EdScratch lesson activities

Student worksheets and activity sheets
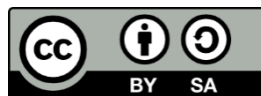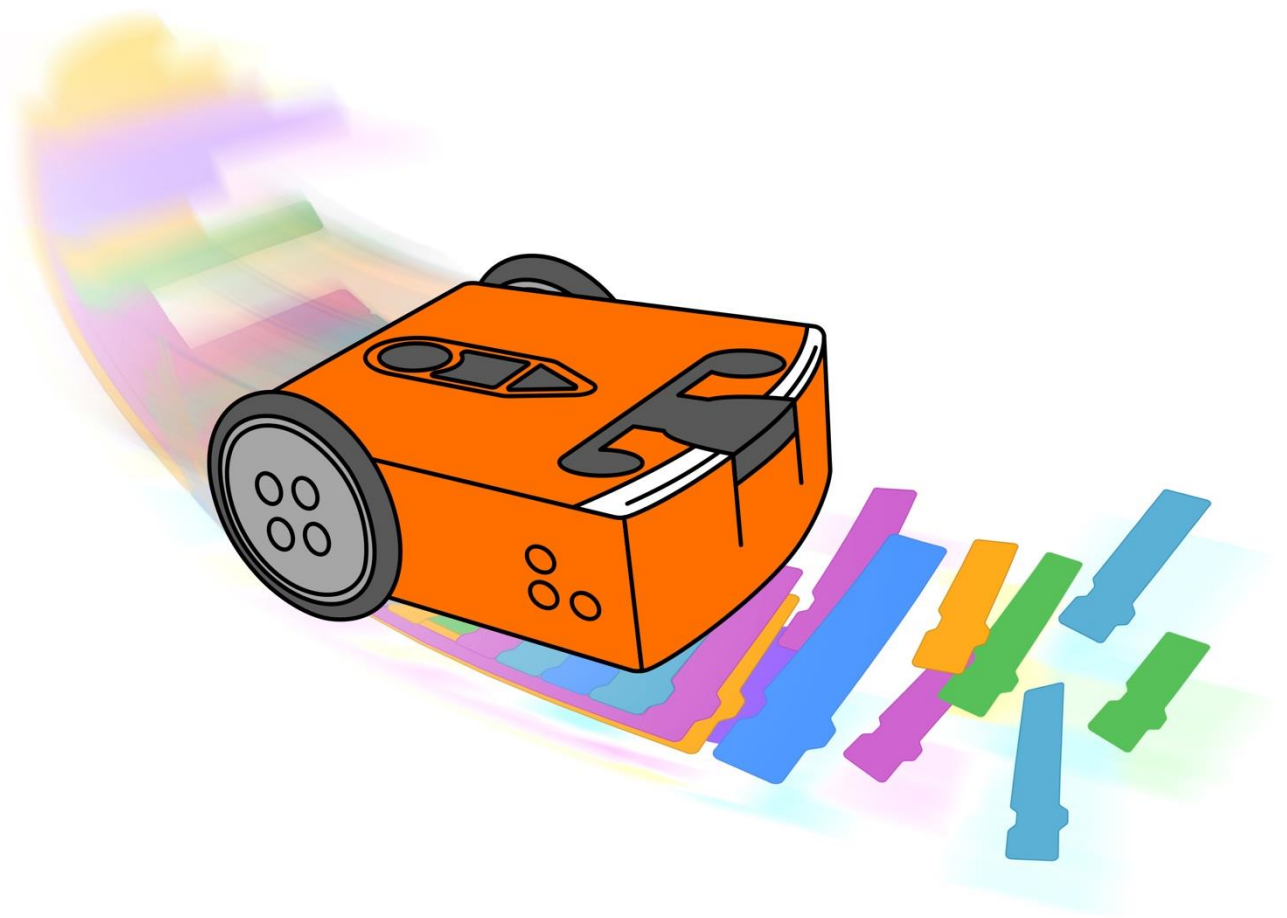
Document number: 3.2.3.4.1 Rev 1.1

Contents

Unit 1: Get started

Edison

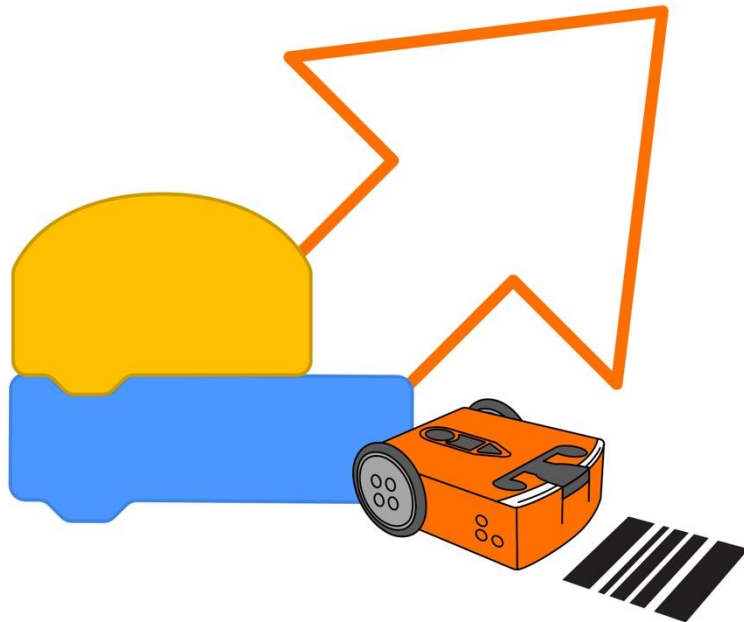# U1-1.1 Let's explore our Edison robots

This is Edison, the programmable robot.
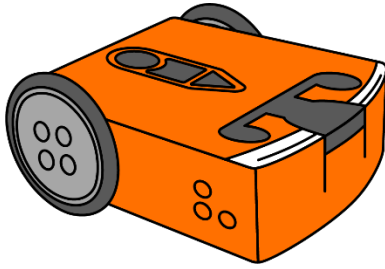
There's a lot we can do with our Edison robots. We can program the robot to do things like drive using its motors, flash its LED lights or make sounds. We can also use Edison to build robotic creations, complete mazes and a whole lot more!

Before we start using Edison, we need to get to know a bit more about the robot.

Edison uses sensors and motors to interact with the world. Edison also has three buttons, a power switch and several removable parts. Knowing where Edison's parts are and what they do will help you use Edison.

