AlgoHack #0

WHAT IS A COMPUTER ?

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AlgoHack aims to teach Computer Science and Programing to young people, initiated by Shilpa Sayura Foundation, supported by GOOGLE RISE and Computer Society of Sri Lanka.

What actually is a Computer ?

Draw 3 ideas for a computer?

What We Know :
Computers are electronic devices.
They operate using electricity.
They do things for our commands.
Computing means Calculation.
So, Computer is a calculating machine.

Take a Text book.
Turn any page.
Write the page number.
Turn any page.
Write the page number.
Turn any page.
Write the page number.
Are all numbers same or different? Why ?
Wow! you made a computing device.

So, Your book is a **Random Number Generator.**
There are many computing machines in our homes. The TV, Clock, Fridge, Microwave Oven are all computing devices. We can program a TV to select

channels. We can set alarms with a clock.

Make a list of computing devices at home and their functions.

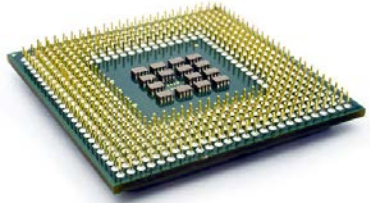
We operate the TV with the remote controller
Remote controller ask the TV do different things.
Remote controller uses infrared (IR) waves to tell the TV what to do. They are light signals and travel through air. They are invisible to the human eye.

How does Remote Controller work with TV ?

You push a button for a channel number.
Remote controller sends infrared signals.
These signals are picked up by a sensor in TV
The sensor passes the signal to the TV.
The TV changes the channel.

Draw a diagram, to show how it works?

The remote control and TV both are like simple computers. They both have a **Microprocessor**.



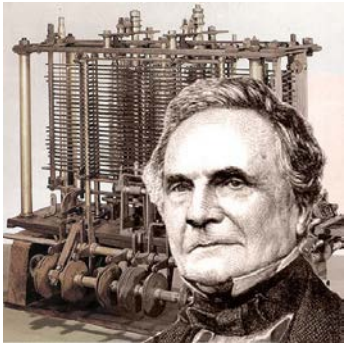
Microprocessor is like brain in a computer. Like our brain controls our body, Microprocessor control all devices connected to a computer. Microprocessor is an electronic circuit.

Computers can't think like human.
They only understand electricity.
They are like a light switch.
Either it's OFF or ON, works when ON.

We need to give computers **instructions** to do things we want them to do. Without instructions computers can't operate by themselves. We can give many instructions to a computer.

Computers have become an essential part of human life. We can't imagine a Life in today's without computers.

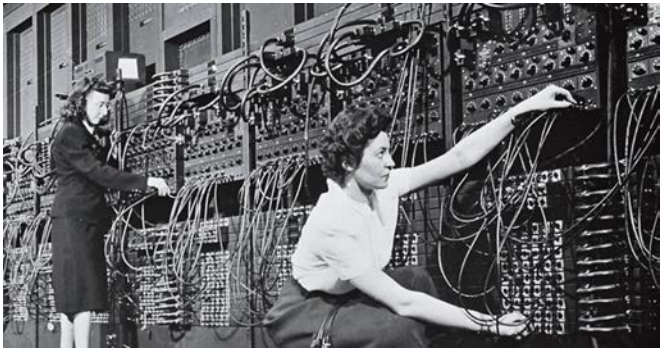
Discuss a use of computers in daily life with a friend. How many ideas can you come across?



Charles Babbage, a British professor in Mathematics invented first mechanical computer in 1882. Would you like to become an **inventor** like him?

First Digital Computer ENIAC

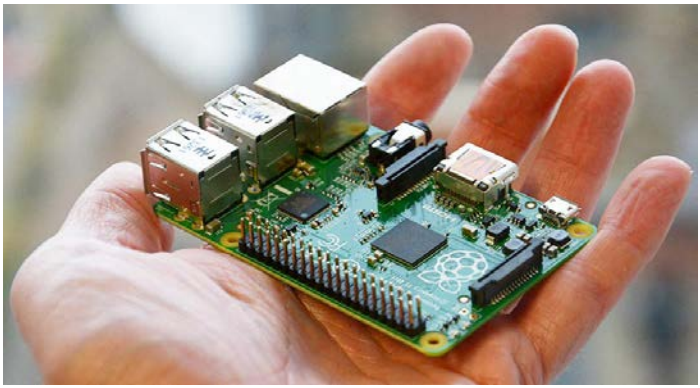
Introduced to the world in 1946 by University of Pennsylvania. It was 30 feet by 60 feet. Weighed 30 tons. It used 19,000 vacuum tubes.



