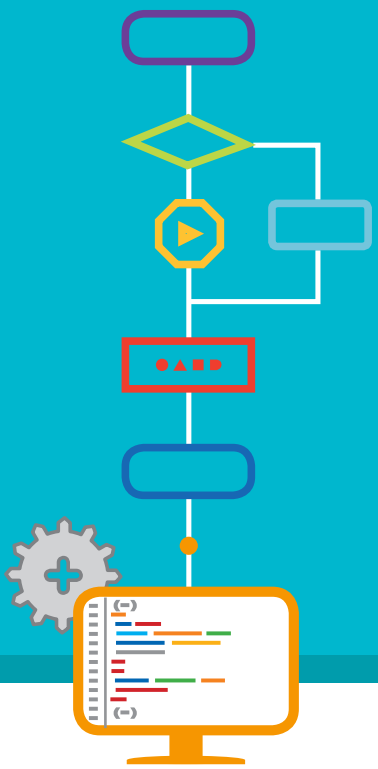
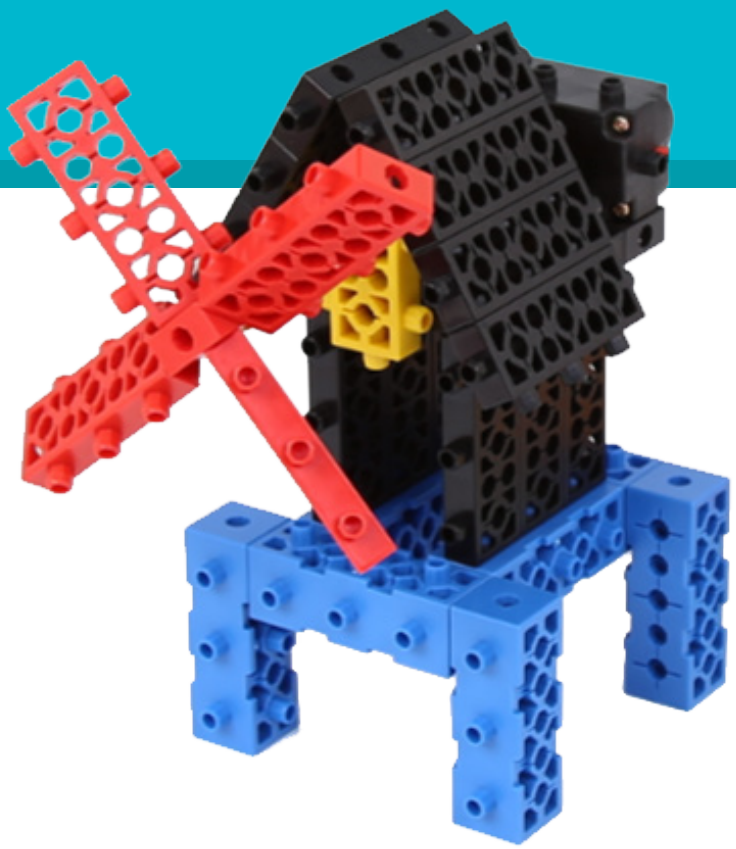
SCRATCH CODING KIT

Logic boost

CODING CLASS



CLASS 1



Educational Toy

ROBOTORI

CLASS 1

Before You Start

Don't just play games, make one.
Learn to code for your future.

Barack Obama (The 44th President of the U.S.)

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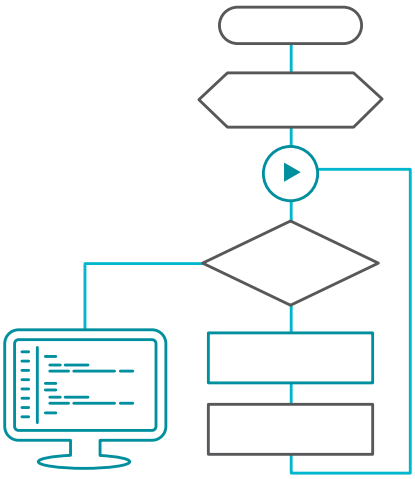
CLASS 1

Intro to Coding

What is "Coding"?

Coding is simply a way of telling a computer what to do. A computer can't do anything by itself, but it does a great job in carrying out orders. If you give out clear and exact commands, it will immediately do what you asked for.
Learning to code is just like learning a new language.
The more you learn, the more complicated programs you can make!



Why coding? Why do we have to learn to code?

Coding is the power source of today's digital world. Coding is essential for internet sites, smartphones, apps, computer programs, calculators, and even microwaves. Coders, people who code, make everything!

In the future, even jobs that aren't directly related to computer science might require some knowledge in programming and coding.

Intro to “Scratch”

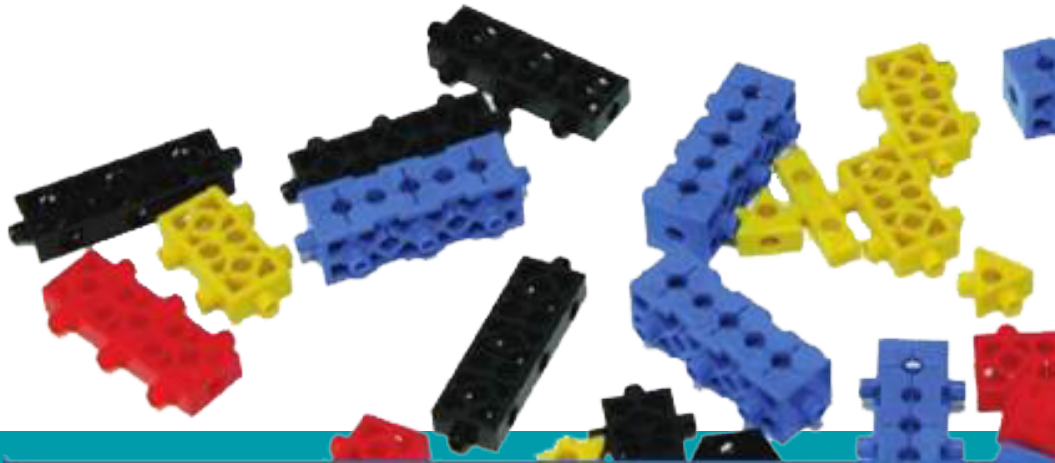
What is “Scratch”?

Scratch is an object-oriented coding program. Every code is organized in blocks of different colors and shapes. Users can combine these blocks to easily program moving robots.

By using Scratch, you can learn the basics of coding without studying complicated words and symbols.
Which one of these two looks easier?

VS

You can make so many different programs by combining the coding blocks.
This book is organized into different levels and uses a combination of Scratch and Robotori to help you with coding and making robots.



CLASS 1

How to use Scratch

Download Scratch

1. Go to http://www.robotori.com/web_eng
2. Click “Program Download” under “Moretips”
3. Download s4a and scratch download driver
4. Unzip the file
5. Activate s4a 1.6

How to use Scratch

Appellation Scratch

Pallette

There are 8 block buttons. Each serve a different purpose. These blocks are used to make a program.

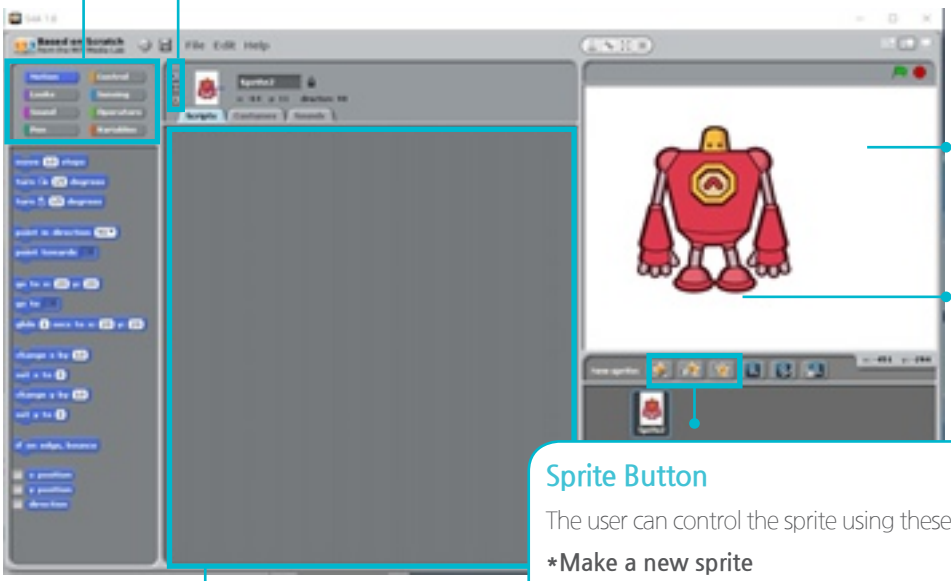
Rotation Settings

The user can change the sprite's rotation using this sequence:

*Rotate

*Left-Right

*Don't rotate



The area where you can control the sprite.

Sprite is the character that will be used in Scratch.

Sprite Button

The user can control the sprite using these three buttons.

*Make a new sprite

*Bring a saved sprite

*Bring a random saved sprite

Script

This is where the user makes a program. You can move the sprite by combining different blocks together.

Script : The combination of different blocks to make a program

Shape: The user can make a new shape or open a saved shape

Sound: The user can record a sound or open a saved recording

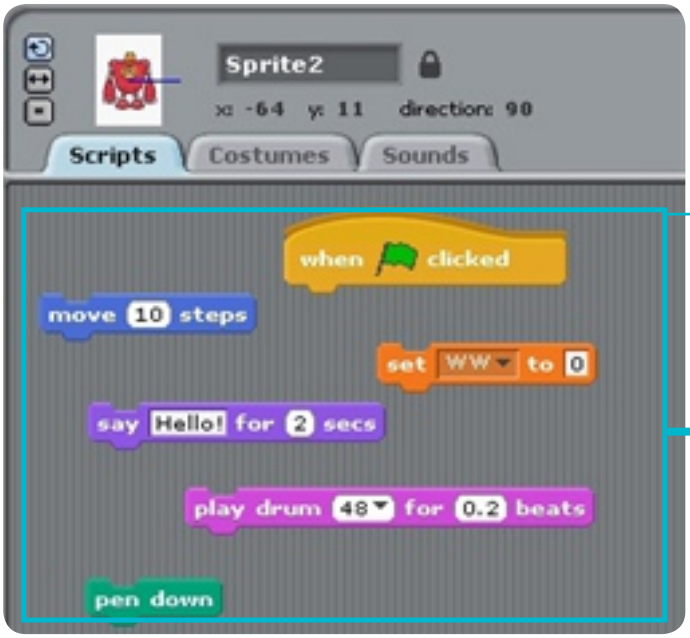
CLASS 1

How to use Scratch

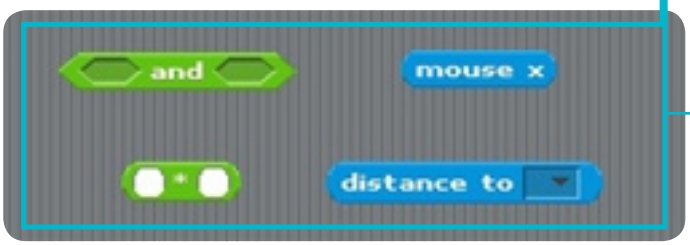
Scratch Blocks

The blocks vary in color and shape. Different color means they serve different purposes. For example, blue blocks are action blocks that are used to move a motor.