Task 1: Look at Edison from the top

Have a look at the top of your Edison robot. Try to find all of the parts labelled in the picture on your Edison robot.

Play button

Stop button

Sound sensor/buzzer

Record button

Infrared receiver

Left light sensor

Left infrared LED

Left red LED

Right light sensor

Right infrared LED

Right red LED
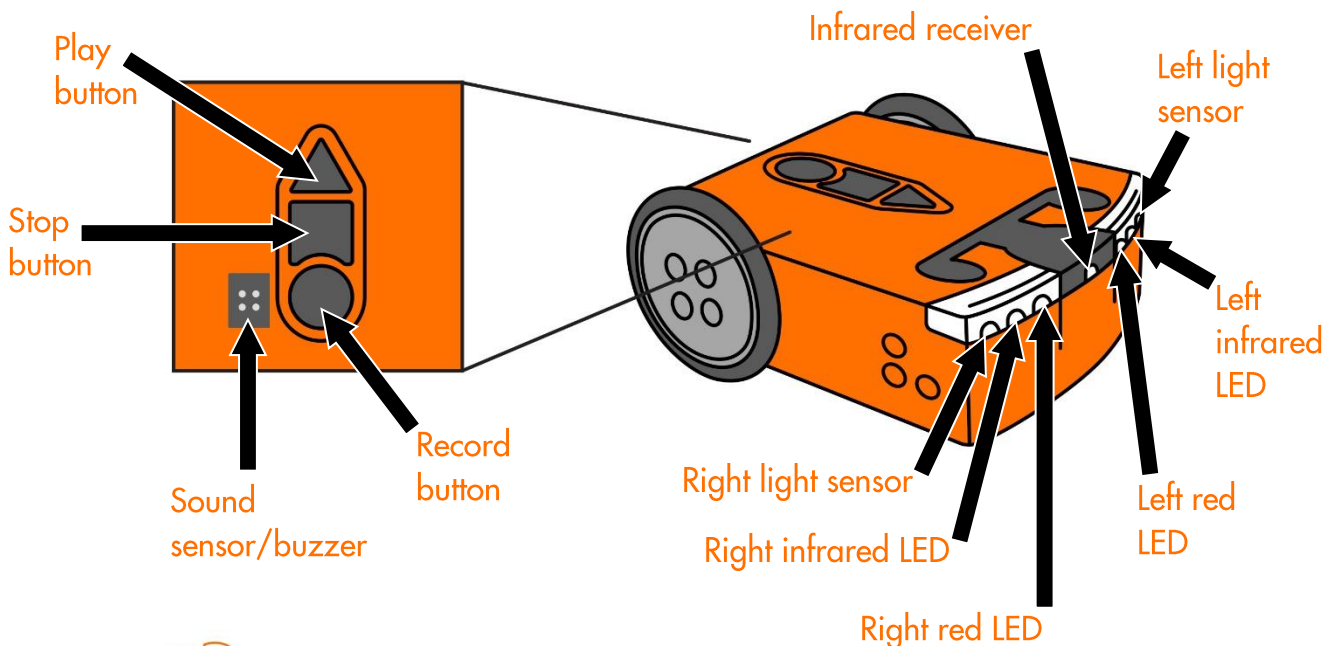
Why is that?

The top of Edison is made of clear plastic. This way you can see the electronic components that make Edison work. One of the most important parts is the black-coloured square that sits just above the tip of the 'play' (triangle) button. Can you see it?

This is the robot's microchip. The microchip is basically a tiny computer, which is sometimes called a micro-computer. It contains the central processing unit (CPU). That's basically Edison's brain!

Task 2: Look at the bottom of Edison

Flip Edison over. Look at the picture and try to find all of the parts labelled in the picture on your Edison robot.

Removable skid

EdComm cable connections

Line tracking sensor

Power switch
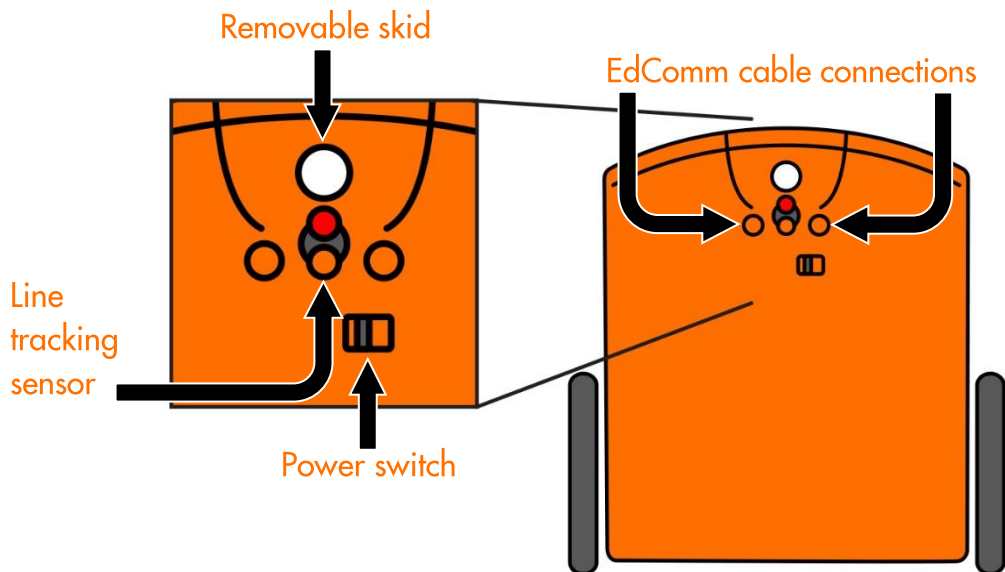
Task 3: Remove and attach the wheels, the skid and the EdComm cable

Sometimes you may want to use Edison in different ways, such as having the robot sit on its side. That's why a few of Edison's parts can be detached from the robot. Both of Edison's wheels can be taken off. Try removing one of the wheels by pulling it straight out away from the robot. Look at the powered socket where the wheel attaches. Be sure to put the wheel back in!

Next, look at Edison's plastic skid. The skid is the clear bit of plastic on the bottom of Edison near the line tracking sensor. Most of the time, you will want to keep the skid in the robot. The skid is very little, and the clear plastic can make it hard to see, so be careful whenever you remove it! You don't want to drop and lose the skid!

There is one other component which we will use a lot with the Edison robot called the EdComm cable.

