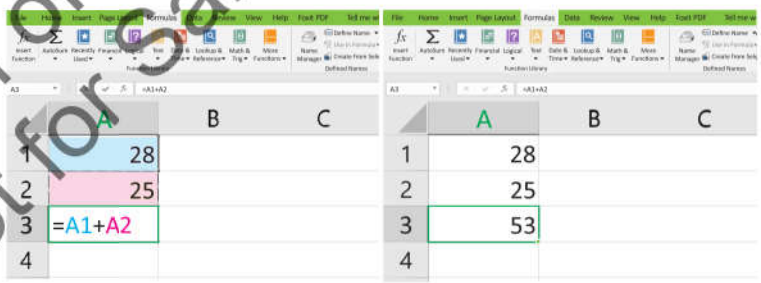
The equal sign (=) and your calculation are always typed in the cell at the beginning of a formula. The equal sign indicates that you are going to enter a formula in the cell. If you do not enter the equal sign, Excel will treat your entry as text and the calculation will fail.

Formulas use references of cells for calculations. It means we have to provide the references of the cell on which the formula will be applied.

For example, if we want to add two values entered in cells A1 and A2 and want to display the result in cell A3, we will use the following formula:

=A1+A2

When you press enter, cell A3 will show you the result.



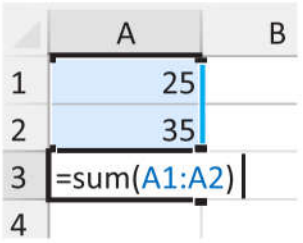
Functions

Functions are formulas with a name. Most of the functions are provided by Excel itself. These functions are called built-in functions. They perform calculations on the values, called arguments. All of Excel's functions are located on the ribbon's formulas tab.

For example, if we want to perform the calculation in the above example with a function, we have to write in cell A3 as:

=sum(A1:A2)

It will show the same result as was calculated by formula =A1+A2



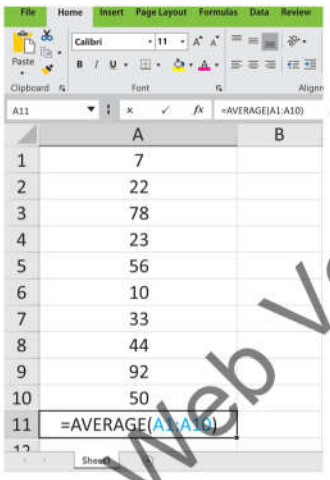
Some of the most common functions include:

Textual Features					
LEFT	MID	RIGHT	LOWER	UPPER	LEN
Logical					
AND	OR	NOT			
Date & Time					
DATE	TIME	NOW	TODAY		
Maths & Trig					
SQRT	ABS	MOD	SIGN		
Statistical					
SUM	COUNT	MAX	MIN	AVERAGE	

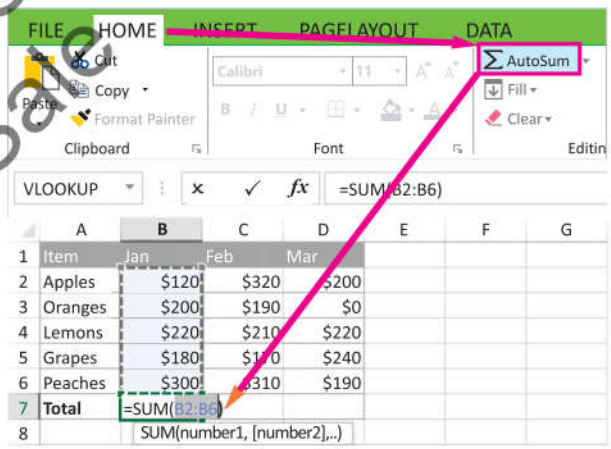
Do You Know?
The SUM function in Excel is perhaps the one that is used the most.

Examples of Simple Built-in Functions:

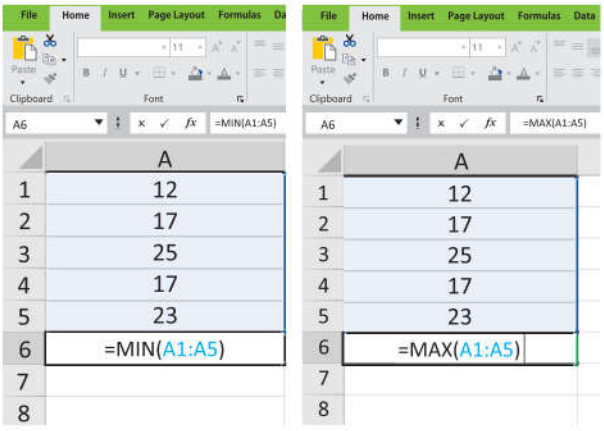
- The SUM formula for adding four numbers from cell B2 to B6 will be written as
  =SUM(B2:B6)



- AVERAGE
  It provides the mean average of the values falling within the given range.
  =AVERAGE(A1:A10)



- MIN/MAX
  MIN function returns the lowest value discovered in a group of values.
  =MIN(A1:A5)
  MAX function returns the highest value discovered in a group of values.
  =MAX(A1:A5)



Introducing the IF Function

The IF function is used to test if a certain condition in a worksheet is true or false.

What does the IF function look like?

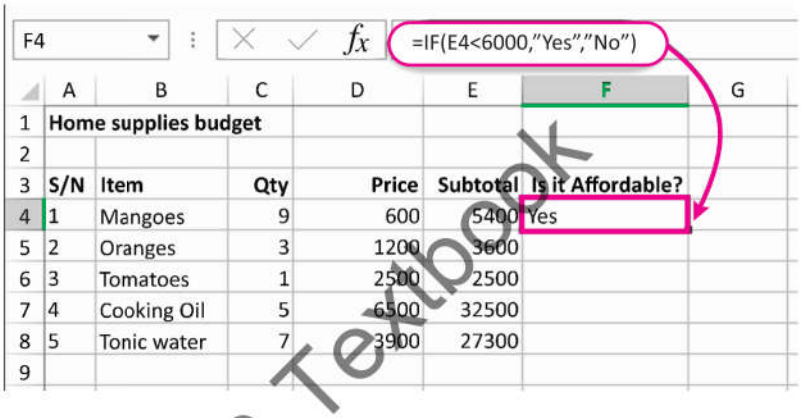
IF (logical_test, value_if_true, value_if_false)

Here is what they mean:

Logical_test: what do you want to test for?

Value_if_true: what do you want to do if the answer is YES?

Value_if_false: what do you want to do if the answer is NO?



	A	B	C	D	E	F	G
1	Home supplies budget						
2							
3	S/N	Item	Qty	Price	Subtotal	Is it Affordable?	
4	1	Mangoes	9	600	5400	Yes	
5	2	Oranges	3	1200	3600		
6	3	Tomatoes	1	2500	2500		
7	4	Cooking Oil	5	6500	32500		
8	5	Tonic water	7	3900	27300		
9							

Most Used Formulas in Excel

Let us try some commonly used formulas in Excel.

Create the following sheet in Excel.

1. To calculate the average number of students in a class, we can use the average function. Write the formula = AVERAGE (C7:F7) in cell G7 and press Enter.
2. To calculate the total number of students, use the sum function. Write =SUM (C7:F7) in cell H7 and press Enter.
   Drag the fill handle to fill in the values in the cells below.
3. To find the Max value, write = MAX (C7:F7) in cell I7 and drag the Fill handle to fill the values in the cells below.
4. To find the minimum value, we can use the MIN function in the same way as we used the functions given previously.

Mathematical Formulas

Excel can be used to calculate and analyse numerical information with the help of various mathematical formulas. A formula is an equation that performs a calculation using values in the worksheet.

Creating a simple formula that adds two numbers

1. Click the cell where the formula will be defined (e.g. C5)
2. Type '=' to let Excel know the formula is being defined.
3. Type the first number to be added (e.g. 1500)

4. Type '+' to let Excel know that an addition is to be performed.
5. Type the second number to be added (e.g. 200)
6. Press Enter on the formula bar to complete the formula.

Project time

- Write a subtraction formula using the point and click method.
- Write a multiplication formula using cell references.
- Write a simple division formula.

Do you remember formatting and formulas?

Formatting

Once you have entered information into a spreadsheet, you can format it with the help of some formatting elements.

Formatingisusedto:

- Change the font style of your text.
- Change the size of your text.
- Make your text appear in BOLD.
- Give the *italics* effect to your text.
- Underline your text.
- Fill the cell with different colours.
- Change the text colour.

Examples of formatting:

- Select a cell and format the number or text in it so that it appears in bold.
- Add a border to a row.
- Change the fill colour of two or more cells.
- Select two or more cells and format their text to italics.

Glossary

manual	physically done by hands	built-in	original part of something
grid	a pattern made by horizontal and vertical lines	computation	doing mathematical calculation
intersection	the point where two or more points cross	format	the arrangement or design
reference	to refer to		

LET'S HAVE A LOOK

- Microsoft Excel is a spreadsheet software developed by Microsoft Corporation.
- Built-in functions perform calculations on the values, called arguments.
- Each cell is identified by its reference or address which is composed of a column head followed by a row header.
- A formula is an equation that performs a calculation using values in the worksheet.
- The IF function is used to test if a certain condition in a worksheet is true or false.

Exercise

A. Multiple Choice Questions: Tick the correct answer.

1. The intersection of row and column in a worksheet is called a _____.

   a. cell **b.** table **c.** spreadsheet **d.** none of these

2. A _____ typically contains one or more worksheets.

   a. spreadsheet **b.** workbook **c.** workspace **d.** office

3. Data may be represented in different formats like _____ and charts to understand data visually.

   a. cells **b.** graphs **c.** formulas **d.** calculations

4. Functions are formulas with a _____.

   a. heading **b.** sign **c.** name **d.** none of these

5. All of Excel's functions are located on the Ribbon's _____tab.

   a. Data **b.** Home **c.** Formula **d.** Function

6. In a cell, ___ sign and calculations are always used at the beginning of a formula.

   a. + **b.** # **c.** / **d.** =

7. Excel comes with built-in _____, which are predefined formulas.

   a. formulas **b.** functions **c.** format **d.**

8. Which of the following allows you to make logical comparisons between a value?

   a. For Function **b.** IF Function **c.** Else Function **d.** None

9. The IF function is used to test if a certain condition in a worksheet is _____ or false.

   a. one **b.** yes **c.** zero **d.** true

10. _____ are also commonly known as graphs.

    a. Cells **b.** Charts **c.** Functions **d.** Formulas

B. Write 'T' for True and 'F' for False in the boxes

1. MS Excel is spreadsheet software.
2. You cannot change the background colour of a cell.
3. Any formula in excel should be preceded by an equal sign.
4. An average function of Excel requires reference to the address of cells.
5. You cannot merge two cells of an Excel sheet.
6. Status Bar is used to display colours.
7. The ribbon does not contain the icons (or toolbars) for commands.

C. Answer the following short questions:

1. What is the difference between a workbook and worksheet?
2. How can you resize a column in MS Excel?
3. Give examples of any three built-in functions.
4. What are some ways formatting is used in MS Excel?
5. Perform a calculation using SUM and AVERAGE functions.
6. Create a chart in MS Excel to show the sales of a store per month.

D Answer the following long questions:

1. Define all Ribbon Tabs.
2. Explain the main components of the MS Excel interface.

Learning Activities

Lab / Computer Activity 1:

Speed drill – The teacher can call out simple addition, subtraction, multiplication, and division questions, and the students need to solve the questions using the data handling software. The student who can solve it the fastest time wins.

Lab / Computer Activity 2:

Create graphs by adding data to a computer. The instructor can conduct a demonstration by collecting data from the class and listing it down in data handling software. The data question for students could be "What is your birthday month" or "Out of these five food items name your favorite". There should be a spreadsheet with the answer choices on the left and the number of results next to them, e.g.:

Month	# of students
Jan	
Feb	
etc.	

Favorite Food	# of students
Food item 1	
Food item 2	
etc.	

The data table should then be used to create a graph, and the results interpreted by the students.

Lab / Computer Activity 3 (follow on from activity 2):

The instructor can ask the students to create their own survey questions, collect results from the class, and create a chart to display the results.

Lab / Computer Activity 4:

The instructor can locate some open-source data tables through internet research or find published financial accounts from company annual report publications and ask students to re-create simple additions/subtraction/multiplication/division formulas in their data handling software to see if they get the same results when they input the numbers.

Lab / Computer Activity 5:

Create a table in Excel to calculate the marks of 10 students in 5 subjects.

For the above query, colour the student's name cell 'red' for those subjects in which the student has failed.

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Answers

A: Tick the correct option.

1	a	2	b	3	b	4	c	5	c
6	d	7	b	8	b	9	d	10	b

B: True and False

1	T	2	F	3	T	4	T	5	F
6	F	7	F						

4 Google Sheets

Knowledge:

Students will be able to:

- Describe the purpose and uses of spreadsheet software.
- List different spreadsheet software e.g. Excel, Google Sheets, OpenOffice
- Recognise and infer spreadsheet interface to create a result card, home budget, timetable, etc.

Skills:

Students will be able to:

- Create a spreadsheet (i.e. result card, home budget, timetable, etc.) using the following tools:
- Organize data in worksheets within a workbook.
- Select a range of cells.
- Add borders.
- Increase/Decrease column width and height.
- Use simple built-in functions (e.g. sum, average, minimum, maximum).
- Create simple formulae (arithmetic operations).
- Create an appropriate chart for data presentation.

Google Sheets

Google Sheets is a widely used spreadsheet program. It is a free online web-based spreadsheet application that is linked with Google Account. It is developed by Google Corporation to run in the web browser. You do not need to install it on your computer.

To save your work online, it provides the option to save your work on Google Drive.

Features of Google Sheets:

Some features of Google Sheets are discussed here:

- **Data Grid**
  It saves and processes data in columns and rows and allows you to do calculations.
- **Editing and Formatting**
  Real-time shared editing and formatting of spreadsheets is possible with Google Sheets.
- **Exploring**
  Users can ask questions, make charts, visualise data, create pivot tables, and format the spreadsheet with various colour schemes thanks to machine learning technology.
- **Many File Formats**
  Multiple spreadsheet file types and formats are supported by Google Sheets.

- **Online Editing**
  Enabling the Chrome extension makes offline editing possible in Google Sheets.
- **Bundled with Other Google Products**
  Other Google products can be connected with Google Sheets.

Application of Google Sheets

Google Sheets is typically used for:

- Data storage
- Data analytics
- Project management
- Finance and accounting
- Visuals and graphs
- Programming
- Print and download
- Financial modelling

Do You Know?

Google Sheets was released on March 9, 2006. It was created using JavaScript language.

What Makes Google Sheets Better than Other Spreadsheet Softwares?

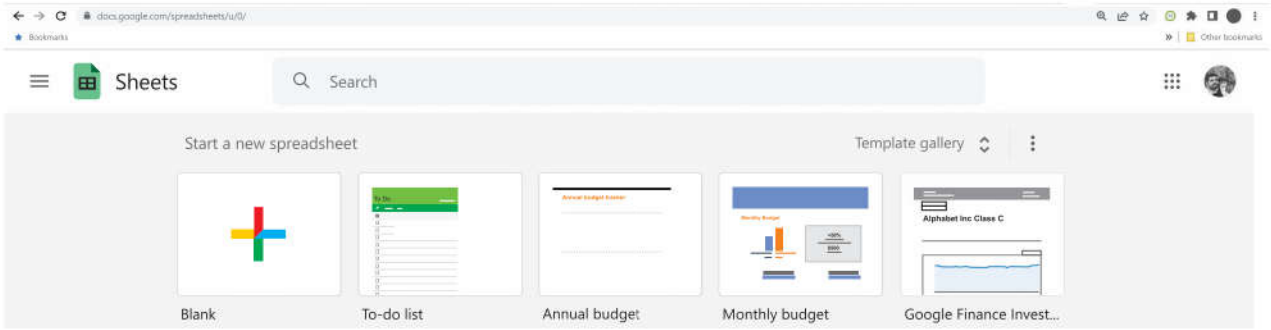
- It is one of the most prevalent spreadsheet programs in the world.
- It is easy to acquire and to get started.
- It can be used for both work and in daily life's routine.
- Multiple users can work on the same spreadsheet at once.
- It can be used to make a financial or professional plan for your organisation.
- Links can also be shared with anyone.

Google Sheets

Google Sheets does not require downloading and installation of the program on the computer. It simply runs in your browser.

How to Start Google Sheets

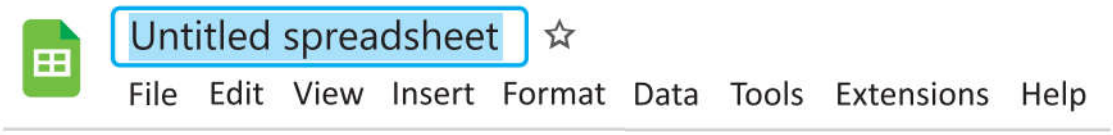
Google Sheets can be accessed from **https://docs.google.com/spreadsheets/**. Just type the link in the browser address bar and press enter. You will be asked to login into your Google account. Login with your Google or Gmail ID.



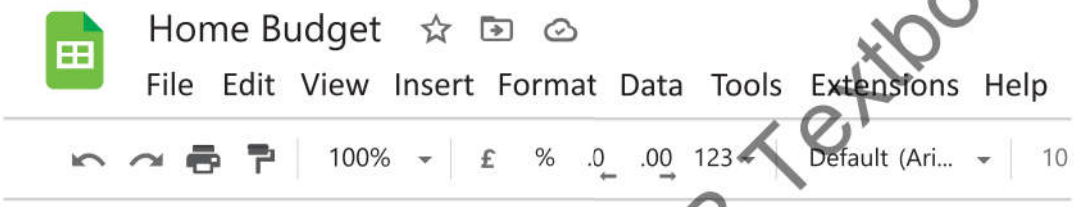
Once you have successfully logged in, you will see Google Sheets' start Page. Click on the Blank button to get started with a new workbook.

Renaming your first Google Worksheet:

By default, Google names your workbook as an Untitled spreadsheet.



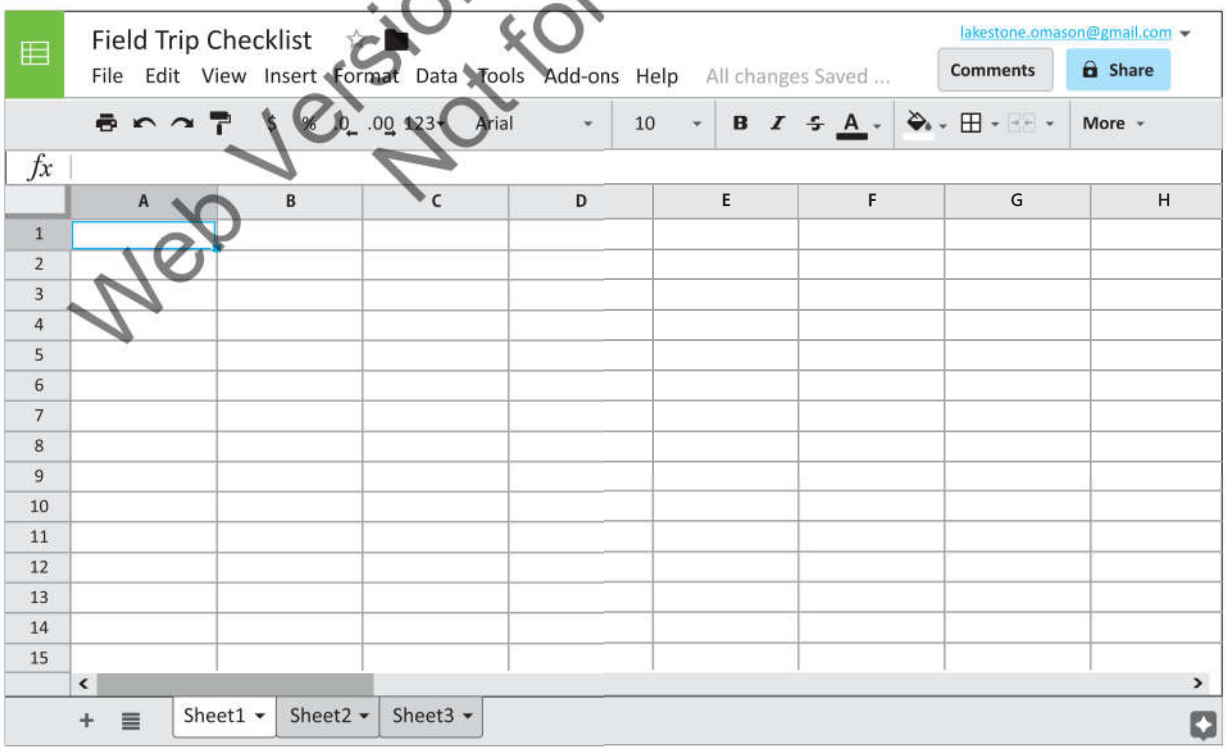
Just click on the Untitled spreadsheet, delete it, and give a name according to your data.



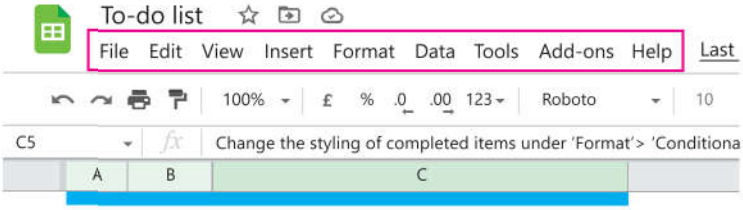
As you will change the name, it will be saved automatically on Google Drive (an online storage place).

The Interface of Google Sheets

Google sheets is an online application. Although it runs in browsers, it provides many features in its interface for its uses. The major components of this interface are discussed here:



• Menu Bar



The Menu bar contains different menus like File, Edit, View, etc. The menus are groups of commands grouped based on their functionality.

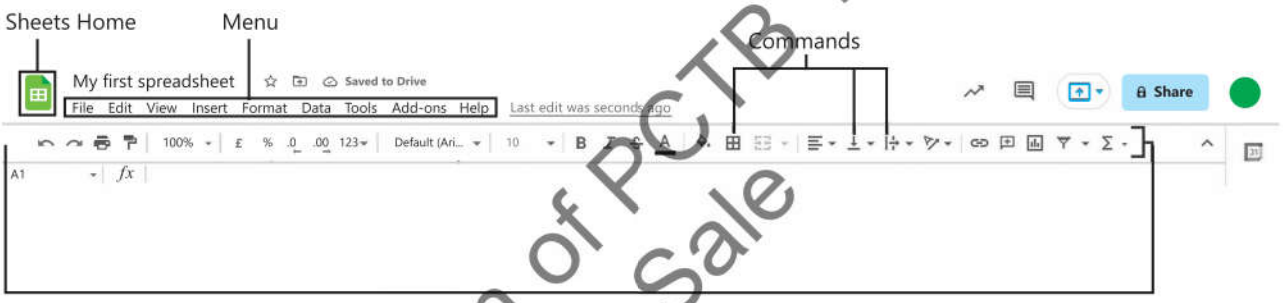
For example, the File menu will show the commands related to File actions like creating a new file, opening a file, saving a file, etc.

• Toolbar

The most common actions from the menu are on the Toolbar. You can activate any command from the toolbar with a single click.

• Groups of Commands in Toolbar

The Toolbar's Groups are collections of related commands. The slim break in the perpendicular line divides the groups.



• Commands

The buttons you press to perform actions are known as Commands.

Basics of Google Sheets

Each spreadsheet in Google Sheets is composed of one or more sheets.

Sheet:

Each sheet in the spreadsheet is composed of columns and rows just like a table. Each column in a sheet is identified by a letter starting with the letter A. These are also called Columns Headers. Each row in a sheet is identified by a number, starting with the number 1. These numbers are also called Row Headers.

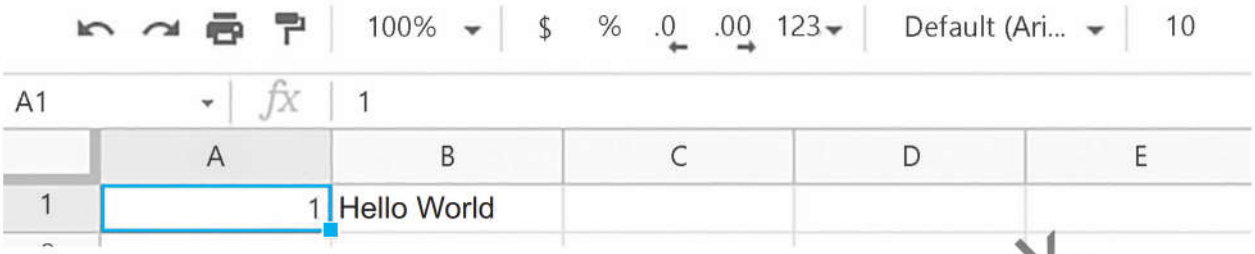
You start with one Sheet by default when you create a new workbook. You can have many sheets in a workbook. New sheets can be added or detached. Sheets can be named to make it calmer to work with data sets.

Tip

You can use the shortcut key Shift + F11 to create new sheets. Try it!

Cell:

The intersection of a row and column is called a Cell. You can enter numbers, text, date and time, currency, scientific data, etc. in these cells.



Cell Reference:

Each cell is identified by the combination of Column Header and Row Header. This identification of a cell is known as the reference of the cell. For example, if we are in column H and row 3, the cell reference will be H3

Name Box

The Name Box displays the reference of which cell or range you have selected. It can also be used to select cells or ranges by typing their references.

Google Sheets Range

The range is an important part of Google Sheets because it makes you work with selections of cells.

There are four different operations for selection:

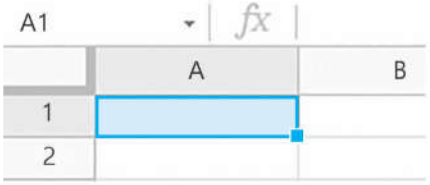
- Selecting a Cell
- Selecting Multiple cells
- Selecting a Column
- Selecting a Row

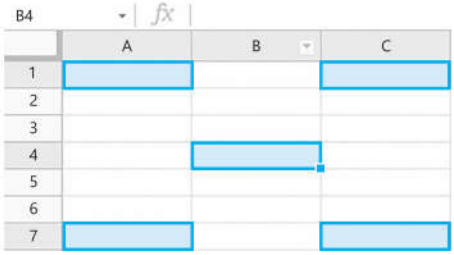
Do you know?

The selected cell is also known as the Active Cell. Every action performed in Google Sheets may be done in active cells only.

Selecting a Cell

Cells are pointed by clicking them with the left mouse button or by navigating to them with the keyboard arrows. When you click on a cell or point it from the keyboard arrow, it is selected. A bold blue rectangle around the cell shows that this cell is selected.





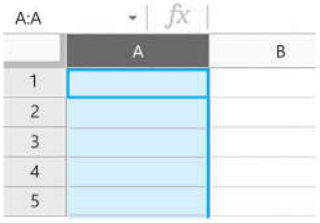
Selecting Multiple Cells

By left-clicking the cells while holding down Ctrl or Command, you can select multiple cells at once. Once completed with selecting, you can let go of Ctrl or Command.

Let's try an example:

Select the cells A1, A7, C1, C7, and B4.

Selecting a Column



Columns are selected by left-clicking on Column Headers. This will select every sheet cell that is connected to the column.

To select column A, click on the letter A in the column bar:

Selecting a Row

Rows are selected by left-clicking on Row Headers. This will select all the cells in the sheet linked to that row.

