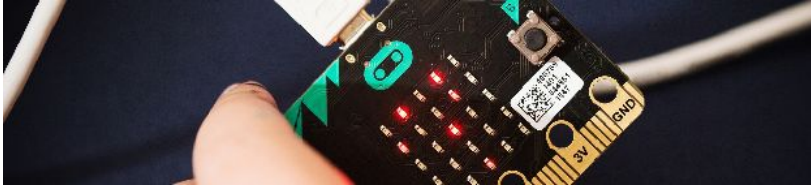


AlgoHack micro:bit [0]



Authors

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

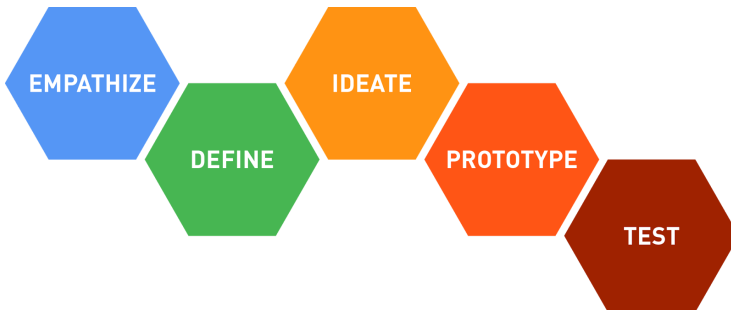
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Design Thinking

We always think a lot before designing something.

When we try to invent something, we use Design Thinking.



EMPATHIZE - Understanding

DEFINE - Define Problem

IDEATE - Identify Solution

PROTOTYPE - early model

TEST - Improve

EMPATHIZE FIRST

Our design must **serve a purpose**.

Can we **solve a problem** in everyday life?.

Can we **help someone** else?

Can our **invention** make world more beautiful?

Ask your self

What do we know about the problem?

What do we don't know about the problem?

Ganindu : **An Everyday Hero's Journey**

Ganindu Nanayakkara, born in 1990, started designing things from his school days. This picture shows the **little Ganindu** getting a big award from Professor V.K. Samaranayake known as Proff Sam, as well as father Computing in Sri Lanka



In 2016 he won Verizon World Innovator Award for his **iHelmet** invention. He was awarded 700 million rupees to develop his idea further. Ganidu is an inventor.

Who is your favourite Inventor?

Mine is Leonardo Da Vinci, Thinker, Artist and Engineer.

What your inventor did invent?

What problem his invention solved?

Has his invention improved today? How?

How you want to build a bicycle today?



This is what I like. I can use it in muddy roads. I can ride on rocks and sands. Never fall. I can easily fix an engine.

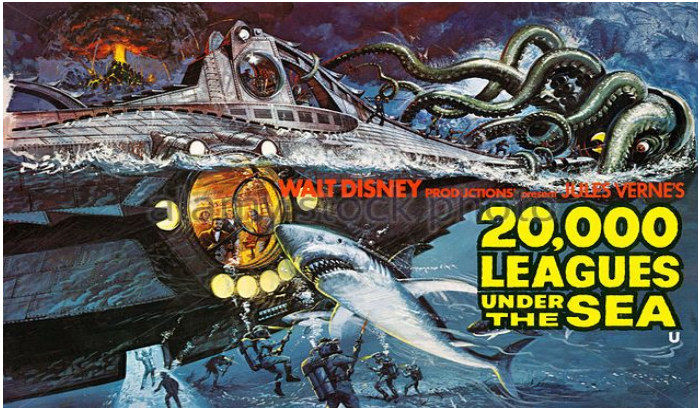
What do you like ? and Why ?

Dream Bicycles : Design Thinking Activity.

Two students ask each other about their **dream bicycles**.

An underwater bicycle is fine. Twenty Thousand Leagues

Under the Sea novel written by Jules verne in 1870 had such bicycles.



Student A interview and gather information from **student B**

A ask B about the bicycle he want to have.

A mostly listen, ask questions from B?

B talking for the entire time

A Make notes and draw sketches

They rotate after 5 minutes. .

Here are some questions to start with:

Do you have a bike? What is it?