You will use the EdComm cable to download your programs to Edison from your programming device, like your computer. The EdComm cable has a connection for Edison on one end, and the other end connects to the headphone socket on your computer.
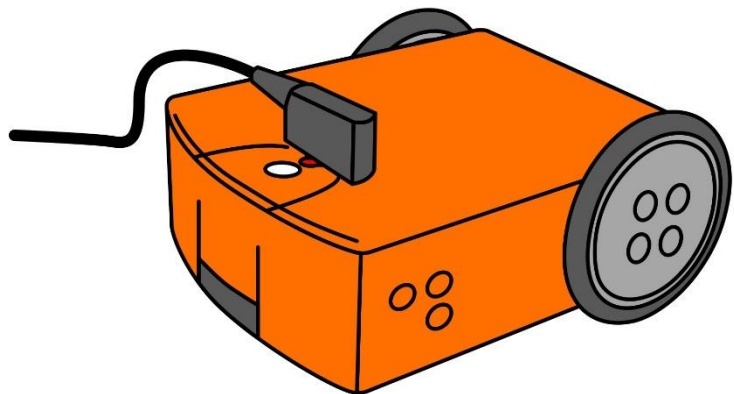
For practice, try connecting the EdComm cable to Edison.

Task 4: Turn Edison on

Whenever we want to use Edison, we need to turn on the robot. Try to turn Edison on now.

1. What happens when you turn the robot on? Describe what happens including what you saw and what you heard. Write your answer here:

_____

_____

_____

_____

_____

Don't forget

Whenever you finish using Edison, make sure you turn the robot back off!

U1-1.1a Change it up: Bricks, blocks and Edison

Take a good look at Edison. Do you see all the bumps and holes on the top, sides and bottom of the robot?

You've probably seen studs just like the ones on the top of Edison and on Edison's wheels before. Why do you think the robot has those studs plus the holes on the sides and bottom of Edison?

Those are all connection points to build with Edison using any LEGO brick compatible building system.

There are lots of things we can build using Edison and different types of building systems. In this activity, your goal is to build something with LEGO bricks and Edison.

What to do

Get your Edison robot, grab some blocks and let your creativity and imagination flow!

Try adding blocks onto Edison's top, bottom, sides or wheels. Decorate Edison however you would like!

Once you finish, write a description or draw a picture of what your Edison looked like all brick-and-blocked up. How did you build with Edison?

U1-1.2 Let's explore barcode programming

Just like all robots and computers, Edison needs programs to function.

What is a computer program?

Jargon buster

A **computer program** is a collection of instructions that tell a computer to perform a specific task.

Jargon is a term for the special words or expressions used by people in a particular group, like a type of job. Jargon is often difficult for people outside of that profession or group to understand. Computer programming uses some words and phrases that might seem like 'jargon' to you now – but these new vocabulary words will soon become very familiar! The jargon buster boxes in these lessons will introduce you to new terms.

Now, let's get back to programming Edison.

Using barcodes to program Edison

Edison comes with some programs already loaded in the robot. We can get the robot to access and run these programs by using special barcodes.

Why is that?

Edison's microchip has the ability to store some things, like programs. These programs are stored in the robot's **memory**. We can tell Edison which of these programs we want to run by driving over special barcodes.

Whenever you use one of Edison's special barcodes, you need to follow the same four steps:

1. Place Edison facing the barcode on the **right side** of the barcode.
2. Press the record (round) button **three times.**
3. Wait while Edison drives forward and scans the barcode.
4. Press the play (triangle) button **one time** to run the program.

Let's try using some of Edison's barcodes.

Task 1: Clap-controlled driving

This program uses Edison's sound sensor. The sound sensor can detect loud sounds, like when you clap your hands. This program tells Edison to 'listen' for a clap.

Have Edison read the barcode.

Don't forget

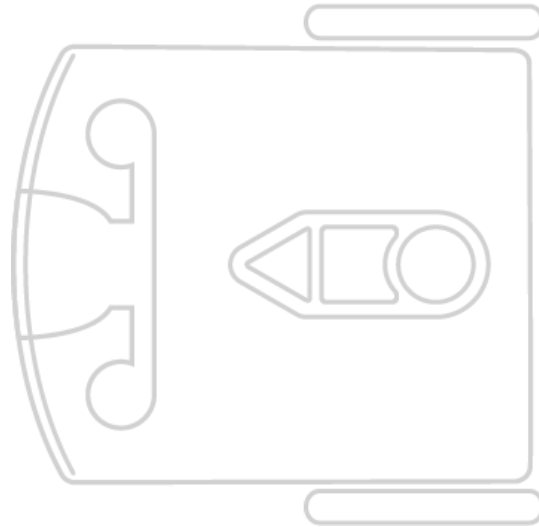To program Edison with a barcode, always follow these steps:

1. Place Edison facing the barcode on the **right side** of the barcode.
2. Press the record (round) button **three times.**
3. Wait while Edison drives forward and scans the barcode.
4. Press the play (triangle) button **one time** to run the program.

Scan the barcode, then put Edison on the floor or table before you press the play (triangle) button. After you press the play button, clap your hands one time. Edison will turn to the right.
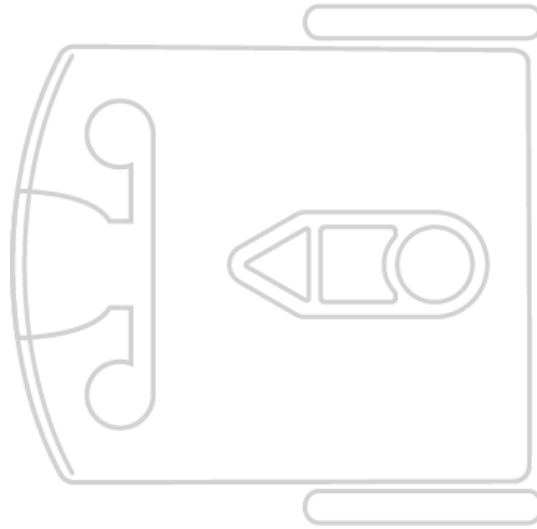
Next, clap your hands two times. Edison will drive forward.

If Edison can't detect your clapping, try tapping your finger on the top of the robot near the sound sensor instead.

Task 2: Avoid obstacles

This program uses Edison's infrared light sensor to detect and avoid obstacles in the robot's path.

Have Edison read the barcode.

Before you press the play (triangle) button, you need to put Edison on the floor or table with some obstacles. Make some obstacles for Edison by putting some objects around Edison. Choose objects that are at least as tall as Edison and are not see-through. You can also use your hands to make little 'walls' for Edison.