Computers are used in education, engineering, agriculture, medicine, business, media and scientific research and many other fields.

Engineers and filmmakers all use computers to design

things. Teachers and students use computers to teach and learn. Office workers use computers for daily work. Scientists use computers for research. Today computers have become much smaller in size and more efficient in power.

. 

List 10 uses of computers in your daily life.
Discuss how to use **computers in your classroom.**

Is your teacher's smart phone a computer?
Why do you think so?

The Smart Tap
Suppose you are living in a desert and water is the most valuable. When we open and close taps some water gets wasted. Suppose we want to save water creating a smart tap.

Think of this idea
When we want a cup of water, We touch a button, The tap opens, water starts filling.
The tap closes automatically when the cup is full.

How does it work?
The button tells the tap to open
After some time tap automatically closes.

Lets design a Smart Tap to save water.
We are going to design computing device for water saving. Instead of hand we are using a motor to open and close the tap. We need a button, a microprocessor, a motor and some wires to connect them.

How it will work
The button creates an electrical signal.
The signal goes to microprocessor.
The microprocessor send a signal to the motor.
The motor opens the tap and water flows.
When the cup is full tap automatically closes.

Opening the tap is fine now.

How do we automatically close the tap?

We have to close the tap when the cup is full.
Suppose it takes 1 minute to fill the cup.
We have to close the tap After 1 minute.
The microprocessor has to send a signal to the motor to close the tap after 1 minute.
So the motor rotates backward to closes the tap.

It's our Smart Tap design.

Is there a problem in this design in real life use?

The speed of water is not uniform all the days.
Because tank's water level can be low in the tank. If the water speed is slow,
more time will take to fill the cup.
If the water speed is high,
less time will take to fill the cup.
Filling time is not uniform, we can't use it.

Let's think smart now on.
We know one cup is about 200ml.
We have to close the tap when 200ml reached.
Will it be ok, if we measure the amount of water?

Let's do some calculations.
If the water is flowing at 20ml per second,
How many seconds will it take to fill the cup?
Easy! 10 seconds.

What if the water flowing at 10ml per second?
Will it be 20 seconds or 10 seconds?

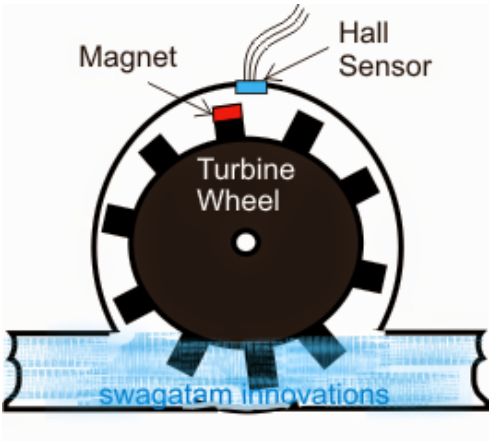
So our computer can calculate water amount, from water speed, Right ? If we know the water speed, we can find number of seconds to fill the cup with water.

How do we measure the water speed?
Can this flow meter help us?

Flow meter is a computing device with a small propeller. Your home water meter has something like that inside. But it is mechanical.

The fan rotates when water is flowing through it. The rotation speed of the fan tells us something about water speed. When the fan rotate fast water speed is high, otherwise less. The fan rotates at a uniform speed, because water flow is uniform.

When rotating, the fan creates number of electrical pulses using magnetism. it works like a generator. We measure these pulses to calculate the amount of water flowing through.



So, the flow meter sends water speed to the microprocessor. The microprocessor calculate water amount. When 200ml is reached, it sends a signal to the motor to close the tap.

Smart isn't it?

Draw a diagram of your Smart Tap.
What will it do if there no water?
What will it do if there is a power cut?
Explain how it works to a friend.

Act it out
In your class assign your friends to act as each component of the smart tap. Fill 5 cups of water.

Computers takes commands one after another to do something. Computers make decisions based on data

they receive. The command to close the tap is based on water speed data it obtained.

Computers need programs.
We operate computers with a program.
A **program controls** the computer.
A program contain our **instructions** to the computer.
Computer can't operate without a program.
We can run many programs on a computer.

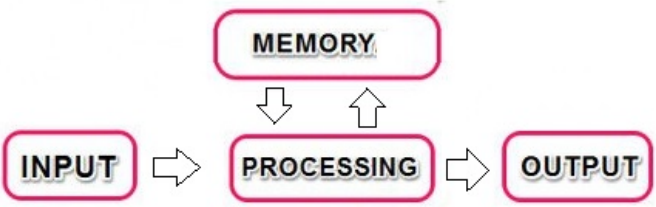
Computers have a memory.