What do you **like** about your bicycle?

What do you **dislike**?

What you want in your bike? Why?

Try to ask **What** and **Why** as much as possible.

**When we design, we create real things for real people.
So we need to start with understanding what people like
and dislike.**

Finally **A and B review** their notes, circle ideas

Both understand **how to create** the best bicycle for their friend.

Write write 5 features and reason in 5 minutes.

My friend needs _____ in his bicycle because
_____.

Draw the dream bicycle for your friend.

do you like your bike to

Tell you directions automatically ...

Perform automatic tail signals ...

Balance the bike automatically ...

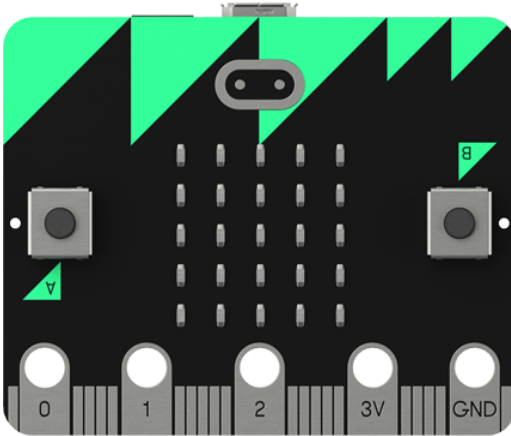
Play a music and drums ...

Sense weather, wind, rain, dangers ...

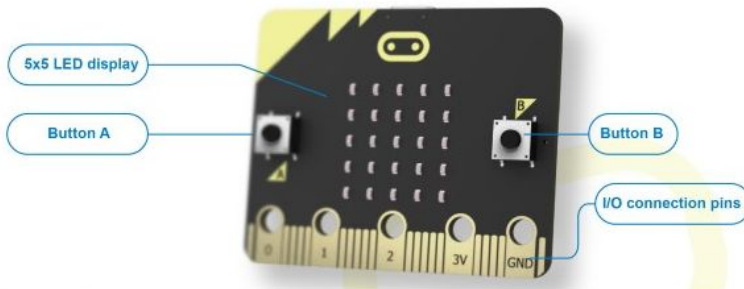
Tell you how fast you need to ride.

What more ?

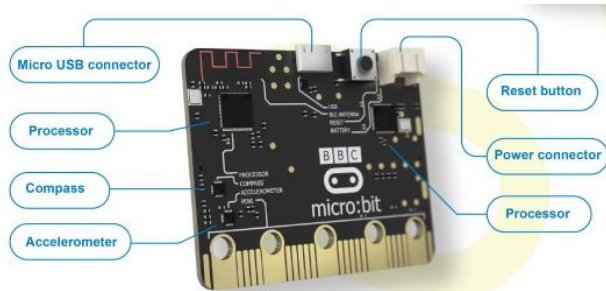
What is BBC micro:bit ?



BBC Micro:bit is a tiny computer. We can program it to do many things. BBC and partners designed it for children to learn coding and build new things. You can learn how to invent with microbit. See <http://microbit.org> for more information.



microbit has 5x5 LED Matrix display.



It two push buttons A and B for interaction.

It also has a compass, Accelerometer and temperature sensor. It has 20 pins you can connect to outside sensors and motors.



Microbit can communicate using serial cable, bluetooth and radio communications. You can send your name to another microbit through air. Isn't it wonderful ?

Microbit also has a magnetometer and accelerometer. It also has temperature and light sensor. That can help drone navigation.

BBC micro:bit Safety

Keep the micro:bit in a anti-static bag when not in use..

Keep it in a cool dry place. Don't expose to hot sun or rain.

Earth yourself before handling it. Touch a metal.

Handle the micro:bit by its edges. Don't touch middle parts.

Don't touch components when power is on..

Use only 3v battery pack or computer USB cable

Do not use any other chargers to power micro:bit.

High current can burn or damage your micro:bit

Coding BBC micro:bit

Goto <http://makecode.microbit.org> microbit simulator.

Makecode provides **3 types of blocks**.

1 Sequential blocks - instructions placed one after the other

2. Selection blocks - instructions are based on conditions

3. Repetition blocks - Instructions repeating on conditions

How to program with blocks?

