

Teach Computer Science

KS3 Computing

Introduction to computers

1.

Revision notes

Introduction

The word 'compute' denotes an activity that is based on mathematical calculations. In modern times, this word is used to refer to a computer. Even before the age of computers, mathematicians used various tools to carry out calculations. An abacus, which is used for calculations, is an example.

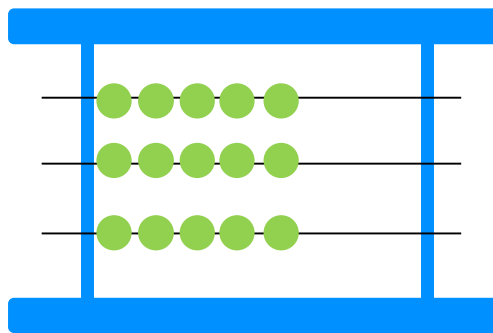


Figure 1: Abacus

A computer is any device or machine that can be programmed to carry out sequences of arithmetic or logical operations automatically. Computers are also called general-purpose machines, as most of the computers with a CPU (Central Processing Unit) are used in many different applications. For example: smartphones and tablets. To perform these wide ranges of functions, a computer is installed with various software. Web browsers, video calling, word processing and games are a few examples of software.

A computer designed to perform a special function is called a special-purpose machine. The Atanasoff-Berry Computer (ABC) was the first automatic digital computer designed specifically to find the solution of systems of simultaneous and linear equations.

Evolution of computers

Charles Babbage and Ada Lovelace developed the first general-purpose machine, the analytical engine, in 1837. In 1935, Alan Turing, a mathematician and code-breaker, developed a design for how modern computers would work with various programs to perform different functions.

The Colossus, built by engineer Tommy Flowers in the 1940s at Bletchley Park, helped British cryptographers decode German messages, which helped win WWII.

German inventor Konrad Zuse developed the first programmable computer, Z3, in 1941. This computer was used to analyse the wing flutter of aircraft during World War Two. The data and programs were stored in a punched film.

The invention of transistors in the 1970s played a very important role in the transformation of computers. Moore's law describes that computers are becoming smaller over a period of years, that the number of transistors doubles every two years, and that the processing speed of computers is also increasing each year. The following figure shows the evolution of computers in a timeline.

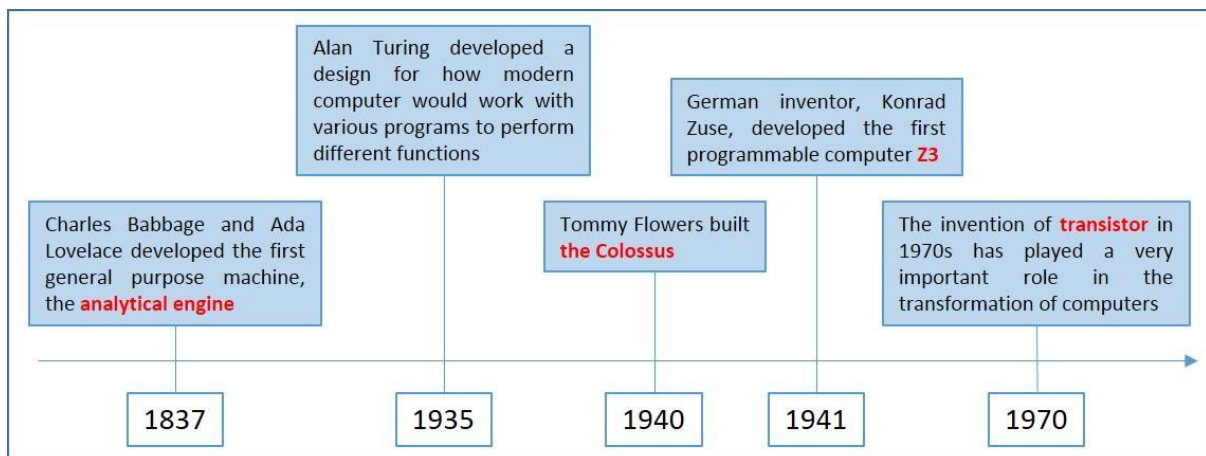


Figure 2: Evolution of computers in a timeline

Input-process-output model

Computer processing uses the input-process-output model for performing its functions. The following figure illustrates the input-process-output model.