Press the play (triangle) button. Watch what happens when Edison detects an obstacle.

Task 3: Follow a torch

This program uses Edison's light sensor to detect and follow a bright light. You will need a torch, a flashlight, or some other way of making a bright light for this program to work.

Have Edison read the barcode.
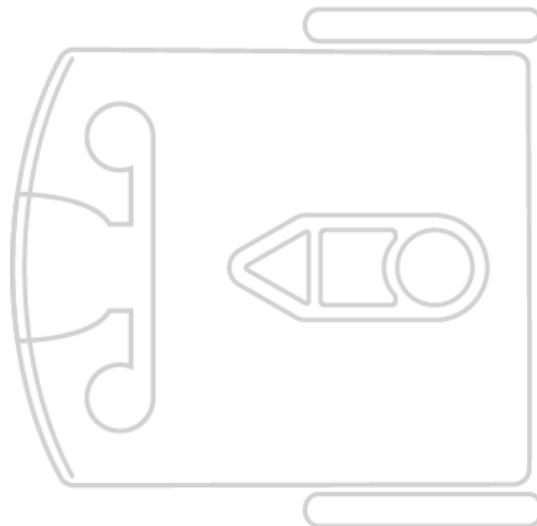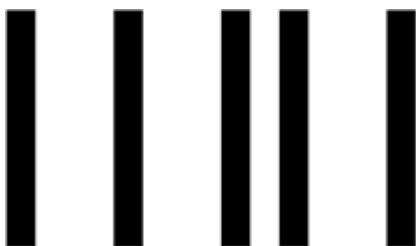
Put Edison on the floor or table and get your torch ready before you press the play (triangle) button. Shine your torch at Edison. The robot will follow the bright light.

Task 4: Follow a line

This program uses Edison's line tracking sensor to detect and follow a dark line. You will need a dark line for Edison to follow. Use activity sheet U1-1, an EdMat or make your own line for Edison to follow.

Have Edison read the barcode.

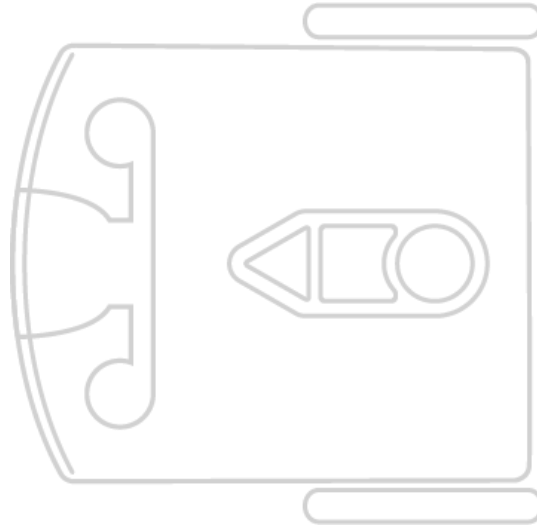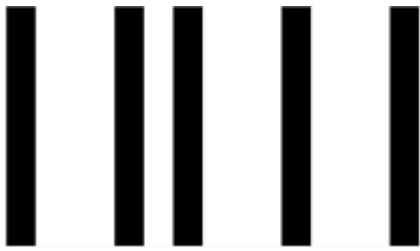Get your activity sheet ready. You need to start the robot on the white surface near the black line. Put Edison next to the black line, **but not on the line**. Press the play (triangle) button. Edison will find and follow the line.

Task 5: Bounce in borders

This program uses Edison's line tracking sensor to detect and avoid dark surfaces. You will need a shape with a dark outline to 'trap' Edison. Use activity sheet U1-1, activity sheet U1-2, an EdMat, or make your own shape to trap Edison.

Have Edison read the barcode.

Get your activity sheet ready. You need to start the robot on the white space inside of the black line. You can put Edison next to the black line, **but not on the line**. Press the play (triangle) button. Edison will 'bounce' around inside the dark borders.

U1-1.2a Change it up: Sumo wrestling

One of Edison's pre-set programs is actually a combination of two of Edison's other programs – bounce in borders and obstacle detection.
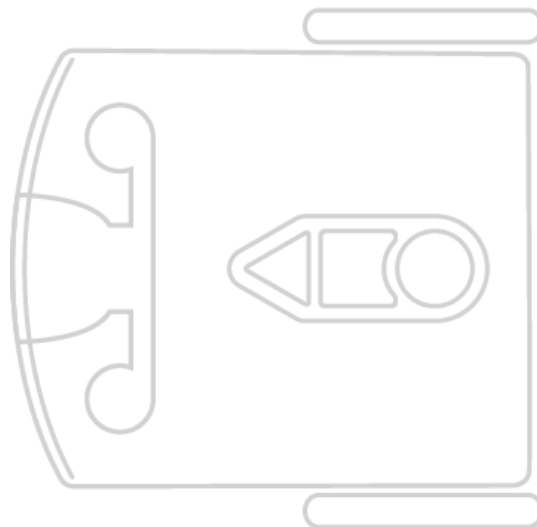
What does this combined program do? It allows two or more Edison robots to sumo wrestle!

The obstacle detection part of the program helps each of the robots to find the other robots. The line detection part of the program helps Edison find a line to knock the other robot out of the ring.

You will need a shape with a dark outline to be the sumo ring for the battling Edison robots. Use activity sheet U1-2, an EdMat or make your own sumo ring.

You will need to work together for this activity. Scan the barcode with at least two Edison robots.

Don't forget

To program Edison with a barcode, always follow these steps:

1. Place Edison facing the barcode on the **right side** of the barcode.
2. Press the record (round) button **three times.**
3. Wait while Edison drives forward and scans the barcode.
4. Press the play (triangle) button **one time** to run the program.

Get your sumo ring ready. If you want, you can mark the different Edison robots with labels or by attaching coloured bricks. Put all the Edison robots in the ring.

Press the play button (triangle button) on all the robots at the same time.

Each Edison robot will start to drive around the inside of the ring slowly, looking for the other robots. When one Edison detects another robot, it will speed up to hit it and try to push it out of the ring.

The Edison that stays in the ring wins!

U1-1.2b Change it up: Make your own barcode?

Using barcodes with Edison is a lot of fun! People often want to know if they can make their own barcode for Edison.

Have a think. What do the barcodes do? Do you remember what is happening when we use a special Edison barcode? Do you think it is possible to make your own barcode for Edison to read?

Why is that?