To select row 1, click on number 1 in the row bar:

Selecting the Entire Sheet

The all-inclusive spreadsheet can be carefully chosen by clicking on the rectangle in the top-left corner of the spreadsheet:

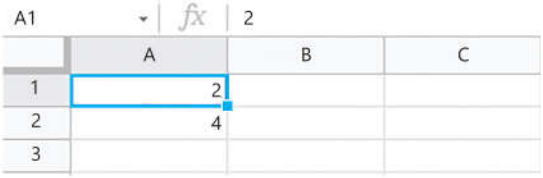
Now, the whole spreadsheet is selected:

Note: You can also select the entire spreadsheet by pressing Ctrl+A for Windows.

Formulas

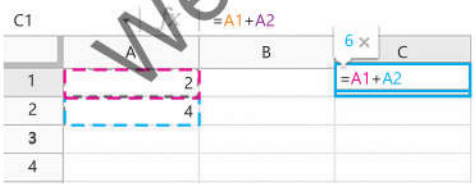
A formula in Google Sheets is used to do mathematical calculations. Formulas always start with an equal sign (=) typed in the cell, followed by your calculation.

Formulas can be used for calculations such as:



- =1+1
- =2*2
- =4/2

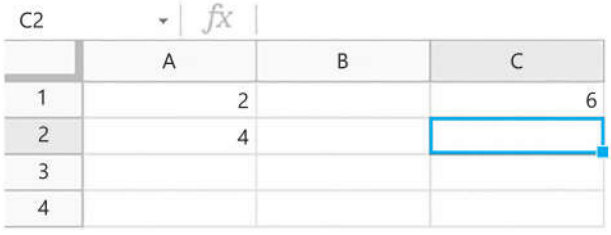
Formulas can take values and cell references as input. It is better to use cell references in formulas instead of values. It is because, when you edit any value in the cell, the formula will recalculate the result based on the cell references.



Let's have a look at an example.

Type the values given in the figure:
Now we want to do a calculation with those values.
Step by step:

1. Select C1 and type (=)
2. Select A1
3. Type (+)
4. Select A2
5. Press enter



You got it! You have successfully calculated A1(2) + A2(4) = C1(6).

Functions

Google Sheets has many predefined formulas called Functions. Functions are formulas with a name. Every function is followed by a function symbol i.e. parenthesis.

Functions are typed with '=' and the 'function's name'.

For example =SUM

You must apply the function to a range once you have typed the function name.

For example =SUM(A1:A5)

The range is always inside of parentheses.

Do you know?

You can use a formula to fill out a whole column. Just select cell F2, position the cursor in the bottom right corner, hold, and drag the Fill handle.

Examples of Functions

Function	Description
=AVERAGE	Calculates the average (arithmetic mean)
=COUNT	Counts cells with numbers in a range
=MAX	Returns the highest value in a range
=MIN	Returns the lowest value in a range
=SUM	Adds together numbers in a range

Difference Between Google Sheets and Excel

Google Sheets	Excel
1. Google LLC developed Google sheets.	1. Microsoft Corporation developed MS Excel.
2. They launched Google Sheets as a pack of G Suite in 2006.	2. They launched MS Excel as a pack of MS Office in 1987.
3. We can use Google Sheets both online as well as offlne modes.	3. We can use Excel in offline mode only.
4. Google Sheets is available in 83 languages.	4. Excel is available in 91 languages.
5. It uses Google Drive.	5. It uses One Drive.
6. It is better for small volumes of data.	6. It is better for large volumes of data.

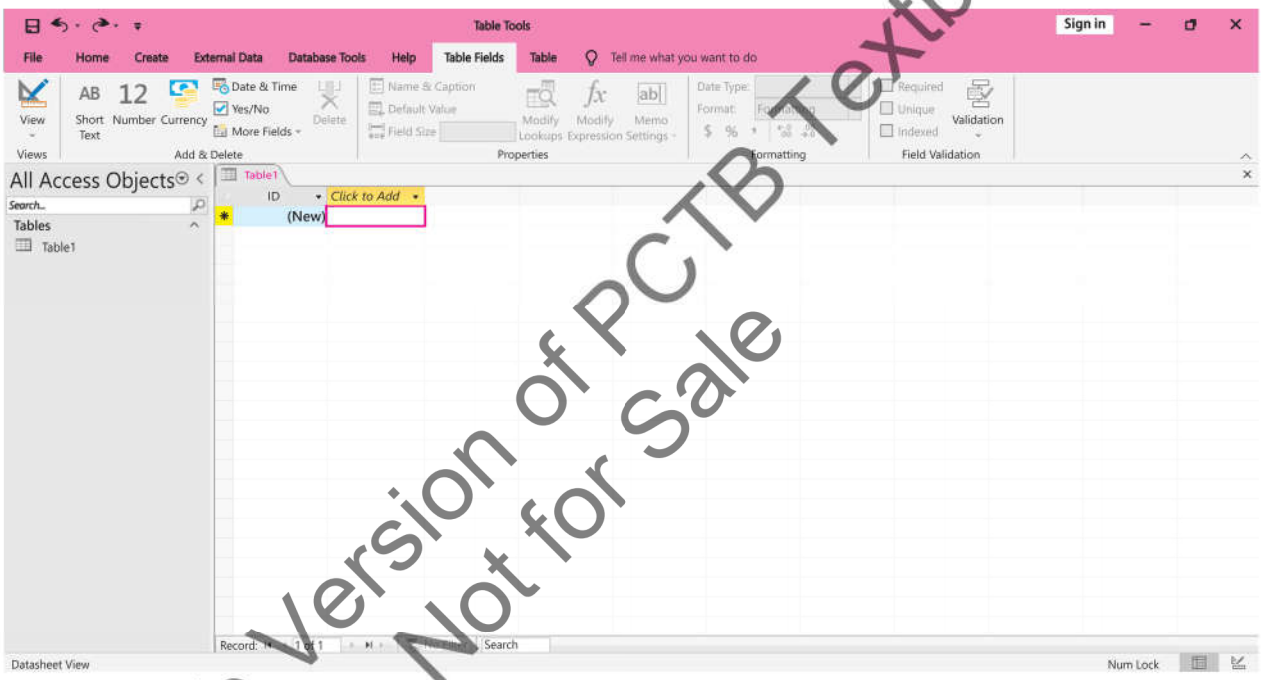
MS Access

Microsoft offers Microsoft Access, commonly known as MS Access. It is a database management system. This database management system offers database functionalities where you are also able to program. It helps to design easy to use screens. It also aids in data management and analysis of vast amounts of information.

There are four objects that make up the Access database. These objects are:

- **Tables**

  A table is a type of object used to hold data in a row-and-column structure.



- **Queries**

  According to search parameters, queries provide answers to questions.

- **Forms**

  A form is a database object that you can use to design a database application's user interface.

- **Reports**

  A report is an item that is primarily used for formatting, computing, printing, and summarising particular data.

Glossary

formatting	to arrange in a particular format
acquire	to gain something or to get
interface	A point where two independent systems meet and interact
predefined	Set or arranged in advance
real-time	the actual time during which a process takes place or an event occurs
Pivot table	used to summarize and arrange data or information
access	to obtain something such as some service

LET'S HAVE A LOOK

- Google Sheets is a free online web-based spreadsheet application that is linked with Google Account.
- Google Sheets is a spreadsheet program developed by Google Corporation.
- Google Sheets does not require downloading and installation of the program. It simply runs on your browser.
- A formula in Google Sheets is used to do mathematical calculations.
- Formulas always start with an equal sign (=) typed in the cell, followed by your calculation.
- Google Sheets has many predefined formulas called functions. Functions are typed with '=' and the 'function's name'.
- Students will be learning databases i.e. MS Access as a follow up of MS Excel. It is a database management system.

Exercise

A. Multiple Choice Questions: Tick the correct answer.

1. Google Sheets is available in ____ languages.
   a. 63 b. 73 c. 83 d. 93
2. We can use _____ in offline mode only.
   a. Google Sheets b. Excel c. both d. none of these
3. You can use the shortcut key Shift + _____ to create new sheets.
   a. F3 b. F6 c. F9 d. F11
4. You can also select the entire spreadsheet by pressing _____ for Windows.
   a. Ctrl+A b. Ctrl+B c. Ctrl+C d. Ctrl+D
5. Formulas always start with the _____ typed in the cell, followed by your calculation.
   a. equal sign b. parenthesis c. dollar sign d. hashtag
6. They launched Google Sheets as a pack of G Suite in _____ .
   a. 2000 b. 2002 c. 2004 d. 2006

7. The _____ displays the reference of which cell or range you have selected.

   a. Name Box **b.** Menu Bar **c.** both **d.** none of these

8. The predefined formulas in Google Sheets are referred to as _____.

   a. functions **b.** row **c.** ranges **d.** groups

9. _____ saves and process data in columns and rows and allows you to do calculations.

   a. Formatting **b.** Data Grid **c.** Exploring **d.** None of these

10. Which of the following are the selection operations:

    a. Selecting a Cell **b.** Selecting Multiple Cells

    c. Selecting a Column **d.** All of these

B. Write 'T' for True and 'F' for False in the boxes.

1. Google Sheets is a spreadsheet program.
2. Excel is better for small volumes of data.
3. Google sheets is used to write letters and memos.
4. You can change the font colour of any cell in Google Sheets.
5. Max function is used to return the minimum value in range.
6. Google Sheets use One Drive.
7. The buttons you press to perform actions are known as commands

C. Answer the following short questions:

1. What is Google Sheets?
2. Why do we use Google Sheets?
3. What are the applications of Google Sheets?
4. How to create new sheets in Google Sheets?
5. How to select multiple cells in Google Sheets?
6. What are the formulas in Google Sheets? Write any three examples.
7. What are the differences between Google Sheets and Excel?
8. What makes Google Sheets better than Excel?
9. How can you use a formula to fill out a whole row?

D. Answer the following long questions:

1. Write a detailed note on Google Sheets range.
2. Explain the Ribbon in the Google Sheets.

Learning Activities

Activity 1: Speed Drill

The teacher can call out simple addition, subtraction, multiplication, and division questions, and the students will have to solve the questions using the data handling software. The student who can solve it the fastest time wins.

Activity 2: (Mapping)

The instructor can locate some open-source data tables through internet research or find published financial accounts from a company annual report publications, and ask students to re-create simple additions/subtraction/multiplication/division formulas in their data handling software to see if they get the same results when they input the numbers.

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Answers

A: Tick the correct option.

1	c	2	c	3	d	4	a	5	a
6	d	7	a	8	a	9	b	10	d

B: True and False

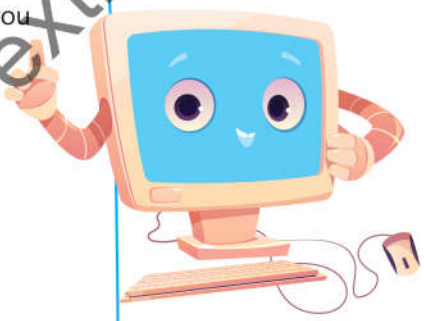
1	T	2	T	3	F	4	T	5	F
6	T	7	T						

5 Computational Thinking

Knowledge:

Students will be able to:

- Define and infer simple and complex problems, and how to identify each.
- Create algorithms/solutions to simple and complex problems.
- Discuss the scope and limitations, and that some problems cannot be solved computationally (e.g. factoring very large numbers in a small amount of time, or Turing's Halting problem, how a computer can never reliably inspect someone's code and tell you whether it will halt or run forever).
- Discuss basics of writing pseudocode
- Discuss the concept of nesting.
- Discuss the concept of constants and variables.
- Distinguish scenario/problem where If, If then else, and If with multiple conditions can be applied.



Skills:

Students will be able to:

- Create algorithms/solutions to simple and complex problems.
- Apply the best possible solution to a problem from a pool of solutions.
- Describe that there are ways to characterize how well algorithms perform and that two algorithms can perform differently for the same task.
- Explain, with examples, some problems, which cannot be solved computationally.
- Represent algorithms using structured language, such as pseudocode
- Apply the concept of nesting up to level 2 in looping and conditions.
- Apply repeat and forever loops in Algorithm building.
- Identify problems using the IF statement with multiple conditions.
- Identify problem-solving techniques (sequence, loop, and conditions) applicable to a specific problem.

PROBLEM-SOLVING APPROACH

Problem-solving refers to the process of finding solutions to problems that you come across in everyday life. In other words, problem-solving states that you always have to try to find the necessary steps to be taken in a sequence to complete a task.

Let us understand this concept with the help of an example. To prepare a cup of tea or

coffee, there are some equipment and ingredients required, and then you need to follow the process involving the steps given below:

- Pour the ingredients into the utensil.
- Put it on the gas stove.
- Turn on the gas stove.
- Bring the solution to a boil until it is cooked.
- Pour it into a cup.

Similarly, to solve any problem on the computer, a step-by-step approach is followed. For example, if you want to get the sum of two numbers, you need to follow the steps given below.

- Input two numbers.
- Perform the addition of input numbers.
- Display the sum.

This shows that there is always a need for problem-solving processes to complete a task whether it is general or it is related to a computer system.

COMPUTATIONAL THINKING (CT)

Computational thinking is a set of problem-solving processes that includes several characteristics and perspectives. Computational thinking allows us to take a complex problem, understand what the problem is and develop possible solutions.

We can then present these solutions in a way that a computer, a human, or both, can understand. It is important to learn computational thinking also for the development of computer programs.

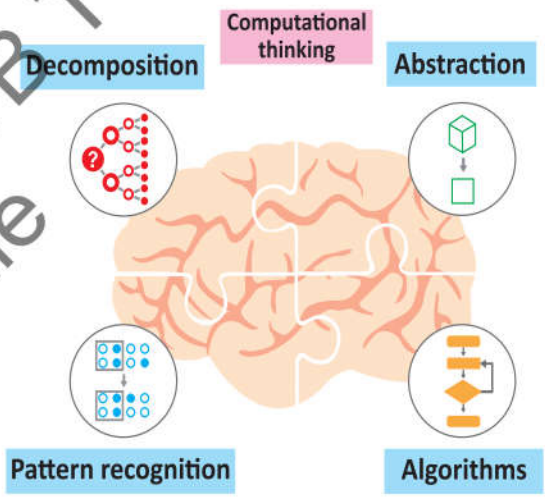
There are four fundamental steps of computational thinking. Let us understand them with the help of some integrated examples.

Computational Thinking Concept	Description	Integrated Example
Decomposition	Analysing and breaking down a problem into smaller parts to solve it in an organised manner and to make it easier to understand and manage.	A person can learn a new language and how to construct sentences using a new foreign language for example by dividing a sentence into parts like a subject, verb, object, etc.
Pattern Recognition	Observing patterns, trends, and regularities in data along with looking for similarities among and within the problem.	In Economics, to find cycle patterns in the rise and drop of the country's economy.

Abstraction	Identifying the general principles that generate these patterns as well as focusing on the important information only, ignoring irrelevant details.	A man operating a vehicle only knows that applying the brakes will make the car stop, but he is unaware of the inner workings of the car or how brakes and other driving controls are truly implemented.
Algorithm Design	Developing a step-by-step approach for solving a problem and similar problems.	The food you eat is the output of the sequential process of making it. The whole recipe is the step-by-step algorithm for making that food.

Thus, computational thinking involves the following steps:

- Taking the complex problem and breaking it down into a series of small, more manageable problems (decomposition).
- Each of these smaller problems is then looked at individually, considering how similar problems have been solved previously (pattern recognition).
- Focusing only on the important details, while ignoring irrelevant information (abstraction).
- Designing the simple steps or rules to solve each of the smaller problems (algorithms).
- Finally, these simple steps or rules are used to program a computer to help solve complex problems in the best way.



ALGORITHMS

An algorithm can be defined as a finite sequence of activities to be processed for getting, a task done or the desired output from a given input. It contains instructions that, when written in any computer language, become a computer program. Thus, an algorithm is important to develop a program.

Even for the same task, two algorithms can perform in different ways. This is because there are currently numerous solutions with various methods. It is comparable to adding water to a bucket. Either use a container to fill it gradually. The alternative is to utilise a pipe that can fill the water all at once. For the same problem, each solution performs differently.

Additionally, this can also help you find a solution in a pool of solutions. Examine all the variables, like cost, time complexity, etc. Considering how little labour will be required, employing a pipe may be the best approach in this case.

Rules for Writing Algorithms

There is a set of rules that you should follow while writing an algorithm.

- It should be clear, exact, and well-defined.
- It should always begin with the word Start and end with the word Stop.
- Each step in an algorithm should be written in a separate line.
- Steps should be numbered as Step 1, Step 2, Step 3, etc.

Some Examples of Simple Algorithms:

Example 1:

Write an algorithm to go for a picnic with your classmates.

Solution:

Step 1 : Start
Step 2 : Decide the picnic venue, date, and time.
Step 3 : Decide the picnic activities.
Step 4 : Rent a vehicle to reach the venue and come back.
Step 5 : Go to the picnic venue on the decided date.
Step 6 : Do the activities planned for the picnic.
Step 7 : Come back to school in the rented vehicle.
Step 8 : Stop

Example 2:

Write an algorithm to make tea.

Answer:

Step 1 : Start
Step 2 : Boil water in a saucepan.
Step 3 : Add tea to boiling water.
Step 4 : Add sugar to boiling water.
Step 5 : Add milk to boiling water.
Step 6 : Boil this water with all the ingredients for 2 mins.
Step 7 : Filter the tea into a cup.
Step 8 : Stop

Example 3

Input the length of two different line segments and check whether they are equal or unequal. Display the message accordingly.

Algorithm

Step 1 : Start

Step 2 : Input the length of the two line segments as l1 and l2.

Step 3 : If l1 and l2 are equal, then print 'Line Segments are equal'.

Step 4 : If l1 and l2 are not equal, then print 'Line Segments are not equal'.

Step 5 : Stop

Do You Know?

If all the instructions in an algorithm are executed in the same order as they are listed, the flow of execution is called as Sequence. The program based on these algorithms will execute their instructions in the same sequence as they were typed.

Example 4:

Write an algorithm m to find if a number is odd or even.

Answer:

Step 1 : Start

Step 2 : Take a number to N.

Step 3 : Divide the number by 2 and store the remainder in R.

Step 4 : If R = 0 Then go to Step 6.

Step 5 : Print 'N is odd' go to step 7.

Step 6 : Print 'N is even'

Step 7 : Stop

Do You Know?

If some of the instructions in an algorithm are executed based on some condition, the flow of execution is called a Selection. The program based on these algorithms will execute their instructions based on the condition.

In the example above, the program will skip the step 5 is the condition R=0 is true. Otherwise, it will skip Step 6.

Some Examples of Complex Algorithms

Example 5:

Write an algorithm to convert a decimal number to a binary number.

Solution:

Step 1 : Start

Step 2 : Divide the number by 2 and store the answer(quotient) and remainder. separately.

Step 3 : Divide the answer of step 2 by 2 and store the answer(quotient) and remainder separately.

Step 4 : Repeat steps 2 and 3 until the number is greater than 0.

Step 5 : Write all the remainder in reverse order.

Step 6 : Stop

Do You Know?

If some of the instructions in an algorithm are executed repeated based on some condition, the flow of execution is called as Iteration or Loop.

The program based on these algorithms will execute their instructions based on the condition repeatedly until the condition remains true. When the condition is false, it will come out of the loop and begin executing next instructions.

In the example above, the program will repeat step 2 and 3 until the quotient is greater than 0.

Difference Between Simple and Complex Problems

Simple Problem

A simple problem is one with a certain source and a certain outcome that is simple to locate and resolve.

Example

Let's say you place food in an oven, but you do not remember to set the timer. When left unattended for too long, it burns. Burnt food is the result, and you may need to eat something else for supper.

Solution:

Establishing an oven timer for your meals is a simple option.

Complex Problem:

A complex issue has various root causes. While some of these factors could be clear, others might be difficult to find.

Example

Raising a Child:

- You do not know much about bringing your first child up.
- While having one child gives you experience, it does not guarantee that you will be successful with the next.
- It neither guarantees success nor is it necessary.
- Each child is different and needs to be treated as an individual.
- The result still is not guaranteed.

The difference between these two problems is that the simple problems can be solved easily while a complex problem's solution is not guaranteed. These types of examples cannot be solved computationally.

Multiple Solution of the Same Problem

In many of the cases, there are always more than one solution available. We must choose the best one. The best one is the solution that will solve our problem in minimum steps, using minimum computer resources.

For example, please read the following problem.

Write an algorithm to find whether a given positive number is prime or not.

Solution 1:

Step 1 : Start

Step 2 : Take a number n as an Input.

Step 3 : If the n is greater than 1, keep on dividing this number with natural number start from 2 and ending with n-1.

Step 4 : If any number from 2 to n-1 divides n and you get the remainder 0, print that the number is not a prime number.

Step 5 : If step 4 fails, print that the number is prime.

Step 6 : Stop

Solution 2:

Step 1 : Start

Step 2 : Take a number n as an Input.

Step 3 : If the n is greater than 1, keep on dividing this number with natural number start from 2 and ending with n/2.

Step 4 : If any number from 2 to n/2 divides n and you get the remainder 0, print that the number is not a prime number.

Step 5 : If step 4 fails, print that the number is prime.

Step 6 : Stop

Solution 3:

Step 1 : Start

Step 2 : Take a number n as an Input.

Step 3 : If the n is greater than 1, keep on dividing this number with natural number start from 2 and ending with √n.

Step 4 : If any number from 2 to √n divides n and you get the remainder 0, print that the number is not a prime number.

Step 5 : If step 4 fails, print that the number is prime.

Step 6 : Stop

Analysis of All Three Solutions

If you look at all three solutions, you will get that all are correct. All solutions find whether the given number is prime or not but still they are different. Now the question is what solution should be selected for problem solving?

By carefully examining the solutions, you will find the following points:

- In first solution, the steps of calculations are starting from number 2 and ending on n-1 value.
- In second solution, the steps of calculations are starting from number 2 and ending on n/2.
- In third solution, the steps of calculations are starting from number 2 and ending on √n.
- Now it is evident that √n<n/2<n-1.
- Hence, we can choose the best solution i.e., the third solution that is offering the least steps and maximum efficiency of the algorithm.

Do You Know?

The speed and efficiency of an algorithm is measured in terms of **Time and Complexity** and **SpaceComplexity** . It means that an algorithm will be efficient if it is taking less processing time and less storage space in the computer system.

That is why, two algorithms for the same problem will perform differently even on same computer system as both are different is using processor time and storage space in memory.

FLOWCHARTS

A flowchart is another problem-solving tool that represents an algorithm in pictorial form. It uses a set of symbols that represents various instructions and shows the sequence and interconnection of functions with the use of lines and arrows.

Symbols Used in a Flowchart

Different symbols used in drawing a flowchart are listed in the following table.

Symbol	Name	Description
Oval	Start/Stop box	represents the beginning and the end of a flowchart
Parallelogram	I/O box	represents the input and output instructions in a flowchart
Rectangle	Process box	represents the processing instructions in a flowchart
Diamond	Decision box	represents the instructions that involve a condition with two options–'Yes' and 'No', to choose from
Lines with Arrowhead	Flow lines	show the direction of flow of data and instructions in a flowchart
Circle	Connector	used to connect various sections of a flowchart

Rules for Drawing a Flowchart

Like an algorithm, certain rules must be followed while drawing a flowchart.

- There can be only one start and one stop symbol in a flowchart.
- Only one flow line can be used with the Start symbol.
- Only one flow line can come out from a process symbol.
- Only one flow line can enter a decision symbol and two flow lines can come out from it.
- The flow lines should not cross each other.
- The direction of the flow of information in a flowchart is either from top to bottom or from left to right.

Examples of Flowcharts

Example 1:

Draw a flowchart for printing "Hello World" once.

Solution:

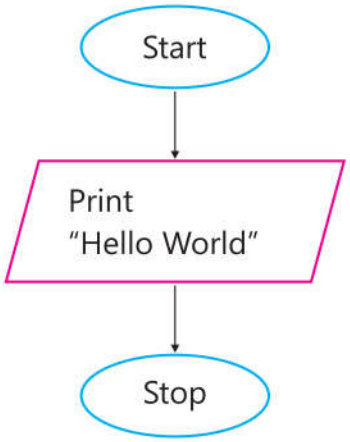
The algorithm for printing 'Hello World' once is as follows:

Step 1: Start

Step 2: Print 'Hello World'.

Step 3: Stop

Each rectangle represents a step in the sequence, and the arrows flow from one step to the next.



Things to Know

In algorithms and flow charts, some terms are used which are briefly defined here:

Declare: Declaring means to reserve memory location for a value,

Variable: Variable is the named memory location to store a value temporarily during the execution of a program

Read: Read is the command used to store values in the variables.

% Symbol: It is used to show the remainder in a division process. It is called Mod operator e.g. 5 % 2 =1

Example 2:

Add two numbers entered by the user.

Solution:

The algorithm for the sum of two numbers is as follows:

Step 1: Start

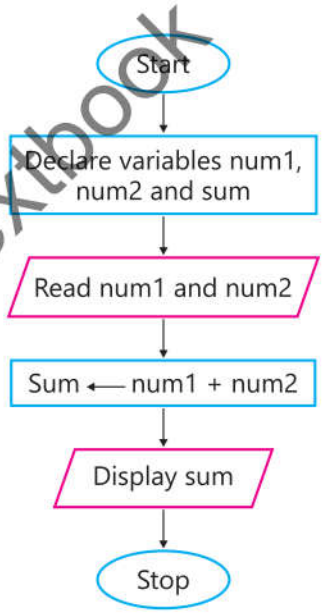
Step 2: Declare variables num1, num 2 and sum.

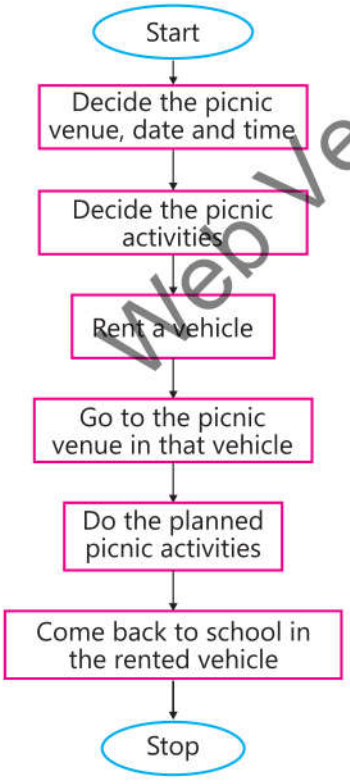
Step 3: Read the values num1 and num 2

Step 4: Add num1 and num 2 and assign the result to the sum.

Step 5: Display the sum.

Step 6: Stop





Example 3:

Write an algorithm to go for a picnic with your classmates:

Solution:

Step 1: Start

Step 2: Decide the picnic venue, date, and time.

Step 3: Decide the picnic activities.

Step 4: Rent a vehicle to reach the venue and come back.

Step 5: Go to the picnic venue on the decided date.

Step 6: Do the activities planned for the picnic.

Step 7: Come back to school in the rented vehicle.

Step 8: Stop

Example 4:

Write an algorithm to make tea.

Answer:

Step 1: Start

Step 2: Boil water in a saucepan.

Step 3: Add tea to boiling water.

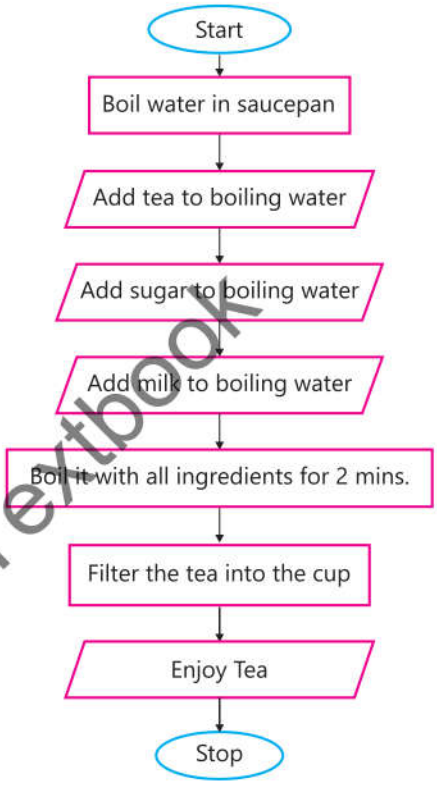
Step 4: Add sugar to boiling water.