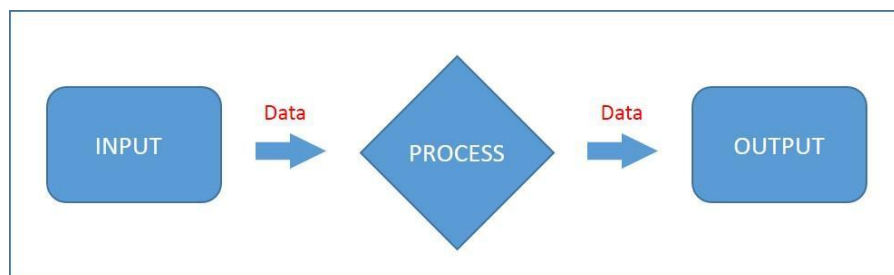


Figure 3: Input-Process-Output model

The system receives an input, processes the data and presents information to the user. For example:

Input	Process	Output
Image of the page.	Stores the image in its memory.	Sends the image to the computer.

Components of a computer

A computer consists of various components such as processor, input devices, output devices, storage devices and memory.

The input devices enables the user to enter data into the computer. The processor processes the data entered by user and the results are displayed through output devices. Memory stores the input, software applications and results of processing for a short period of time. The files and installed software are stored in storage devices for a long period of time.

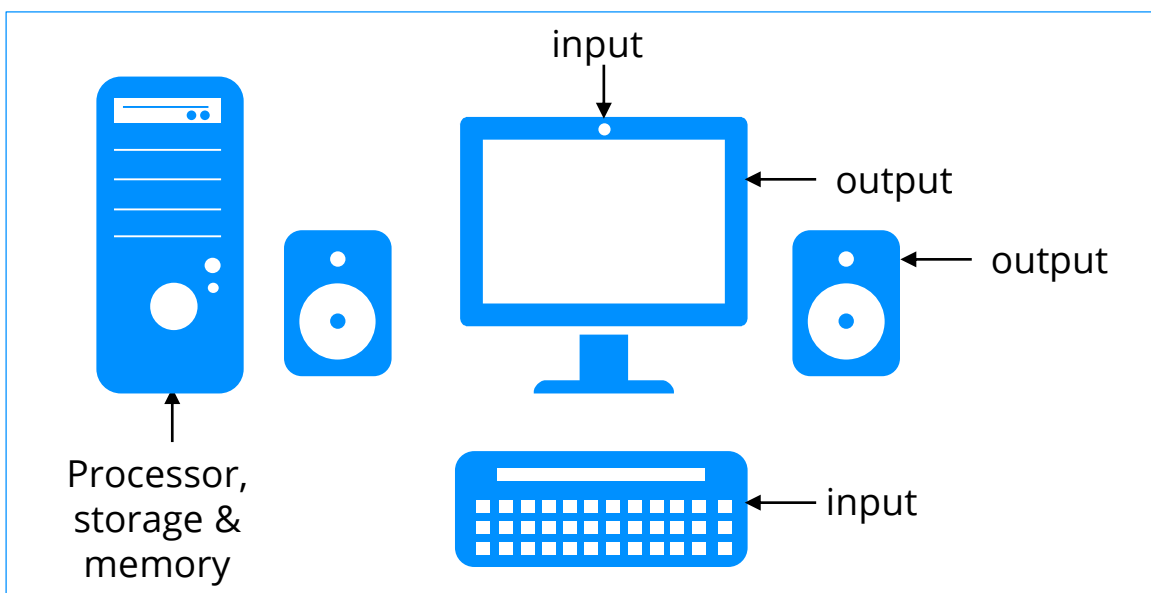


Figure 4: Components of a computer

A simple mathematical calculation is completed by computer as shown in the functional block below. The input sent by user is stored in memory and processed. The function here is times 2 and then, subtract 5. The output is stored in memory temporarily and displayed to the user.