Different shapes show if a block can be connected with other blocks or not.



Blocks with these shapes can be connected to each other. It's easy if you think of it as a puzzle!



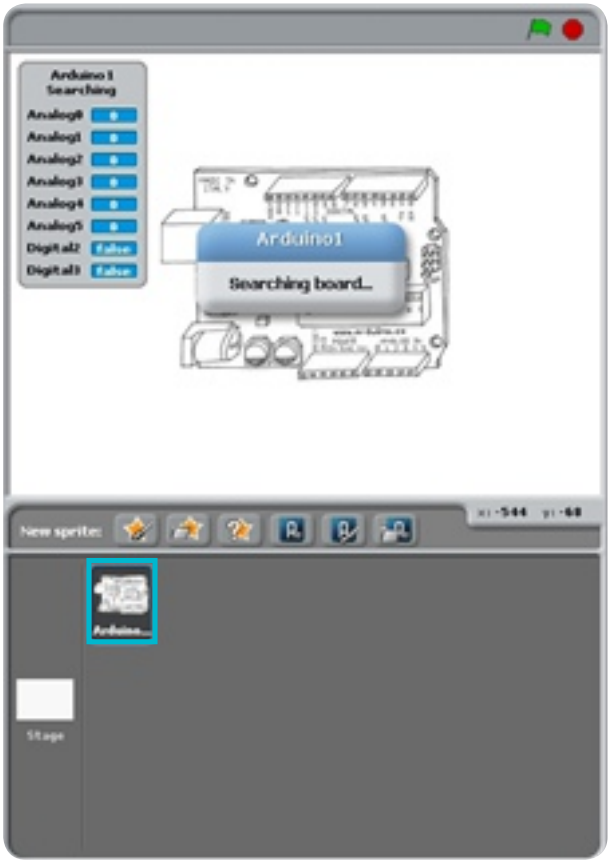
These blocks can't be connected to anything. Instead, they can fit inside other blocks. We will learn how to use these later!

Practice Using Scratch

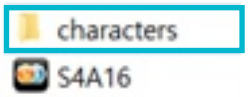
How to Open Sprite

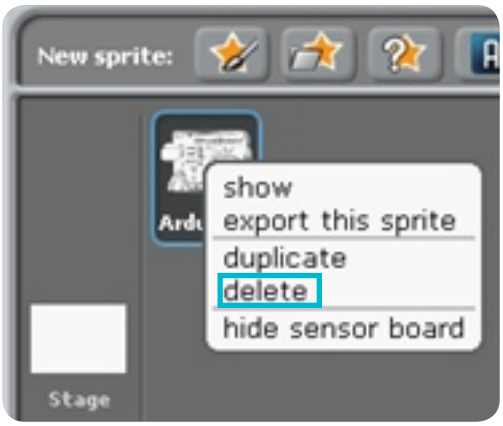
Let's start using blocks in Scratch.
First, activate S4A program. Once you activate it, you will see a screen like this. Delete 'Arduino 1' sprite using a right button of a mouse.

Click 'Select new sprite file' icon and open 'Celly'.
Refer to the pictures.



You can download celly
from this folder





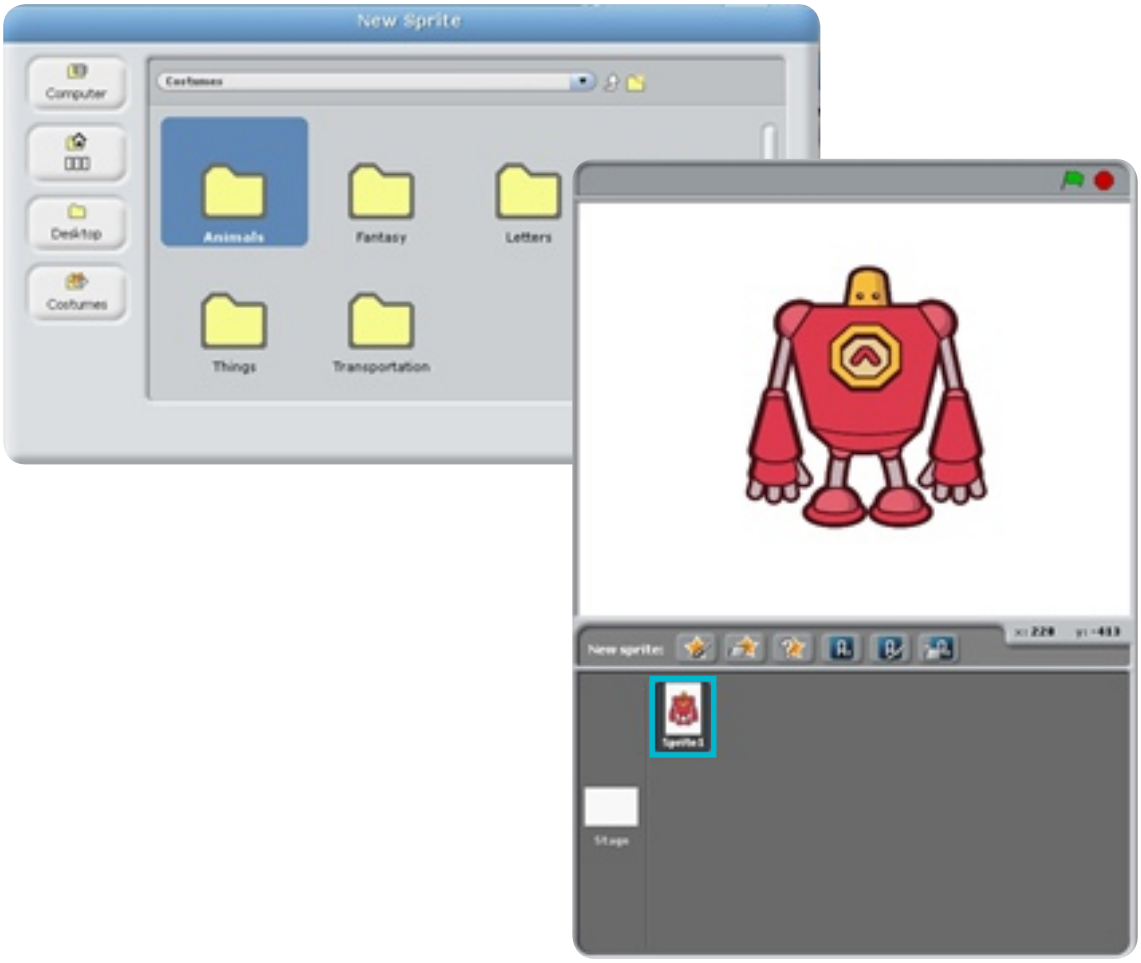
CLASS 1

Practice Using Scratch

How to Use Sprite

Were you able to open the sprite, 'Celly'?
You can easily open a sprite. Later, you will be making your own robots and coding its motions.
Right now, we will learn the basics of Scratch.

Let's see what kind of blocks we have.



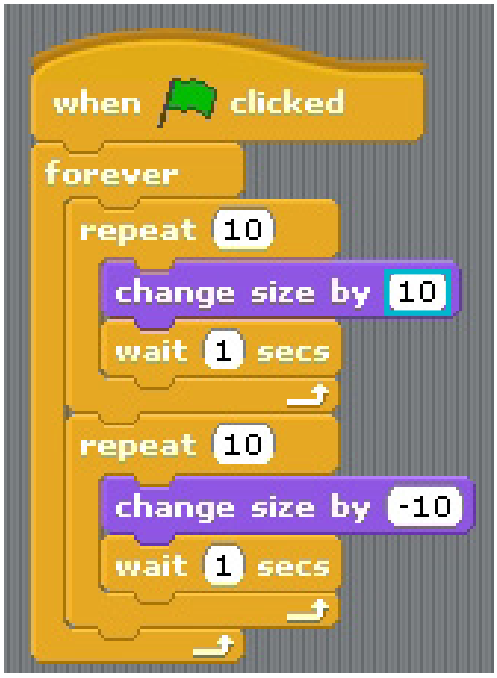
Practice Using Scratch

How to Change the Size of a Sprite

We are going to code a program that will change the size of 'Celly.'

Refer to the picture to organize the blocks by dragging them from the Control and Looks menus.

Double click to edit numbers.



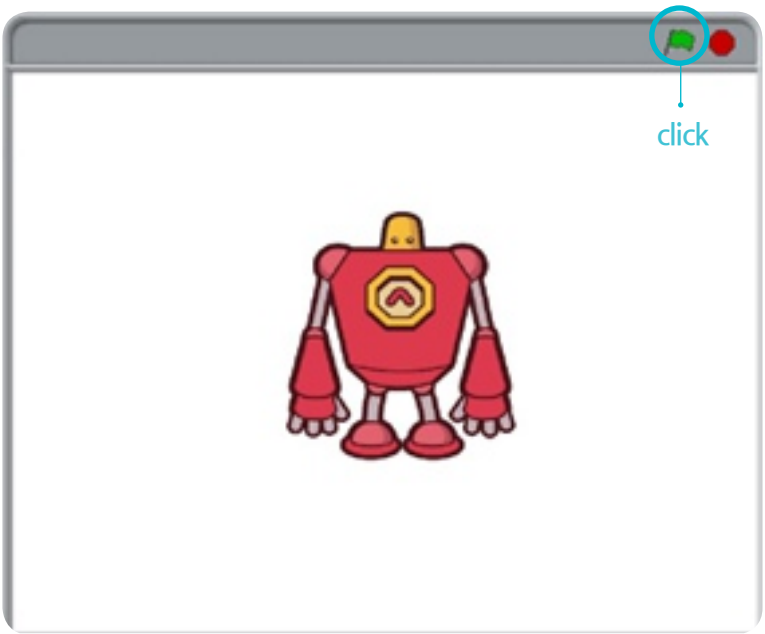
CLASS 1

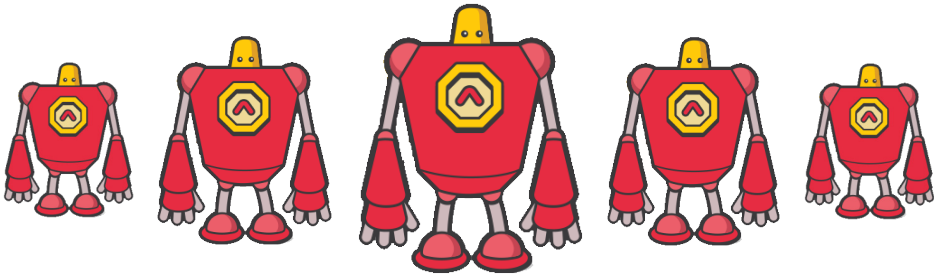
Practice Using Scratch

How to Change the Size of a Sprite

Did you make the script?
If it's hard to make one, just drag the blocks in and organize them like the picture on the front page. It's not too difficult if you connect the blocks together!