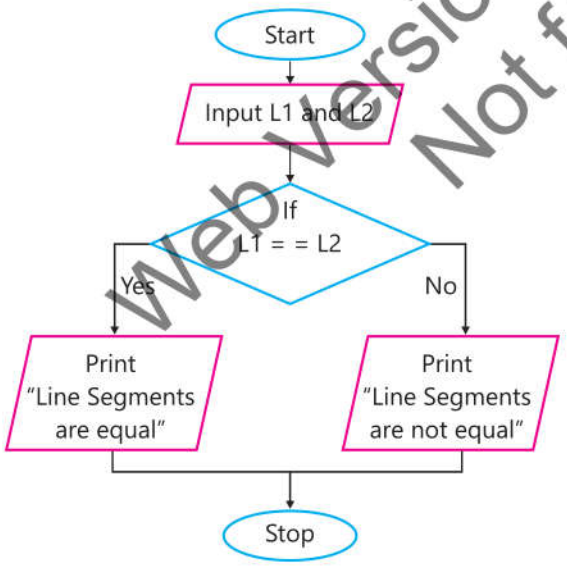
Step 5: Add milk to boiling water.

Step 6: Boil this water with all the ingredients for 2 mins.

Step 7: Filter the tea into a cup.

Step 8: Stop





Example 5

Input the length of two different line segments and check whether they are equal or unequal. Display the message accordingly.

Algorithm

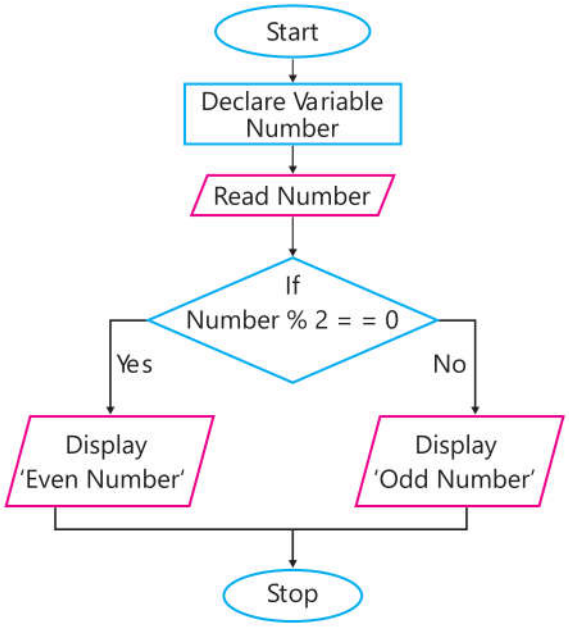
Step 1 : Start

Step 2 : Input the length of the two line segments as L1 and L2.

Step 3 : If L1 and L2 are equal, then print 'Line Segments are equal'.

Step 4 : If L1 and L2 are not equal, then print 'Line Segments are not equal.

Step 5 : Stop



Example 6:

Draw a flowchart to find whether a number is even or odd.

Solution:

Algorithm to find whether a number is even or odd:

Step 1: Start.
Step 2: Declare the variable Number
Step 3: Read the value Number
Step 4: if Number % 2 == 0 then
Print 'Even Number'
Step 5: Otherwise
Print 'Odd Number'
Step 6: Stop

Advantages of Flowcharts

- Expressing an algorithm in a flow chart allows us to see an algorithm in action.
- It forces us to think very carefully about sequencing and selection. Which arrow goes to what node? Are there any missing arrows? Those are the kinds of valuable questions that can come up while translating an algorithm into a flow chart.

Do You Know?

Although using flowcharts is fairly simple, making changes to them is a problem. Most likely, you'll have to redo the entire flowchart.

COMPUTATION THINKING in PRACTICE

Before computers can be used to solve a problem, the problem itself and how it could be resolved must be understood. Computational thinking helps with these tasks. It enables the programmer to work out exactly what to instruct the computer to do. Once it is clear, the solution can be converted into the programming language.

Look at the given table to find the advantages and disadvantages of computational thinking.

Terms	Advantages	Disadvantages
Thinking abstractly	Allows us to make predictions	Predicting markets, users, trends, and technical factors could be challenging. Too many factors that are changeable may mean the scenario is too complex to model accurately.
Thinking ahead	Caching can speed up a process	Caching can be complicated to implement. Caching requires the correct data to be fetched for the next task.
Thinking procedurally/ Decomposition	Can be done with flowcharts, etc.	It may not be entirely possible with an event-driven approach rather than a procedural approach to problem solving.
Thinking concurrently	Concurrency speeds up the solution.	It may be difficult to program

Hence, we can say that it is not possible to solve all the problems computationally.

Some Problems Cannot be Solved Computationally

Some problems cannot be solved computationally. Some of these examples include:

Factoring Large Numbers in Small Time

The factoring problem asks you to identify the prime factors of an odd integer. It is an example of a computational challenge. The factorization problem is said to not be solved computationally. The factoring effort increases exponentially as the size of the input integer increases.

The Halting Problem

The halting problem is a decision problem. Halting means terminating or stopping our program after a certain execution. We are unable to create a generic algorithm that can accurately predict whether a certain program will ever stop or not. Additionally, there is no generic algorithm that can tell us whether a certain program will complete its execution and stop. The best approach is to run the application and check to see if it stops or halts.

Keep in mind that if our program does not halt, it will keep the CPU busy forever. In programming, we say it is an infinite loop. Our programs should never get into infinite loops otherwise, the system will not work properly.

PSEUDOCODE

A collection of instructions to solve a problem simply described in plain English is called Pseudocode. Pseudocode can be viewed as a collection of well-organised ideas for solving issues. It is an informal way to describe problem-solving instructions. It also serves as a

communication option that can help you explain your ideas to other people.

Although there are no set guidelines for writing pseudocode, it can be useful to use common terms like input, output, if-then-else, while-do, for, etc. Coders often use pseudocode as an intermediate step in programming in between the initial planning stage and the stage of writing actual executable code.

Writing a Basic Structured Pseudocode

It can be easy to convert pseudocode into actual code once you program. We must remember the purpose of our pseudocode and explain what each line of the program should do. This will keep us focused while creating the pseudocode document.

Following are some basics of writing pseudocode:

- Put the tasks in the proper order, then start writing.
- Start with a statement that states the primary objective.
- Use the proper sentence case for each type of word.
- Apply the proper naming conventions. The name must be clear and concise
- It should be easy enough for a layman to understand.
- Write everything that will occur in the real code without abstraction.

It can be easy to revert to writing in code once you plan your program. We must remember the purpose of our pseudocode and explain what each line of the program should do. This will keep us grounded while creating the pseudocode document.

A Pseudocode to Print the Sum of two Integer Numbers

Step 1: Use plain-text editors. Here we have opened Notepad.

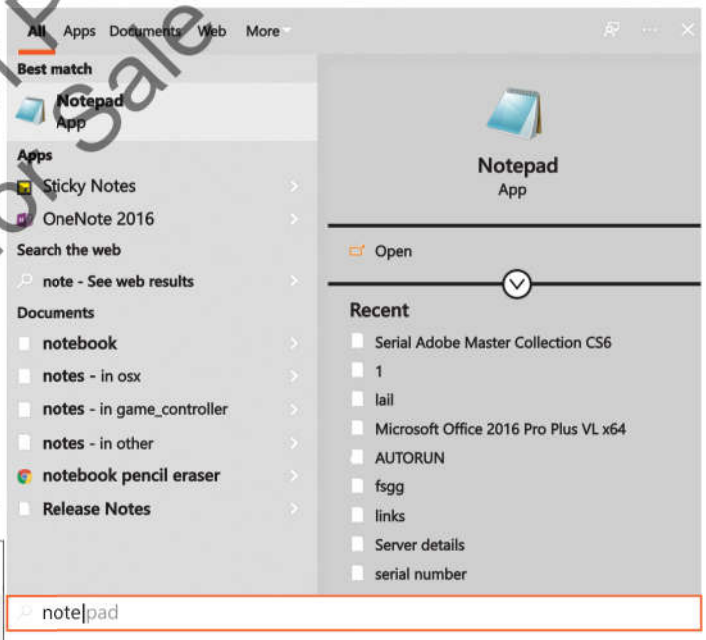
Step 2: Write down the purpose of the process.

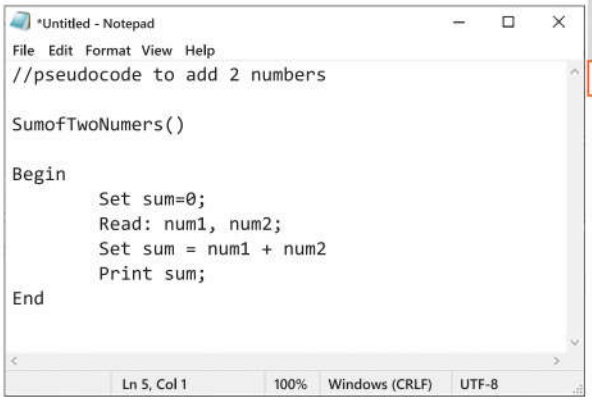
Step 3: Write the opening command.

Step 4: Start the program.

Step 5: Set the variable 'sum'

Step 6: Read the first number 'num1' and the second number 'num2'.





Step 7: Sum 'num1' and 'num2' and save the result in the variable 'sum'.
sum -> num1 + num2

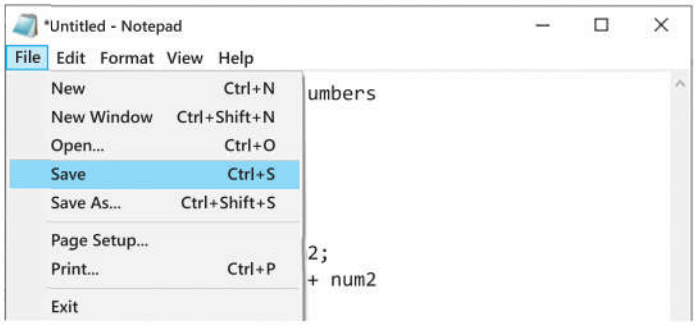
Step 8: Print the variable 'sum'..

Step 9: End the program.

As per this method's example, your final pseudocode document should look something like this:

Step 10: Press Ctrl + S to save your document. Enter a name and click Save to do so.

You have created your pseudocode well.



Conditions in Problem Solving

Conditions are the key factor in problem solving. Conditions tell us to take the right path based on some test. These tests may be simple tests like checking the value of a statement or selecting the right key for your home door lock from a bunch of keys. These conditions decide which tasks will be performed if the condition is true. For example, if the right key for the door lock is chosen, the lock will be opened.

The way you can differentiate between the problems where the 'if', 'if then else, and if with multiple conditions can be applied depends on the problem.

if condition:

In the 'if' condition, a statement or a block of statements are only executed if a specific condition is true. Otherwise, neither the statement nor the block of statements is executed. For example, consider that if it is cold outside; we would take tea.

'if then else' condition:

In the 'if then else' condition, a statement or a block of statements under the 'if' are only executed if a specific condition is true; otherwise, it goes for the 'else' statement or block of statements and executes it. So 'else' represents otherwise.

Consider this example: if it is cold outside; we would take tea, 'else' we would enjoy ice cream.

Here we will take tea if the condition of cold outside gets true. Otherwise, we will enjoy ice cream. Both actions can not be done at the same time.

Iterations in Problem Solving

Sometimes we want to repeat an action again and again, it is called Iteration. It is also referred to as loops. Loops allow you to repeat an action or set of actions until a particular condition is satisfied. Consider the example where you are asked to collect the balls in a hall and put them in a box. You will go to the ball, collect it, and put it in the box. Then you will go to the next ball, collect it, and put it in the box. You will repeatedly perform the same task until all balls are collected and put in the box.

These types of situations are called iterations or loops. In algorithms, we use Repeat or Repeat

Forever to represent these loops. Repeat tells to repeat the instructions until a condition is met. Repeat Forever loops are the loops that execute an instruction or a set of instructions infinitely. For example, the security algorithms keep on working to secure your system.

Example:

Write an algorithm that prints even numbers from 2 to 100.

Step 1: Start

Step 2: Declare the value 2 to Num

Step 3: Print the value Num

Step 4: Add 2 to Num

Step 5: If the value of Num <=100, Repeat Steps 2 and 3.

Step 6: Stop

This algorithm will keep on printing the value of Num i.e. 2,4,6... until the value is 100. Then it will stop.

Concept of Nesting

Nesting is the placement of one object within another object. In problem solving, different elements may be placed within other elements. For example, you may place conditions within other conditions, or loops within other loops.

Problem solving is made powerful yet easy because of nesting. The number of steps required is decreased.

Nested Conditions:

Conditions may be placed within other conditions to solve a problem. These conditions will have many 'if' condition blocks that are checked line by line until a condition is true. If it is not, then it executes the 'else' block at the end.

Example:

Step 1: Start

Step 2: Declare three values a, b and c

Step 3: Read the values a, b and c

Step 4: Check if a is greater than b

Step 5: If true, then check if a is greater than c

1. If true, then print "a" as the greatest number
2. If false, then print "c" as the greatest number

Step 6: If false, then check if b is greater than c

1. If true, print "b" as the greatest number
2. If false, print "c" as the greatest number

Step 7: Stop

Nested Iterations or Loops:

Just like the nested conditions, you can also nest the loops. Nesting can be done to any level. You can use as many loops within other loops as you want but increasing the level of nesting will result in increasing complexity.

Example:

An example of the way nested iteration or loops can be:

```
repeat (condition)
{
        repeat (condition)
        {
                statement(s)
        }
}
```

Glossary

step-by-step	to progress slowly from one stage to the next	computational	using computers
characteristic	a typical quality or feature of a person, place, or thing	pictorial	illustrated in pictures
perspective	a particular outlook regarding something	concurrent	happening or done simultaneously
regularity	something regular	halt	to stop
finite	to have a limit	informal	unofficial or not formal

LET'S HAVE A LOOK

- Problem-solving refers to the process of finding solutions to problems that you come across in everyday life.
- Computational thinking is a set of problem-solving processes that allows the user to take a complex problem, understand what the problem is and develop possible solutions.
- There are four fundamental steps of computational thinking–decomposition, pattern recognition, abstraction, and algorithm design.
- An algorithm can be defined as a sequence of activities to be processed for getting a task done or the desired output from a given input.
- A flowchart is another problem-solving tool that represents an algorithm in pictorial form.
- In the halting problem, we are unable to create a generic algorithm that can accurately predict whether a certain program will ever stop or not.
- Pseudocode can be viewed as a collection of well-organised ideas for solving issues. It is an informal way to describe problem-solving instructions.

Exercise

A. Multiple Choice Questions: Tick the correct answer.

1. Developing a step-by-step approach for solving a problem is:

   a. Decomposition **b.** Abstraction

   c. Algorithm Design **d.** Pattern Recognition

2. _____ allows us to take a complex problem, understand what the problem is and develop possible solutions.

   a. Computational thinking **b.** Excel **c.** Formulas **d.** None of these

3. Observing patterns, trends, and regularities in data along with looking for similarities among and within the problem are:

   a. Decomposition **b.** Abstraction

   c. Algorithm Design **d.** Pattern Recognition

4. Focusing only on the important details, while ignoring irrelevant information is:

   a. Decomposition **b.** Abstraction

   c. Algorithm Design **d.** Pattern Recognition

5. Sometimes we want to repeat an action again and again, which is called _____.

   a . iteration **b.** solution **c.** copying **d.** deletion

6. There can be only one start and ___ stop symbol in a flowchart.

   a. one **b.** two **c.** three **d.** four

7. The Start/Stop box is represented by _____.

   a. an oval **b.** a parallelogram **c.** a rectangle **d.** a diamond

8. The decision box is represented by _____.

   a. an oval **b.** a parallelogram **c.** a rectangle **d.** a diamond

9. What is the full form of CT?

   a. Computer Technology **b.** Computational Thinking

   c. Computer Tomography **d.** None of these

10. _____ is the placement of one object within another object.

a. Halting b. Flowchart c. Nesting d. None of these

B. Write "T" for true or "F" for false statements.

1. An algorithm always begins with the word Start. ☐
2. A diamond shows the direction of the flow of data and instructions in a flowchart. ☐
3. Computational thinking does not allow the development of solutions to a problem. ☐
4. Each step in an algorithm should be written in a separate line. ☐
5. The flow lines can cross each other. ☐
6. Like an algorithm, certain rules must be followed while drawing a flowchart. ☐
7. Concurrency slows down the solution. ☐

C. Answer the following questions:

1. Explain computational thinking. Why do you think it is important to learn?
2. Differentiate between decomposition and abstraction.
3. What are the rules to write an algorithm?
4. What do you think is the process to boil water? Write an algorithm and draw a flowchart for boiling the water.
5. Explain the factoring problems.
6. What is a pseudocode?
7. How are algorithms used in real life?
8. Are pseudocodes better than flowcharts? If yes then explain why.

D. Answer the questions comprehensively:

1. Write two pros and cons of computational thinking.
2. What do you mean by the halting problem? How can we prove that the halting problem is undecidable?

D. Define the following terms:

1. Computational thinking
2. Decomposition
3. Abstraction
4. Flowchart

E. Application-based questions:

1. Ali and his friends are playing tic-tac-toe. What will be his main strategy to win against his opponents?
2. Bilal left his house at the crack of dawn. He looks at his watch to see what time it is. He takes the bus to get to school if it is before 7 a.m.; otherwise, he takes the subway. Create a flowchart for this scenario.

Learning Activities

1. Represent algorithms using pseudocodes.

• Activity 1:

Provide a set of instructions or pseudocode. Using graph paper, follow the instructions and draw the output on a grid. Start from a point on the top left corner, initially 46 facing East and the distance between two points on the graph paper is 50 steps

The list of instructions/pseudocode is:

- Move forward by 100 steps
- Turn right by 90 degrees
- Move forward by 100 steps
- Turn right by 90 degrees
- Move forward by 100 steps
- Turn right by 90 degrees
- Move forward by 100 steps
- Turn right by 90 degrees

- If the activity has been done correctly the students are facing in the same direction as originally and should have drawn a square.

2. Activities that describe that there are ways to characterise how well algorithms perform and that two algorithms can perform differently for the same task.

• Activity 3:

Solve the Sudoku puzzle. The rules of the game are very easy. For the 4 x 4 game, the numbers 1 to 4 must be filled in each row, column, and smaller 2 x 2 boxes. Each number in a row, column, or box must be used exactly once! A 4 x 4 Sudoku puzzle looks as follows.

	1		
		2	
	3		
		1	

The main idea is to consider all the valid possible solutions and then eliminate the options that do not satisfy the rules of the game

• Activity 4:

Ali, Mariam, Neha, and Usman were the only four participants in a cake-baking competition; they placed 1st, 2nd, 3rd, and 4th in some order. Also,

1. Mariam was not first, and Usman was not last.
2. Neha was placed next to neither Mariam nor Usman;
3. Ali scored better than Mariam.

Based on these clues, who placed 1st, 2nd, 3rd, and 4th?

3.Apply the best possible solution to a problem from a pool of solutions.

• Activity 5:

A man finds himself on a riverbank with a wolf, a goat, and cabbage. He needs to transport all three to the other side of the river in his boat.

However, the boat has room for only the man himself and one other item (either the wolf, the goat, or the cabbage). In his absence, the wolf would eat the goat, and the goat would eat the cabbage.

Show how the man can get all these 'passengers' to the other side. ("Puzzle | Farmer, Goat, Wolf and Cabbage - GeeksforGeeks", 2022)

• Activity 6:

Once upon a time, there was a city that had no roads. Getting around the city was particularly difficult after rainstorms because the ground became very muddy -- cars got stuck in the mud and people got their boots dirty.

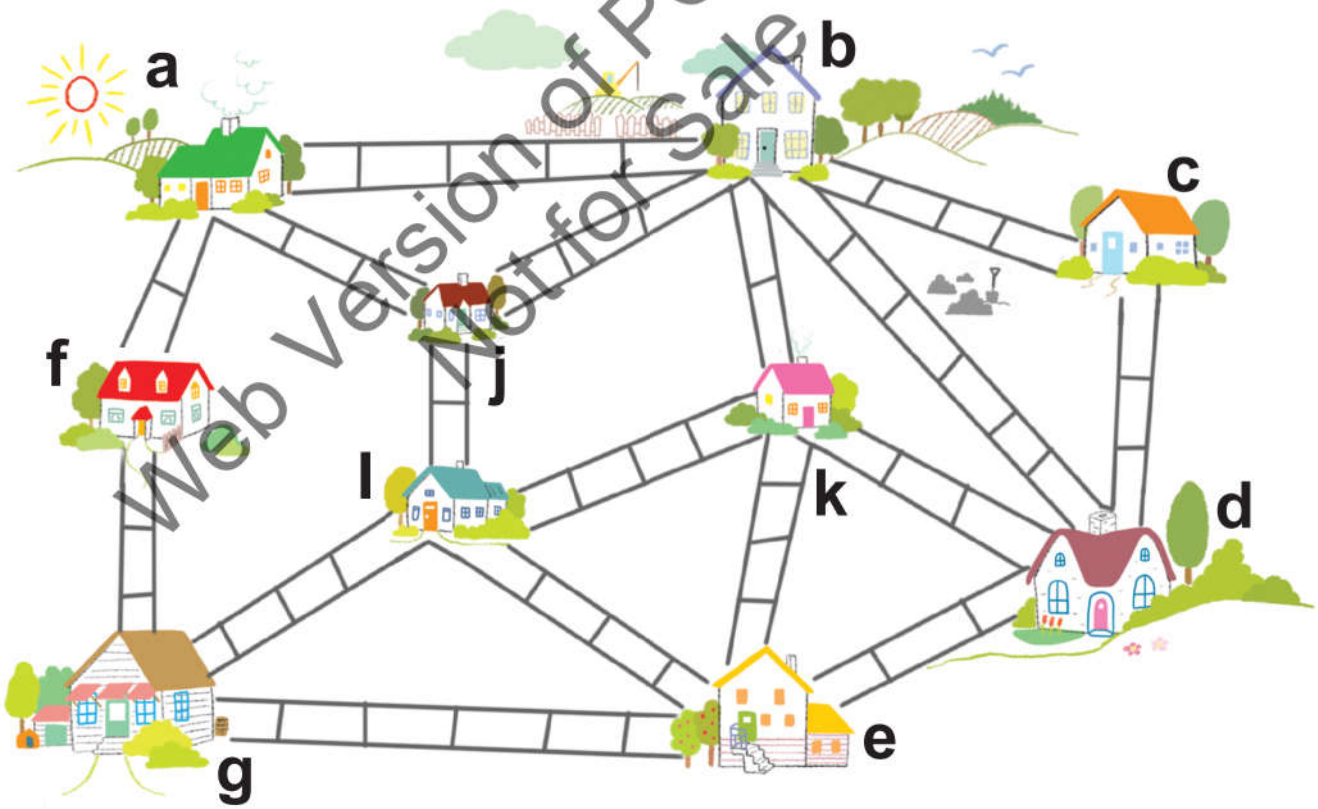
The mayor of the city decided that some of the streets must be paved but did not want to spend more money than necessary because the city also wanted to build a road.

The mayor, therefore, specified two conditions:

1. Enough streets must be paved so that everyone can travel from their house to anyone else's house only along paved roads.

2. The paving should cost as little as possible. Use as few stones as possible. On the map of the city, the number of paving stones between each house represents the cost of paving that route. Find the best route that connects all the houses but uses as few counters 47 (paving stones) as possible. What kind of strategies did you use to solve the problem?

Enough streets must be paved so that everyone can travel from their house to anyone else's house only along paved roads. The paving should cost as little as possible. Use as few stones as possible. ("The Muddy City Problem", 2022)



In Class Activity

1. Write the pseudocode of any 3 different algorithms.
2. Design an algorithm of 3 different problems (easy, difficult, and complex) and translate them into pseudocodes.
3. Identify whether the problem can be solved or not? If not write the reasons, if yes write the reasons.
4. You have nine cards of the following colours. We need to arrange these cards into three rows and three columns, for example, blue, orange, teal, blue, green, blue, gold, teal, green,
   We also want the following rules to be satisfied:
   - The two green cards are on the left.
   - The two teal cards are at the bottom.
   - The three blue cards are at the top.
   - The orange card is on the right.

   Based on these rules, arrange the nine cards in the grid.
5. A farmer is on his way back from the market, with him he has a fox, a chicken, and some grain. When he reaches a river crossing he must use a small boat only big enough for him and one other item.

   Unfortunately, if the fox is left alone with the chicken it will eat it, as will the chicken eat the grain? Explain how the farmer can cross the river. ("Crossing a river in a boat with some grain, 45 a chicken and a fox.", 2022)
6. In the eighteenth century the city we now know as Kaliningrad was called Königsberg and it was part of Prussia. Like many other great cities, Königsberg was divided by a river, called the Pregel. It contained two islands and seven bridges linking the various land masses.

   A famous puzzle at the time was to find a walk through the city that crossed every bridge exactly once — the path wasn't allowed to cross any bridge more than once, and it wasn't allowed to leave any bridge out. Apply graph theory to determine the solution to this problem. ("The Bridges of Königsberg", 2022)
7. Students should be able to write at least 2 different solutions to the same problem and identify which one is the best algorithm to solve the problem and why.

   (This activity can be a group/ class activity where students can identify their solutions and write the algorithm and pseudocode and then decide which solution is best and why?)

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Answers

A: Tick the correct option.

1	c	2	a	3	d	4	b	5	a
6	a	7	a	8	d	9	b	10	c

B: True and False

1	T	2	F	3	F	4	T	5	T
6	T	7	F						

6 Programming

Knowledge:

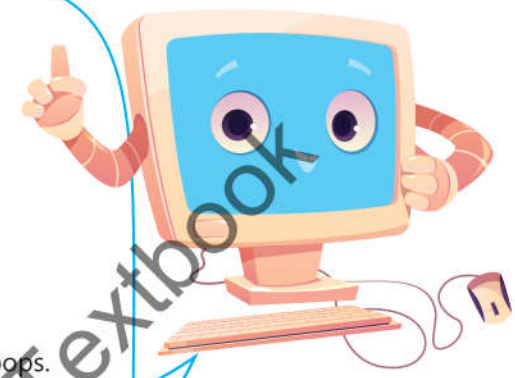
Students will be able to:

- Use simple as well as complex loops.
- Use simple as well as complex conditions.
- Discuss the concept of Functions in a computer program.
- Discuss the concept of cloning in a computer program.

Skills:

Students will be able to:

- Use simple and complex loops in computer programs.
- Differentiate between 'repeat', 'forever', and 'repeat until' loops.
- Use different types of loops together in a program.
- Nest different types of loops together in a program.
- Differentiate between If, If-Then, and If/Else conditions.
- Use different types of conditions together in a program.
- Nest different types of conditions together in a program.
- Use simple functions in a computer program.
- Use cloning blocks in a computer program.
- Design high-level games like tic-tac-toe, maze with multiple levels, etc.



Programming

- Programming is the art of writing instructions to tell a computer what to do. A set of instructions is called a Program. The instructions are written in a programming language.
- Programming may be done in a Textual Computer language e.g., GW Basic, C, C++ etc, or any Visual Language like Scratch, LOGO Turtle, etc.
  In this unit, we still study Scratch.

Scratch: A Visual Proramming Language

Scratch is a programming language that is perfect for making games, animations, interactive stories, and other visually rich programs. Scratch is easier to use than most other programming languages for several reasons.