The barcodes simply tell Edison to run the correct pre-set program when the triangle button is pressed. The actual programs are stored in a section of Edison's memory that does not ever get changed, so it is not possible to add additional programs that can be read using barcodes.

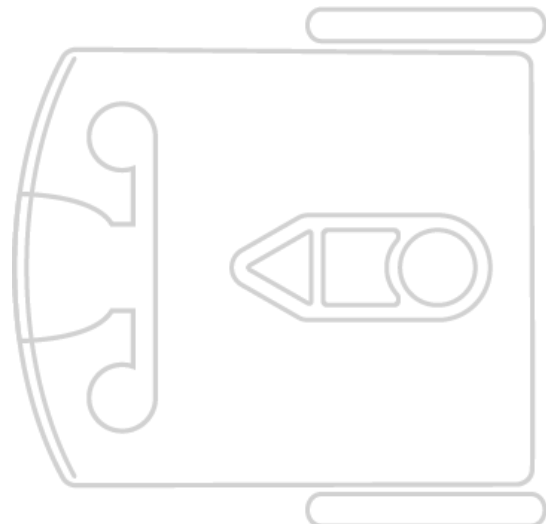So, no, we cannot make our own barcode for Edison. But let's pretend that we can!

What to do

Pretend that you could make your own barcode for Edison that would run a program. What would that program tell Edison to do?

1. Write a description of your pretend program. Explain what Edison would do if the robot could run your program.

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2. Draw your pretend barcode.

U1-1.2c Change it up: TV remote control barcodes

There is another set of special barcodes we can use with Edison. These barcodes allow Edison to react to button-press commands from your TV or DVD remote control.

Why is that?

The remote-control barcodes are a special type of barcode. These barcodes let Edison store a code from a remote control. Edison can then reference that code later.

Unlike other Edison barcodes, these barcodes don't activate a program in Edison on their own. Instead, these barcodes tell Edison to look for a remote-control code. If Edison detects a remote-control code it recognises, the robot performs a pre-programmed action.

Using these barcodes along with a TV or DVD remote control will let you drive Edison around like a remote-controlled car!

Task 1: Plan out your remote-control pairing

Look at the eight barcodes on activity sheet U1-3. Six of the barcodes tell Edison to run programs which control how Edison will move. The last two barcodes tell Edison to run programs that make sounds. You need to pair each barcode program with a different button on your remote control.

To make it easier to control Edison with the remote control, match the program action to a button on the remote control that makes sense. For example, you could use an 'up' arrow (like on 'volume up') for the drive forwards program.

Look at the remote control you are using and decide on a button for each program. Write down your button choice for each program:

Program	Remote control button
Drive forwards	
Drive backwards	
Spin left	
Spin right	
Turn left	
Turn right	
Play beep	
Play tune	

Task 2: Program Edison with the remote control

Program Edison with each TV remote control barcode one by one.

Don't forget

To program Edison with a barcode, follow these steps:

1. Place Edison facing the barcode on the **right side** of the barcode.
2. Press the record (round) button **three times.**
3. Wait while Edison drives forward and scans the barcode.

When pairing an Edison to a TV remote, you need to do a different final step:

4. Press the button on your TV remote that you want to match to that barcode's action.

When using these remote-control barcodes, you **don't press the play (triangle) button** on Edison. Instead, press the button you just paired on the remote control. When Edison detects the remote code signal, the robot will perform that barcode's action.

Try it out!

Try controlling Edison with your remote control using the actions you've programmed with the remote-control barcodes.

U1-1.2d Challenge up: Edison soccer

You can use a TV or DVD remote together with the TV remote control barcodes to control your Edison robot's movement. Can you control Edison well enough to play soccer against another Edison robot? Grab an opponent, set up the field and play a match to determine the Edison soccer champion!

What to do

You will need to work together for this activity. Make sure each player has an Edison robot and a remote control. All the Edison robots playing in the match need to be programmed with the TV remote control barcodes. Use the barcodes on activity sheet U1-3.

Hint!

You might want to use different commands from the other players. Otherwise you might end up controlling your opposition!

You also need to set up a field for the robots to play on, plus goals and a ball.

How can you design the field? What size ball will work best?

Experiment to see what works!

U1-1.2e Challenge up: Build and control the EdTank

The TV remote control barcodes let you control your Edison robot to move in different ways. The remote-control barcodes that control Edison's movement are actually controlling the robot's motors. What happens if the motors don't have wheels attached, but something else?

What to do

In this activity, you will build and control the EdTank.

The EdTank is a remote-controlled tank that you can drive around. You can use a second Edison robot as well to build a top layer to the tank with a cannon which you can use to fire a rubber band.

Use this link

Go to meetedison.com/content/EdCreate/EdBuild-EdTank-instructions.pdf

This link will take you to the step-by-step instructions for building and programming the EdTank.

Try it out!

Once you have built and programmed the EdTank, try driving it around!

1. Do you notice any differences in how the EdTank drives compared to how Edison normally drives when the robot just has its wheels attached? Think about what might cause any differences you notice. What might be affecting how the EdTank drives?

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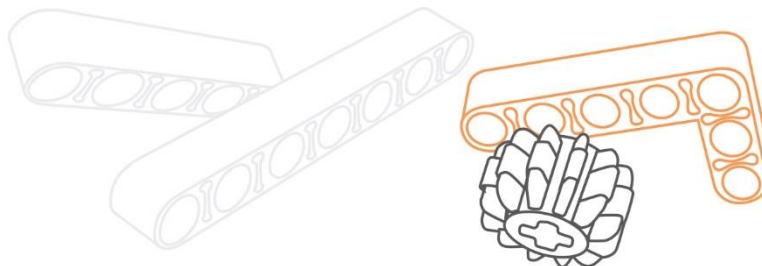
U1-1.2f Challenge up: Build and control the EdDigger

The TV remote control barcodes let you control your Edison robot to move in different ways. The remote-control barcodes that control Edison's movement are actually controlling the robot's motors. What happens if the motors don't have wheels attached, but something else?

What to do

In this activity, you will build and control the EdDigger.

The EdDigger is a remote-controlled excavator, or digger, with a scoop that you can drive around. The digger scoop of the EdDigger can lift and lower, plus it can carry small objects.

Use this link

Go to meetedison.com/content/EdCreate/EdBuild-EdDigger-instructions.pdf

This link will take you to the step-by-step instructions for building and programming the EdDigger.

Try it out!

Once you have built and programmed the EdDigger, try driving it around! Be sure to try to scoop up some objects too!