If you are done making the script, click the , and you will see Celly's size change!





Practice Using Scratch

How to Rotate the Sprite

Were you able to change the size of the sprite?

Just change the numbers in the blocks for more different sizes!

Now let it rotate every time we click on it. Refer to the picture and organize the blocks by dragging them from the 'Control' and 'Motion' menus.

Edit angles by double clicking the blocks.

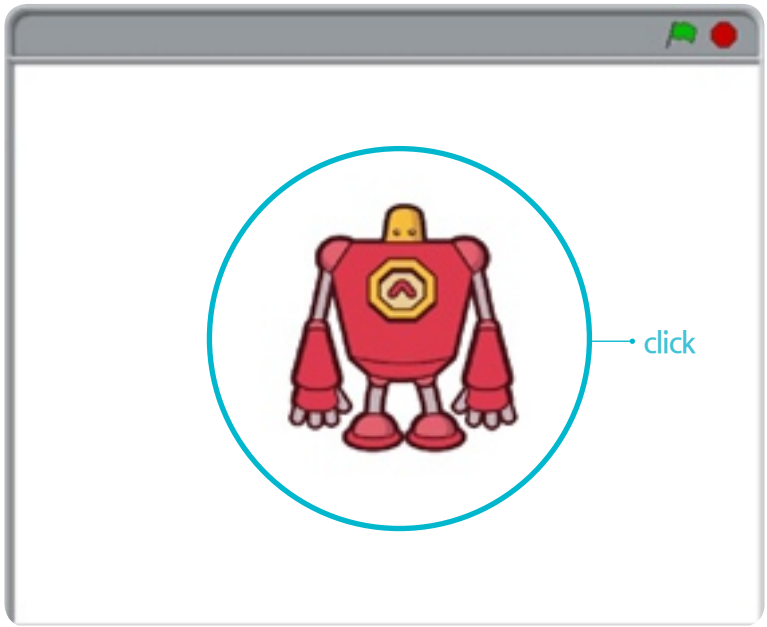
CLASS 1

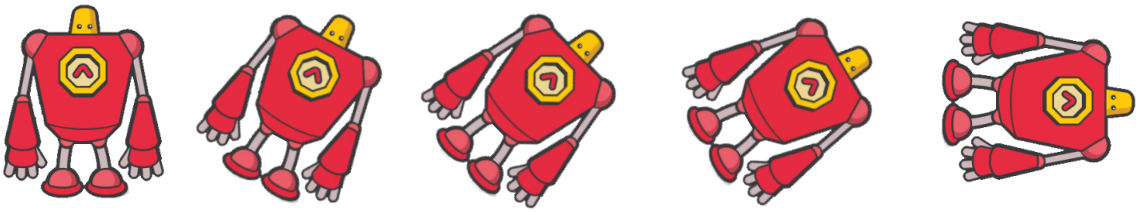
Practice Using Scratch

How to Rotate a Sprite

Did you make the script?
Now we can easily make scripts. The script we just made starts with 'Sprite 1 when clicked,' so the blocks under it will start working once we click the sprite.

Click 'Celly' when you finish making the script!
Everytime you click 'Celly', you will see the sprite rotate 15 degrees.





Practice Using Scratch

How to Change the Color of a Sprite

Were you able to rotate the sprite?

You can change the angles by editing the numbers in blocks!

Now, we will change the color of a sprite. Everytime you click the space bar on your keyboard, the color of 'Celly' will change.

Refer to the picture to organize the blocks.

CLASS 1

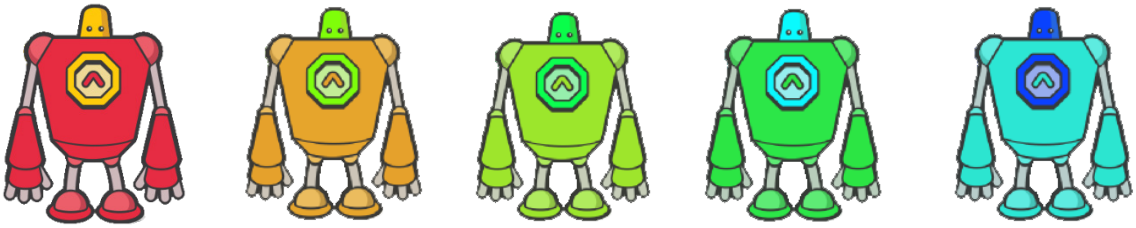
Practice Using Scratch

How to Change the Color of a Sprite

Did you make the script?

This script starts with 'when a space bar is pressed,'so the blocks under it will start working once you press the space bar.

Keep pressing the space bar if you are done making the script! Everytime you press the space bar, you will be able to see Celly's color change!



Practice Using Scratch

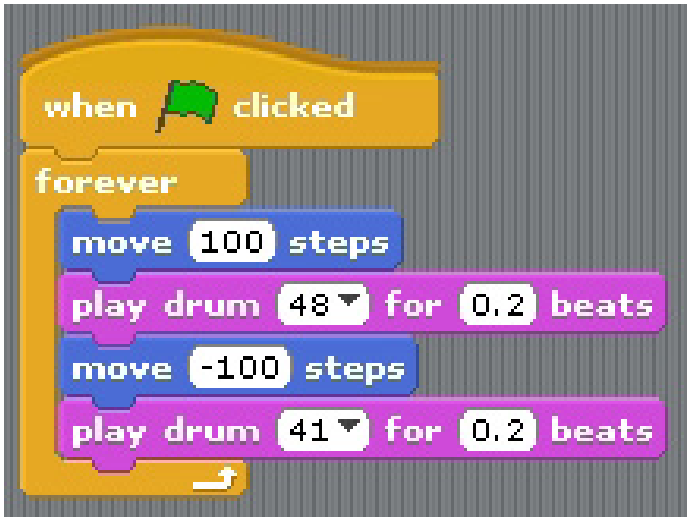
How to Set Rhythm for the Sprite's Movement

Were you able to change the color?

You can change the color effect by editing the numbers in the blocks!

Now, we will set the rhythm for the sprite's movements. We're going to use the sound tap of Scratch, so turn on your speakers or plug in earphones!

Refer to the picture to organize the blocks.



CLASS 1

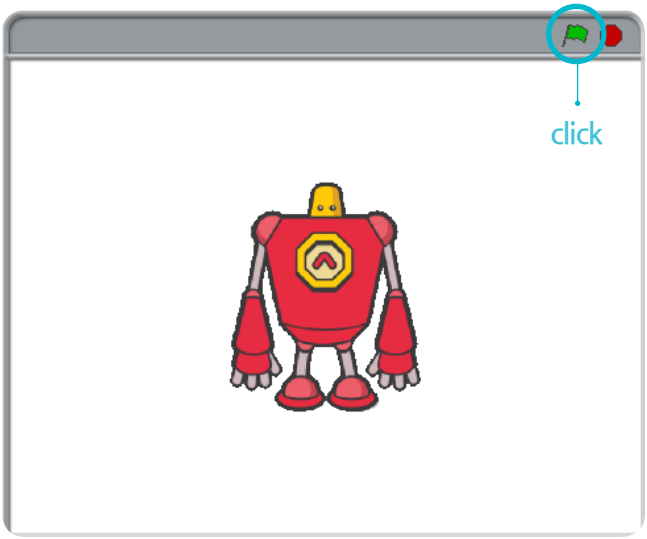
Practice Using Scratch

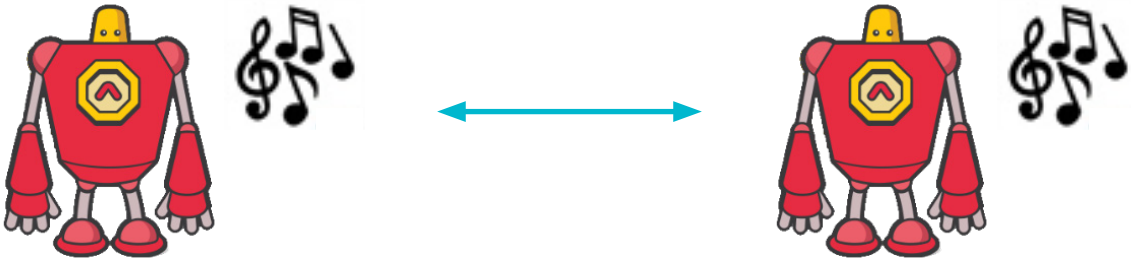
How to Set Rhythm for the Sprite's Movement

Did you make the script?
You can make the script by dragging in blocks from Scratch's sound tab.
Click the flag icon to activate the script!

When it's activated, the sprite, 'Celly' will move '100' beats in rhythm. You can change the sound of the drum by clicking the black arrow of the block that plays the music.

Set the sprite's move by changing the rhythm!





Practice Using Scratch

How to Make a Speaking Sprite.

Were you able to move the sprite rhythmically?

You can change its movement by editing the numbers in blocks! Now, we are going to make a speaking sprite. Click the 'New sprite file' icon and drag in 'Chacha'!

Click 'Celly' and make the script 'when sprite1 is clicked.' Click 'Chacha' and make the script 'When sprite2 is clicked.' Refer to the picture to organize the blocks.