We can drag and drop blocks to design our program.

We build the program using many code components.



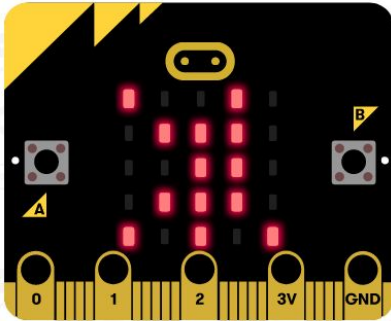
We connect them like pipes.

A block gives a command to the computer.

The hole gives additional information to the command.

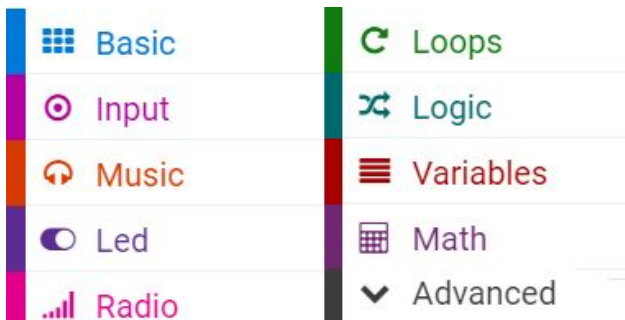
You can drag and drop inputs, outputs, variables and more instructions in visual block form. You can also see the code generated by clicking **{ Javascript** button on menu bar.

On the left you see microbit simulator.



When you program microbit, the simulator shows how it will run on actual microbit.

Following are main block sections to program microbit. They contain blocks that can be used to create program structure and instructions.



Makecode Examples

You can find several example programs in **Projects** Section
Play with them to understand how makecode works.

On Start and Forever

The code you place in “**on start**” block runs first.

On start run only once.



The “**forever**” code block runs next.

Forever keeps running code inside. it **loops** on.

Print your name on microbit

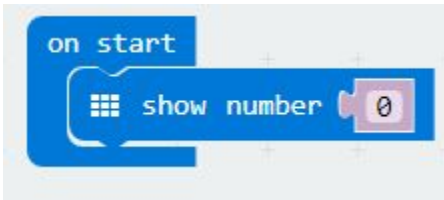


Drag show string block from Basic inside on start block then type your name

Switch to { } Java Script. **What do you see?**

Wow! Makecode did the coding for you.

What else is there under Basic?



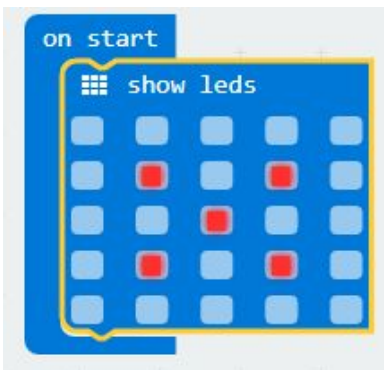
We use **show number** to display whole number.

The block is placed inside on start.



You can display different icons in microbit.

You can show LED patterns using **show leds** block.

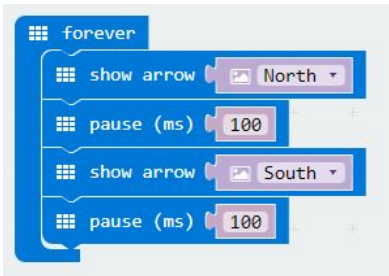


This animation uses **pause block** from basic menu.

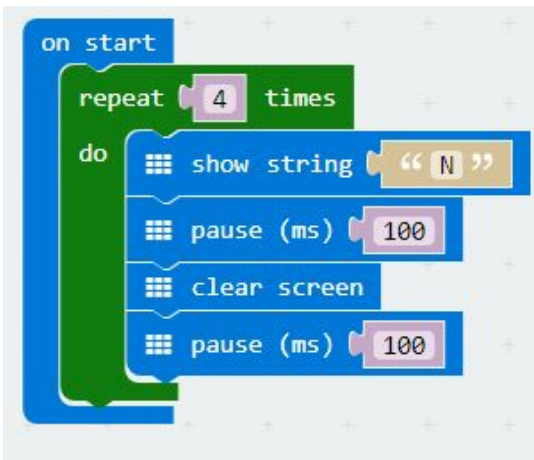
Forever loop runs continuously

pause 100 makes a 100 millisecond delay.