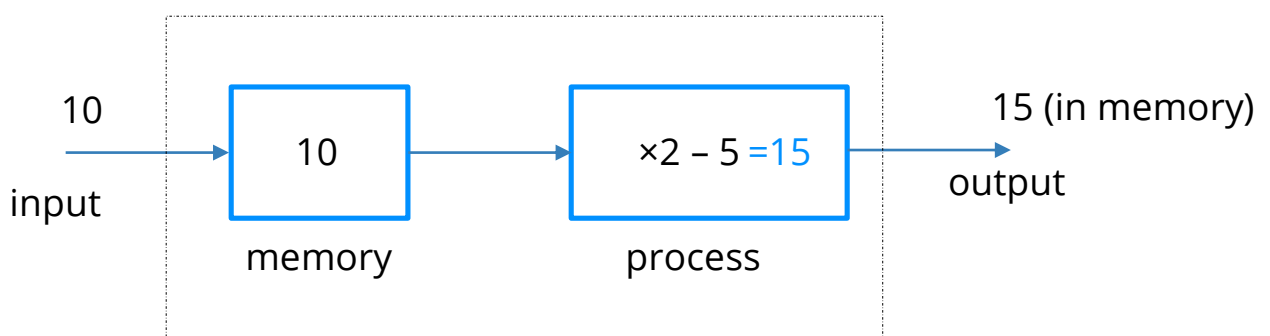


Figure 5: Functional block

Application of computers

Computers are used in a wide range of applications. The following figure illustrates some of the applications of computers.

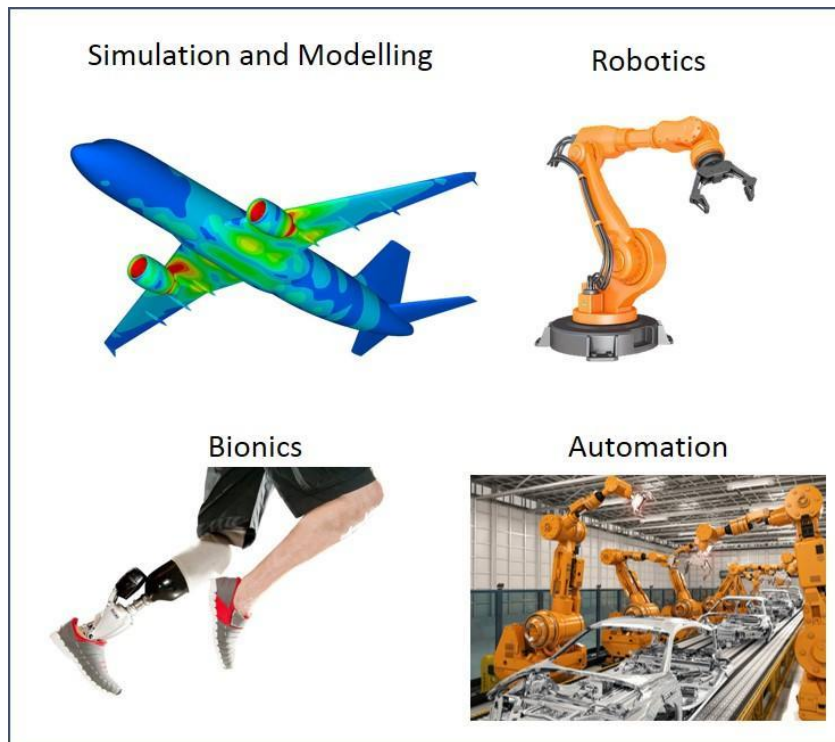


Figure 6: Applications of computers

a) Simulation and Modelling

Computers are used to simulate and model designs based on their theories. Once the desired results are achieved through modelling, the designs can be manufactured. Forecasting weather, modelling a car, and analysing the DNA of organisms are a few examples of modelling using a computer. Various software tools are available for modelling and simulation.

b) Robotics

A robot is a programmable machine that can perform a series of actions automatically. Robots are used in unmanned space probes, mining, healthcare and domestic tasks. Robots used in military-based applications are designed to use a variety of weapons. Unmanned combat air vehicles are also designed for a variety of missions.