Do You Know?

Scratch is created by the MIT Media Lab. It is used all over the world and has been translated into more than 70 different languages. Scratch is taught and used in many after-school programmes, educational institutions, and colleges.

Advantages of Scratch:

- There is no need to remember or type the commands. They are all on the screen, so just dragging and dropping helps us to write the program.
- Commands fit together like jigsaw pieces, so there are strong visual hints about how to combine them.
- Error messages are generally not seen. As Scratch commands lock together, programs always make some sense. It is possible to write programs with logical errors if they don't do what was expected.
- Scratch guides to writing things that work, rather than keeping the programmer confused with the codes that do not work.
- The commands in Scratch simplify common activities in games, such as testing whether a missile has hit an alien (collision detection), or rotating a character on screen.
- The commands are colour-coded and categorised, so it is very easy to find a command when required.
- Scratch enables you to quickly see results from work, and even includes graphics and sounds. Many other programming languages require learning text commands and strict rules about how to use them.

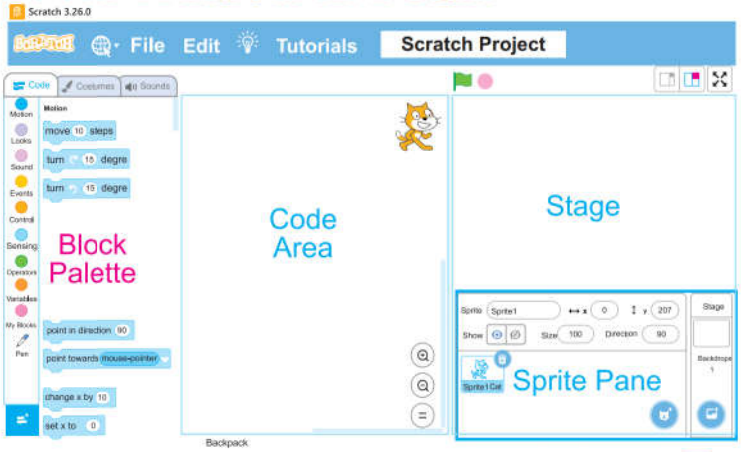
What is the Relation Between Programming and Scratch?

Computers always understand commands written in Machine Language, i.e., 0 and 1. But machine language is very difficult to understand and work with. High-level languages were introduced to overcome the difficulties in machine language. Most high-level languages use text commands. We must memorise these commands to write programs in high-level languages. Visual languages provides us with more options and text free programming interface where we do not need to write text commands. We use graphical blocks and add them in the sequence to perform any task.

Scratch will generate text code automatically. This text code will be converted into machine language by the compiler, a software that is used to convert high-level language to low-level language.

Understanding the Scratch Window in Detail

The scratch window is broken up into several sections such as a sprite pane, stage area, etc. On the left, the projects are carried out which is called the Stage. A list of sprites, or images, is situated below the stage. On the right side, instructions are created which are called the Scripts area and Blocks Palette.



- Sprites can be moved, drawn on the screen, respond to clicks, change their appearance, and interact with each other. For example, a space game might have an alien sprite, a spaceship sprite, and a missile sprite.
- Many projects have more than one sprite, and any sprite can be chosen by clicking them in the sprite list, in the bottom right.
- The blocks serve as commands that can be joined together.
- When the program is tested, sprites can be seen responding to the codes on the stage.
- Those instructions come in the form of blocks that can be joined.

Do You Know?

How to snap two blocks together? As you drag a block onto another block, a while line displays to indicate that the block you are dragging can be added to the script. When you see the white line, release your mouse to snap the block in place.

Categories of Blocks

The blocks are sorted into the following categories:

Motion: Used for moving sprites around the stage. For example, move, turn, etc.

Looks: Used for animating sprites, giving them speech bubbles, and changing their size and appearance. For example, say, think, etc.

Sound: Used to regulate sound functions and playing recordings or musical notes. They are colour-coded pink/magenta. For example, play sound, stop all sound, etc.

Events: Used to make the sprite perform according to the event done for example when the Green flag is clicked.

Control: Used to describe what happens when, and for making bits of your program repeat. This block is used to manage scripts in specific conditions. For example, repeat, forever, etc.

Sensing: Used to test whether your sprite is touching another sprite or another colour, or to get information about other sprites. This block identifies various project-related elements.

Operators: Used for Maths equations, random numbers, and handling strings. There are blocks used for combining the blocks used in decision-making.

Variables: Used to change the values recorded in Scratch. Variables can only hold one value at a time. These values can be either numbers or text. For example, roll number, name, etc.

My Blocks: Used to make a new block from scratch. It contains procedures for the sprite that is selected at the moment.

There are some of the new categories of blocks available in the Add Extension section at the bottom of the blocks category. Some of these are:

Music: Used to play more instruments and drums by the sprite from scratch.

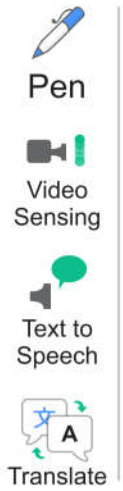
Motion
Looks
Sound
Events
Control
Sensing
Operators
Variables
My Blocks
Music

Pen: Used to draw as the sprite moves around the stage. It is used for making random art or giving some special effects on the stage.

Video Sensing: Used to make a video using the camera on the computer. It can be used in programming by the sprite to make a video by sensing it.

Text to Speech: Used to convert text into speech from scratch. We can also change the language in it.

Translate: Used to translate any text in different languages available from scratch.



Elements of Programming in Scratch

In programming, we use many elements just like we use different elements in the English language. Some of them are discussed here:

Variables

In programming, a variable is a place for some value in memory, much like x and y are popular variables in algebra. In Scratch, variables are represented with blocks shaped like elongated circles, uniquely labelled by you.

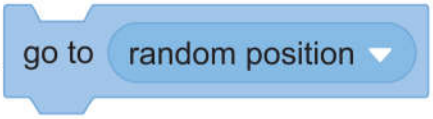
- Variables can be local or global. In Scratch, a local variable can be used by just one sprite, a global variable can be used by all sprites.
- A variable that takes only the value of true (i.e., 1) or false (i.e., 0), is called a Boolean variable.

Statements

In programming, a statement is simply a directive that allows the computer to do something.

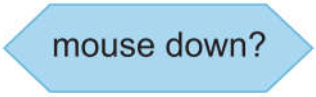
It can be thought of as a command or an instruction. In Scratch, any block whose label is read like a command is a statement. One such block instructs a sprite to say something:

Another such block instructs a sprite to go to some location.



Boolean Expressions

In programming, a Boolean expression is an expression that is either true or false. In Scratch, any block shaped like an elongated diamond is a Boolean expression. One such block is:



After all, it is either true that some number is less than another number or it is false.

Conditional Statements

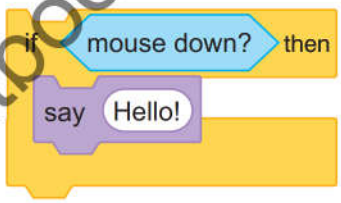
Statements with a condition and a result are said to be conditional. Depending on whether a condition is true or false, a conditional statement instructs a program to act.

Here is an example: You want to cross the street. If there are no incoming cars, you cross the street. If there are incoming cars, you wait and check again.
If we re-frame our example of crossing the street into a programming statement using one of Scratch's conditional statements, we might say the following:

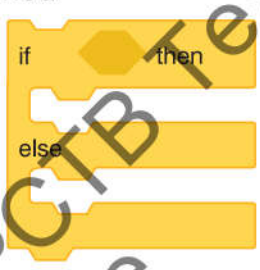
1. If no cars are coming, cross the street.
2. If cars are coming, do not cross the street; or else, close the street.
3. You will wait until no cars are coming, and then cross the street.
4. When you receive a walk signal, cross the street.

In programming, a condition is something that must be true for something to happen. A condition is thus said to 'evaluate to true' or 'evaluate to false.' In Scratch, any block whose labels say 'if', 'when' or 'until' is a sort of conditional construct.

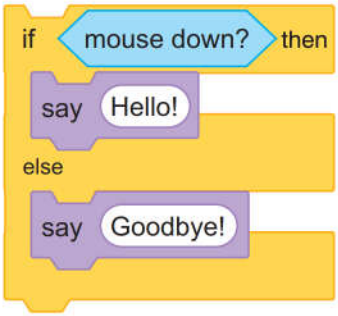
With 'if' construct, we can instruct a sprite to say hello only if, the user has pressed the mouse button down or not:



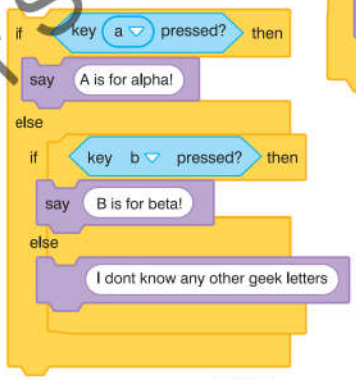
A related construct is the 'if-else construct':



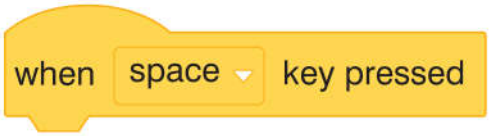
With this construct, we can instruct a sprite to say hello or goodbye, depending on whether the user has pressed the mouse button down or not:



Realise that these constructs can be nested to allow, for example, three different conditions:



Another conditional block is given, which performs an action when a certain key is pressed:



Yet another such block is a control block and a stack block together make up a block called the wait until () block. If the given Boolean condition is true, the block stops its execution.

The difference between the 'if block' and the 'if-then-else block' is that in the 'if block', the blocks inside it will execute if the Boolean condition is true. The blocks inside the block will not be executed if the condition is false. The condition is only tested once; if it becomes false

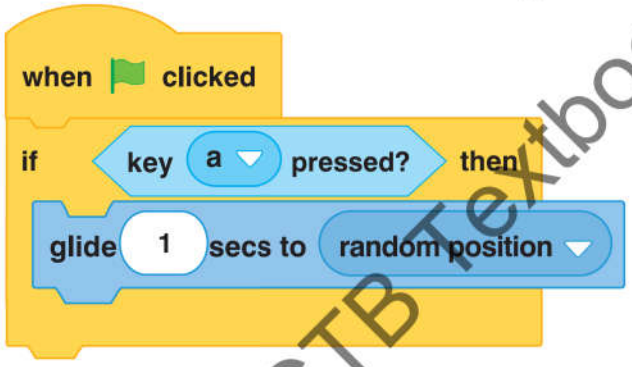
while the block's script is in progress, it will continue to execute until it is done.

On the other hand, in the 'if-then-else block', if the Boolean condition is true, the code stored inside the 'if' will execute; if the condition is false, the code stored inside the 'else' will execute. The block tests its Boolean condition.

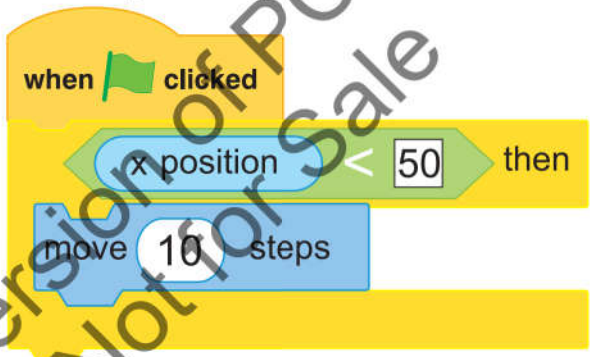
Examples:

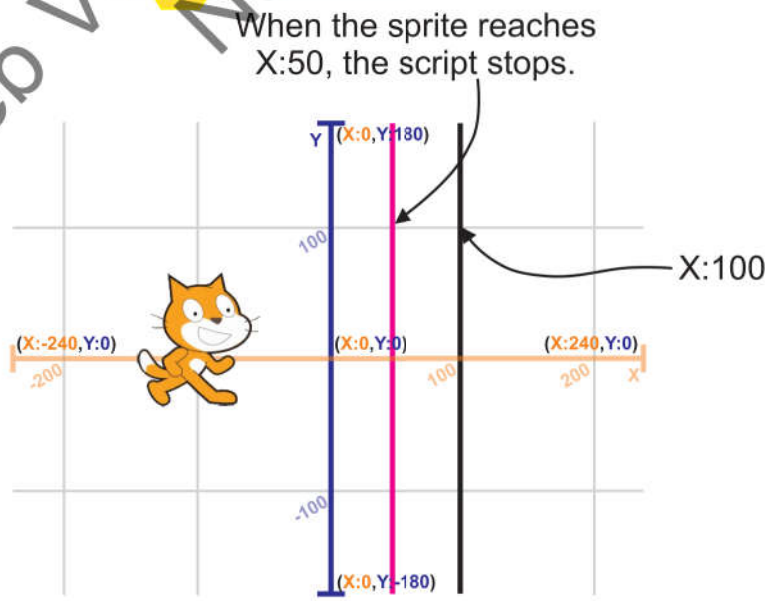
1. For all values of x that are bigger than 0, it is a true condition.

2. In this example, the sprite will glide for 1 second if the user types 'a.'



3. In this example, the cat will stop moving after it hits the red-lined X coordinate location of 50.



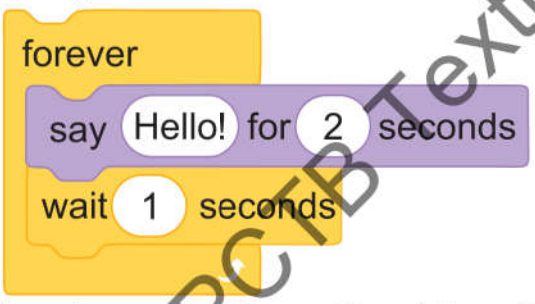


Loops

A loop in programming can execute statements several times depending on a condition. In Scratch, any block whose label begins with 'forever' or 'repeat' is a looping construct.

One such block is:

For example, with this construct, we may tell a sprite to say 'Hello!'. If the project is running or the Stop button is not pushed, the instructions contained in the forever block continue to be executed forever. This is very helpful for things like making background music or other actions that you do not want to stop.

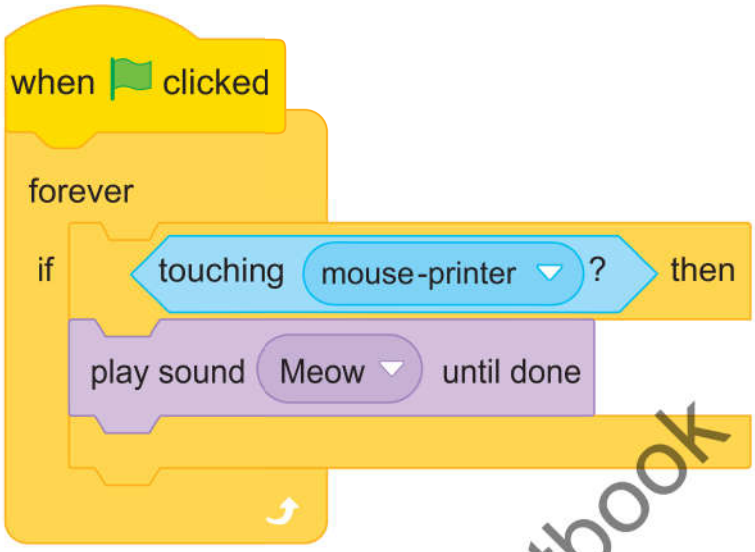


Another block allows you to play a loop a specific number of times. This loop would be used to repeat an activity, for example, four times if we knew we intended to perform that task four times. This greatly reduces the overall length of the code and helps to prevent minor errors.

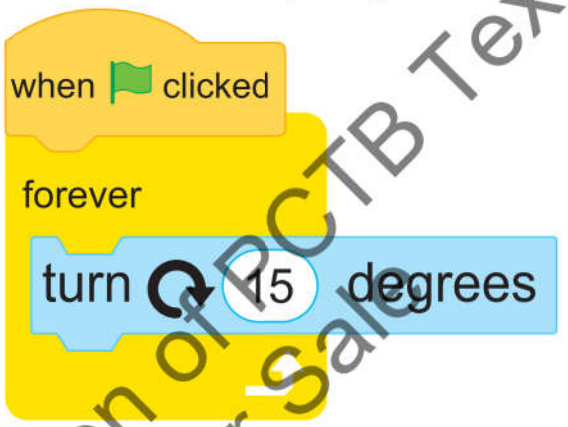
Another block allows you to play a loop until some condition is true. A loop and a condition are combined in the 'repeat until' block. Depending on the situation, you might not always be able to predict how often you want a certain action to occur. This block determines whether a condition is met at the beginning of each loop, and if it is, it stops running.

Example:

1. When the mouse pointer is over the cat and the 'forever' block is selected, we can hear our cat meow repeatedly.



2. The cat spins in a circle as a result of this loop using the Forever block.



Concept of Nesting

It indicates that you combine two structured programming constructs in a way that one construct is inside the other. Examples of these constructs are 'if,' 'for,' 'while,' and others.

Nested Loops

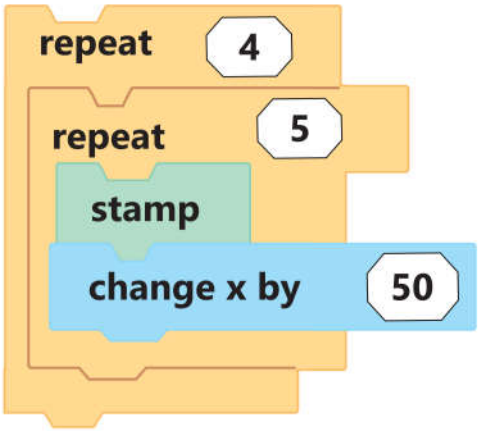
A loop that has been inserted inside another main loop is called a nested loop. Thus, a few

lines of code can be used to carry out complicated operations.

Example:

You must repeat your 'line' of cats four more times to create our cat-shaped rectangle image. The script section that stamped the line of cats can be 'wrapped' in another repeating control to do this. An example of this is a Doubly Nested Loop. The repeat 4 loop and the repeat 5

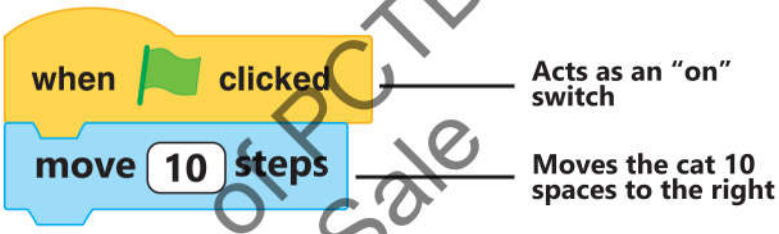
loop are frequently referred to as the outer and inner, respectively.



Functions

In programming, a function is a block of code that you may reuse repeatedly rather than having to write it out several times. A function, in the context of Scratch, is a block that performs some task.

The very first block, for example, says 'move 10 steps', and we can use it by dragging it from the library of blocks to the left, to the editor part of our project in the center.



Now that our first function has been written, if we click the block, our cat will shift a little to the right and the x-value of its position will also have changed.

In a programming language, a function is a piece of code that 'knows' how to carry out a specific task. For instance, a function that calculates the average of three input numbers can be written. This function does not need to be repeatedly rewritten once it has been written; it can be used many times.

Cloning

A sprite can duplicate itself while the project is active using the cloning capability. The clothes, sounds, scripts, and variables of each clone are identical to the original, yet they are

all autonomous.

Main cloning blocks include:

You will not be able to create a clone in the first place without the block. It creates a duplicate of the sprite you specify.

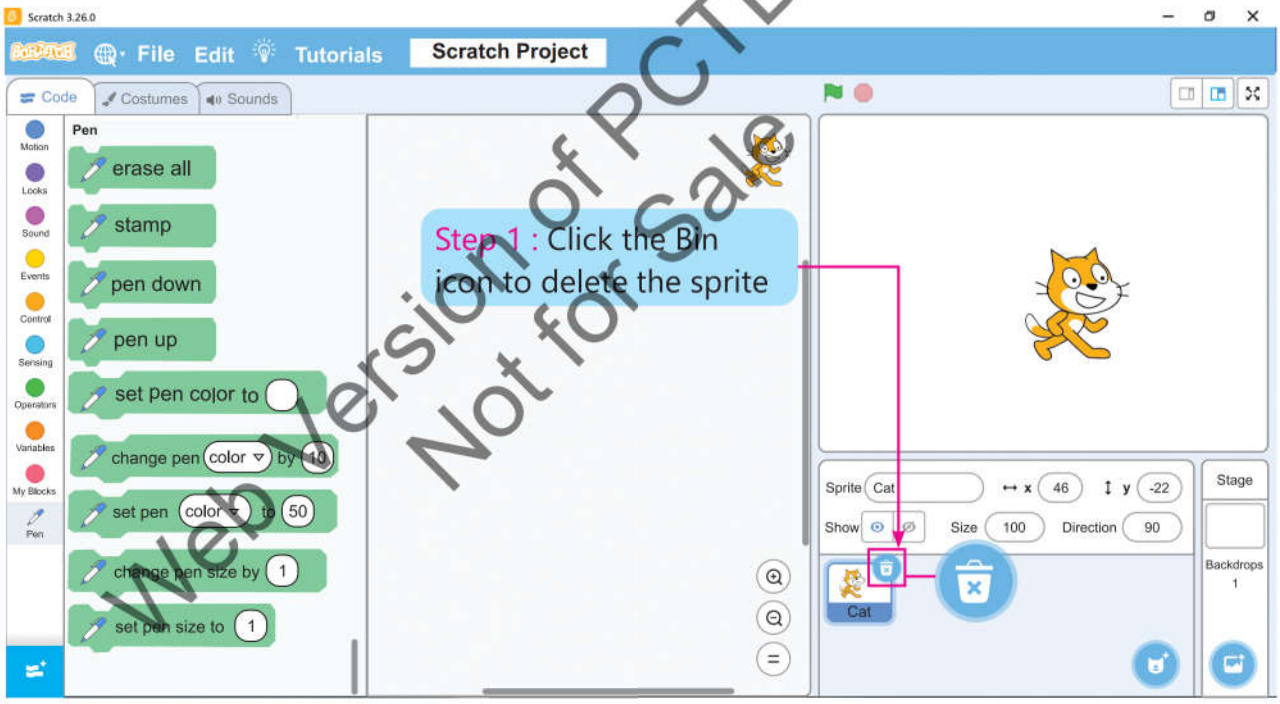
You have complete control over the clone's behaviour with this block. Below this block, you just need to add the coding to make it do something.

This block gets rid of the copy. You can make a clone cease what it is doing by making it delete itself. It should be noted that a clone that has been deleted cannot be restored.

Let's Make a Pong Game from Scratch Creating the Game Objects

Pong is an arcade game where the player must hit a ball with a bat, and then get it into the enemy goal. It is like table tennis or air hockey.

Step 1: Click the Bin icon to delete the sprite

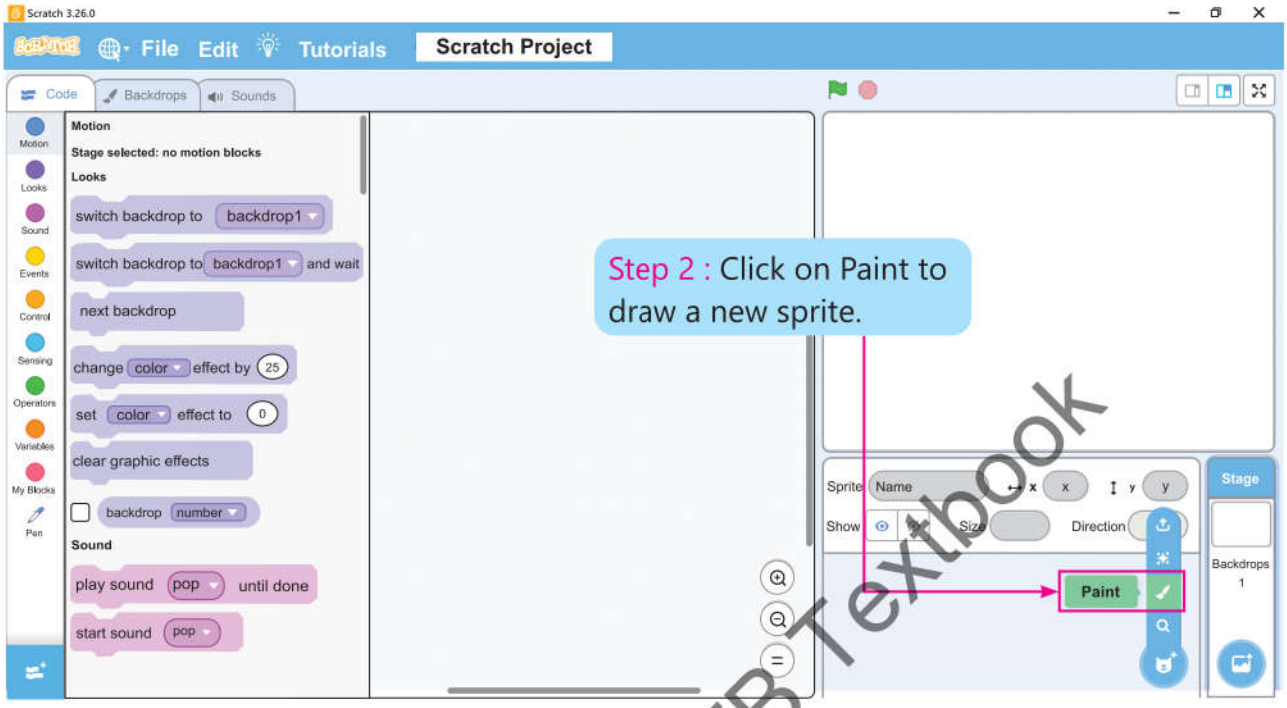


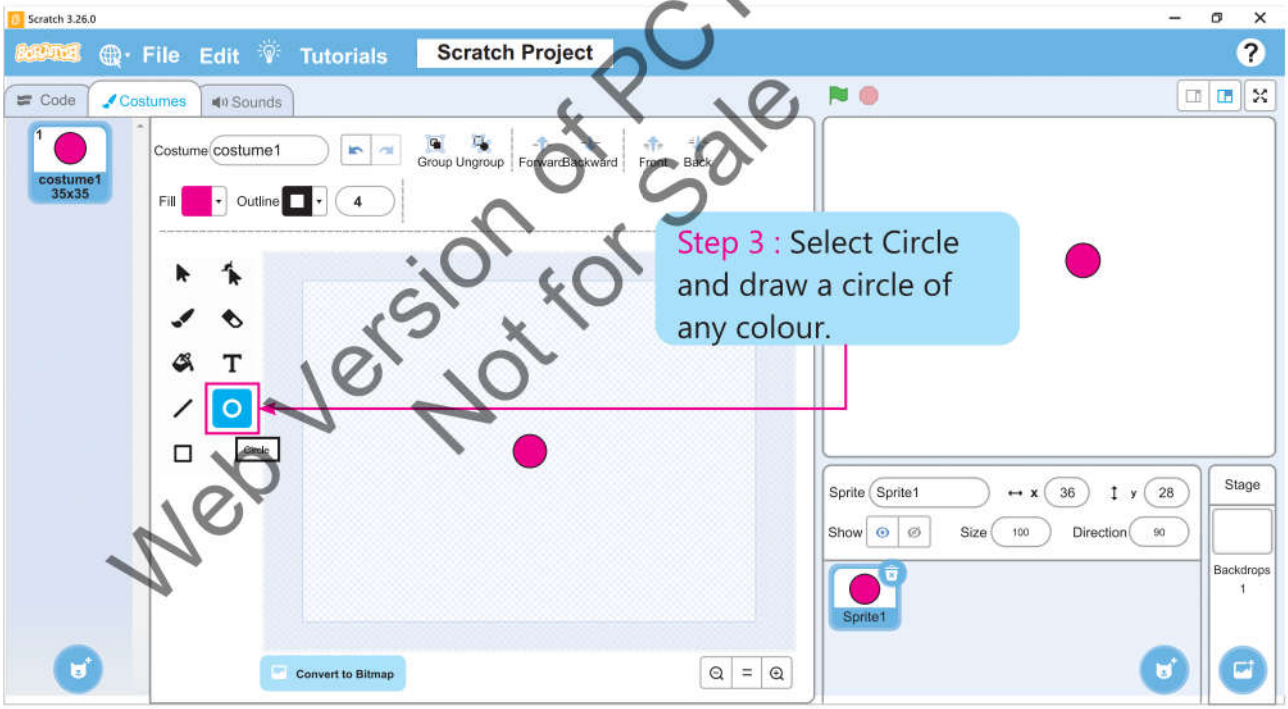
Creating the Game Objects

There are 5 different objects that we need to make the Pong game.