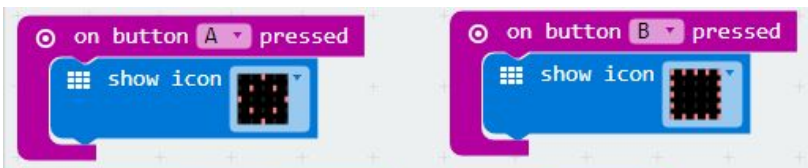
Another forever loop with two pause blocks



The loop below repeat 4 times. Not more



We can program microbit A , B buttons



When you press button A and B show different icons.

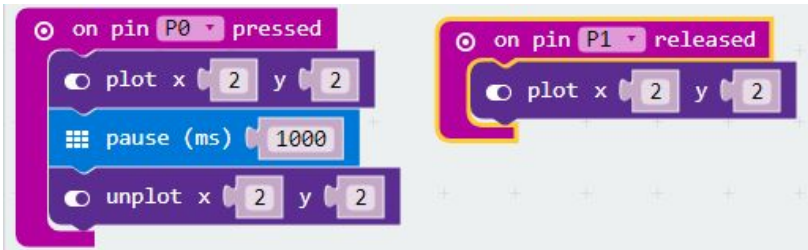
The button press is a microbit event

We can capture and code to do something **on events**

We can get inputs on **A+B** buttons and **shake event**



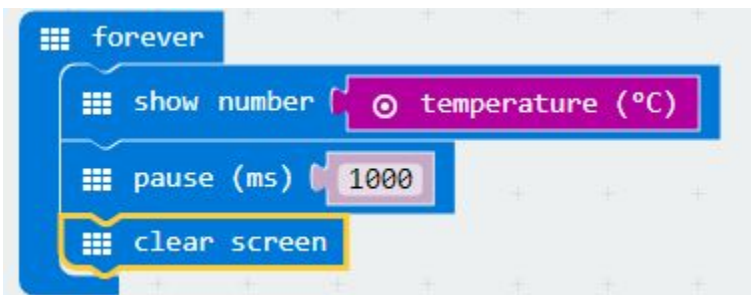
We can get input from **Pin 0** and **Pin 1**



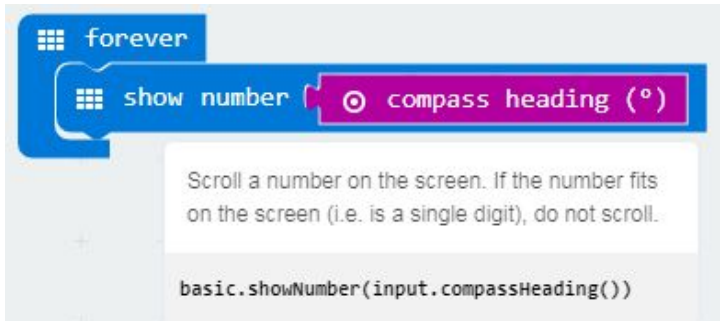
We can **measure** and display **Light Level**



Forever show the **Temperature** in Centigrade

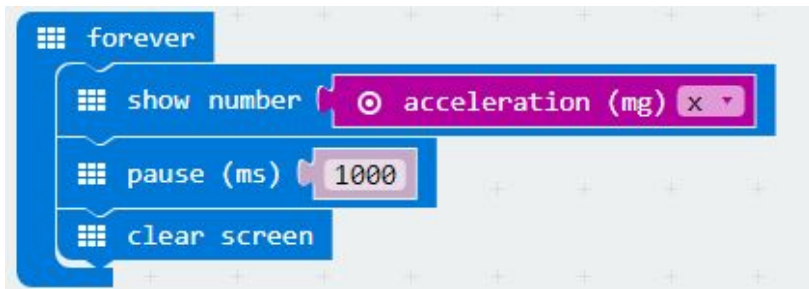


This code show **compass heading** from **magnetometer**



The accelerometer measure rate of speed change.