CLASS 1

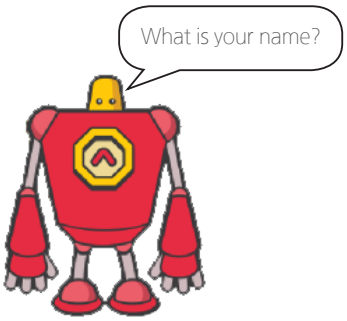
Practice Using Scratch

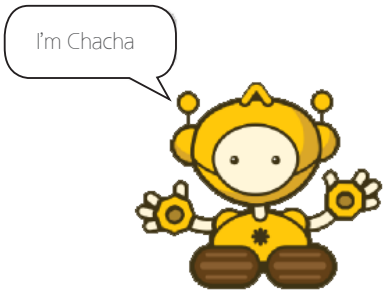
How to Make a Speaking Sprite.

Did you make the script?

Bring the 'speak' block from Scratch to make the script. Now, click each sprite to activate the scripts!

If you click the sprite, you will see it talking. Just like 'Celly' and 'Chacha' below!





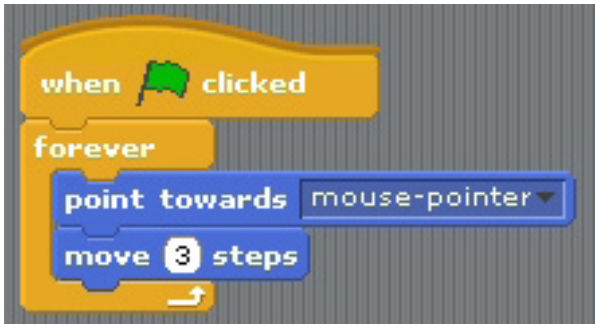
Practice Using Scratch

How to Make the Sprite to Follow the Pointer

Did you see the two sprites talking?

Change their conversation by editing the numbers of the blocks. Now, we are going to make one of the sprites follow the pointer. Erase 'Chacha' for this one!

Refer to the picture below to organize the blocks.



CLASS 1

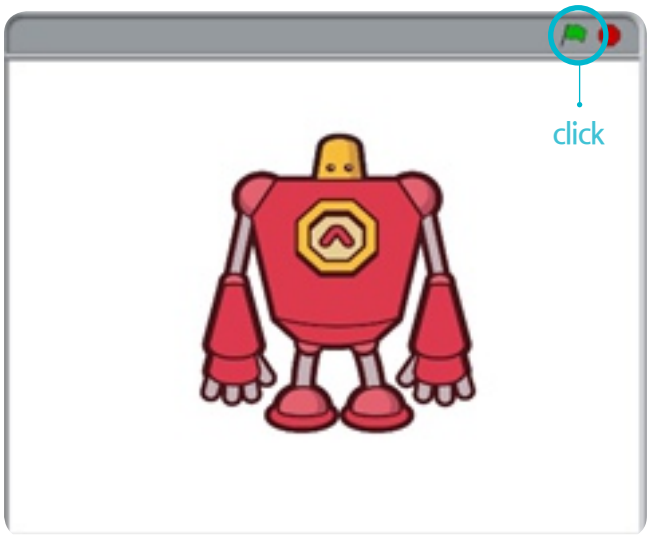
Practice Using Scratch

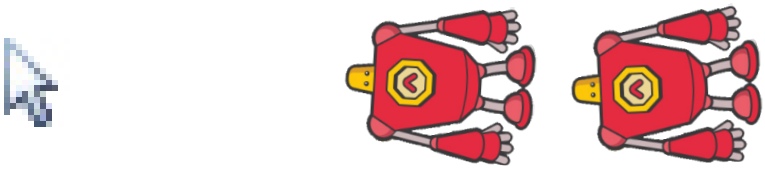
How to Make the Sprite to Follow the Pointer

Did you make the script? You can bring the 'face ____' block and choose 'mouse pointer' to make the script.
Click the flag icon to activate the script!
If the sprite is activated, 'Celly' will follow the pointer. Edit the numbers to change the speed.

We have learned the basics by making simple scripts. Let's start coding robots now.

Let's learn about the main cell!

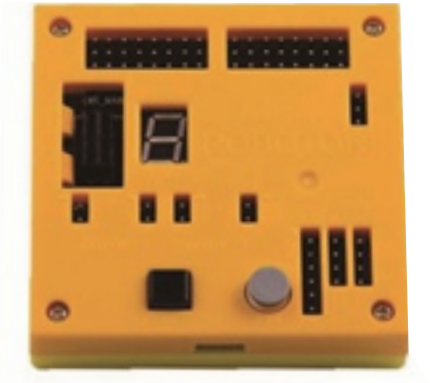


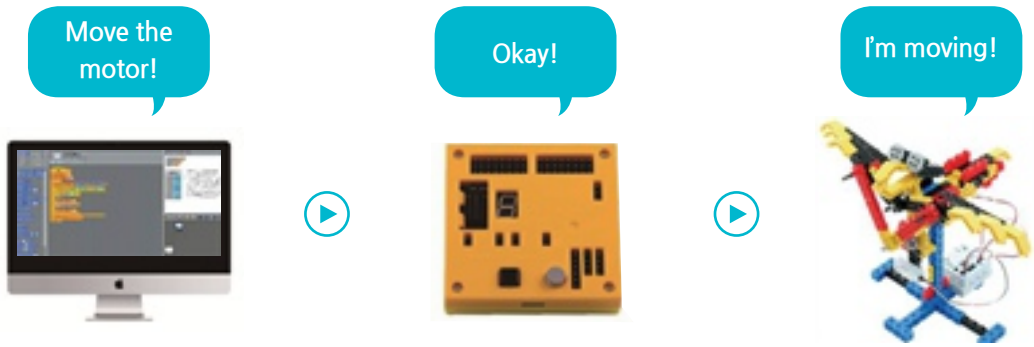


Main Cell

Main Cell

There are different kinds of electric cells in robotori, and below is the main cell.
The main cell works like a brain that controls the robot.
It connects Scratch and the user's computer to command and move robots as well as give it feedback from the information it got from different sensors.





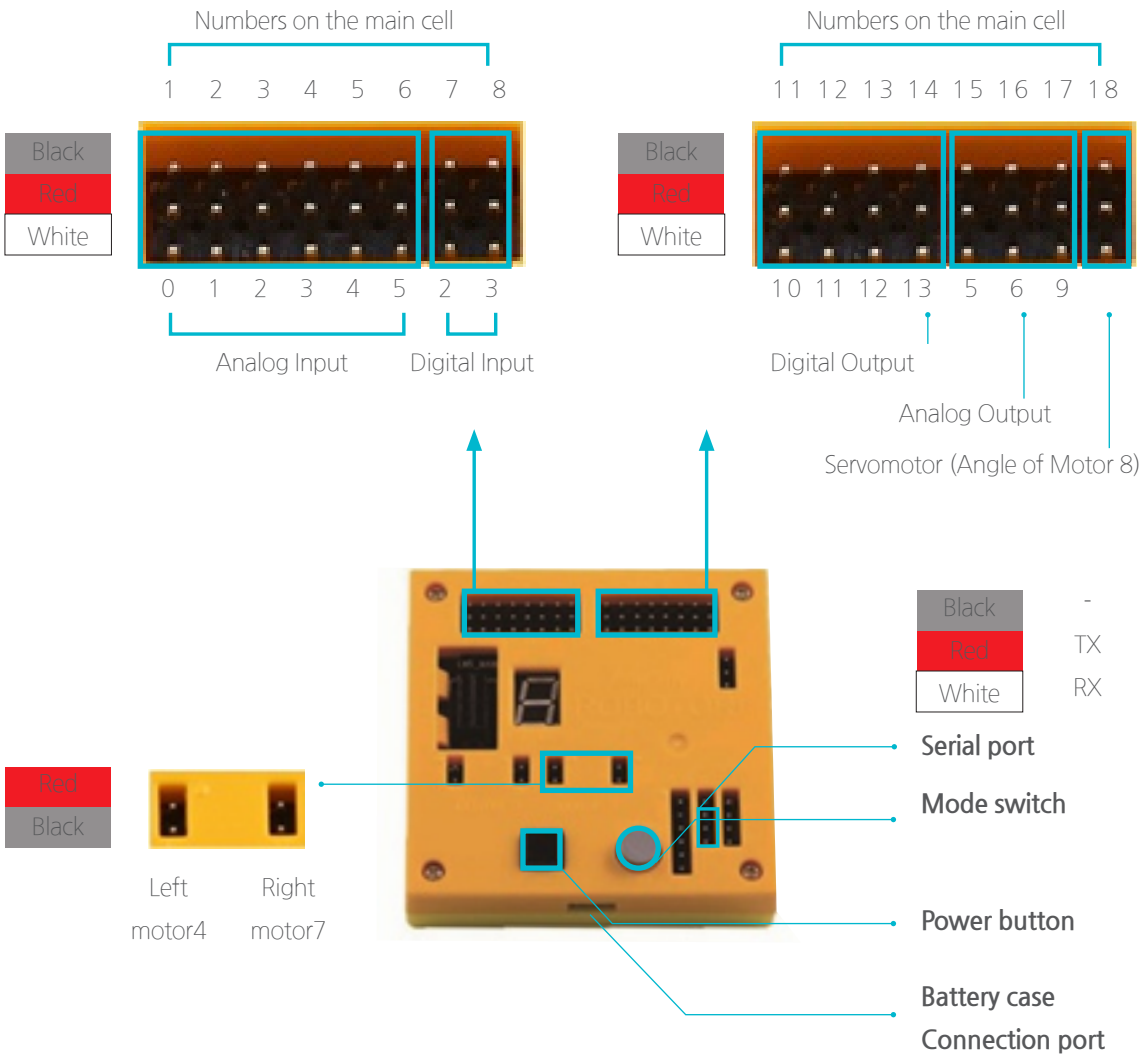
Scratch is a way of coding the main cell to control the robot!