1. Two paddles (2 Players) **2.** Two goals

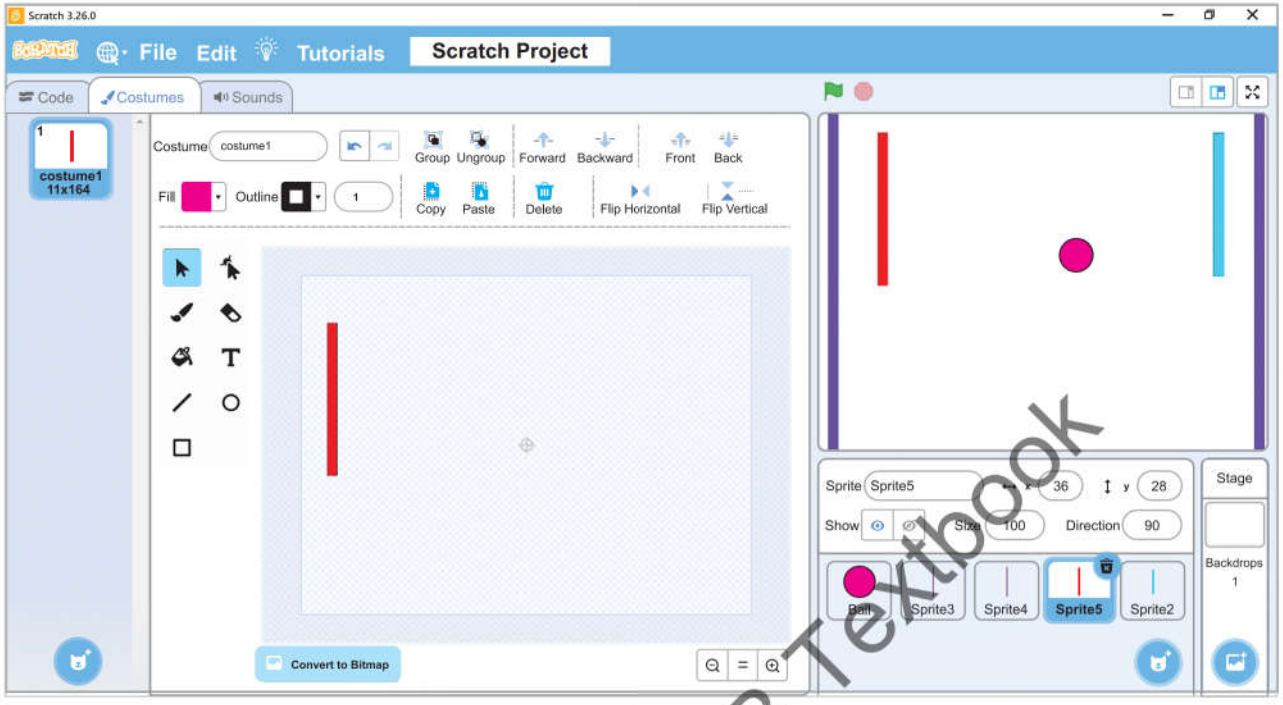
3. Now we will create those objects or sprites in Scratch.





Step 2: Click on Paint to draw a new sprite.

Step 3: Select a Circle and draw a circle of any colour.

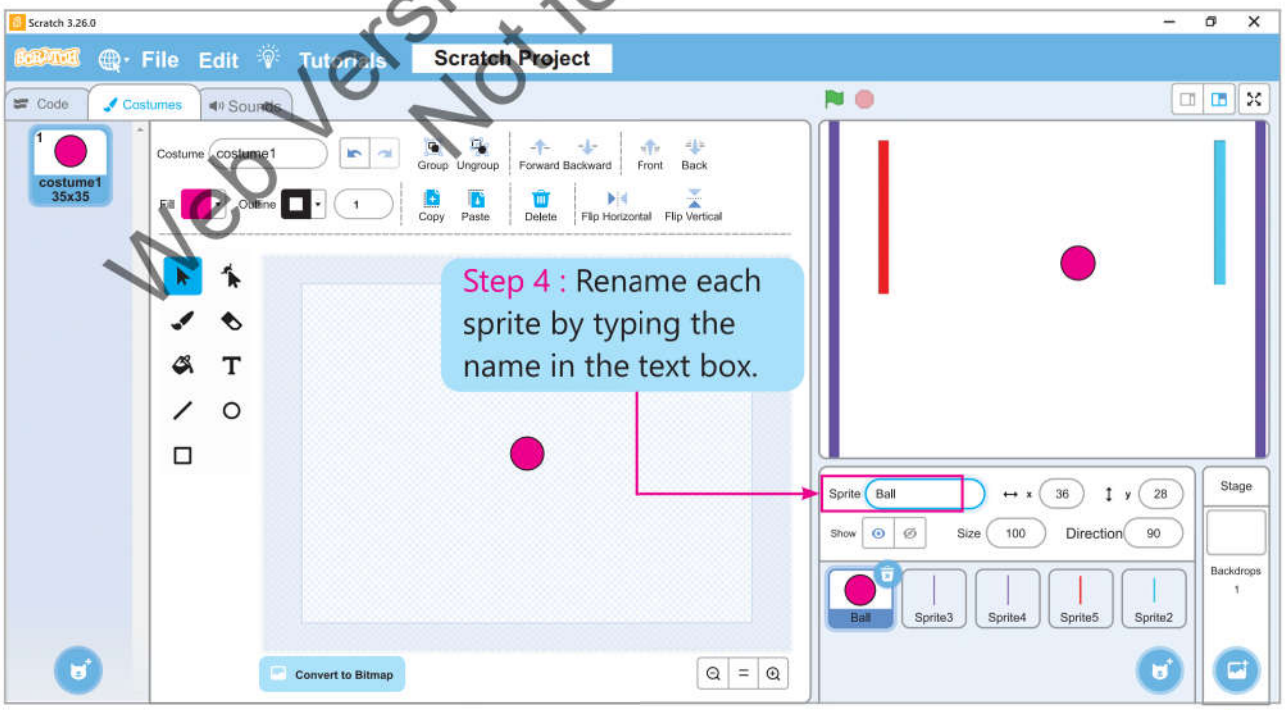


Similarly, draw 2 small rectangles of different colours for the 2 players and 2 lines for the goal post.

Renaming the Sprites

As of now, we have all the sprites on the stage. As we can see that all the sprites are named Sprite 1, Sprite 2, etc. But while we do coding for these sprites we need to have different names so that it will be easy to program. So now we will rename these sprites.

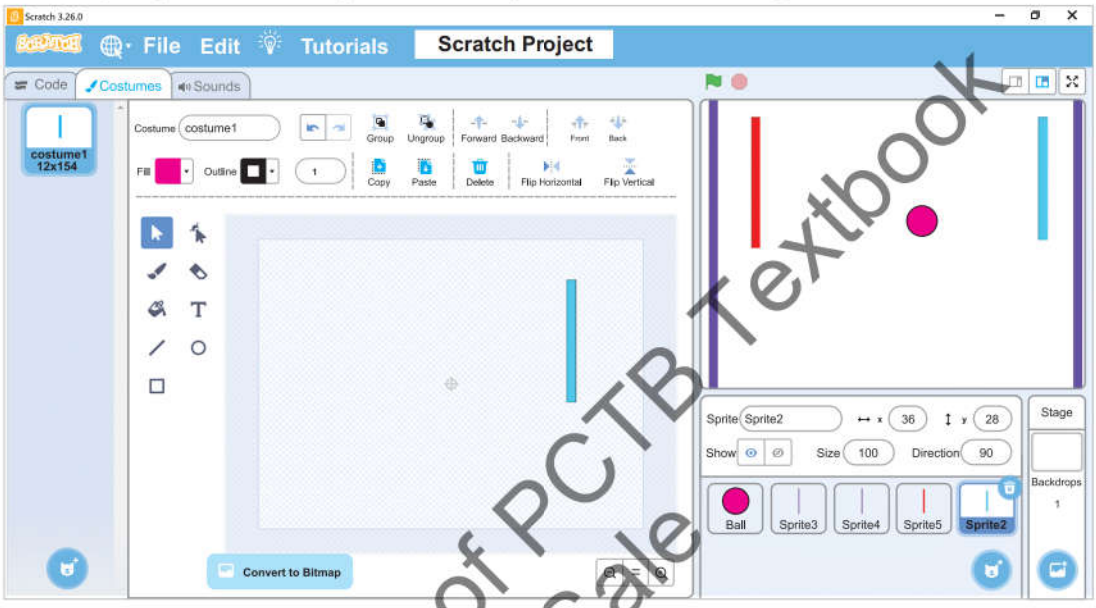
Step 4: Rename each sprite by typing the name in the text box.



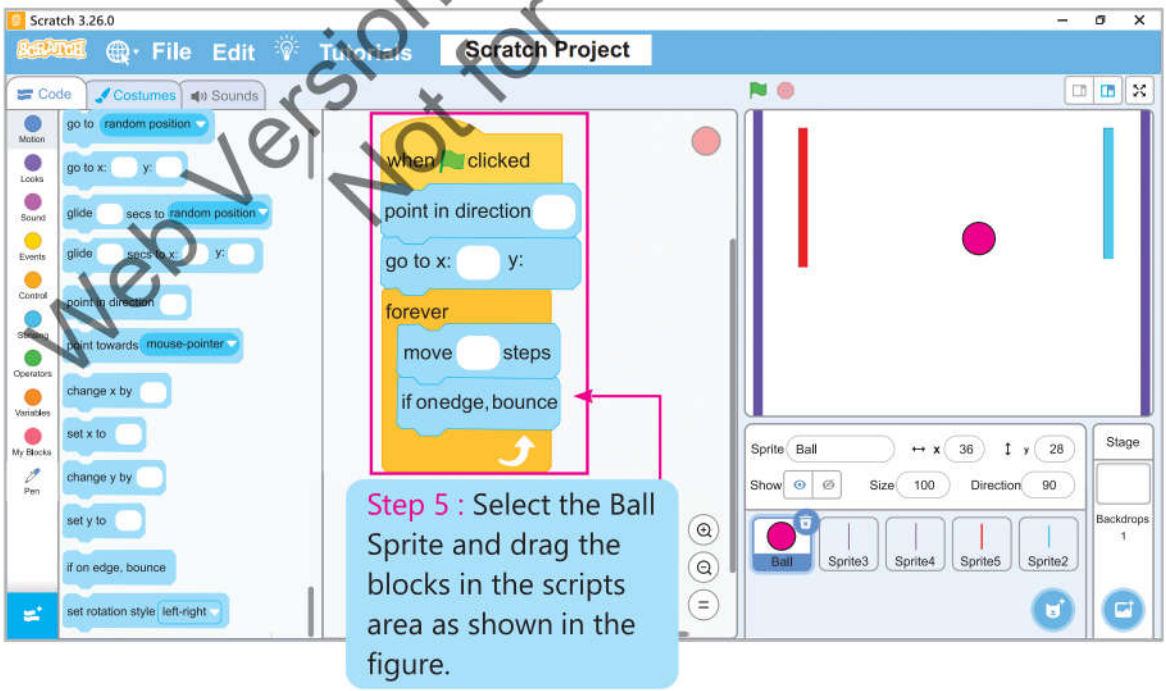
Similarly, rename all the 5 sprites as shown in the figures.

1. Ball
2. Goal 1
3. Goal 2
4. Player 1
5. Player 2

Now, we will program all the sprites one by one to make the game.



Step 5: Select the Ball Sprite and drag the blocks in the scripts area as shown in the figure.

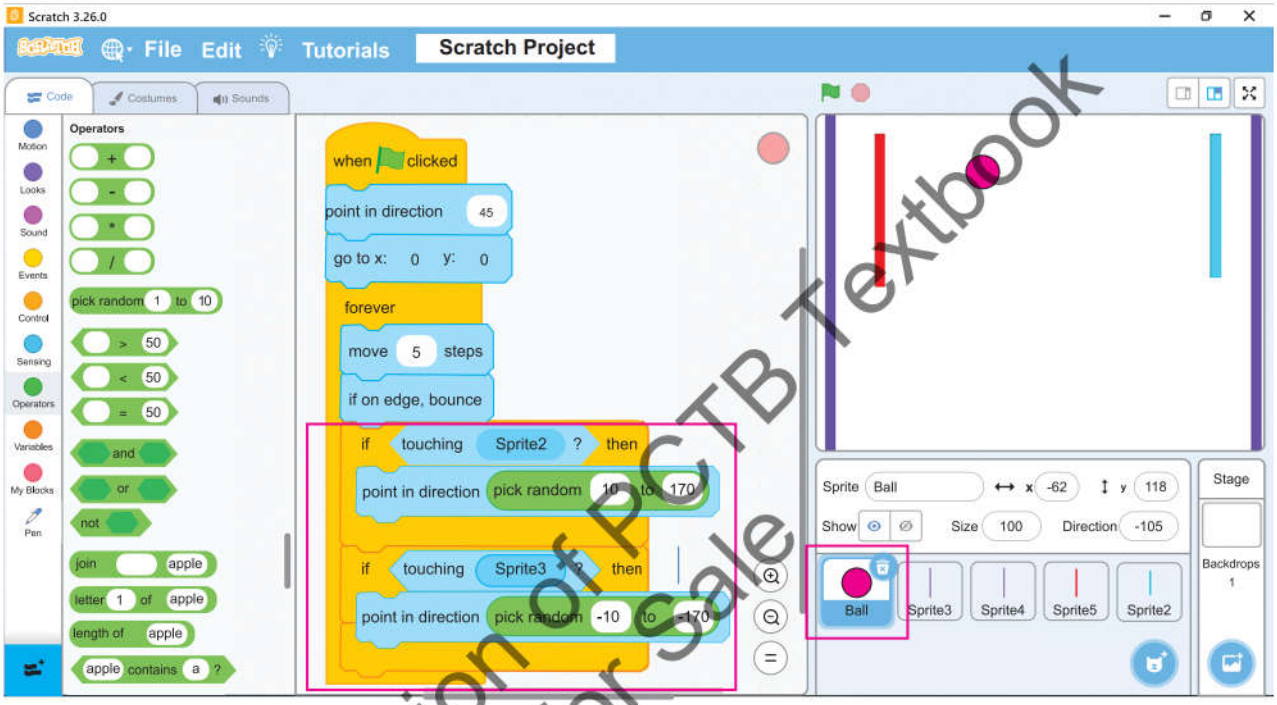


When we click the green flag the ball will move back to 0,0 (the middle of the screen) before it starts moving around!

Hitting the Bat

Now, we want the ball to bounce off player 1 and player 2 'bats'. It means that player 1 and player 2 can defend their goals by pushing the ball away from themselves. When the ball touches one of the bats, it will go off in a random direction.

Step 6: Add the blocks to the ball sprite as shown in the figure to make the ball bounce off if it touches the player 1 or player 2 paddles.

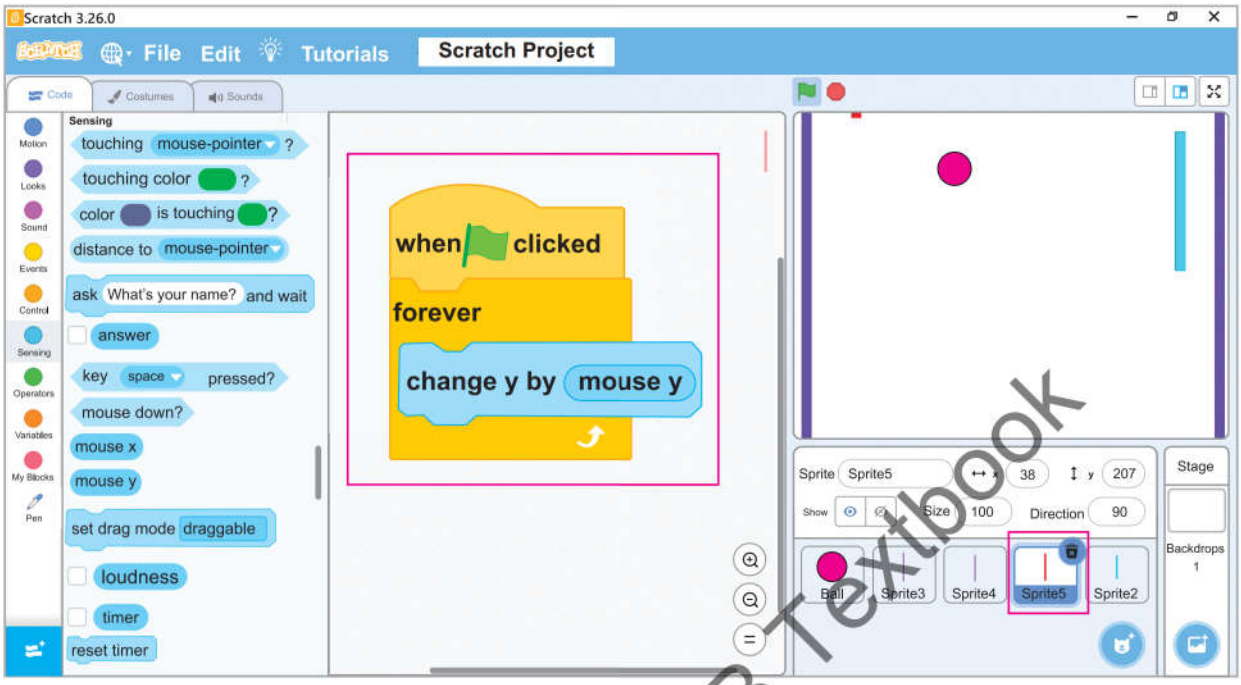


These two 'if' statements will check if the ball is touching player 1 or player 2 objects in the game. We want the ball to choose a RANDOM direction to bounce towards though, so to add that to the code we go to the green 'Operators' menu, and then add the blocks to the code.

The 'Pick Random' operator should fit nicely into the 'point indirection' command. When it is used, it will choose a random number between the minimum and maximum you give it. In this case, we tell it to bounce towards the right if it hits player 1, and to the left, it bounces off player 2!

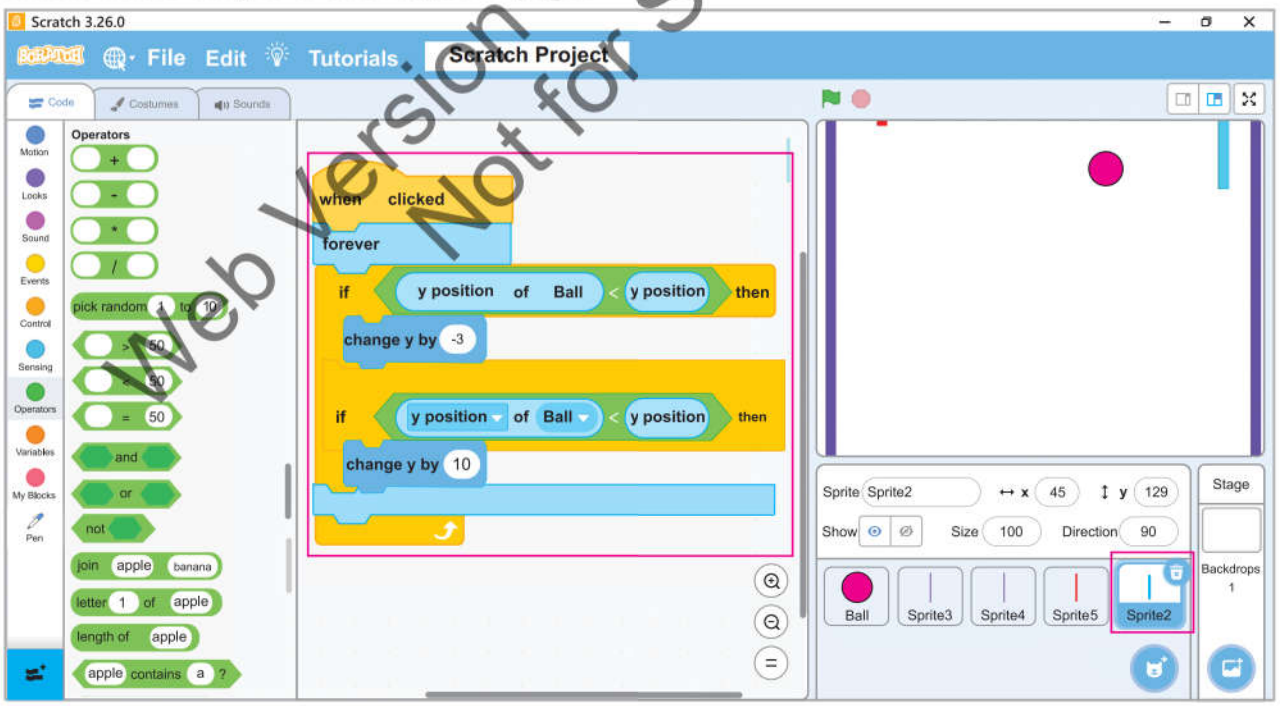
The players need to control where their bat is, so move the Player object up and down on the 'Y' axis.

Step 7: To move player 1 with the mouse add the following blocks in the Scripts of the player 1 sprite.



Artificial intelligence is simply a computer making decisions based on the information given to it. In this case, I want player 2 to try and block the ball from getting into its goal. So, when the ball is higher than the bat, we move it up, and when the ball is lower than the bat, we move it down.

Step 8: To move Player 2 automatically as per the position of the ball add the following blocks in the Scripts of the Player 2 sprite.



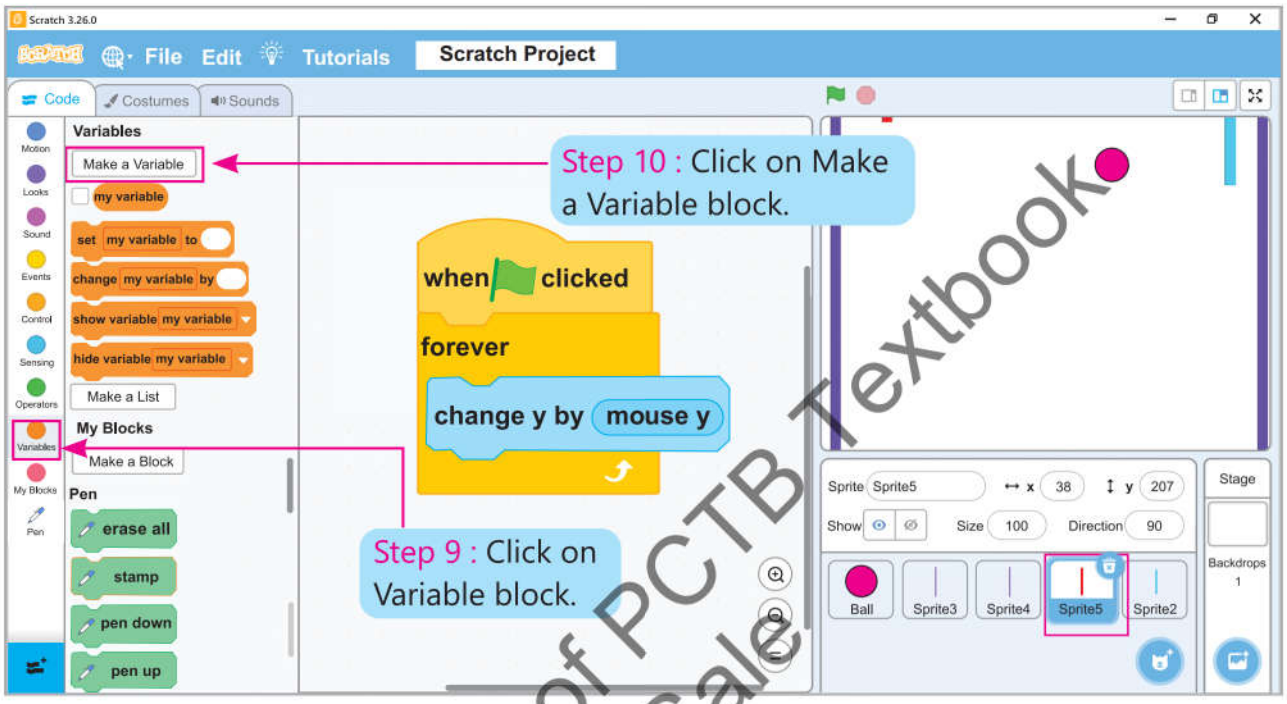
To store the scores of player 1 and player 2 we need to create two variables 'Player1Score' and 'Player2Score'.

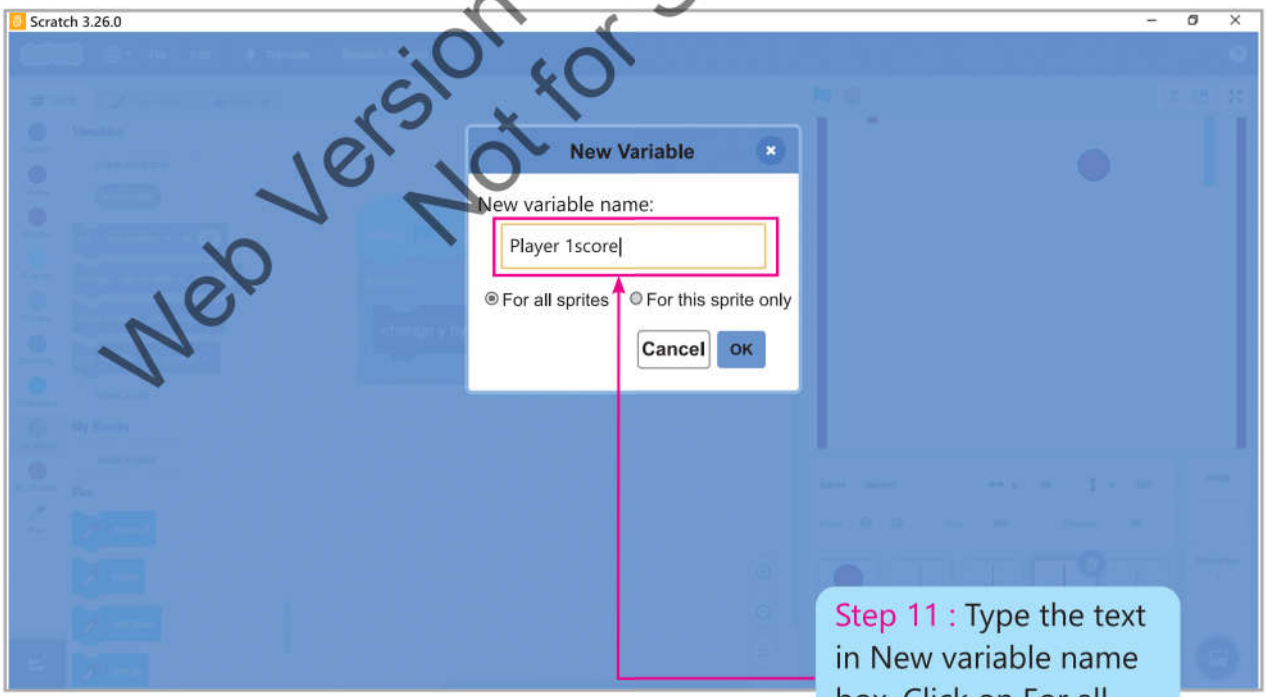
We will make the score variable for Player 1.