This code show X axis acceleration in mg (-1023 to +1023)

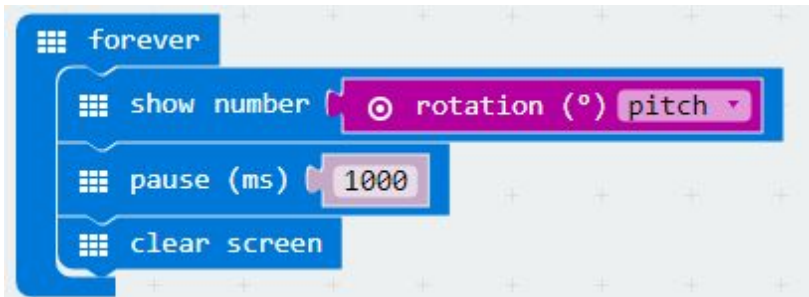


Shall we play a game based on x & y acceleration

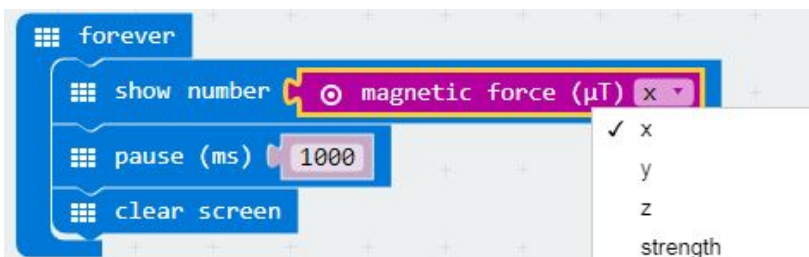
<https://makecode.microbit.org/24551-54594-76183-44868>

You can create programs in makecode and share using a url.

How to sense microbit rotation?



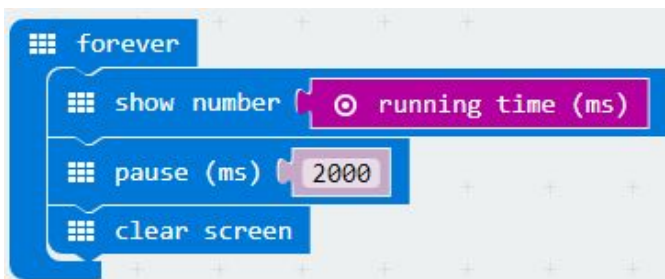
How to sense magnetic force around you?



Microbit don't have a permanent clock.

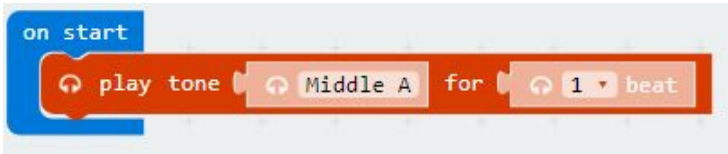
But it keeps how long it has been running since last power up.

Find running time in microbit.

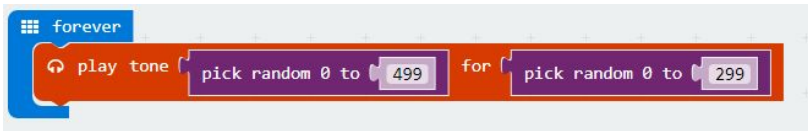


We can use blocks for **play music**.

This code block plays one beat of Middle A tone.