CLASS 1

MainCell

Parts of the Main Cell

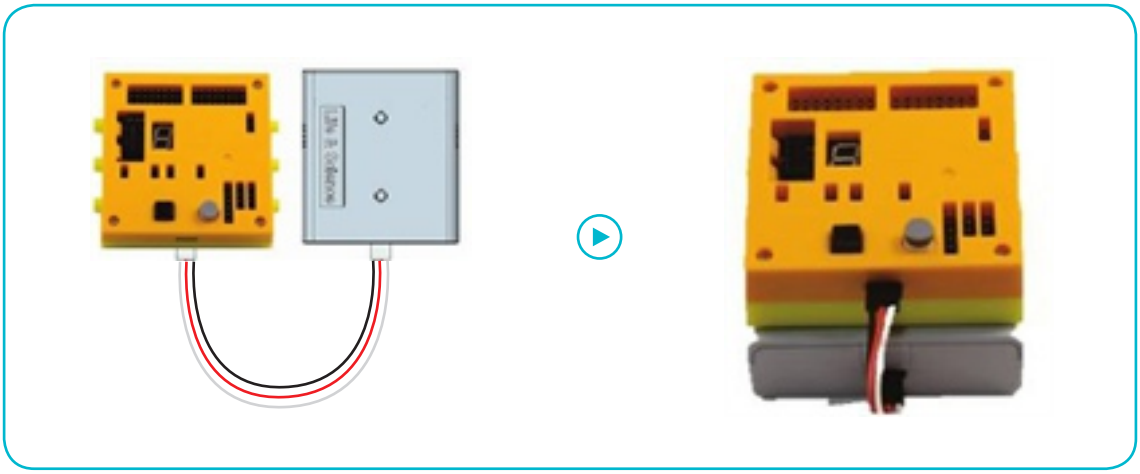
Below is a picture that explains the ports. From now on, you will connect different motors and sensors with this main cell. Let's take some time to learn about each port!



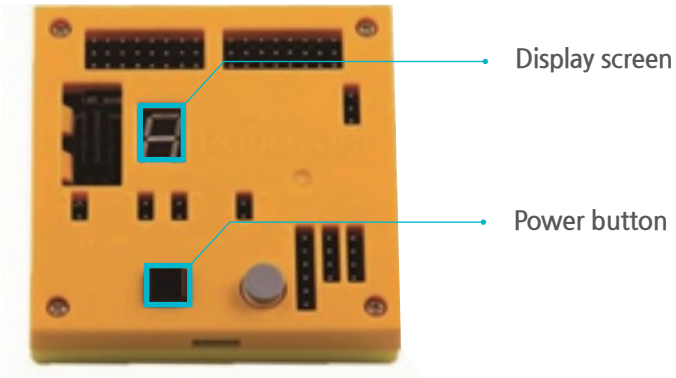
Main Cell

Powering the Main Cell

First, we need the main cell and the battery case.
Refer to the picture below to connect them with 3-pin power cable.



Once the main cell and the battery case are connected, click the power button to turn on the main cell.
Then, you will see the red light on the display screen.



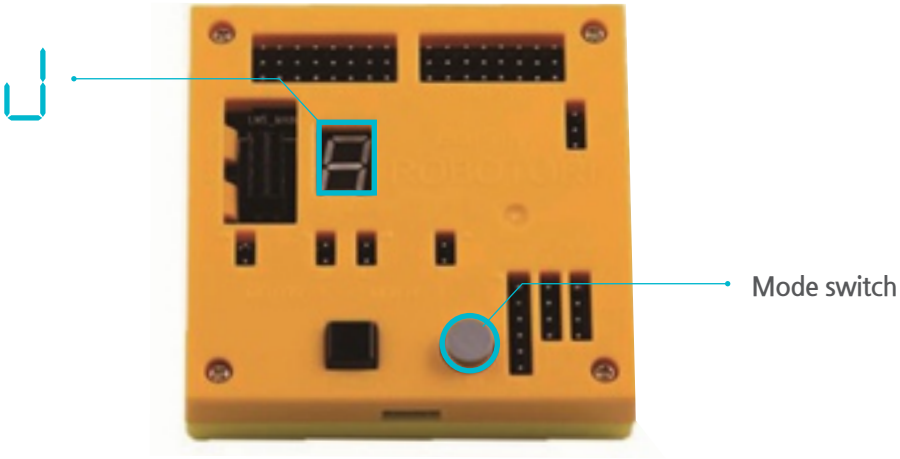
CLASS 1

MainCell

How to Set the Main Cell in Scratch Mode

We have to set the main cell to scratch mode to use Scratch so that when it's connected to the computer it can download the program from Scratch.

Press the round gray button next to the power button for mode settings. You can see the number or letter change consequencially on the display screen. Keep pressing the mode switch until you see 'J' on the screen.



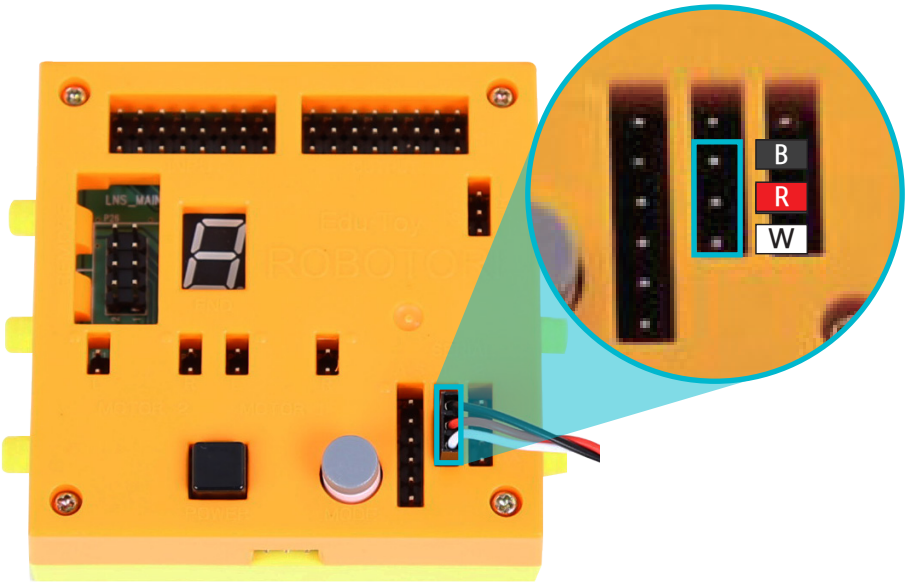
Check if you see 'J' on the display screen.

You have to use 'J' mode when connecting Scratch and the main board.

Main cell

How to Connect the Main Cell to the Computer.

There is a gray USB cable (download driver) included in the materials of this coding class. Use this and refer to the picture below to see where to plug in.



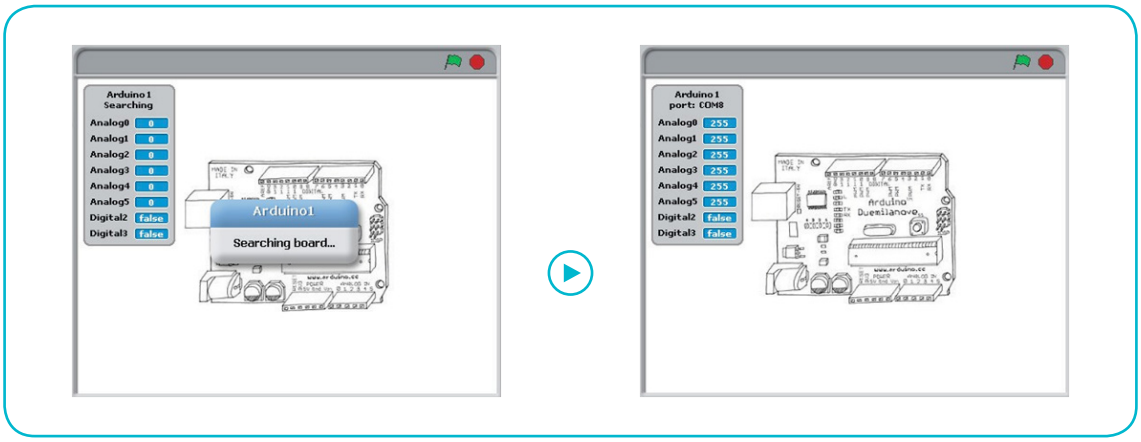
Look at the picture above. Ignoring the topmost hole, plug in black, red and white cable in order.

CLASS 1

Main cell

Check that the Main Cell is Connected to Scratch

Start the 'S4A' program once the main cell is connected to the computer. After the Scratch is activated and the main cell is connected to the computer, you will be able to see the notice, 'Searching board···' on the screen disappear.



If the main cell is well connected, it will show analog values on Scratch.

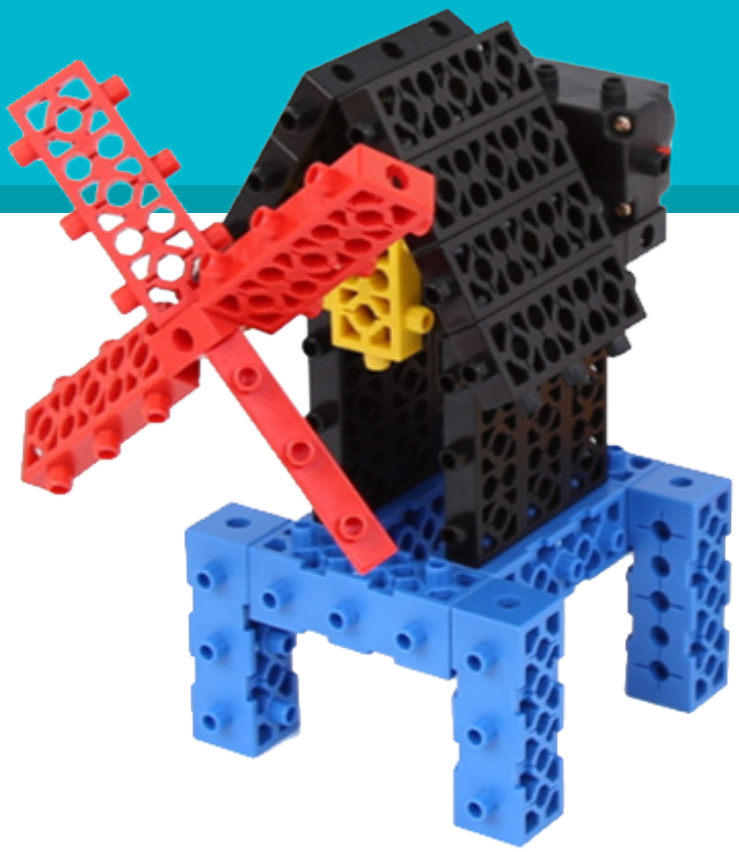
Wait! Digital values are shown as only 'true' or 'false.'

S C R A T C H C O D I N G K I T

Logic boost

DC MOTOR

LESSON 1



CLASS 1

What is DC Motor?

What is DC Motor?