1. Can you operate the digger scoop smoothly? What do you need to do to get the EdDigger to scoop up objects? What do you need to do to get the EdDigger to drop off objects it was carrying?

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U1-1.2g Challenge up: Build and control the EdRoboClaw

The TV remote control barcodes let you control your Edison robot to move in different ways. The remote-control barcodes that control Edison's movement are actually controlling the robot's motors. What happens if the motors don't have wheels attached, but something else?

What to do

In this activity, you will build and control the EdRoboClaw.

The EdRoboClaw is a remote-controlled robotic arm with a moving base that you can drive around. The robotic arm of the EdRoboClaw can open and close to pick up and carry objects.
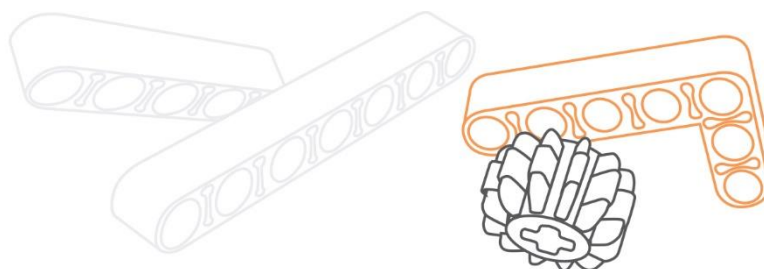
Use this link

Go to meetedison.com/content/EdCreate/EdBuild-EdRoboClaw-instructions.pdf

This link will take you to the step-by-step instructions for building and programming the EdRoboClaw.

Try it out!

Once you have built and programmed the EdRoboClaw, try driving it around! Make sure you try to pick up and carry some objects too!

1. Experiment with different objects using the EdRoboClaw. What types of objects can you carry? What types of objects didn't work? Think about what the objects that worked well have in common with each other. What makes a good object for the EdRoboClaw?

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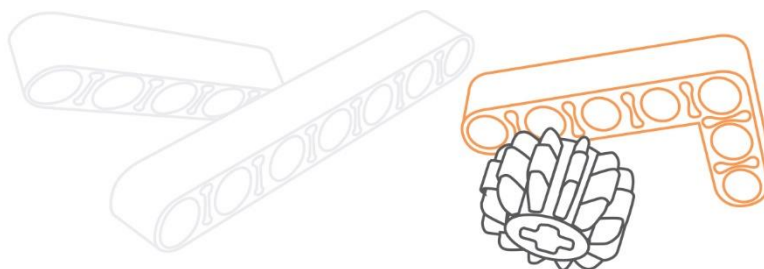
U1-2.1 Let's explore the EdScratch environment

One of the best things about Edison is that you can make your own programs for your robot! To write a program for Edison, we need to use some special software.

Jargon buster

All computers have two main parts: hardware and software.

Hardware is the physical parts of a computer (or robot).

Software is the set of programs and applications that make hardware, like a computer or a robot, run.

The software we will use with Edison is a robot programming language.

Jargon buster

A programming language is a set of rules and instructions used to write computer programs. EdScratch is a programming language specially designed for programming Edison robots.

The programming language we will use is called EdScratch. Let's learn a bit about the EdScratch programming language.

Task 1: Check out EdScratch
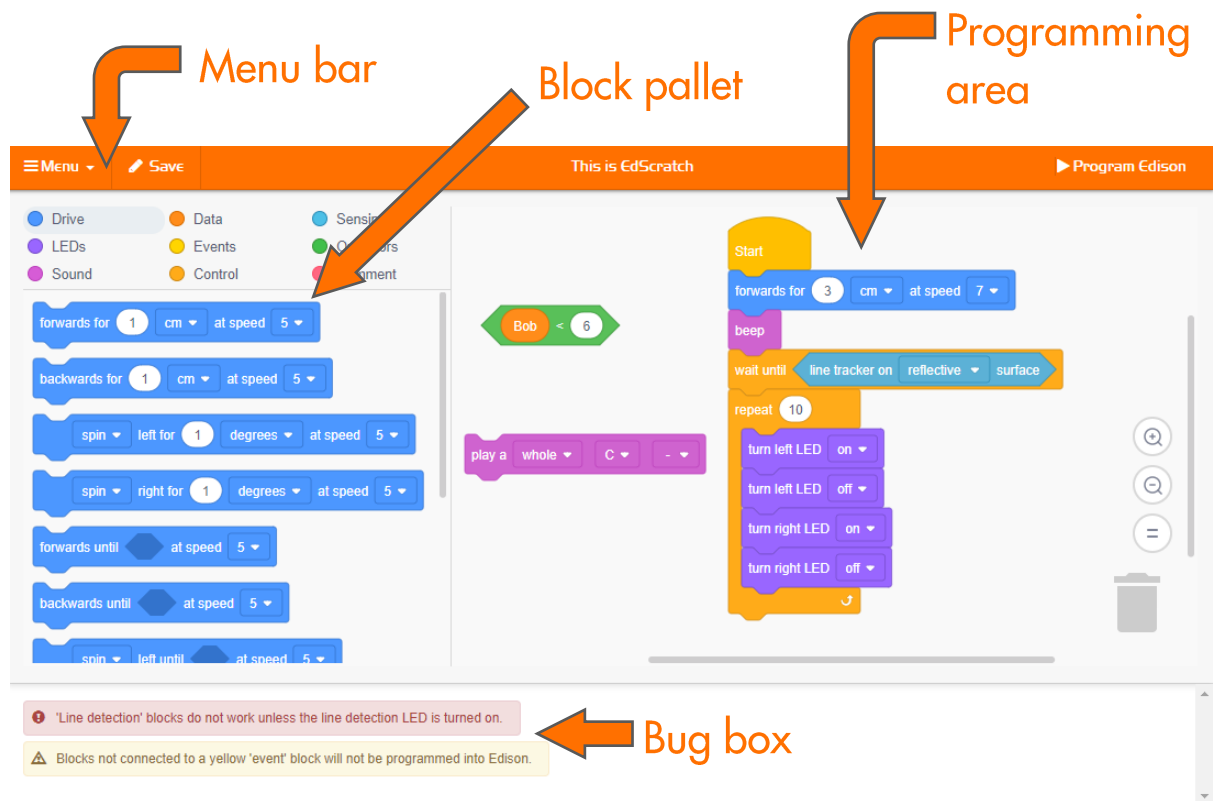
You can access EdScratch online.

Use this link

Go to www.edscratchapp.com

Whenever you want to program Edison using EdScratch, you will always need to go to the EdScratch app.