This code plays random music pattern

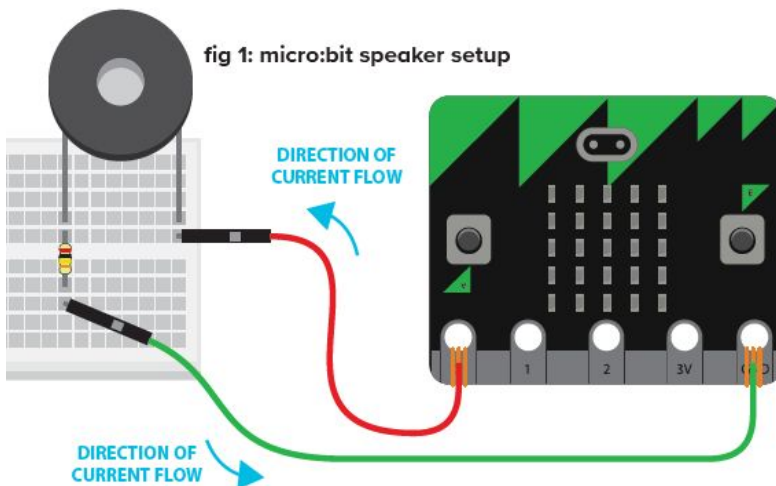


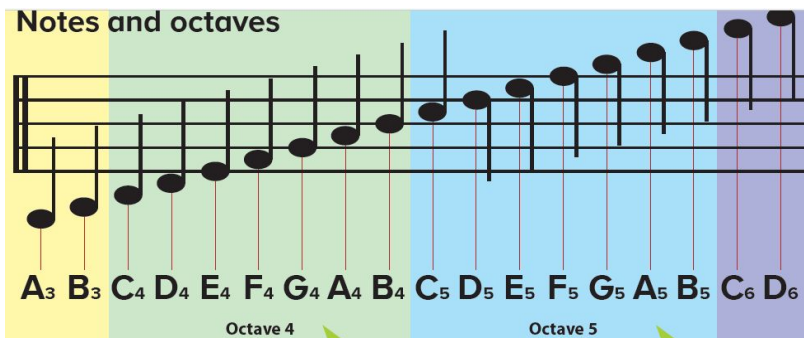
`music.beginMelody(["C4:4"])`

Here **C4:4** mean **C(4th octave):4 beats**

Check this song piece

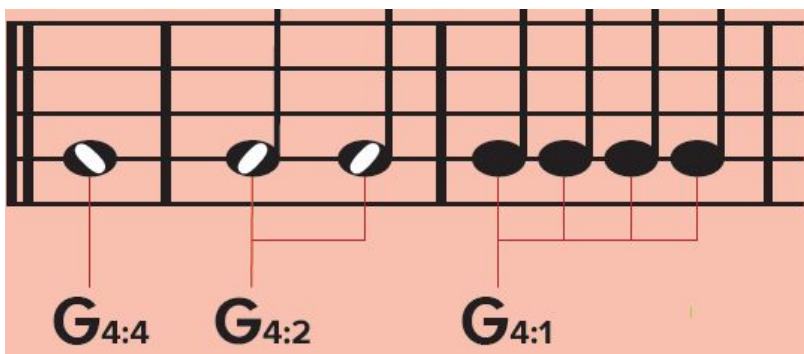
https://makecode.microbit.org/_4UjVeh4CL2gP





In music an octave is 8 measured notes
they run from C o B.

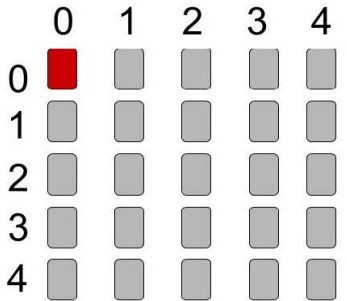
Notes Length



We change length of a note to create a pleasing composition.
"G4:4" means play G from octave four for 4 beats. This lasts
for the same duration as two "G4:2" or four "G4:1"s.

Controlling LED Display

There are 5 LED columns are on **X axis** and 5 on **Y axis**.



`led.plot(0,0)`

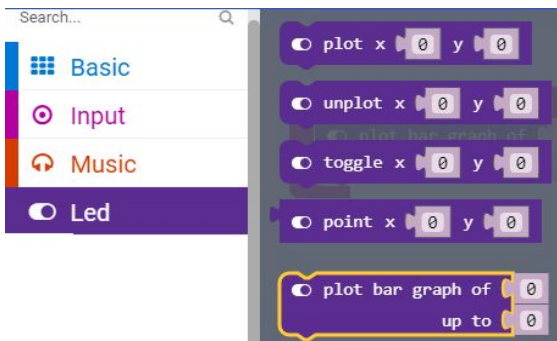
You know in computers counting starts from 0.