Step 9: Click on Variable block.

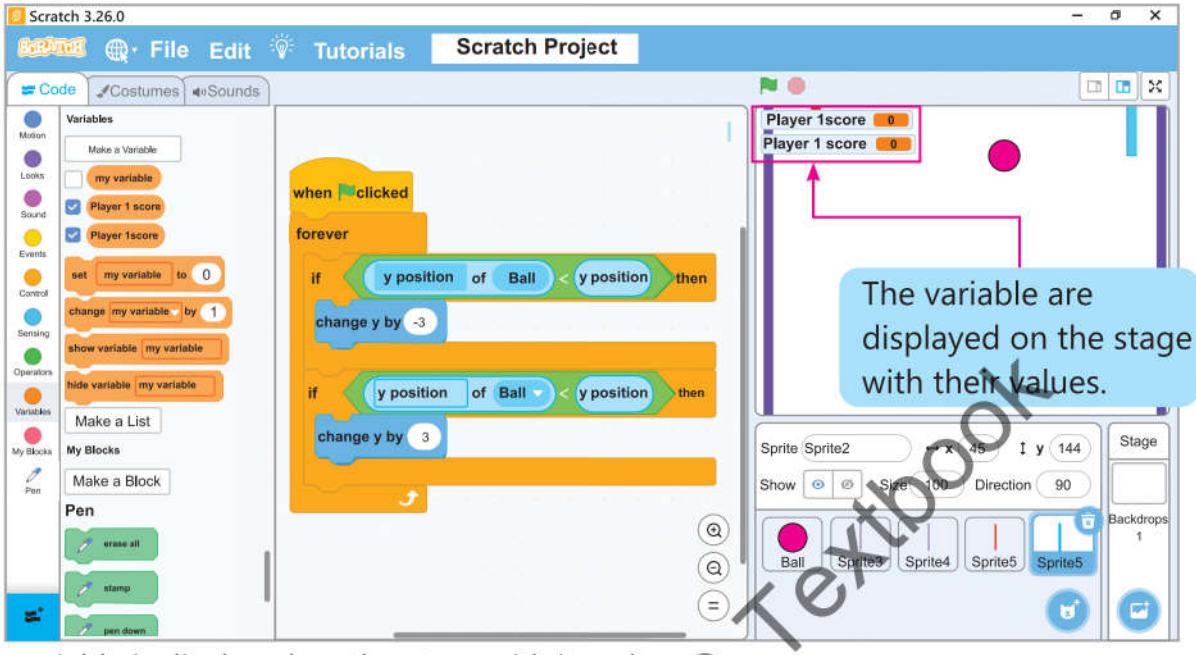
Step 10: Click on the Make a Variable block.

Step 11: Type the text in the New variable name box. Click on for all sprites option.





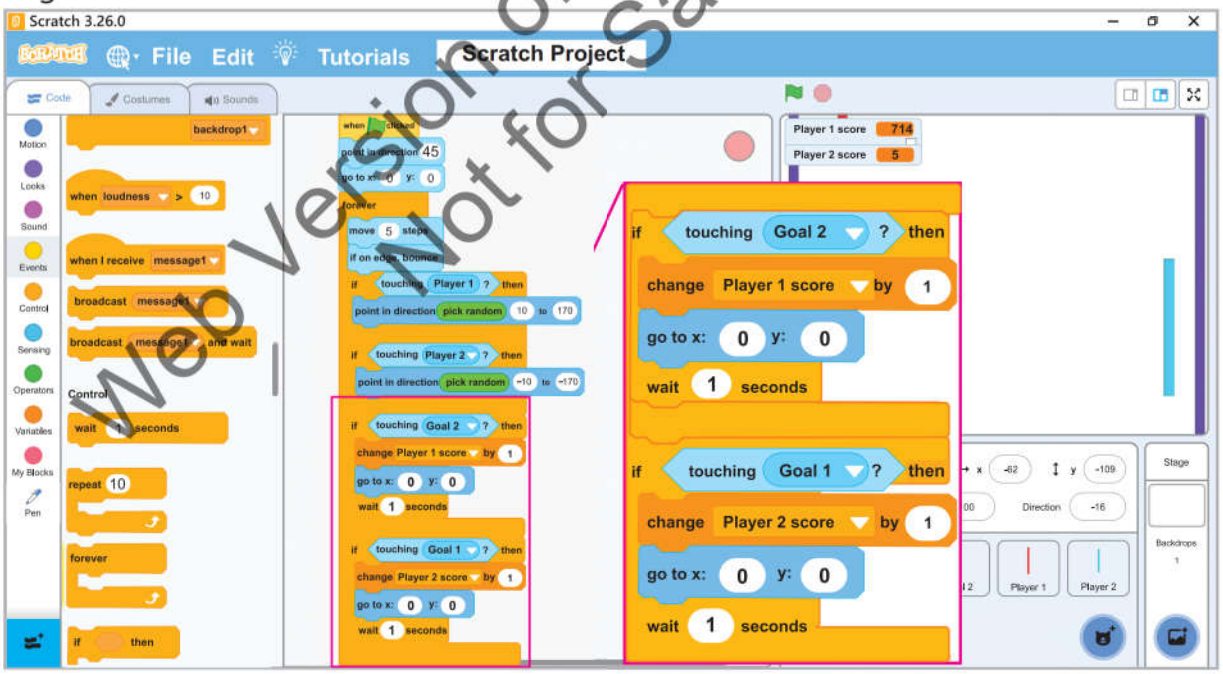
Similarly, create the other variable to.



The variable is displayed on the stage with its values.

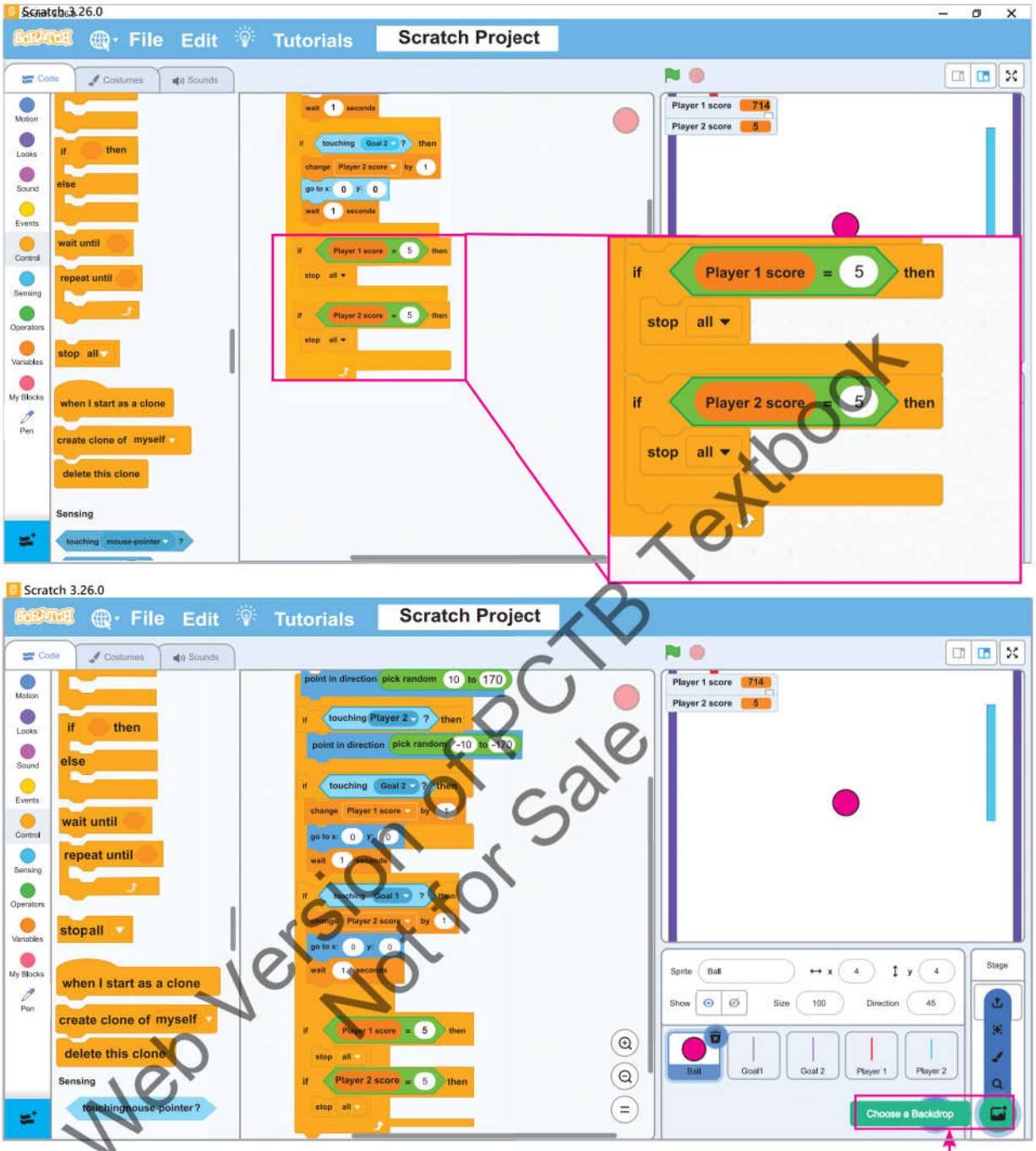
We need to set the Player 1 and the Player 2 score to 0 when the game starts. Player 1's score should increase if the ball touches the goal of Player 2 and Player 2's score should increase if the ball touches the Player 1 goal. The main aim of the game is to protect one's goal post.

Step 12: Add the following blocks (look at the picture given below) in the ball script to change the values of the variables.



Now the scoring is started in the game, now we have to make a code so that if any player reaches the specified score the game should end.

Step 13: Finally, add the following 'if' blocks in the ball script to check the Player 1 and Player 2 score, if anyone has reached 5, the game would stop.



Step 14 : Click on Choose a backdrop to select any backdrop.

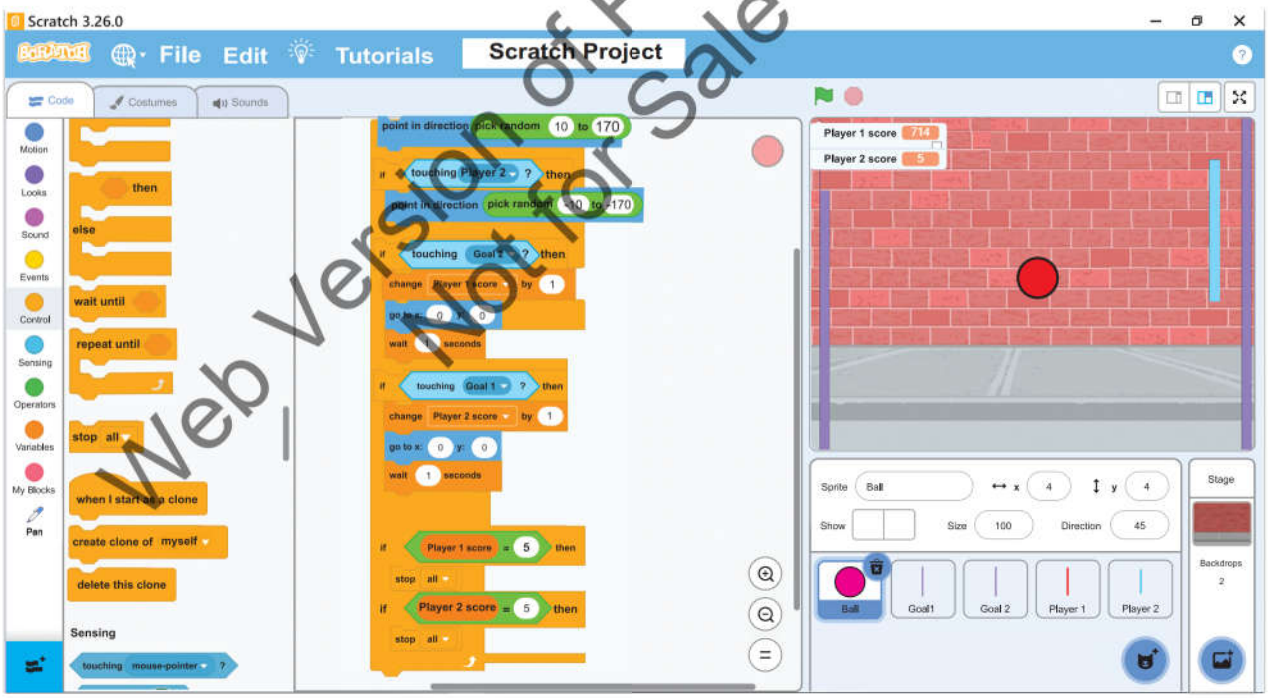
Now, as our code is complete, we can play our game of Pong.

The background of our game is white, as it looks a little dull, so let's add a beautiful backdrop to our game.

Step 14: Click on Choose a backdrop to select any backdrop.

Step 15: Choose Wall 1 backdrop.

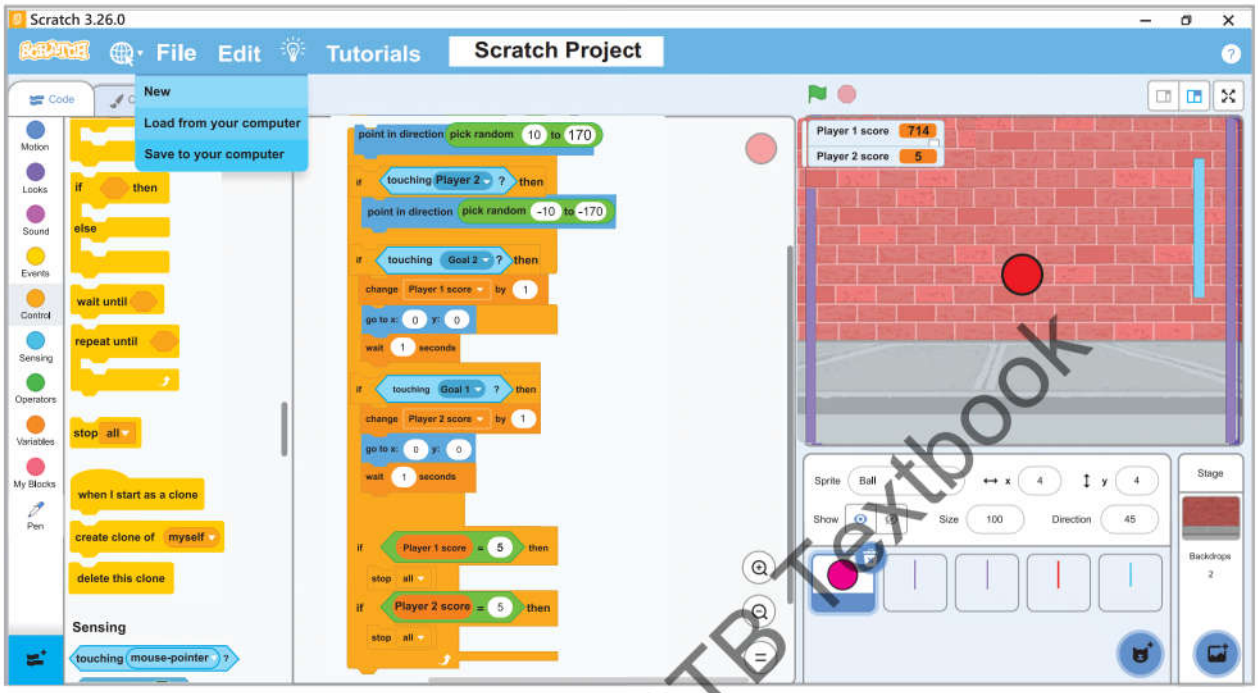
Step 15 : Choose Wall 1backdrop.

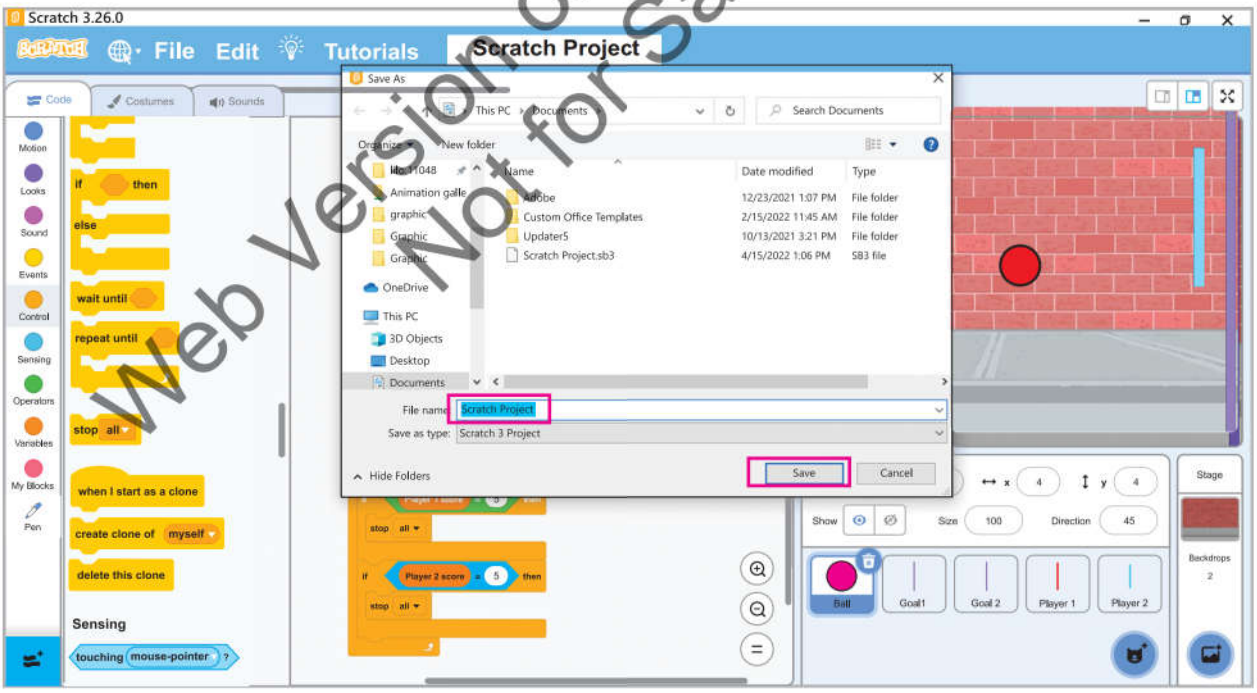


Save

We should save the project.

Step 16: Click on File -> Save to your computer. In the Save As dialog box enter the name for the project and click the Save button.

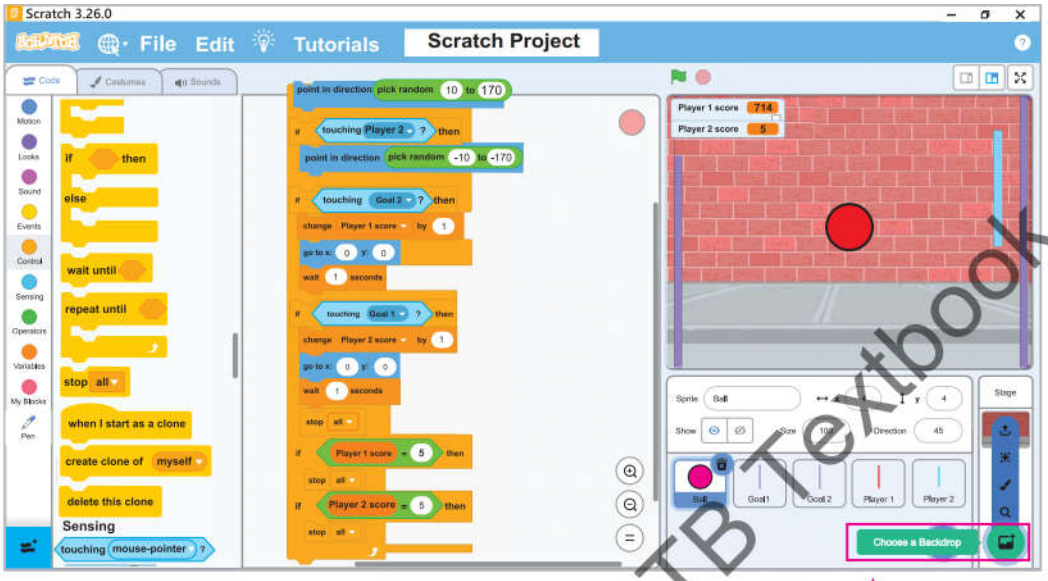




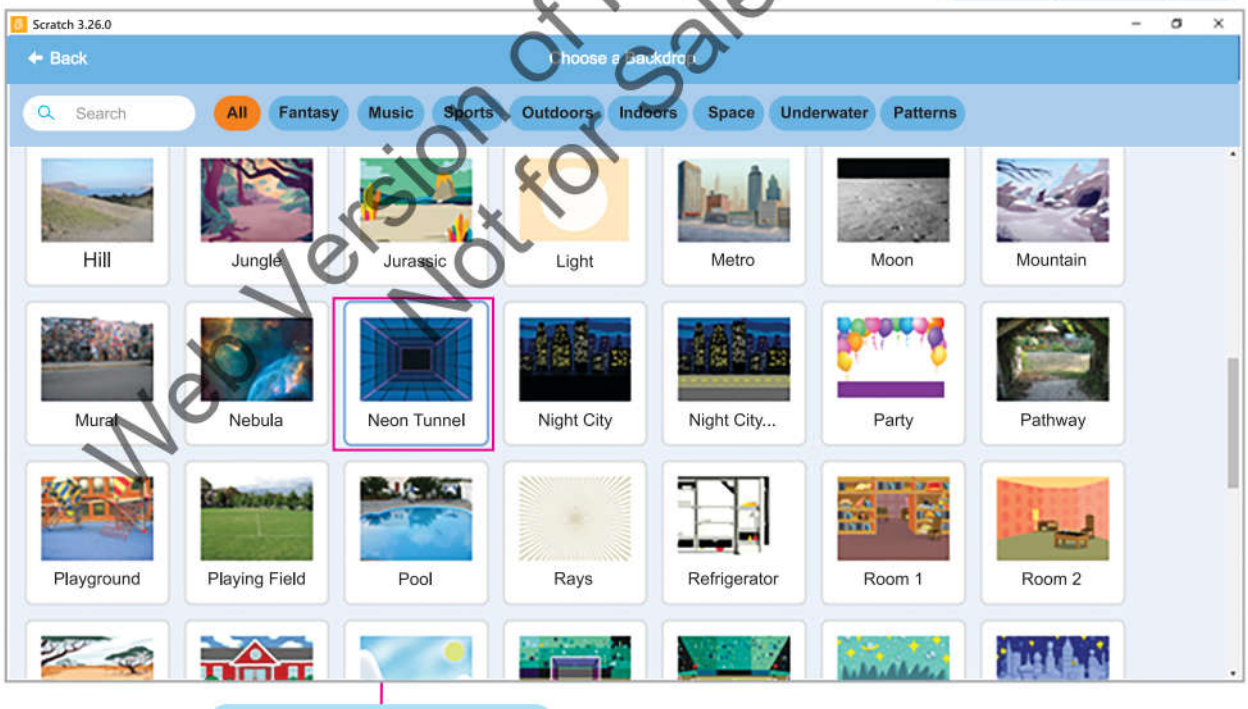
We would also like to change the background when the game is over. We have to add another background to our program.

Step 17: Click Choose a Backdrop. Select any backdrop.

Step 18: Choose a Neon Tunnel backdrop.



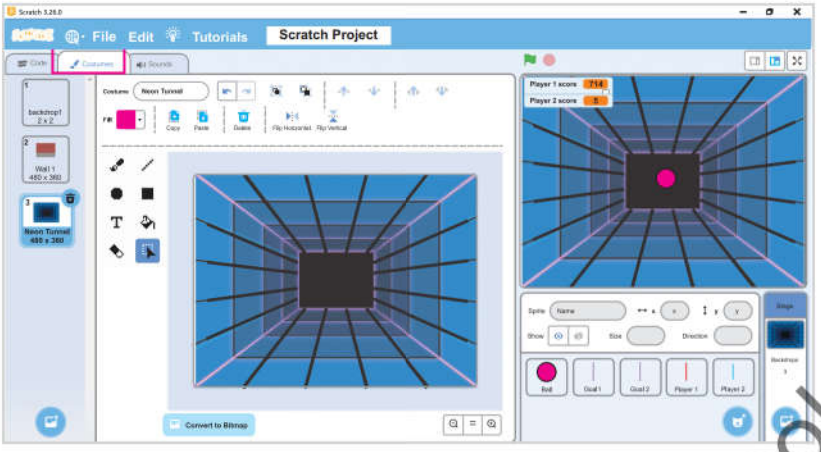
Step 17 : Click Choose a Backdrop.
Select any backdrop.

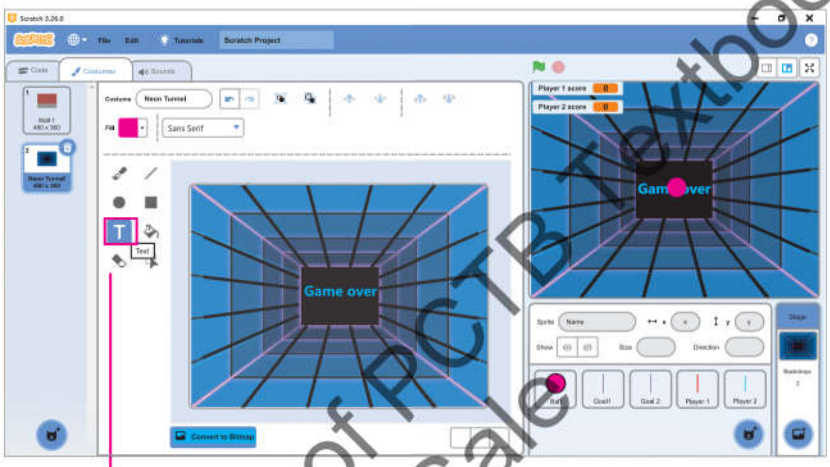


Step 18 : Choose Neon Tunnel backdrop.

After the backdrop is added click on the Backdrop section to customise the backdrop.

Step 19: Click on the Text button and add the text 'Game Over'.



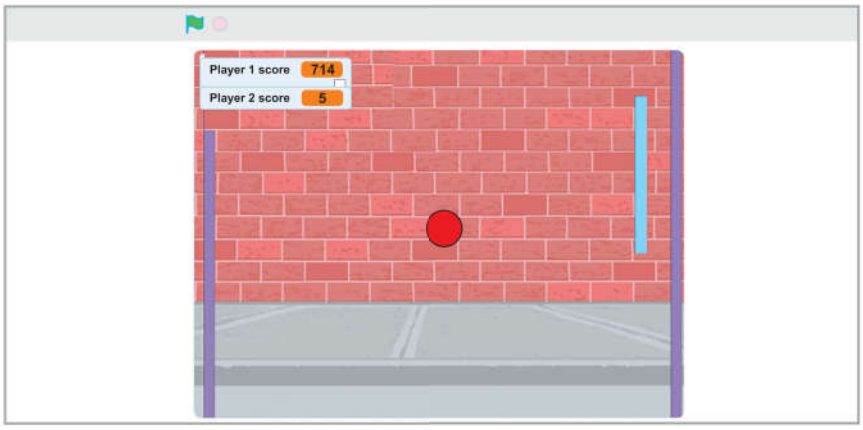


Step 19 : Click on Text button and add text 'Game Over'

The game should start with the first backdrop and when the game is over the backdrop should be changed and the game should stop.