The motors we use were also used by our ancestors. They are important in modern society; they are used in electric cars, fans, trains and even computers. DC motors are made to distribute consistant rotation movement.

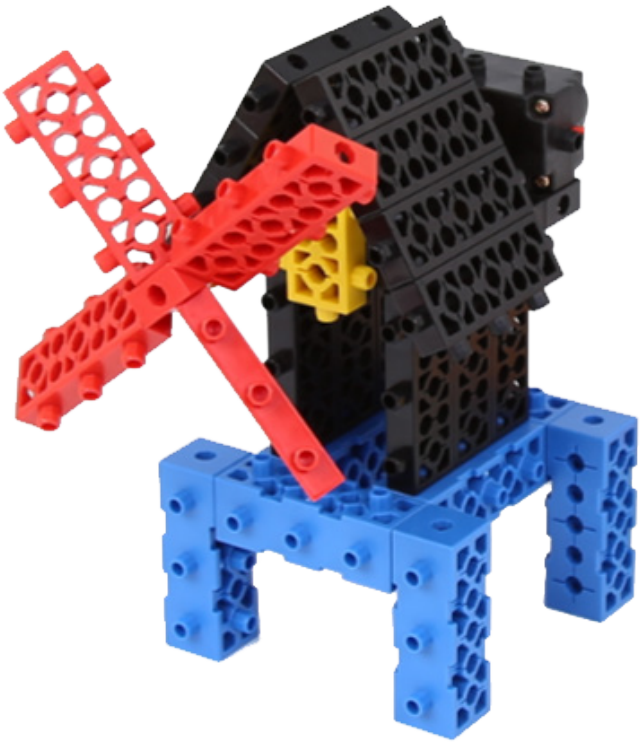
Electiricity gives the DC motor the ability to rotate. There is a copper wire surrounded by strong magnets inside a motor. A magnetic field is formed when electricity is given to the wire. As you know, the copper wire will rotate using the power of the magnets pushing each other away. This is used to rotate the electric motor.

In 1832, a scientist in England named William Stergeon invented the world's first electric motor.

How to Make a Robot

Introduction

We just learned how to connect your computer and the main cell. Let's start learning how to move the DC motor by using Scratch.



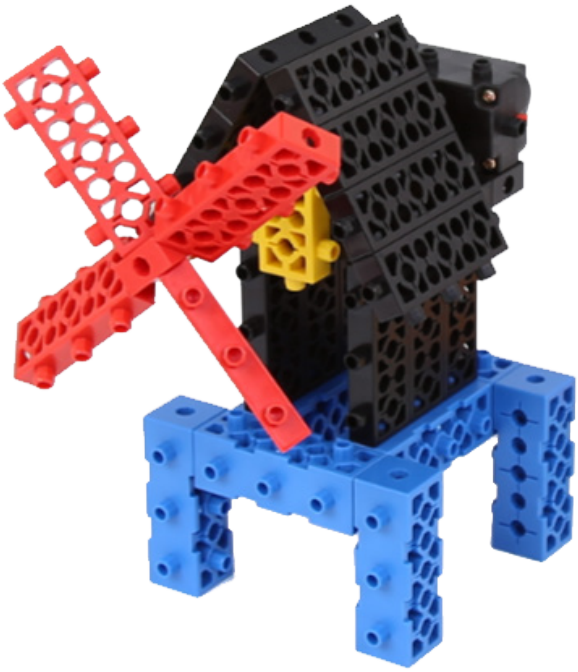
The user can use Scratch to move the DC motor in a clockwise or counter-clockwise motion. Knowing how to use the motor helps us to code and control robots.

Let's start with making the small windmill above.

CLASS 1

How to Make a Robot

How to Make a Small Windmill



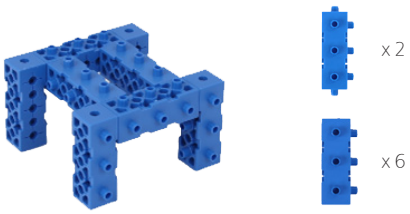
Windmill Materials

Diamond V8 x 2	Diamond V6 x 6	Rubi 8 x 4	Rubi 7 x 2	Rubi 6 x 2	Rubi 4 x 8	Rubi 2 x 5	Rubi 0 x 1	Mini 2 x 1
Mini 1 x 1	Triangle x 3	Motorconnector x 1	A 96 x 1	DC motor x 1	Battery case x 1	Maincell x 1	DC motor x 1	

How to Make a Robot

How to Make a Small Windmill

1

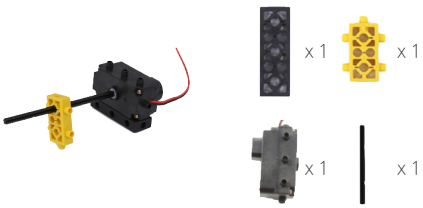


2

3

Combine the two from 1 and 2

4



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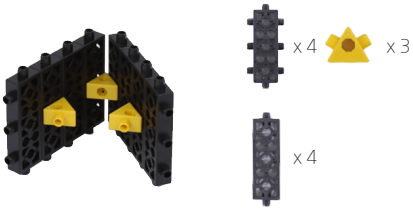

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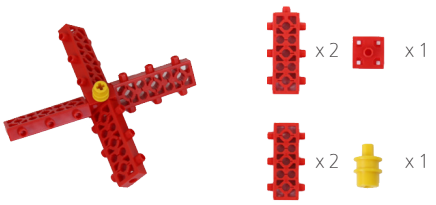

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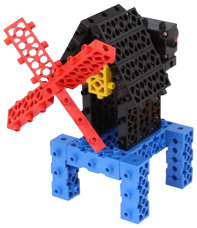


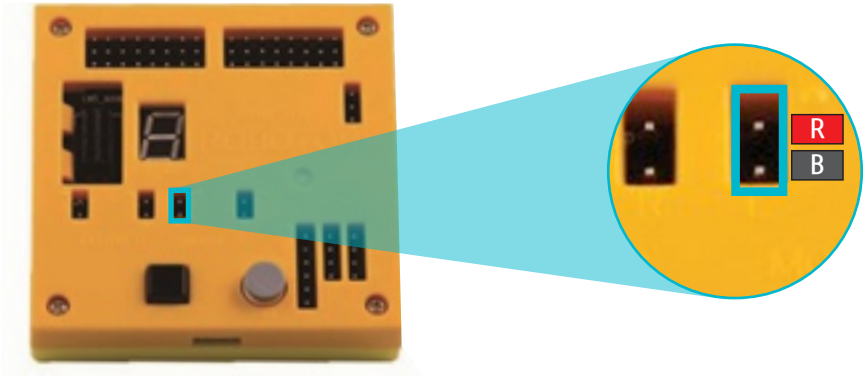
CLASS 1

Connection

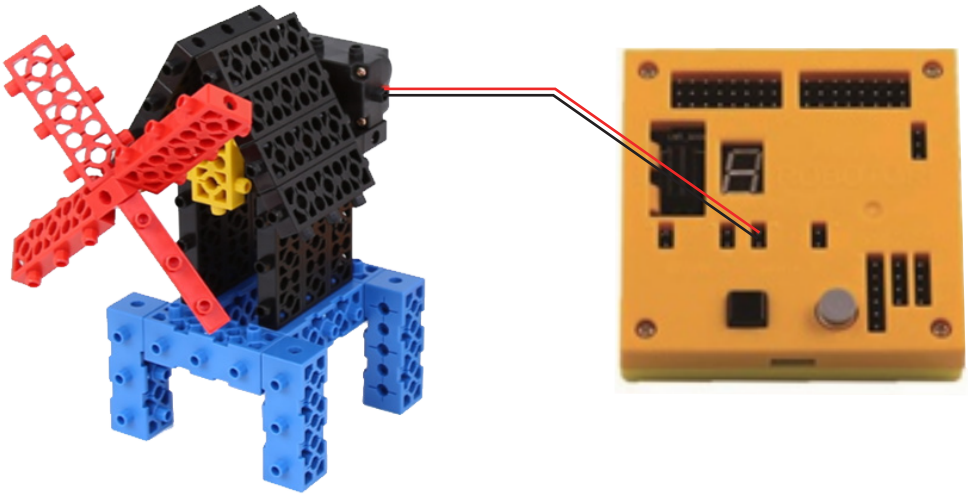
How to Connect the Windmill and Main Cell

Let's learn how to connect the cable of the DC motor with the main cell.
Refer to the picture below to plug in the cable to the main cell. Connect the red cable to the top pin and the black one to the bottom pin.

*If you switch these two, it will rotate in the opposite way.



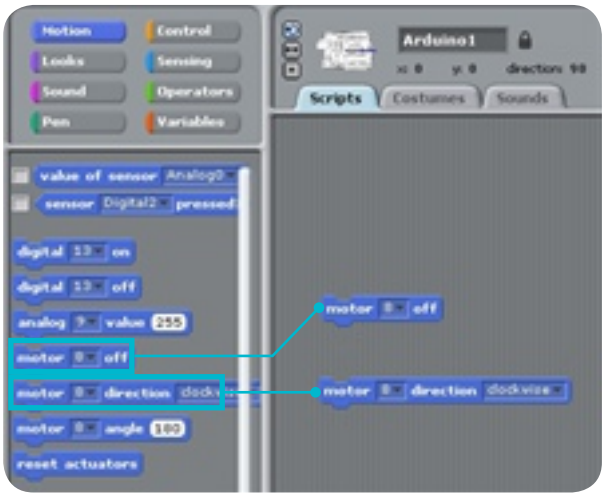
It should look like this if it was built correctly.



Intro to DC Motor Coding

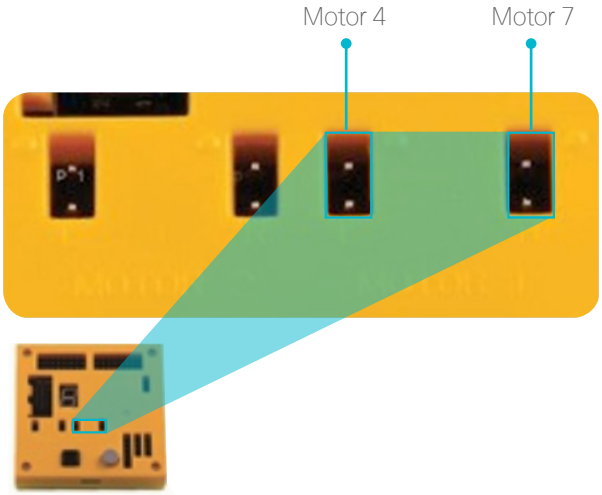
Activate the DC Motor

Place the windmill in front of you. Click the 'movement' button to control the motor. Then, it will look like the picture below.