Here is what the EdScratch environment looks like:

The EdScratch programming environment has four main parts:

Block pallet
All of the blocks you can use are in the block pallet. To use a block, select it from the block pallet, and drag it into the programming area.

Programming area
The large area where you can connect blocks together into programs is called the programming area. Drag and drop blocks from the block pallet into this area to use them in your program.

Menu bar
Options such as 'Save' and 'Load' are accessed from the menu bar. The menu bar also has the 'Program Edison' button.

Bug box
Below the block pallet and programming area is the bug box. Warning messages will show up in the bug box.

Look at EdScratch on your computer. Find each of the four main parts of the EdScratch environment.

Task 2: Load and download the test program

EdScratch has some demo programs already written. Try loading and downloading the demo program called **Test_program**.

Load the Test_program demo program

To load the demo **Test_program**, follow these steps:

1. In EdScratch, go to the menu bar and select the menu drop-down. Find and select the option called **Load Demos**. This will open a pop-up window with all of the demo programs.
2. Find and select the program called **Test_program**. The program will load in the programming area.

Here is what the **Test_program** looks like:
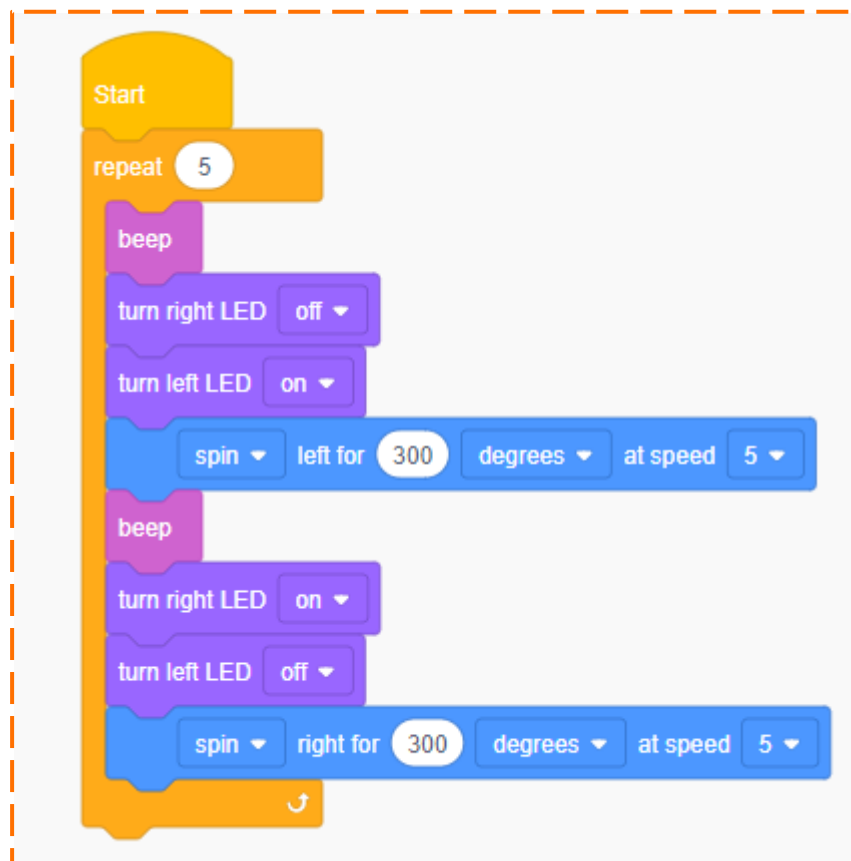
Once the program loads in the programming area, you can download it to your Edison robot.

Download Test_program to Edison

Whenever you want to download a program from EdScratch to Edison, you need to follow these steps:

1. Connect Edison to your computer using the EdComm cable.
2. Make sure the volume is turned up all the way on the computer.
3. Press the record (round) button on Edison **one time**.
4. Go to the menu bar in EdScratch and click on the Program Edison button.
5. A pop-up window will open. Once the program is ready, a button called Program Edison will appear at the bottom of the pop-up window.
6. Click on the Program Edison button in the pop-up window.
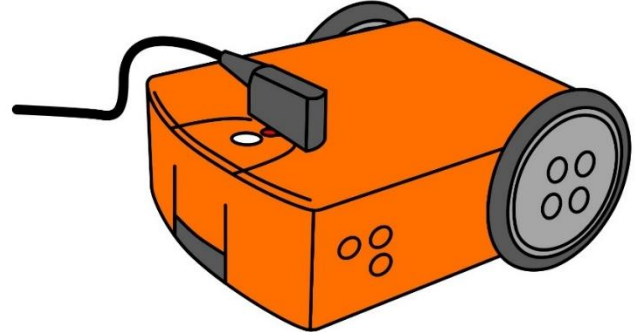
Why is that?

Edison cannot understand the blocks in EdScratch the way they look on your computer screen. The blocks need to be changed into a format that Edison can understand before the program can be downloaded. This can take a bit of time.

That's why it can take a little while for the Program Edison button in the pop-up window to appear.

You will hear the program downloading to Edison. Once it is done downloading, Edison will make the 'success' beep. Don't unplug Edison until you hear the beep!

Why is that?

Edison will let you know if the program downloads correctly by making the 'success' beep. This is the same sound you hear when you first turn Edison on.

There's another sound Edison might make if a program does not download correctly. We call this the 'fail' sound. It means something went wrong when the program tried to download. If Edison makes this sound, try starting your download again.

After you hear Edison make the 'success' beep, unplug the robot from the EdComm cable. Press the play (triangle) button **one time** to run the program.

Try it out!

Load the Test_program demo program in EdScratch. Download and run the program with your Edison robot. Then answer the following questions.

1. Which part of the EdScratch environment is the Program Edison button located in?

_____

_____

2. How many warning messages are there in the bug box when you load the Test_program?

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3. What does the robot do when you run the Test_program? Describe what happens.

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U1-2.1a Challenge up: Download another!

There are multiple demo programs in EdScratch. Choose a program other than **Test_program** from the demo program list.

Try downloading and running the demo program of your choice to see what that program does.

1. What was the name of the program you chose?

    _____

2. What did you expect the program to do? Did the program do what you expected?

    _____

    _____

    _____

3. Look at the program you chose in EdScratch. Think about what the robot does when you run the program. What do you notice? How do the blocks in the program relate to what the robot does when you run the program in Edison?

    _____

    _____

    _____

    _____

    _____

U1-2.1b Change it up: Does EdScratch = Scratch?