Step 20: Add the following blocks in the scripts of the ball sprite.

Click the green flag at top of the code blocks and check if the background changes when the game is over or not.



Glossary

we textual	relating to text	regulate	to control
interactive	mutually influencing each other	elongate	to make something longer
interface	a device or program that creates a link between a user and computer	directive	an instruction

LET'S HAVE A LOOK

- Programming is the art of writing instructions to tell a computer what to do.
- A set of instructions is called a Program.
- Scratch is a programming language that is perfect for making games, animations, interactive stories, and other visually rich programs.
- Sprites can be moved, drawn on the screen, respond to clicks, change their appearance, and interact with each other.
- The blocks of Scratch are sorted into the following categories: Motion, Looks, Sound, Events, Control, Sensing, Operators, Variables, and My Blocks.
- In Scratch, variables are represented with blocks shaped like elongated circles, uniquely labelled by you.
- A Boolean expression is an expression that is either true or false.
- A condition is something that must be true for something to happen.
- A loop in programming can execute statements several times depending on a condition. In Scratch, any block whose label begins with 'forever' or 'repeat' is a looping construct.
- In programming, a variable is a place for some value in memory, much like x and y are popular variables in algebra.

Exercise

A. Multiple Choice Questions: Tick the correct answer.

1. Which of the following items are in each Scratch project?
   a. Sprite **b.** Stage **c.** Script **d.** All of these
2. A loop and a _____ are combined in the "repeat until" block.
   a. formula **b.** sprite **c.** variable **d.** condition
3. Which of the following is used to make a new block from Scratch?
   a. Sensing **b.** Control **c.** My Blocks **d.** Variables
4. In programming, a Boolean expression is an expression that is either true or _____.
   a. blank **b.** yes **c.** false **d.** true
5. The blocks serve as _____ that can be joined together.
   a. commands **b.** stories **c.** reminders **d.** scores
6. In programming, a function is a block of code that you may _____ repeatedly rather than having to write it out several times.
   a. reuse **b.** print **c.** destroys **d.** all of these
7. A _____, in the context of Scratch, is some block that performs some task.
   a. function **b.** loop **c.** variables **d.** statements
8. _____ is used to convert the text into speech from scratch.
   a. Loops **b.** Conditionals **c.** Text to Speach **d.** Editor
9. _____ block is used for moving sprites around the stage.
   a. Control **b.** Stage **c.** Motion **d.** Loop
10. It indicates that you combine two structured programming constructs in a way that one construct is inside the other.
    a. Loop **b.** Nesting **c.** Statements **d.** Commands

C. Name the Category that Perform the Following Action:

1. Used for moving sprites around the stage.

   _____

2. Used for animating sprites, giving them speech bubbles, and changing their size and appearance.

   _____

3. Used for playing recordings or musical notes.

   _____

5. Used to describe what happens when, and for making bits of your program repeat.

_____

6. Used to test whether your sprite is touching another sprite or another color, or to get information about other sprites.

_____

7. Used for Maths random numbers, and doing things to text.

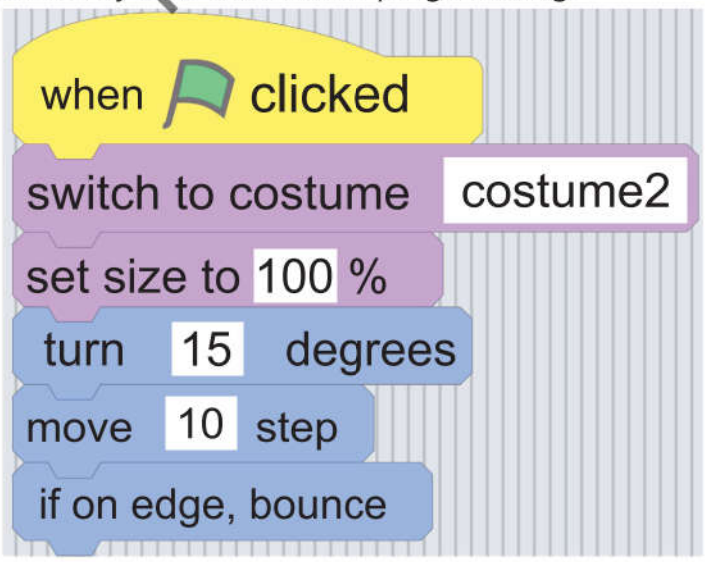
_____

D. Answer the following questions:

1. Explain the difference between programming and program.
2. Why is Scratch considered to be a good programming language for animation, games and storytelling?
3. Explain the usage of the events and control category.
4. What are variables?
5. What are boolean expressions? How can you identify them?
6. Can we have more than one backdrop in our program? If yes, then how to create them and change the backdrop?
7. What are the three main blocks for cloning in Scratch? Explain them in two lines.
8. Explain any five different categories of blocks.
9. What are some of the limits of Scratch?
10. What does this block of code do?

E. Answer the following long questions:

1. Explain loops with examples.
2. Write a note on any four elements in programming.



Learning Activities

• In-class Coding Task #1 – CLONING:

When the program starts (e.g., in block coding using the event block "When green flag clicked"), create a clone. When the clone is created, make the clone do a certain action (e.g. make a clone do something like change colour and move right), and then delete the clone.

• In-class Coding Task #2 – CLONING:

Students can create a mini-game called 'asteroid belt' by creating a 'player' sprite that moves with right and left keys, and an 'asteroid' sprite that clones itself every few seconds. The clone should start moving down and delete itself when it touches the end of the screen. The game should end when the asteroid touches the player.

A sample game with code can be found here:

https://scratch.mit.edu/projects/621128947/

• In-class Coding Task #3 – FUNCTIONS:

Create a new function (e.g. function jump) which should run a sequence of two or three instructions (e.g. in block coding make the sprite change y-coordinate by 100, wait 1 second, and change y-coordinate by -100). Now 'call' the function when an event occurs (i.e. when key space is pressed call function jump).

Reflection question – What are the advantages of writing a function? Why did we not just write these instructions directly? The sample code can be found here:

https://scratch.mit.edu/projects/621130010/

• In-class Coding Task # 4 –

students can build a real-life maze and write out instructions in pseudocode to the 'sprite' (played by a fellow student).

• In-class Activity # 5 (follow on from activity # 4) –

Students can learn to integrate various constructs in creating scripts in response to coding prompts by coding a MAZE GAME. Students can draw a maze or generate one on sites such as **https://mazegenerator.net/** and upload it as a sprite.

Create a player sprite and create functions for the player sprite to move right (change x by 10) if the right arrow key is pressed. If the player sprite is touching the maze wall (i.e. touching the wall colour) then the player sprite should move back (change x by -10). This step should be repeated for creating functions for moving up, down, and left.

The sample project can be found here: **https://scratch.mit.edu/projects/484415216/**

• In-class Coding Task # 6:

Students can learn to integrate various constructs in creating scripts in response to coding prompts by coding a JUMP GAME.

Create a player sprite, background, and obstacle sprite. The player sprite should be placed on the left side of the stage and should jump when the player presses the space key (i.e. change the y-coordinate by 100, wait, and then change the y-coordinate by -100).

When the game starts, the obstacle should go to the right of the screen and glide across the screen, and this instruction should be repeated forever. If the obstacle hits the player, the game ends.

Challenge Exercise 1 –

Students can create a variable 'lives', set it to 3 lives when the game starts, and change the variable when the obstacle hits the player. The game should only end at 52 if the lives are zero.

Challenge Exercise 2 –

Students should add a new backdrop and change the level once the player sprite reaches a certain score.

Challenge Exercise 3 –

Use IF-then/else condition to check if the player is on the ground before jumping. The sample project tutorial can be found here: **https://www.youtube.com/watch?v=1jHvXakt1qw**

1. Create a Mathematical calculator, that asks for two numbers from the user and finds the sum, difference, product, or quotient according to the choice of the user.
2. Create a sprite and make it jump on the trampoline. Also, change the costume when the sprite goes up.

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A Answers

A: Tick the correct option.

1	d	2	d	3	c	4	c	5	a
6	a	7	a	8	c	9	c	10	b

7 Digital Citizenship

Knowledge:

Students will be able to:

- Discuss the ethics and ethical issues in digital environments.
- Explain the importance of being safe, responsible, and respectful online.
- Define the key concepts of copyright, plagiarism, and piracy.
- Identify Improper use of computer resources.
- Steps to secure information privacy and confidentiality.
- The possible dangers of the internet and related security measures.

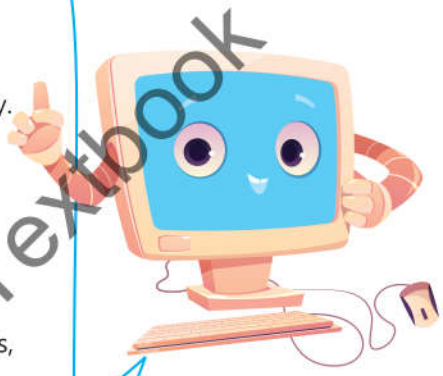
Students will know...

- Identify the purpose of major internet uses such as business, social networking, entertainment, information/news.
- Evaluate digital media bias and messaging.

Skills:

Students will be able to:

- Identify appropriate and inappropriate behaviour when navigating the digital environment.
- Identify threats and actively protect devices and networks from viruses, intrusion, vandalism, and other malicious activities.
- Describe and use safe, appropriate, and responsible practices (netiquette) when participating in online communities.
- Identify positive and negative impacts of using social media, both online and offline.



Introduction:

Societies are evolving with the passage of time. We use technology for communication instead of writing letters, sending faxes, or meeting with people. The Internet and smart devices have become an essential part of our daily routine.

The use of social media and the Internet is prevailing day by day. This massive increase in the use of digital means of communication resulted in increasing data security issues also. Let us also have a look at the safety aspects we need to consider to create a healthy cyber environment.

INTERNET

The Internet is also called 'the NET' or 'Network of Networks', which means International Network. It is a network used all over the world where users located at different locations can communicate and exchange information with each other. It is a collection of networks that are

connected and form a global network.

The Internet provides you the services of online shopping, electronic banking, advertisement, data sharing, communication, education, entertainment, etc. The Internet has transformed our lives and made us more digitised.

Advantages of Internet

The usage of Internet has increased over the years as it has many advantages. Let us discuss some of its advantages:

- **Treasure of Information**

Internet is a hub of information. We can search and access any type of information on any topic through the Internet. It is used extensively by people to do their projects and research.

- **Web Services**

Internet provides many useful services like chatting, email, video conferencing, etc. which help people to connect all around the world. Using these services, organisations can exchange information and conduct meetings with their employees which are located at different places.

- **Promoting Business**

Internet also helps companies to promote their products online through websites and social networking sites. It allows users to sell their products online. It also allows being in contact with the customer 24/7.

- **E-Learning**

Internet has changed learning from physical classroom to virtual classrooms. These days students can study by sitting at home in their comfortable timings. Internet is also used by teachers as well as students to collect information on various topics.

- **Entertainment**

Internet is used by people for entertainment. People can listen to music, watch movies, and play games on the internet. The Internet allows people to read newspapers and magazines online. There are various services on the Internet like Newsgroups and Blogs where people can contribute as per their interests.

- **Internet Banking**

Conventional banking systems are getting obsolete now. Customers use their credit and debit cards for payments. Cash is withdrawn from ATMs (Automated Teller Machines) which are available 24/7 all day and night. Mobile banking has taken the banking system to a high level. From your mobile phones, you can pay your bill,

Do You Know?

Blogs are virtual diaries created by people to share their hobbies, thoughts with like-minded people.

transfer money, pay for shopping, top up your mobile phone sim cards, and many more.

Disadvantages of Internet

The Internet has many advantages for users. But, as we know, excess of everything is bad. So, the internet has some disadvantages too.

- **Violent Information**

Several websites on the internet have violent videos and images. This type of content can disturb the mental health of children as well as adults.

- **Wastage of Time**

It is a waste of time as with the excessive use of internet, people get addicted to it and spend a lot of time surfing without any useful outcome.

> **Do You Know?**
>
> A librarian by the name of Jean Armour Polly came up with the term "internet surfing" in 1992.

- **Virus and Spam Attacks**

Internet has also increased the cases of virus attacks. Users can lose their data and programs in these virus attacks.

- **Loss of Personal Information**

We share our personal information over the internet that can be misused by cyber criminals to harm us.

Social Media

The website or program known as Social Media is where users can share their content. Additionally, it facilitates online conversations with other users. Millions of people all over the world are actively using it because of its enormous popularity and usefulness.

Advantages of Social Media

Social media has a lot of benefits.

- You can use it for educational purposes.
- You can use it for entertainment.
- It is easier to communicate and share information.
- You can create your brand and content to share original material to.
- It is easier to get updated information and news.

Disadvantages of Social Media

Social media also has several drawbacks, but fewer than its advantages. Some of its disadvantages include:

- It may also be the cause of a great deal of inefficiency.
- Lack of privacy can lead to identity theft, stalking, and other problems.
- As it is easy to get distracted from your work and loose focus when using social media, it may also be the cause of a great deal of inefficiency.
- It can be quite damaging to not know how to respond to negative feedback and to become easily distracted.
- Your shared data may be used against you after tempering it.

Digital Media Bias and Messaging

The idea that the media is reporting the news in a biased or partial way is known as media bias. When digital media looks to favour one point of view over another while covering the news, this is known as Digital Media Bias.

We could use the example of the difference between two news broadcasters that have very different audiences. They tend to be biased in what they report and how they report it due to ideological and political views.

Digital media is heavily used for messaging purposes as well. Many big platforms are used for messaging purposes as well. Some of them are:

- Twitter
- Instagram
- WhatsApp
- Facebook

Ethics and Ethical Use of Digital Environment

Ethics

At its simplest, ethics is a system of moral principles. They affect how people make decisions and lead their lives. Ethics is concerned with what is good for individuals and society and is also described as moral philosophy.

Digital Environment

The digital environment is an increasingly popular tool in family and child research that is argued to pose new ethical challenges. There are many issues in digital environments, such as:

- Participant Privacy

- Confidentiality
- Anonymity.

These concerns apply to internet research across all disciplines, not just those involving families and children.

Ethical Use of Digital Environment

If not handled ethically, using a digital environment can be dangerous. The following is a list of some ethical principles you should follow when using the digital environment:

- Be respectful
- Protect your reputation
- Protect your privacy
- Trustworthiness and honesty
- Doing good and preventing harm
- Avoidance of conflicts
- Fairness
- Accountability

Identify Improper Use of Computer Resources

Everything has its boundaries. When that limit is violated, both you and others are at risk. The following are some examples of inappropriate computer resource use:

- Actions that endanger people's life or harm their property.
- Actions that break the law.
- Uses that breach information confidentiality
- Actions that encourage others to break the law.

An employee using the company's computer for personal use could serve as an example. The company prohibits its employees from using the company's computer for personal benefit. A cyberbully is another example of the person who uses of computer resources improperly. He unlawfully stalks someone online and spreads hate against them using a computer.

Importance of Being Safe Responsible and Respectful Online

Users should place a high priority on online safety. The threats which can be faced online include your personal information to be in danger. It could be used against you if you are not careful. You as well as others can suffer harm from it. You can prevent a lot of potential harm from happening if you exercise caution.

Even though we communicate with each other online, we still need to show respect for others. we should be aware of the thoughts and feelings of others. It teaches us to show respect, and in doing so, will also be respected.

Cyber Crime with Preventive Measures

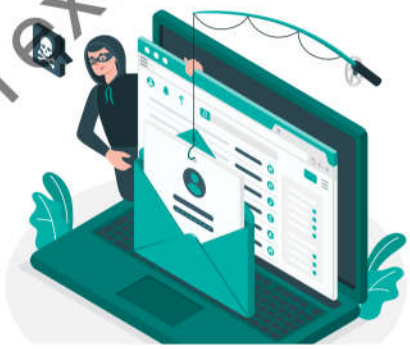
Cyber crimes are offences that are committed using computers and smart devices connected to the Internet. The victims of cybercrimes can be organisations or individuals. Most cybercriminals use e-mails, social media websites, or pirated software as a medium to trouble their victims.

It is important to remember that data once shared over the Internet is rarely deleted completely. Cybercriminals use this data unethically to trouble their victims.

Let us discuss some of the most used ways to commit cybercrimes.

E–mail Spoofing

When someone sends e-mails that appear genuine from a trusted e-mail ID but, in reality, they are not to be trusted. we call it E-mail Spoofing



For example, a user may receive an email from a portal or social media platform where the spelling of the service provider or email ID has been slightly changed.

For example, mailto:customer@tridentportall.com.

Notice that the spelling of 'portal' is incorrect. These emails contain links that will direct the user to another web page where the user would be asked to enter information which means the user ends up providing personal credentials to cybercriminals. This is also called Phishing.

Do You Know?

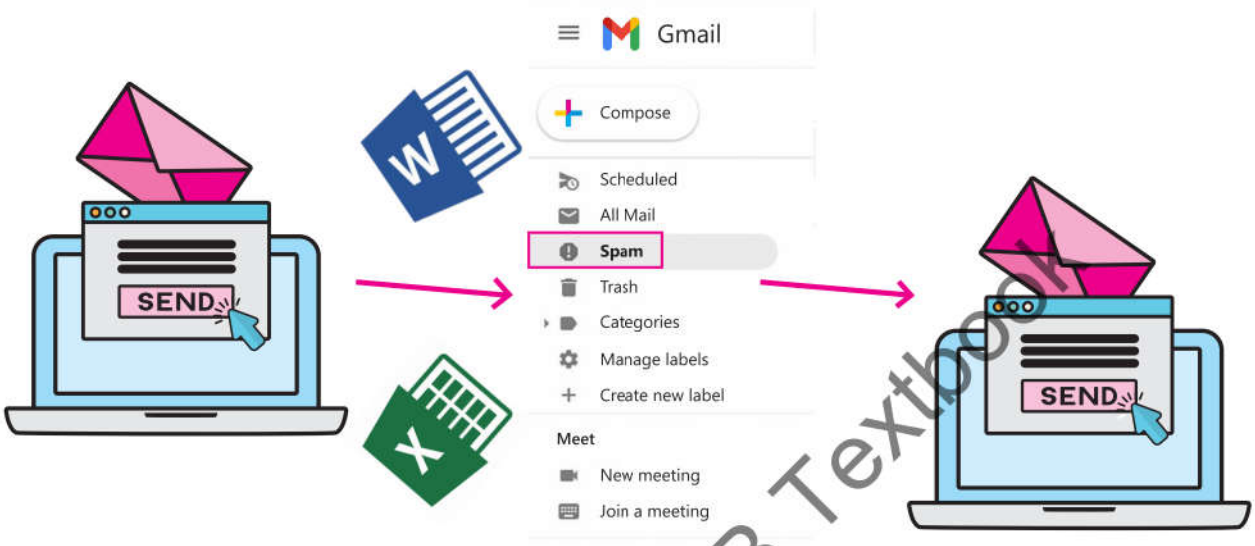
The best defence against phishing assaults is human intellect and comprehension.

Spamming

It refers to the spending of bulk mail by an identified or unidentified source. Sometimes, certain businesses send bulk-advertising mail to many accounts at the same time. Some people intentionally send bulk mail to a user until the mail server runs out of disk space.

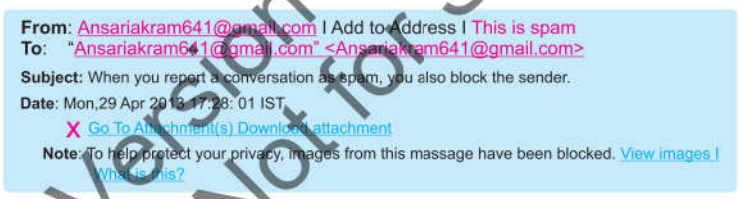
Some people send virus-infected applications and files through the internet via emails,

chats, games, etc. to get access to your smartphone and personal data. These emails may contain a document (Word or Excel file) with malware (a dangerous program that can impact your computer) attached to it. Opening such documents result in malware installed on your computer or mobile.



Using reputable websites to download files and not opening doubtful e-mails are some ways to counter these threats.

Some cybercrimes send emails informing the victim that they have won a lottery or a surprise gift. The cyber criminal then asks for personal details and bank details for transferring the winning amount. Cyber criminals may also ask the victim to deposit a small processing fee to lure the victim to transfer the winning amount.



Dear Winners,

Please, find the attachment form and fill out the required information and immediately send it back by email attachment to zxwerwaa, for your winning details.

These emails are not to be trusted and one must not reply with any personal information. Further, these must be immediately deleted from the email account to avoid accidental access in the future.

Measures to Avoid Spam

To avoid spam, we can take the following measures:

- Preview your message before opening them.

- Do not click any link in a spam email otherwise, you will invite many such emails in your inbox.
- Do not reply to a Spam email.
- Do not forward an email received from someone you do not know to a list of people.

E-mail account Hacking

It is another common method used by cybercriminals to trouble victims. Using malware or other tricks to obtain your email ID and password, cybercriminals can gain access to your critical information like social media accounts, bank accounts, etc. Cybercriminals may also send offensive emails to a victim's contacts via hacking.

Do You Know?

Cracking refers to the act of breaking into systems to steal or destroy data. Crackers may disturb applications by using malware or changing the program of the applications.

Measures to avoid Hacking

To prevent unauthorised access to your computer and internet we can take the following measures:

- Keep a password for your Wi-Fi connection and computer.
- Keep changing your passwords.
- Keep updating your operating system.
- Do not plug into devices you are not sure about.
- Always look at the green lock sign at the address bar of the window before accessing any website that states that the site you are visiting is secure.
- Always download trusted applications from the internet and check permission and authentication.

Cyber Troll

In internet slang, a troll is a person who starts quarrels or upsets people on the internet to distract and create discord by posting mean and unwarranted messages in an online community.

A cyber troll refers to a person who purposely posts opposing, sarcastic, demeaning, or insulting comments about something or someone.

Social Engineering

Social engineering is a technique used by cybercriminals to gain the information from individuals. Cybercriminals try to interact with the victims to understand their likes and dislikes to seek personal information and/or commit some harm to them.

Cyber Bullying

Cyber Bullying refers to the use of the Internet, e-mail, instant messaging, chat rooms, or social networks, such as Facebook, Twitter, etc. to harass, demean, embarrass or intimidate someone else.

Measures to prevent Cyber Bullying

- Remember never to share personal details such as age, address, date of birth, etc. with unknown people on social media.
- Restrict access to your data on social media platforms. For example, only your friends must be able to see any pictures on Facebook.
- Try avoiding friend requests from unknown people on social media.
- In case, any post hurts or upsets you, talk about it to your trusted set of people like family or friends instead of posting aggressive replies.
- If your parents/elders feel the need, they can also contact the local police station to complain about the cyberbully.
- Never install unwanted software and applications like online games, etc.

Do You Know?

Verbal harassment is the most frequent kind of bullying, followed by social harassment, physical bullying, and cyberbullying.

Online Transaction Fraud

Although at this age, as students, most of you may not be using banking services such as debit cards, credit cards, net banking, etc. yet it is important to be aware of this type of cybercrime.

Online transaction fraud refers to the illegal withdrawal or transfer of money from one bank account to another by a cybercriminal. Online transaction frauds generally take place when a cybercriminal steals a user's login credentials, bank account details, credit card details, etc.

Cybercriminals use many ways to cheat people online:

Cybercriminals may send emails from a fake account that can appear to be from a bank or credit card service provider.

Cybercriminals may also fake their identity and call people pretending to be bank employees to obtain a user's banking details.

Types of Online Transaction Frauds

Identity Theft: Sometimes, cybercriminals deliberately use another's identity to gain a financial advantage over someone else. Cybercriminals may also pose as someone else to obtain credit and other benefits in the other person's name.

Job Frauds: Cybercriminals portray incorrect details as an employer.

Banking Frauds: Some cybercriminals fraudulently obtain money from users for investment by posing as a bank or other financial institution.

Measures to Safeguard Ourselves from Online Fraud

We can safeguard ourselves from online fraud by keeping in mind the following points:

- Regularly update your banking passwords and Pin of the debit/credit cards.
- Be sure to check for the bank's security certificate details.
- Also, check for various signs such as green address lines, lock signs on websites, and HTTPS in the address bar to confirm you are visiting a secure bank website.
- Never share your bank and credit card details such as your online account password, card number, PIN, OTP, etc. with anyone.
- Always check the website URL starts with HTTPS. The website URL with HTTPS encrypts your data on the website and protects it from any kind of tampering.
- Avoid making online transactions using public Wi-Fi or a computer in a cyber cafe.
- Review the monthly statements of your bank account and credit cards to detect any unrecognised transactions.
- In case the credit/debit cards are stolen or lost, call the bank immediately and block your card/bank account.
- Never install pirated software on your mobile or computer. It is not only illegal but may also compromise the security of your devices.

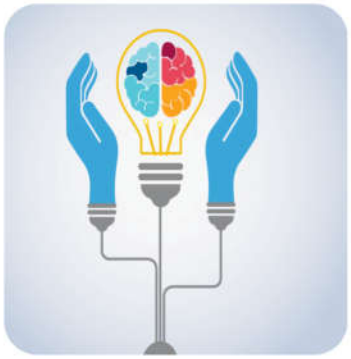
Some rules we must remember while using Social Media:

- **Maintain Authenticity :** We must be honest about our identity. Never pretend to be someone else.

- **Always use a disclaimer :** While sharing personal views about something, we must make it clear that these are personal views.

- **Neverpickfightsontheinternet:** We must convey our opinion carefully by choosing the rights words.
- **Protect your identity :** Never list your full name, parent's details, home address or telephone number online.
- **Respect your audience :** Maintain good conduct, even on the Internet. Refrain from using slang, personal insults or obscene language.

- **Respect for other's feelings :** One must always be considerate and mindful of other's feelings on sensitive topics such as politics or religion.
- **Try to monitor comments :** One should prefer to monitor comments so as to maintain the quality of comments on a personal post/site.



Intellectual Property Rights

Intellectual property is a term that refers to the legal property rights of a person over creations of his/her mind, both artistic and commercial. Under Intellectual property Rights, the owners of the property are granted exclusive rights over their creation. These creations could be artistic, musical, or literary.

Intellectual property rights ensure that the creator's hard work is safe and protected from any unauthorised copying or piracy.

Types of Intellectual Property Rights (IPR)

There are three main types of Intellectual Property Rights:

- **Copyright :** It is the legal right given exclusively to the person for a fixed number of years to publish and record the literary, artistic, musical, or musical use of his or her work. Copyright of work lasts even after the death of the originator.
- **Patent :** It is the right that gives an inventor the complete right to make, use, and sell his or her work for a specific time period. Usually, the validity period for a patent is 20 years.
- **Trademark :** It is a symbol, word or logo legally registered or established and used as representing a company or a product. Trademarks help to protect brand names, logos, and the design of the product. The validity period for a Trademark is 10 years and can be renewed after that.

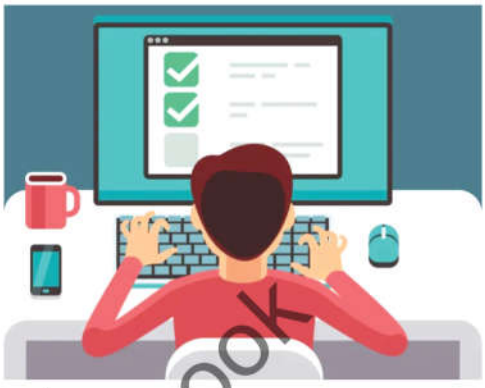
Measures to Protect Intellectual Property Rights

We can take the following measures to protect Intellectual Property Rights:

- Do not share your business ideas with others.
- Have detailed drawings, descriptions, plans, and records that can prove it is your

creation.