Drag the blocks 'Stop Motor8' and 'Rotate Motor8 clockwise' to the script.

Why does it say Motor 8? Scratch lets the user use two electric motors. If the user clicks the black arrow next to the number, you can see the numbers 8, 7 and 4.



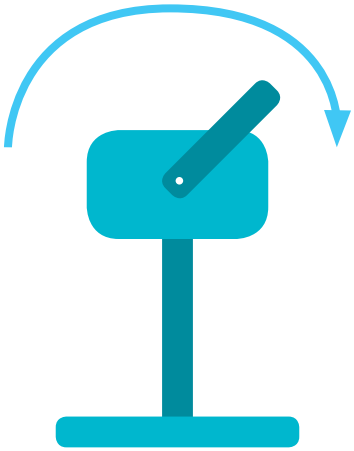
To activate Motor4, we have to change Motor8 to Motor4. Do you remember how to plug in the motor?
The left plug represents Motor4 and the right plug represents Motor7.

CLASS 1

Intro to DC Motor Coding

How to Control the Rotation Using Scratch

Click **'Rotate Motor4 clockwise'** and the windmill will turn clockwise.



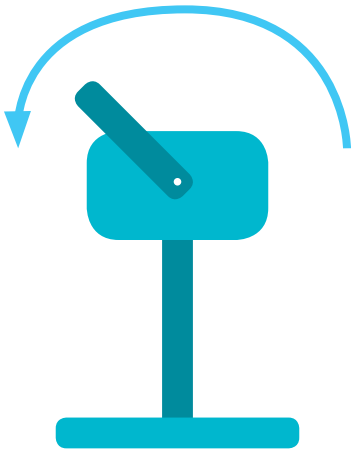
Click **'Stop Motor4'** and stop the windmill.

Now, turn the windmill counter-clockwise. Change **'clockwise'** to **'counter-clockwise'** in the block.

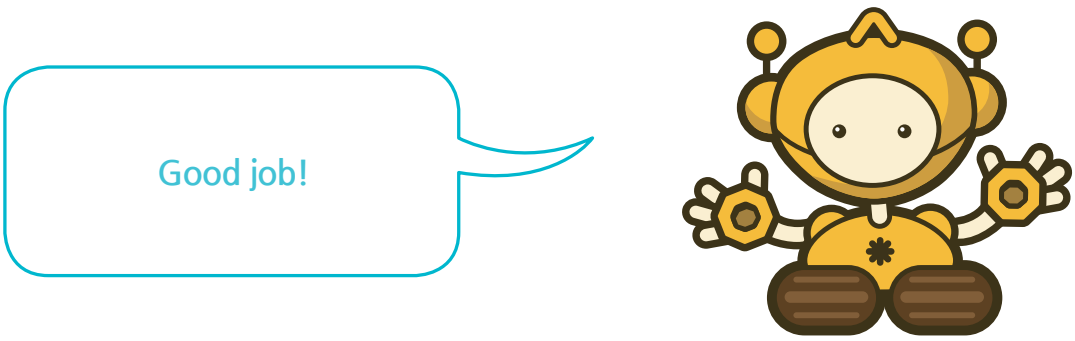
Intro to DC Motor Coding

How to Control the Rotation Using Scratch

Click **'Rotate Motor4 counter-clockwise'** to see the windmill rotate counter-clockwise.



Congratulations! Now, you can start the DC motor and control its rotation direction using Scratch.
That was the first step to lead us to more advanced coding!



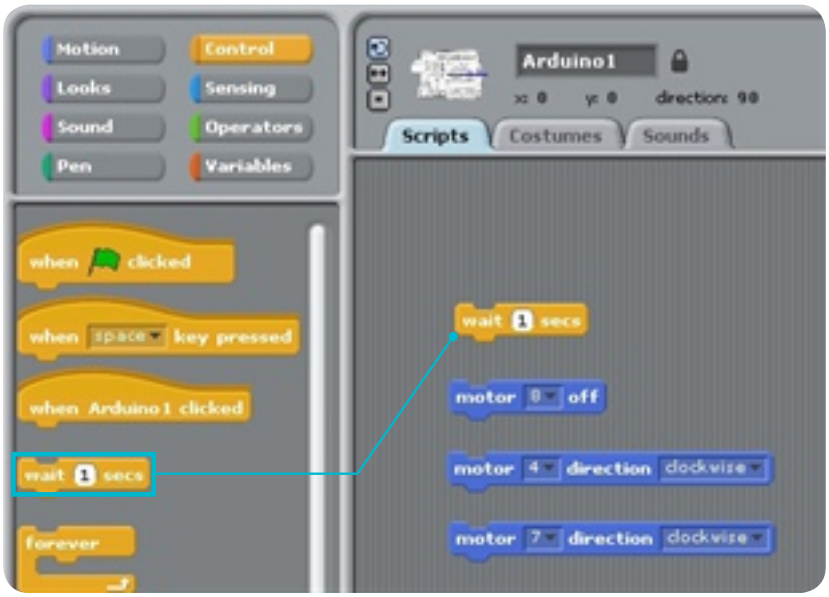
CLASS 1

Intro to DC Motor Coding

'Wait' Block

We are going to learn about the 'Wait' block. Click the yellow control button in the palette toopen up the control blocks. Drag the 'Wait 1 second' block to the script like the picture below.

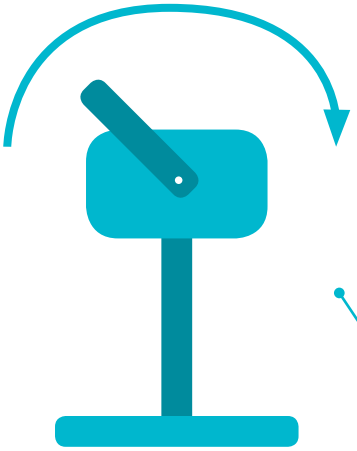
'1 second' represents the time it takes for the first command before moving onto the second one.



Just clicking the 'Wait 1 second' block doesn't do anything. The 'Wait' block activates only when it's connected to other blocks. To see how it works, refer to the picture below and organize the blocks.

Intro to DC Motor Coding

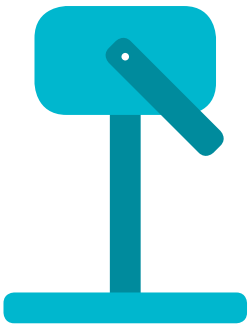
'Wait' Block



Rotate Motor4 clockwise

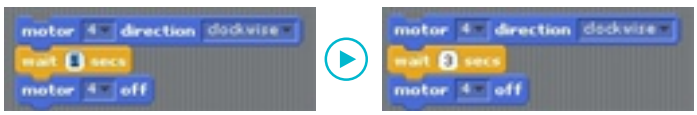
Now the windmill will stop after rotating clockwise for one second.

How did the computer successfully carry out the orders? This is the 'sequence.' It's when the computer does what it was told to in order from top to bottom.



Stop Motor4

The user can also change how long the motor works. Edit the number of **'Wait'** blocks just like the picture below. Try it!

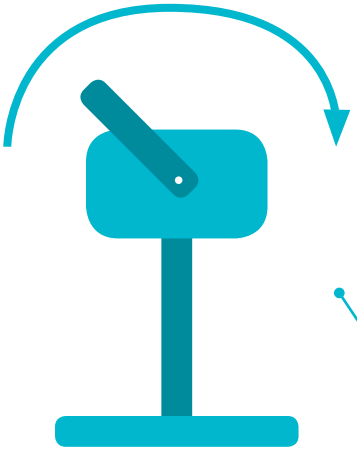


CLASS 1

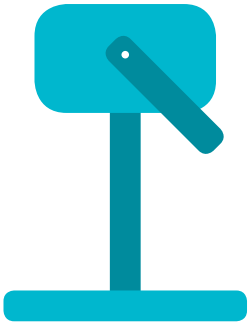
Intro to DC Motor Coding

Wait block

What will happen if you erase the 'Wait' block?



Rotate motor 4 clockwise



Stop motor 4

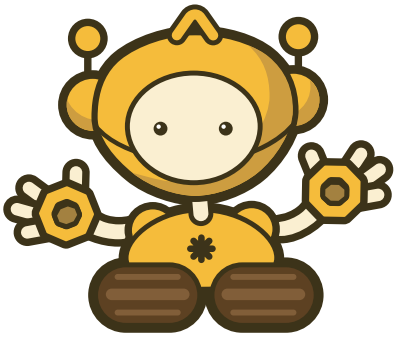
If you activate the code, nothing will happen! Because you ordered the computer to stop the motor right after turning it on. You have to order the motor to 'Wait' and then stop.

Intro to DC Motor Coding

'Wait' Block

Lastly, let's make a more complicating code with the windmill. We will combine at least 9 coding blocks to set each of the motors to rotate in different directions for different lengths of times and stop. Refer to the picture below.

Good job!
You just made your
first program!



CLASS 1

Intro to DC Motor Coding

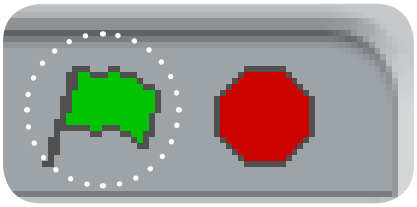
Activate a Program

There are many ways to activate a program. You already learned that you can activate programs by simply clicking blocks.

There are two other ways is to add the 'Start' block as the beginning of the program. This 'Start' block can be found if you click the yellow 'Control' button in the palette. The first way is to use the 'When the flag icon is clicked' block. It looks like the picture below.

Like the picture below, it can be connected to the top of every program.

Click the green flag icon on the top right corner to start the program.