Application of computers

c) Biologically-inspired engineering

Biologically-inspired engineering (or bionics) is the application of biological methods and systems found in nature to design engineering systems. Replacement or enhancement of body parts is possible with bionics. Bionic devices are also equipped with sensory systems that take input from the device and send it to the brain.

d) Automation

Automation is a technology by which a sequence of operations can be performed without human assistance. An automatic teller machine (ATM) is an example of automation in which the computer interacts with the user to perform online transaction processes.

e) Predictive texting

Computers predict the text the user may type. This application is used while sending email, searching in Google and using spreadsheets. Computers use the history of searches in Google to predict what the user may enter using the first few letters of a user's text.

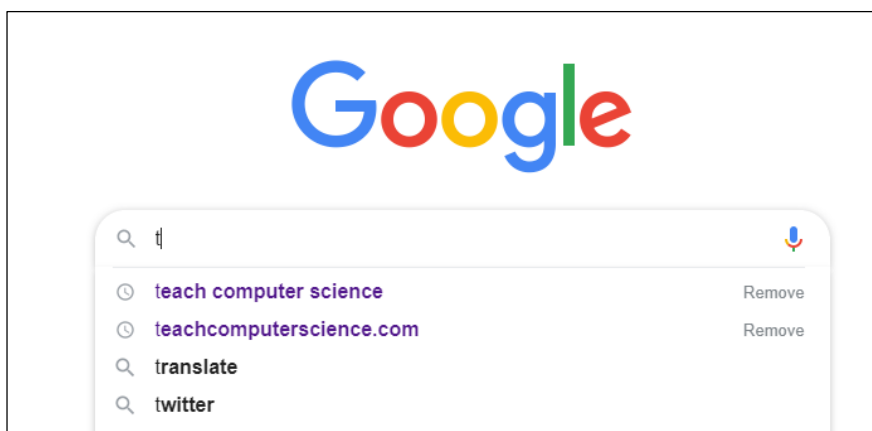


Figure 7: Predictive texting

Artificial intelligence

Artificial intelligence enables computers to perform activities at a human expert level using complex algorithms. Speech recognition system that identifies words and understands them is an example of artificial intelligence.

A chatbot is an application of artificial intelligence that makes the user think that they are interacting with a human being.