- As soon as you have a business name and logo for your idea, you should register those Trademarks right away.



Plagiarism

It refers to the usage or imitation of the language and thoughts of another person projected as one's original work. It is considered a crime or fraudulent act.

Plagiarism as described by the Merriam-Webster dictionary is as follows:

- To steal and pass off ideas or words of another as one's own.
- To use another's production, without crediting the source.
- To commit literary theft.
- To present as new and original, an idea or product derived from an existing source.

Ways to Prevent Plagiarism

Some of the ways you can prevent plagiarism are:

- Use Citation-Citation refers to acknowledging the original writer and the source from where the material has been taken.
- Rephrase the matter.
- Use " " for statements quoted by another person.
- Encourage original ideas and use authentic resources.

VIRUS

A virus is a type of software or malware that spreads between several computers and corrupts data. It targets the computer's data and software. Its primary goal is to disrupt or interfere with the systems so that data can be corrupted or even leak.

Some indications of a virus attack are listed down below:

- Unwanted pop-ups that repeatedly appear
- Modifications to your desktop or files
- The system speed slows down and suddenly crashes. It can also make the computer shut down itself.
- You keep being logged out of your account.

- It sends out mass emails from your account to infect other machines with viruses.

Malicious activities are those that aim to compromise or corrupt the confidentiality of data or software in computers. There are numerous further varieties of malware and computer viruses. Some of the most common ones include:

Ransomware: It makes the victim's files inaccessible by disabling them. Once the ransom is paid, only then can they be accessed.

Spyware: It gathers information about the victims without their awareness. The information is then utilised to their benefit.

Malware for mobile devices: This malware harms mobile devices through phishing and other means.

Keyloggers: They record the victim's keystrokes. It gathers private information or sensitive data like passwords.

Cyber Safety

Cyber safety refers to the safe and responsible use of the Internet in order to safeguard one's personal information while not misusing anyone else's personal information.

We can take the following safety measures while using the Internet or computer:

- Install the most recent antivirus software on your computer.
- Use caution when entering your password on the internet.
- Do not respond to shady emails or strangers.
- Do not disclose your personal information to anyone online.
- Refuse friend requests from unfamiliar people.
- Always leave your privacy settings on.
- Be cautious when downloading.
- Be careful what you post on social media platforms.
- Encryption can be used to protect data privacy while transferring files between locations.

Ethical Hacking

Not all hacking is destructive. Some hackers use this technique for national security, creating safer systems, etc. This is known as ethical hacking. It is a legitimate practice to uncover potential data breaches and risks in a network or system. In order to find vulnerabilities that malicious hackers can exploit or eliminate, ethical hackers search the system or network.

DIGITAL FOOTPRINTS

Footprints are the impression we leave through a foot or walking on the ground while moving. In the same way, a digital footprint is a trail of data of a user that he leaves while using the Internet.

The information exchanged online through emails and attachments, uploading videos or images leave marks of personal information about you which is available to others online. When you allow cookies from websites, businesses might obtain your digital footprints. They may also be taken without your permission. Your data can be sold and utilised for gain if you provide them access. Cyberattacks may also emerge from this. A Digital Footprint is also known as Digital Dossier.

Some measures you can take to prevent digital footprints are:

- Beware of posting personal information online.
- Change your platform settings to private.
- Be mindful of what kind of feedback you can get when you share data
- Double-check before posting online to avoid accidental leakage of information.

Glossary

prevail	to become stronger or superior	hub	is a simple communication device.
surfing	looking or visiting websites on the internet	stalking	to follow someone illegally
confidentially	privacy	credentials	someone's background or general information
bulk	mass or size of something in large amount	lure	to attract someone into doing something
slang	informal terms or phrases		

LET'S HAVE A LOOK

- The Internet is also called 'the NET' or Network of Networks, which means International Network.
- Cyber Crimes are offences that are committed using computers and smart devices connected through the Internet.
- A virus is a type of software or malware that spreads between several computers and corrupts data.
- Cyber safety refers to the safe and responsible use of the Internet to safeguard one's personal information while not misusing anyone else's personal information.
- A digital footprint is a trail of data of a user that he leaves while using the internet.

Exercise

A. Multiple Choice Questions: Tick the correct answer.

1. The Internet is also called the network of:

   a. networks **b.** computers **c.** mobiles **d.** tablets

2. Studying from home through the Internet is called:

   a. i-Learning **b.** e-Learning **c.** c-Learning **d.** all of these

3. A Digital footprint is also known as:

   a. Digital Diary **b.** Digital Dossier **c.** Database **d.** None of the these

4. Why do hackers break into the other's computer system?

   a. To steal important data **b.** To destroy the system

   c. Both (a) and (b) **d.** None of these

5. Crimes that are committed through the internet are called:

   a. Fiber crimes **b.** Internet crimes **c.** Cyber crimes **d.** None of these

6. Spamming refers to:

   a. Sending an email from an unidentified source

   b. Sending wrong information **c.** Sending bulk of information

   d. None of these

7. We can adopt the following measures to avoid spam:

   a. Preview your message before opening them **b.** Don't click on spam email

   c. both a and b **d.** None of these

8. We can adopt the following measures to avoid email hacking:

   a. Keep changing your passwords

   b. Keep updating your operating system

   c. Don't plug into devices you are not sure about

   d. All of these

9. The technique used by cybercriminals to attain information from individuals is called:

a. Cyber bullying **b.** Cyber troll **c.** Social engineering **d.** All of these

10. Which of the following are not transaction fraud

a. Identity theft **b.** Cyber troll **c.** Banking fraud **d.** Job fraud

B. Write 'T' for True and 'F' for False in the boxes.

1. A digital footprint is an impression of a user that he leaves while using the Internet. ☐
2. Always upload inappropriate content online. ☐
3. Keep your privacy settings always off. ☐
4. We should not use the content written by others without theirpermission. ☐
5. Don't share your business ideas with others. ☐
6. Don't install updated antivirus on your computer system. ☐
7. Avoid friend requests from strangers. ☐
8. Digital footprints are used to describe the traces that a person leaves when he uses the internet. ☐

C. Answer the following short questions.

1. What is the Internet?
2. What is hacking?
3. Give any two examples of intellectual property rights.
4. Write two types to stop cyberbullying.
5. How can email spoofing be done?
6. What are the ways to prevent cyberbullying?
7. Describe the types of online transaction fraud.
8. What is the Internet? Write any three disadvantages of it.
9. What are digital footprints?
10. How can we avoid hacking?

D. Answer the following long questions.

1. What are Ethics? Write about the ethical use of the digital environment.
2. Write a detailed note on intellectual property rights.
3. Explain online transaction frauds in detail.
4. What is meant by social media? Write about its advantages and disadvantages as well.

Learning Activities

Application-based question.

Ayesha has got an email in her account. She is not sure whether the mail she has received is genuine or spam. Help her in identifying the spam.

(The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

• In-class Activity 1

Teachers can show videos on protecting your computer in class, and lead a discussion on ways to protect computers. Reflection questions can include (but not be limited to) What are some common ways in which computers can be protected? What happens when computers are not protected?

Suggested video: **https://www.youtube.com/watch?v=6mMZFoXbKqI**

• In-class Activity 2

Students will then work in groups to create a presentation that will teach parents how to protect their online identity and computer. Students can choose the tool they want to use to create their presentations.

They can: (1) record a skit with a video camera, (2) create an interactive lesson with Office Mix, (3) create a Sway, or (4) design a brochure using Word templates. (reference: Microsoft Digital Citizenship Module)

• In-class Activity 3

The teacher will place students in groups, and request each group to prepare a chart of ethical rules regarding the use of ICT. Students will present their posters, and the teacher can display posters in class.

• In-class Activity 4

The teacher can hold a debate, where two students can argue for and against the impact of using social media. The debate can include positives of social media, and students listening to the debate can vote for the winning debater. The teacher can ask reflection questions about the advantages of social media, such as connection to distant friends and relatives, selling goods & services, advertising revenue, learning more about culture and the world, entertainment, etc.

The teacher can also ask reflection questions related to the negative impact of social media, such as health consequences, addictive behaviour, sale of personal data, identify fraud, cyberstalking, etc.

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Answers

A: Tick the correct option.

1	a	2	b	3	b	4	c	5	c
6	a	7	c	8	d	9	c	10	b

B: True and False

1	T	2	F	3	F	4	T	5	T
6	F	7	T						

8 Entrepreneurship in Digital Age

Knowledge:

Students will be able to:

- Explain the concept of promotion, value proposition, and quality assurance.
- Define Business Plan and its components.
- Understand the difference between payment and transactions; choose safe transaction methods.
- Discuss Search Engine Optimisation (SEO), using social media websites such as Instagram, Twitter, and blogs.
- Analyse how technology is an enabler in entrepreneurship.
- Name and describe the digital platform that can be used for entrepreneurship
- Describe the basics of the components of a business plan, i.e. market need, product design, costing, operations, and marketing.

Skills:

Students will be able to:

- Describe and apply the tools and techniques used for digital marketing.
- Design and develop a digital marketing plan and its component
- Discuss the importance of project management and media literacy as a tool for a business plan.

Technology is an Enabler in Entrepreneurship

Technology gives people the tools to create and impact the world. Entrepreneurship enablers are those who initially provide the situations for entrepreneurs to emerge and develop. The development of business processes is driven by the combination of IT and the marketplace. They work together to start and design a new process to produce an effective outcome.

Everything can be purchased online, including services, education, and e-commerce. This gives you the power to set the guidelines by which your business will run. The location, the team, and the

logistics can all be as fixed or flexible as you like, depending on what works best for you. You may work whenever and wherever you choose.

You have the option of choosing a nearby or distant team. Your production facility might be in a third country, you might be in a fourth, and your designer and finance specialist might be spread out across the world. An online business allows for endless possibilities. Once geographic restrictions are lifted, the world is yours, and each new location presents new opportunities.

We have several examples in the market of people who are managing online businesses. However, before getting successful, you need to spend a lot of time studying the possibilities of digital entrepreneurship and creating a good plan.

Do You Know?

Even though you have made the decision to become a digital entrepreneur, this does not ensure your success. The journey may be tougher than you anticipate.

Digital Marketing

Digital marketing, also called online marketing, is the promotion of brands to connect with potential customers using the internet and other forms of digital communication. This includes not only email, social media, and web-based advertising, but also text and multimedia messages as a marketing channel. Simply digital marketing, also called online marketing, is the application of digital media, data, and technology integrated with traditional ways of promotion, value proposition, and quality assurance.

Let us study each of these for better understanding.

1. Promotion

In marketing, promotion refers to any type of marketing communication used to inform target audiences of the relative merits of a product, service, brand, or issue, most of the time persuasive in nature. It helps marketers to create a different place in the customers' minds.

2. Value Proposition

A value proposition is a simple statement that summarises why a customer would choose your product or service. It connects the most obvious benefit that customers get from doing business with you.

3. Quality Assurance

Quality assurance is a way of preventing mistakes and defects in manufactured products, services and avoiding problems when delivering products or services to customers. It is

defined as "part of quality management focused on providing confidence that quality requirements will be fulfilled".

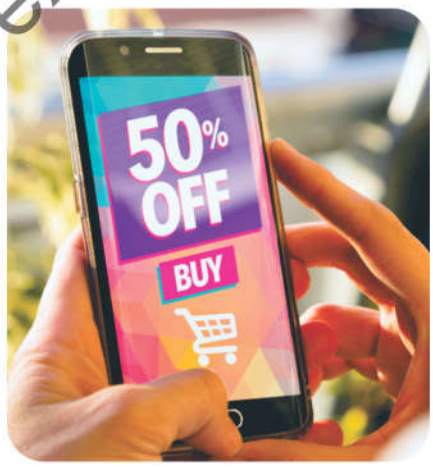
How to Create a Digital Marketing Plan

Digital marketing methods provide a wide variety of ways for marketing managers to engage upcoming customers. However, it is important to finance the channels and media that help you acquire, grow, and retain customers.

A business plan describes the goals of a company and how it plans to achieve them in detail. In a business plan, the marketing, financial, and business strategy are set out in detail.

A business plan can also be improved using the digital marketing plan. You will gain profit by promoting your business through digital marketing.

Marketing teams can better determine the appropriate digital initiatives to pursue by asking the questions below:



- What are your business and marketing goals?
- What is your digital marketing budget?
- Who are your target customers?
- Can you describe your audience?
- Which online channels does your audience use?
- What customer outcomes do you want to achieve?
- What benefits are you going to promote?
- What alternative solutions are your potential customers selecting?
- What change is needed to improve the customer experience?
- How would digital marketing methods improve the experience?
- What data does your company need to better understand customer behaviour and preferences?
- How will success be measured?
- Who do you need to share your plan with?

Use these questions to help you define which digital marketing programs to invest in. You can gradually change your plan to improve results as you gain more knowledge of your client's online behaviour and interests.

Components of a Digital Marketing Plan

• Advertising Online

Online advertising is the bidding and buying of appropriate ad units on third-party sites, such as display ads on blogs, mediums, and other relevant websites. Types of ads include images, text, pop-ups, banners, and videos. Retargeting is an important characteristic of online advertising. Retargeting requires code that adds a cookie to track new visitors to your site. You can show them advertisements for your goods or services when the visitors browse other websites.

Things to know

Cookies are small piece of code that are downloaded on your computer and keep track of your actions done on the browsers. These cookies may contain viruses to compromise your data. For this reason, your browser will ask for the permission to let any website download cookies on your system. If you do not allow, the cookies will not be downloaded. Be careful while allowing any site to use cookies.

• Content Marketing

Content marketing is an important strategy for attracting potential customers. Publishing a regular high-quality, relevant content online will help you establish a connection with your customers. It can educate target customers about the problems your product can help them resolve, as well as boost SEO rankings. Content can contain blog posts, case studies, whitepapers, and other materials that provide value to your target audience. These digital content possessions can then be used to attain customers through direct and paid efforts.

Things to know

SEO (Search Engine Optimisation) is the process of showing your business on the first page of Search Engines' results. If your business is not on the first page of search engine, i.e., Google, the people will not get aware of it.

Once, The Huffington Post stated, ***"The best place to hide a dead body is page two of Google"***

• Email Marketing

Email marketing is a direct marketing scheme that involves sending promotional messages to customers. Email marketing continues to be an effective approach for sending custom-made messages that target customers' needs and welfare. It is most popular for an e-commerce business as a way of staying top of mind for consumers.

Things to know

There are a lot of email marketing tools available online that automatically get the email from your website, enter email in the list, and offer to send your business promotions and offers to the customers. The pages on websites that get this email from users are called OPT-IN PAGE

• Mobile Marketing

Mobile marketing is the advertisement of products or services via mobile phones This includes mobile advertising through text messages or advertising in downloaded apps. However, a comprehensive mobile marketing approach also includes optimising websites, landing pages, emails, and content for a professional experience on mobile devices.

• Paid Search

Paid search increases search engine visibility by allowing companies to plan for certain keywords and obtaining advertising space in the search engine results. Only those who are actively looking for the keywords you've chosen will see advertisements. There are two main types of paid search advertising — pay per click (PPC) and cost per mile (CPM). With PPC, you only pay when someone clicks on your ad. With CPM, you pay based on the number of impressions.

Things to know

Google Awards is the most widely used paid search advertising platform.

• Reputation Marketing

Reputation marketing focuses on gathering and endorsing positive online reviews. Reading online reviews can influence customer buying decisions and is an important part of your overall brand and product reputation. An online reputation marketing scheme encourages customers to leave positive reviews on sites where possible customers search for reviews.

Many of these review sites also offer inherent advertising that allows companies to place ads on contender profiles.

Things to know

Every shopping site provide its users the facility to review the products they have purchased. Always read these reviews before purchasing the product. You should go for the products who have more positive reviews and feedbacks than the negative reviews.

• Search Engine Optimisation

Search engine optimisation (SEO) focuses on improving natural traffic to your website. SEO activities include technical and creative tactics to increase rankings and increase mindfulness in search engines. This suggests that the greater the quantity of visits to your website, the greater the likelihood that a broader audience will be interested in your goods or service. In the simplest of terms, good SEO increases your worth online.

The most widely used search engines include Google, Bing, and Yahoo. Digital marketing managers focus on improving levers to maintain a strong ranking. Levers are marketing strategies that can change your outcomes such as keywords, crosslinks, backlinks, and original content. There are 4 steps to optimising your website:

- **Step 1:** Target Market Business Analysis.
- **Step 2:** Keyword Research and Development.
- **Step 3:** Content Optimization and Submission.
- **Step 4:** Continuous Testing and Measuring.

• Social Media Marketing

Social media marketing is a key component of digital marketing. Platforms such as Facebook, Twitter, Pinterest, Instagram, Tumblr, LinkedIn, and even YouTube provide digital marketing managers with waged opportunities to reach and interrelate with potential customers. Digital marketing promotions often combine organic efforts with subsidised content and paid advertising promotions on key social media channels to reach a larger audience and proliferate brand lift.

• Video Marketing

Video marketing enables companies to connect with customers in a more visually engaging and cooperating way. You can showcase product launches, events, and special announcements, as well as arrange for educational special announcements, as well as arrange for educational

most used podiums for sharing and advertising videos. Pre-roll ads (which are shown for the first 5–10 seconds before a video) are another way digital marketing managers can reach onlookers on video platforms.

SEO Using Social Media Websites

Let's discuss the four most widely used social media platforms for SEO:

• Instagram

Instagram SEO is a great opportunity for businesses and brand owners. You may optimise your content to increase its visibility across all Instagram pages. It can include Explore and Search results. It can help in finding your target audience and increase engagement with more people.

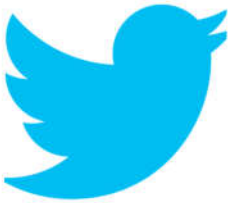
Do You Know?

On Instagram, there are more female users than male users. So, it is considered as a better platform to advertise products and services for female users.

• Blogs

For SEO, blogging is quite beneficial. It's because uploading high-quality content can significantly boost your website's search engine rankings. Your blogs must reflect the preferences of your readers. When you upload blogs regularly, your website stays fresh and there is more user engagement. It is a great way to communicate with your audience.

• Twitter



Twitter is also a fantastic social media platform for SEO. It is known that more social signals positively impact Google rankings. The more your content gets shared on Twitter and other social media sites, the more it could help your website's ranking on SERPs (Search Engine Results Pages).

To increase visibility, include relevant hashtags as well.

Hashtags make it easier for users to find your tweets, which improves brand recognition and boosts traffic. eg. #PakistanZindabad, #PakistanIndepenceDay2022

To draw visitors and increase traffic to your blog, tweet your links frequently but without being repetitive. Your website's likes, shares, and comments are effective social signals that Google can use to rank your site.

- **Facebook:**

Facebook is the most popular social media website that can connect you with billions of customers and offer key information about your business, products, services, and upcoming events. Facebook Ads and Messenger Ads are highly targeted and effective ways to reach potential customers.

Do You Know?

You can advertise your business on Facebook, Instagram and WhatsApp at the same time without paying to all these platforms separately as these social media platforms are now under a single company management named Meta which is owned by Mark Zuckerberg .

Business Plan

A business plan is a document setting out a business's future objectives and strategies for achieving them.

The essential components of a business plan are as follows:

Executive Summary

The entire business plan is summarised in the executive. It is at the beginning of your paper. The mission statement of the business as well as other details like its services and products must all be included in this summary.

Business Overview

This means that you must describe the services or goods that you will offer to the clients.

Products and Services Design Overview

An overview of the company's goods and services is included in this section. In this process, products that address consumer concerns are understood, built, and improved.

Market Need

We must determine whether the company service or product has a greater possibility than current options of meeting a market need. This process also involves identifying a potential market, assessing the size of the market, and determining an approximate estimate of the product's value.

Operations

Investors will find the operations portion of your business plan useful. This section gives a detailed explanation of your workflow as well as the goals, objectives, and processes of your firm.

Marketing

You need to research your competitors to understand their strengths and weaknesses. Finally,

you need to be aware of the marketing steps you must take to carry out this business plan successfully.

Bios of the Company

You must also include a bio of the executives and managers of your business. This will show investors how capable the company's staff is and assist you in achieving your objectives.

Costing

To implement the busines plan, you must address the budget. It describes the balance sheets, funding, cash flow statements, and profit and loss statements, among other things.

Do You Know?

According to a study, having a formal business strategy was significantly linked to increased gross revenues and sales growth.

Media Literacy

Media literacy provides tools to help people develop approachable media capability to critically analyse messages, offers opportunities for learners to expand their experience of media, and helps them develop generative media proficiency to increase creative skills in making their own media messages.

Hence, media literacy is highly important to create a successful business plan.

Project Management

Project management is crucial since it guarantees that the project is being followed properly. Some of the things guaranteed by project management tools are very important and useful in a business plan. Project management ensures in a business plan that:

- Every initiative has a strategic objective.
- Things are accurate and will benefit the business opportunity.
- Everyone is aware of their responsibilities.
- Project's progress is monitored and accurately reported.
- Risks are effectively managed to prevent problems.

Transaction vs Payment

Transaction	Payment
1. Transaction is an instance of buying or selling something.	1. Payment is the processing of a payment from a Payer to a Payee.
2. The act of agreement between a buyer and a seller is referred to as a transaction.	2. It is the act of making a payment.
3. The amount of money exchanged for products and services.	3. Trade or exchange of products and services.

Examples of transactions along with their payments are as follows:

- Acquiring ownership of a property the seller previously owned, by paying the seller with cash and a note.
- Paying an employee for hours of work.

List of Payment Methods

While cash is the original and oldest payment method: the physical coins and notes you'll find in your wallet, at an ATM or at the bank. We need to be very careful while we are going through a transaction and choose safe methods.

- Debit cards
- Credit Cards
- Bank transfers
- Direct debit
- Mobile payments
- Mobile payments: E-wallets
- Mobile payments: Payment Links

How to Make Safe Payments?

Some ways you can do safe payments:

- Try to use only trusted and official websites or apps for online payments.
- Don't save your card information after online purchases. Make sure to delete it right away.
- Try not to use public computers.
- Use strong passwords and don't share them with others.

Digital Marketing Platforms Used by Entrepreneurs

Following are the names of the digital marketing platforms that are commonly used by entrepreneurs:

- Facebook
- Quora
- Our Blog
- YouTube
- LinkedIn
- Instagram
- Twitter
- Tumbler

• Facebook

Facebook allows you to target your perfect target demographic. It is always making changes for a better user experience. you can start a Facebook Message with your company page.

Additionally, you can program automated messages for your company page.

• LinkedIn

LinkedIn allows advertisements to be altered and modified to a consumer persona. You can also target ads to people's professions. It's a great way to meet people who can hire your business, stock your goods, or work with you in a partnership.

• Instagram

Instagram will assist you target your audience and boost engagement if you know who they are and there is a product/market match. You can even expand your network and increase revenue. It can give you important audience information which can be useful for your marketing strategy plans.

• Twitter

Twitter is most renowned for its real-time updates. It is one of the easiest places to create a group of like-minded people. It provides a convenient platform for sharing blogs and YouTube videos.

• YouTube

You can benefit from YouTube's access to Google's advertising network by placing YouTube advertisements. With the right keywords, you may improve the YouTube video searches for your business.

Glossary

entrepreneurship	the process of setting up a business	multimedia	is a form of communication that uses a combination of different content forms
bidding	offering of particular prices for something	retargeting	to target audiences who have visited your website before
attain	to achieve something successfully	comprehensive	covering completely or broadly
influence	To cause an effect	tactics	To take specific actions or strategies to accomplish goals
waged	people who are paid regularly for work	podium	a small platform on which a person may stand to be seen by an audience

LET'S HAVE A LOOK

- Digital marketing, also called online marketing, is the promotion of brands to connect with potential customers using the internet and other forms of digital communication.
- Promotion refers to any type of marketing communication used to inform target audiences of the relative merits of a product, service, brand, or issue, most of the time persuasive in nature.
- Online Advertising is the bidding and buying of appropriate ad units on third-party sites, such as display ads on blogs, mediums, and other relevant websites.
- Email marketing is a direct marketing scheme that involves sending promotional messages to customers.
- Mobile marketing is the advertisement of products or services specifically via mobile phones.
- Search engine optimisation (SEO) focuses on improving natural traffic to your website.
- Social media marketing is a key component of digital marketing.
- A business plan is a document setting out a business's future objectives and strategies for achieving them.
- Transaction is an instance of buying or selling something.

Exercise

A. Multiple Choice Questions: Tick the correct answer.

1. Entrepreneurship refers to the convenience of launching a _____ online.
   a. business **b.** education **c.** shopping **d.** program
2. Which of the following is also referred to as digital Marketing?
   a. Online Banking **b.** Online Shopping
   c. Online Marketing **d.** All of these
3. _____ process also involves identifying a potential market, assessing the size of the market, and determining an approximate estimate of the product's value.
   a. Costing **b.** Market need **c.** Operations **d.** Marketing
4. Video marketing enables companies to connect with customers in a more _____ engaging and cooperating way.
   a. tastefully **b.** audible **c.** visually **d.** none of these
5. The entire business plan is _____ in the executive summary.
   a. copied **b.** summarised **c.** deleted **d.** shared
6. The _____ is an instance of buying or selling something.
   a. transaction **b.** payment **c.** sharing **d.** storing

7. The act of _____ between a buyer and a seller is referred to as a transaction.

a. agreement **b.** disagreement **c.** dispute **d.** none of these

8. Email marketing is a direct marketing scheme that involves sending promotional _____ to customers.

a. calls **b.** orders **c.** magazines **d.** messages

9. A _____ is a simple statement that summarises why a customer would choose your product or service.

a. value proposition **b.** quality assurance

c. promotion **d.** executive summary

10. _____ marketing focuses on gathering and endorsing positive online reviews.

a. Reputation **b.** SEO **c.** Email **d.** Video

B. Write 'T' for true or 'F' for false in the boxes.

1. Digital Marketing is also called inline marketing. ☐
2. The way to prevent mistakes is called quality assurance. ☐
3. Advertisement is not a component of digital marketing. ☐
4. Email is not used for Marketing. ☐
5. Paid Search increases the visibility of Search Engine ☐
6. Hashtags help people to find your tweets. ☐
7. A business plan is a document setting out an objective of the business. ☐

C. Answer the following short questions:

1. What is entrepreneurship in digital marketing?
2. Write down the goals of digital marketing.
3. Name the components of a digital marketing plan.
4. Discuss content marketing.
5. What is email marketing?
6. What are some ways a digital entrepreneur may enhance creativity?
7. What is SEO? Why do we use SEO on our websites?
8. What obstacles does digital entrepreneurship face?
9. What are the four steps to optimising a website?
10. What factors should you take into account when selecting a social media platform for your business? Describe with examples.

D. Answer the following long questions:

1. Write a detailed note on digital marketing.
2. Explain any four components of a digital marketing plan.
3. What are the differences between transaction and payment? Also explain how to make safe payments?
4. How would you use digital marketing platforms to enhance your business?

Learning Activities

Activity 1:

In-class activity: Students can watch a video on social media and discuss. Discussion questions can include "What is social media marketing? How can it help with a start-up? What would be the components of a social media marketing plan?" Sample video: What is Social Media Marketing in 2 minutes

https://www.youtube.com/watch?v=9m45nVsvvEY

Activity 2:

Students can watch a video on business plans and comment on the key learning outcomes. Reflection questions can include "What are the key components of the business plan? What are the benefits of a business plan? What would happen if you didn't use a business plan" Sample video: How to Write a Business Plan to Start Your Own Business

https://www.youtube.com/watch?v=Fqch5OrUPvA

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Answers

A: Tick the correct option.

1	a	2	c	3	d	4	c	5	b
6	a	7	a	8	d	9	a	10	a

B: True and False

1	F	2	T	3	F	4	F	5	T
6	T	7	T						