So the first LED is at 0,0

We identify a LED with column by **x** and row by **y**.

What is the x,y of most center LED?

What LEDs make + sign ? Give x,y coordinates of LEDs



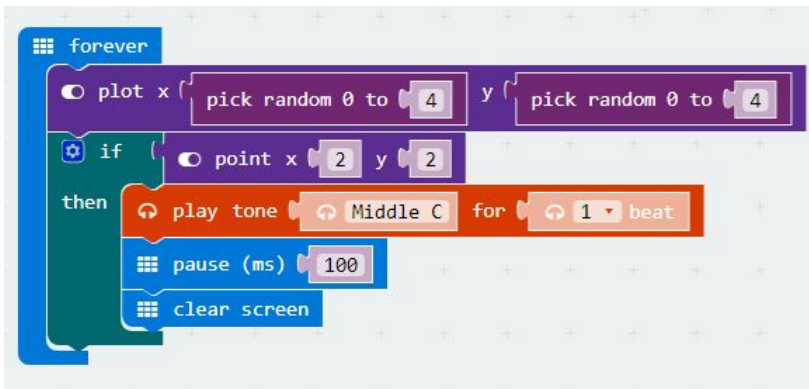
The x axis is horizontal. Y axis is vertical.

Time to play with LED now

Try plot, unplot, toggle and bar graph blocks

Point block checks if LED at x and y is lighted?

Following code plays a music,if LED at 2,2 is plotted.

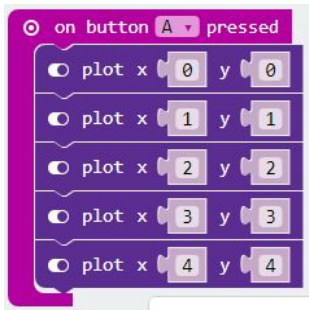


Math - Math operation blocks..

Logic - Help us testing of program conditions

An example is that Button A and B shows different icons.

What does this code output?



The javascript code looks like below.

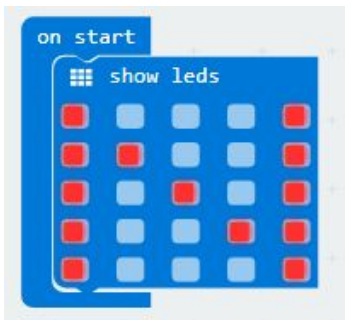
```
input.onButtonPressed(Button.A, () => {  
    led.plot(0, 0)  
    led.plot(1, 1)  
    led.plot(2, 2)  
    led.plot(3, 3)  
    led.plot(4, 4)  
})
```

What does following code do ?



Once program is completed you need to download the **hex code** and upload it to microbit memory to run. We call this process as **flashing**. Microbit can run only one program at a time. When you flash microbit, the last program get erased. **So save your code.**

To upload a hex code simply drag and drop it to microbit.



This is how above visual code block downloaded to your computer looks like when opened in a text editor.

```
1 :0200000040000FA
2 :1000000000400020ED530100295401002B54010051
3 :1000100000000000000000000000000000000000E0
4 :1000200000000000000000000000000000000002D5401004E
5 :1000300000000000000000000000000000000002F54010031540100B6
6 :10004000335401004D440100E55D010033540100CB
7 :10005000335401000000000000F59701003354010003
8 :10006000B9B000003354010055940100335401002D
9 :100070003354010033540100335401003354010060
0 :1000800033540100D15A01003354010033540100AC
```

This is the language microbit understands. Its **Hex!**

Microbit Videos

<https://www.youtube.com/watch?v=qWcDuyYIUkk>

<https://www.youtube.com/watch?v=tzK1AKUiGy0>

<https://www.youtube.com/watch?v=-fZm1JCvxIE&t=218>

https://www.youtube.com/watch?v=SIAlLxO_CU4

Get more lessons from AlgoHack project

<https://goo.gl/mH5vPS>



කමෙහි විෂය
කමෙහි වෙලාවක
කමෙහි තැනක
නිදහසේ ඉගෙන ගන්න
පාඩමි සහ ප්‍රශ්න

Shilpa64.lk



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