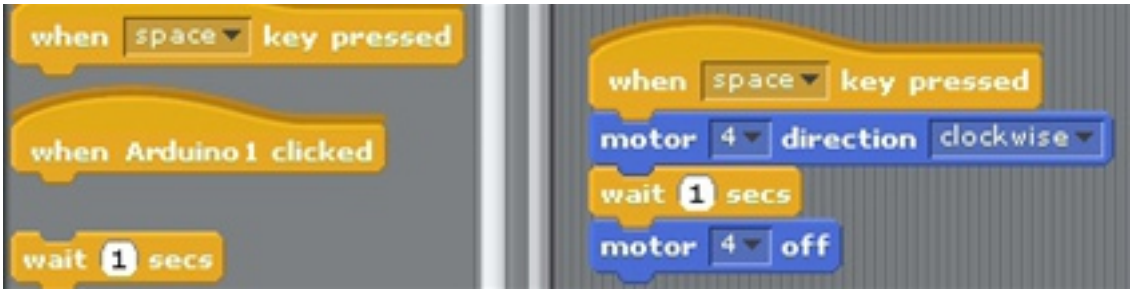


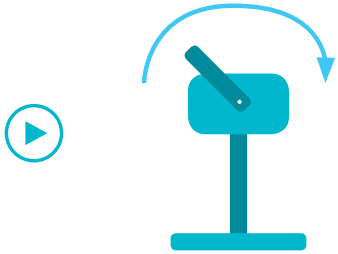
Intro to DC Motor Coding

Activate a Program

The second way to start a program is to use the computer keyboard.
The picture below shows the 'When spacebar is pressed' block, which can be found when you click the 'Control' button of the palette.

This activates the code when the user presses a specific button. Connect this to your code.





Make this code so that it will start whenever the spacebar is pressed. Also, click the small arrow on the right of 'Spacebar' to change the key that activates the program. Refer to the picture on the right.

SCRATCH CODING KIT

Logic boost

Lizard Robot

LESSON 2

How to Make a Robot

Lizard Robot

Let's make a moving lizard robot!

By using Scratch, it can move frontward or backward. We will be moving on from activating one motor to activating two motors for a more complicated movement. To use two motors at the same time, we have to carefully set their rotating directions.

Let's learn about their rotating directions.

After that, we will learn to code for the lizard robot to move for some random amount of time. Also, we will learn how motors move according to a random number and how to use 'Loop' to repeat the script. Let the lizard robot help us learn these.

Are you ready to make the lizard robot?

CLASS 1

How to Make a Robot

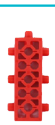
How to Move the Lizard Robot

We will learn how to use the program to control two motors. Also, we can code for it to follow a certain route.

Last time, we learned how to start a motor. This time, we will use the motors to move the wheels of the robot.

First, let's make the robot.

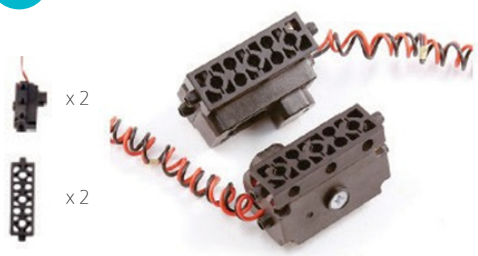
Materials of Lizard Robot.

										
Diamond H6 x 1	Diamond V8 x 2	Diamond V6 x 3	Rubi 2 x 4	Rubi 7 x 3	Rubi 6 x 1	Rubi 4 x 4	Rubi 0 x 1	Rubi 8 x 2	Curve x 3	Mini 2 x 7
Triangle x 4	Mini 1 x 1	Sawtooth 24 x 2	Sawtooth 36 x 4	Middle connector x 2	Off-road wheel x 2	A45 x 3	Battery case x 1	DC motor x 2	Maincell x 1	connector x 1

How to Make a Robot

How to Make Lizard Robot

1



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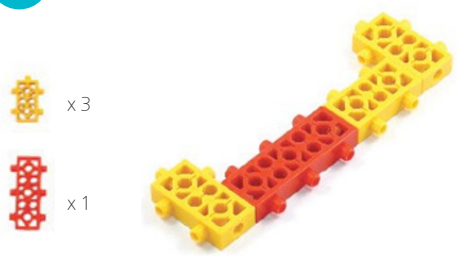

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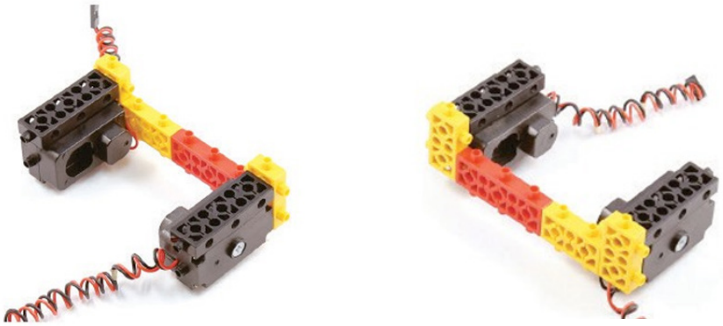
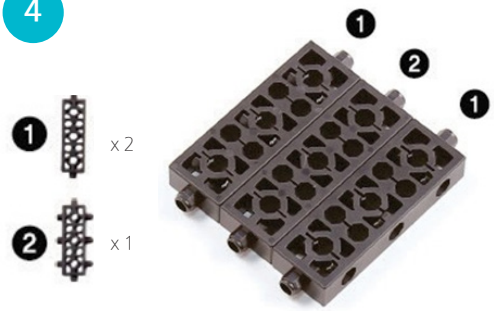


4



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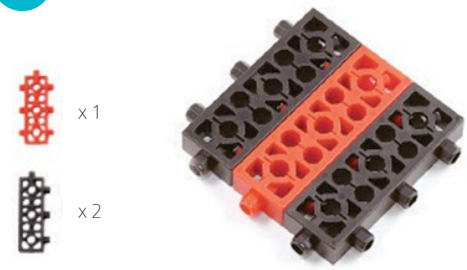


CLASS 1

How to Make a Robot

6

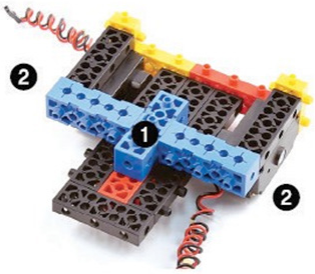
x 1

7

8

x 1

x 2



9

x 2

x 1

10

11

x 2

x 2
A45

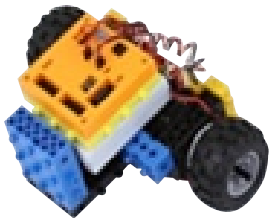
12

x 2

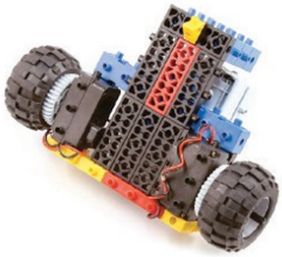
x 2

How to Make a Robot

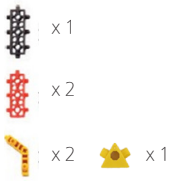
13



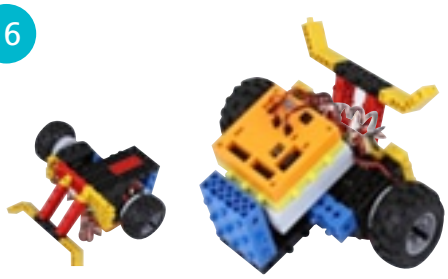
14



15



16



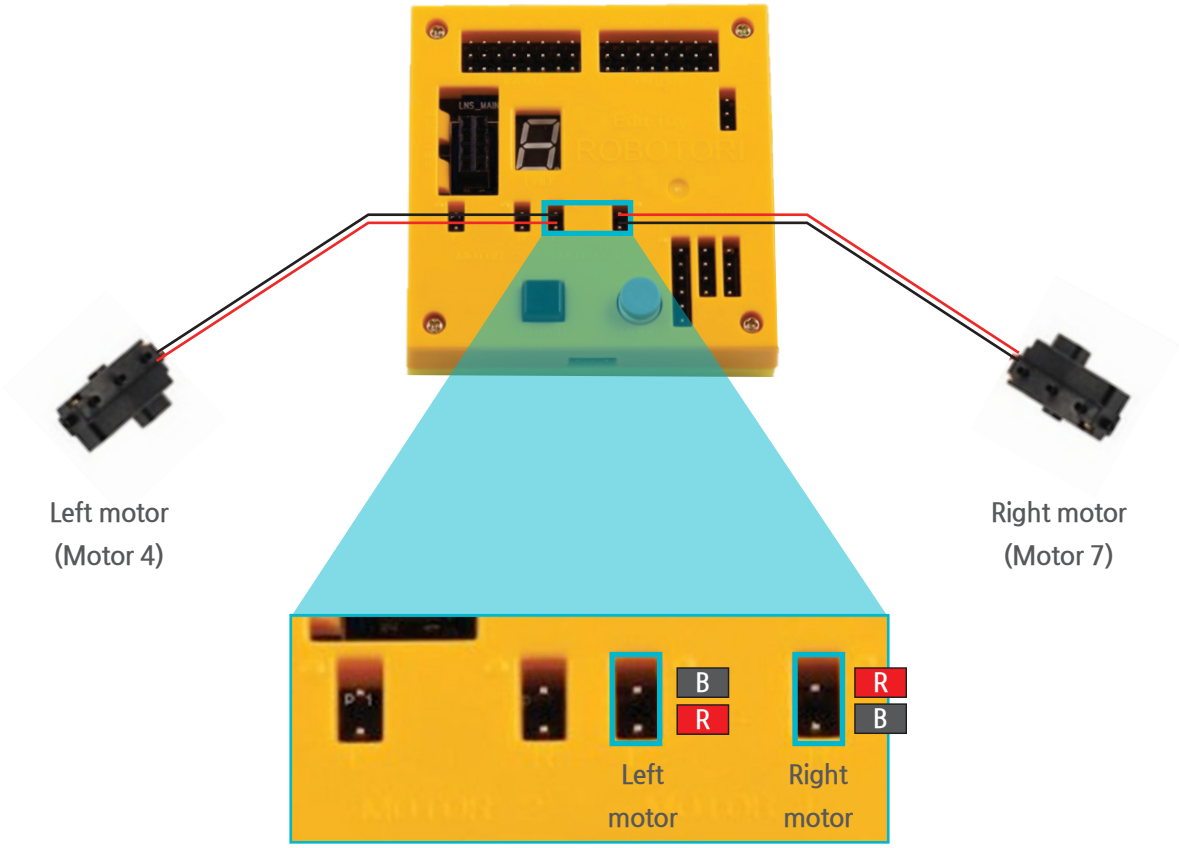
17

CLASS 1

Connect to the Main Cell

How to Move the Lizard Robot

Connect the lizard robot and the mainboard.
Study the picture below! When connecting the left motor, the black cable goes into the top pin and the red cable goes into the pin below it. When connecting the right motor, the red cable goes into the top pin and the black pin goes into the pin below.



Be careful when plugging in the cables.