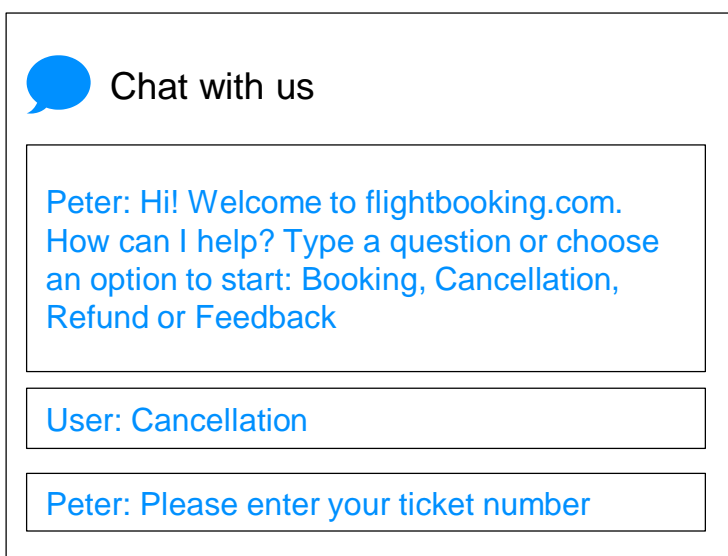


Figure 8: Chatbot used in customer service

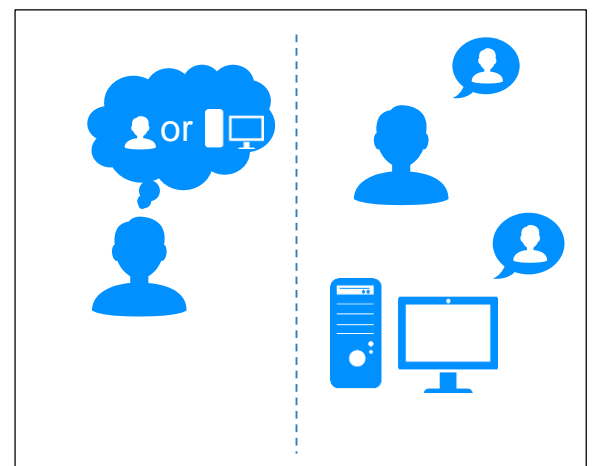


Figure 9: Turing test

Alan Turing, mathematician and code-breaker, developed a hypothetical machine called the Turing Machine. This model led to the evolution of computers that could be programmed by users through instructions.

He also proposed his ideology of artificial intelligence. He designed a simple test to find out whether a computer is intelligent or not. This test involves two humans and a computer. Human 1 communicates with the computer and human 2. Human 1 cannot see the computer and human 2 responds only by text. Human 1 may receive responses both from the computer and human 2. If human 1 is not able to differentiate between the responses of the computer and human 2, the computer is said to be 'intelligent'.

Future of computing

a) Moore's law

Moore's law describes the trend according to which computers are becoming smaller over a period of years. This is because the number of transistors in a processor doubles every two years, and the processing speed of computers doubles every two years.

The physical size of a transistor is becoming smaller due to the usage of new materials. However, there is a limit for the minimum size of a transistor. Research is being conducted to use new technologies that will reduce the physical size of computing devices and improve its performance as well.

b) Augmented reality

Augmented reality is an interactive experience of a real-world environment whereby the computer-generated objects appear to reside in the real world. Many companies are creating wearable electronics that incorporate augmented reality. The game Pokémon Go, released by Niantic, is a notable example in the field of augmented reality.



Figure 10: Augmented Reality App

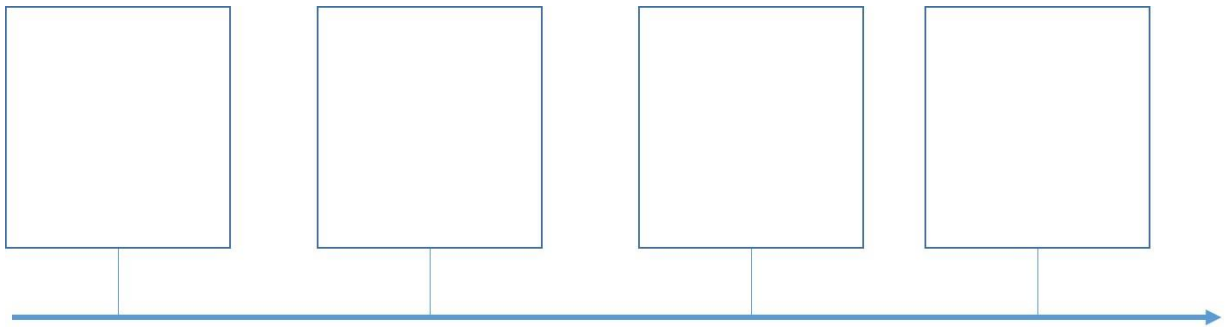
2.

Activities

Activity 1

Duration: 15 minutes

- A. Complete the blank timeline to fill in any four important inventions in the evolution of computers in the order of its occurrence. You may include the name of the inventor or device along with its functionality.



- B. Complete the input-process-output model for a printer.

Input	Process	Output

- C. List any five applications of a computer.

a)	_____
b)	_____
c)	_____
d)	_____
e)	_____

Activity 1

Duration: 15 minutes

- D. Complete the following table by listing examples of components of a computer.

Component	Example
Input device	
Output device	
Memory	
Storage	
Processor	

3.

End of topic
questions

End of topic questions

1. What is the difference between a general-purpose computer and a special-purpose computer? State examples for each.
2. List the components of a computer with its functions.
3. What is the difference between a memory device and storage device?
4. State Moore's law.
5. How is a computer used in the field of robotics?
6. What is predictive texting?
7. Explain Turing's test in detail.