Memory stores our programs and data for operating the computer. Think of memory as a grid of cells. They can keep large amount of information for processing.

1	4	7	8	0	6	6	6
21	41	17	61	45	22	13	19
A	L	G	O	H	A	C	K

Memory is connected to the processor, so that the processor can store data in memory. **Why ?**

Computers takes inputs, stores as data in memory. Computer process data and output something.



Input	Gets data into a computer
Memory	Store programs and data
Processor	The brain of the computer.
Output	The outputs created by process

Keyboard, Mouse, Microphone, Monitor, printer, speakers, processor, Hard disk **What do they do?**

More about the processor

The processor is the brain of the computer.
It controls the computer and devices connected.
Processor runs programs.
The programs take inputs, do calculations, store data in memory and output results.

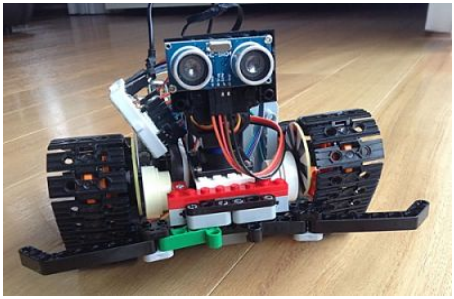
Make a list of computing devices in your home.
List their purpose, inputs, processing and outputs.

Watch the Sky

Are the clouds were same yesterday?
Will it be different tomorrow?
Does louds change shape, size, color over time?
Is it uniform or random?
Will it rain today? Or Will it be sunny?

We make these decisions from our **prior knowledge.** We can program computers to predict weather using prior knowledge. If we provide many days of weather data to a computer, they can be programmed to learn and make predictions on data.

Do you think that future computers can be built to think like humans? **Can they overpower humans?**



Smart Water Gate Design Challenge?

There is a Tank by the village situated in a mountain area. Flash rains in the hills sends excess water

through river to the tank. The tank gates need to release excess water. Unless the dam will be damaged and village will be flooded. You also need to save as much as water, when it rains.

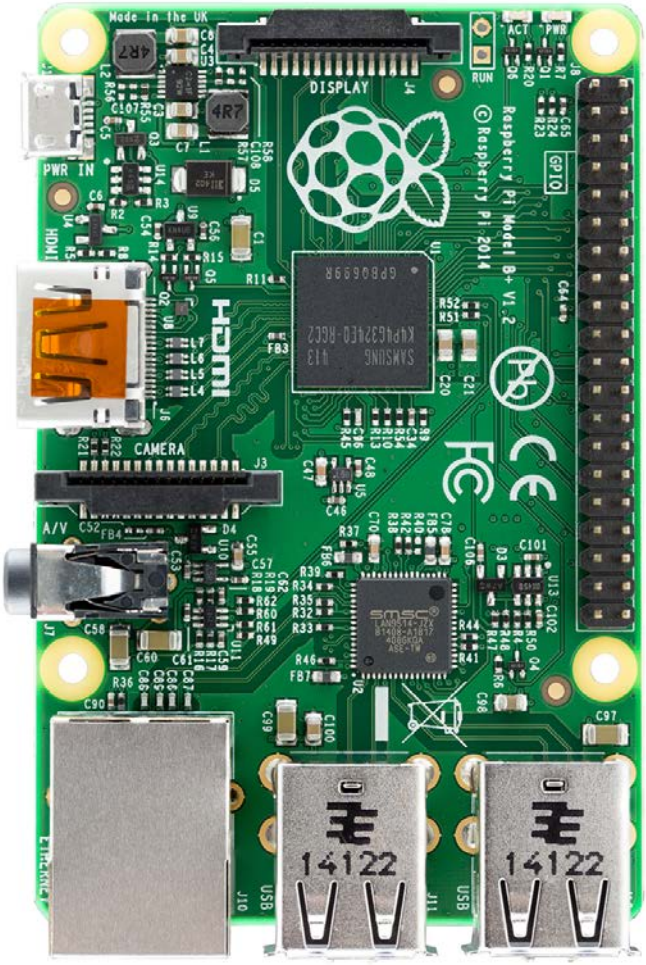
Design a water gate control system for the tank.

What information you need?
What are the features of your smart tank gate?
How can you control it from distance?
How can your smart gate help society?

Suggested steps

1. Gather Information.
2. Draw a diagram.
3. Write your inputs.
4. Write your process.
5. Write your outputs.
6. Explain it to a friend.
7. Get feedback.
8. Write a description in next page.

Raspberry Pi Computer with a ARM processor.



See https://www.raspberrypi.org for computing projects.

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