Does EdScratch look familiar to you? It might, especially if you have done any projects using the programming language Scratch.

Why is that?

EdScratch does look an awful lot like Scratch. That's on purpose! In fact, EdScratch was built using Scratch as a base.

So, if EdScratch was made using Scratch as a base, does that mean EdScratch is the same thing as Scratch?

Nope!

EdScratch and Scratch are different programming languages. They do have some things in common, but there are a lot of things different about the two languages as well. Most importantly, you cannot program your Edison robot using Scratch. You have to use EdScratch for that!

What other things are different about EdScratch and Scratch? What do these two programming languages have in common?

Try it out!

Have a look at Scratch.

Compare it with EdScratch. What is the same and what is different?

Use this link

You can see Scratch using this link www.scratch.mit.edu

Don't forget to look at EdScratch too! Go to www.edscratchapp.com

1. Find three things about Scratch and EdScratch that are the same. Describe each one.

_____

_____

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2. Find three things that are different in Scratch and EdScratch. Describe each one.

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U1-2.2 Let's explore warning messages

Some programming languages have special features to make it easier to use that language. One example of this is the bug box in EdScratch.

Sometimes when we write a program for Edison in EdScratch, something isn't quite right. When this happens, a warning message will show up in the bug box.

Don't forget

The bug box is located below the block pallet and the programming area in EdScratch.

There are two types of warning messages: yellow warning messages and red warning messages.

Why is that?

Yellow warning messages are caution messages. This is EdScratch saying "Heads up! This might not work the way you want it to work." You can download a program even if there are yellow messages in the bug box.

Red warning messages are like 'stop' messages. These messages are EdScratch saying "Sorry! This program won't make sense to Edison." If there are any red warning messages in the bug box, you will not be able to download the program to Edison.

Whenever you write programs for Edison, it is a good idea to check the bug box before you try to download the program. The warning messages can help you fix up your program!

Try it out!

In EdScratch, find and load the demo program called Warning_messages_demo.

Don't forget

To get to EdScratch go to www.edscratchapp.com

Go to the menu bar and select the menu drop-down. Find and select the option called **Load Demos**. This will open a pop-up window with all of the demo programs. Find and load the program called Warning_messages_demo.

Once the program loads in EdScratch, answer the following questions.

1. Try downloading this program to your Edison robot. What happens? Does it work? Why or why not?

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2. Read the red message in the bug box. Look at the program. Can you fix the problem? Describe what you did to fix the red message.

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3. Read the yellow message in the bug box. Look at the program. If you download the program while that yellow message is there, which blocks will not be programmed into Edison?

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Activity sheet U1-1: Line-tracking border
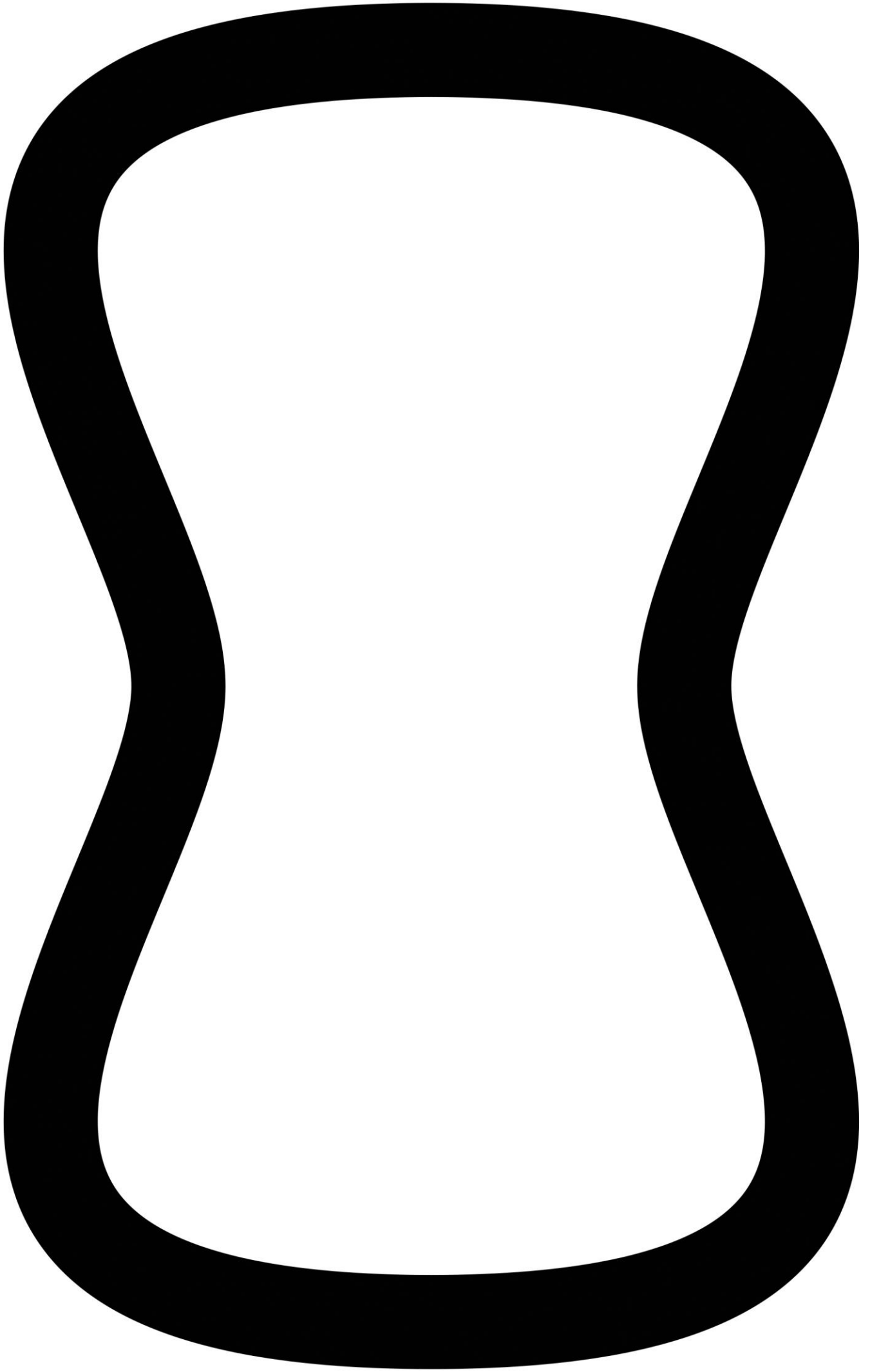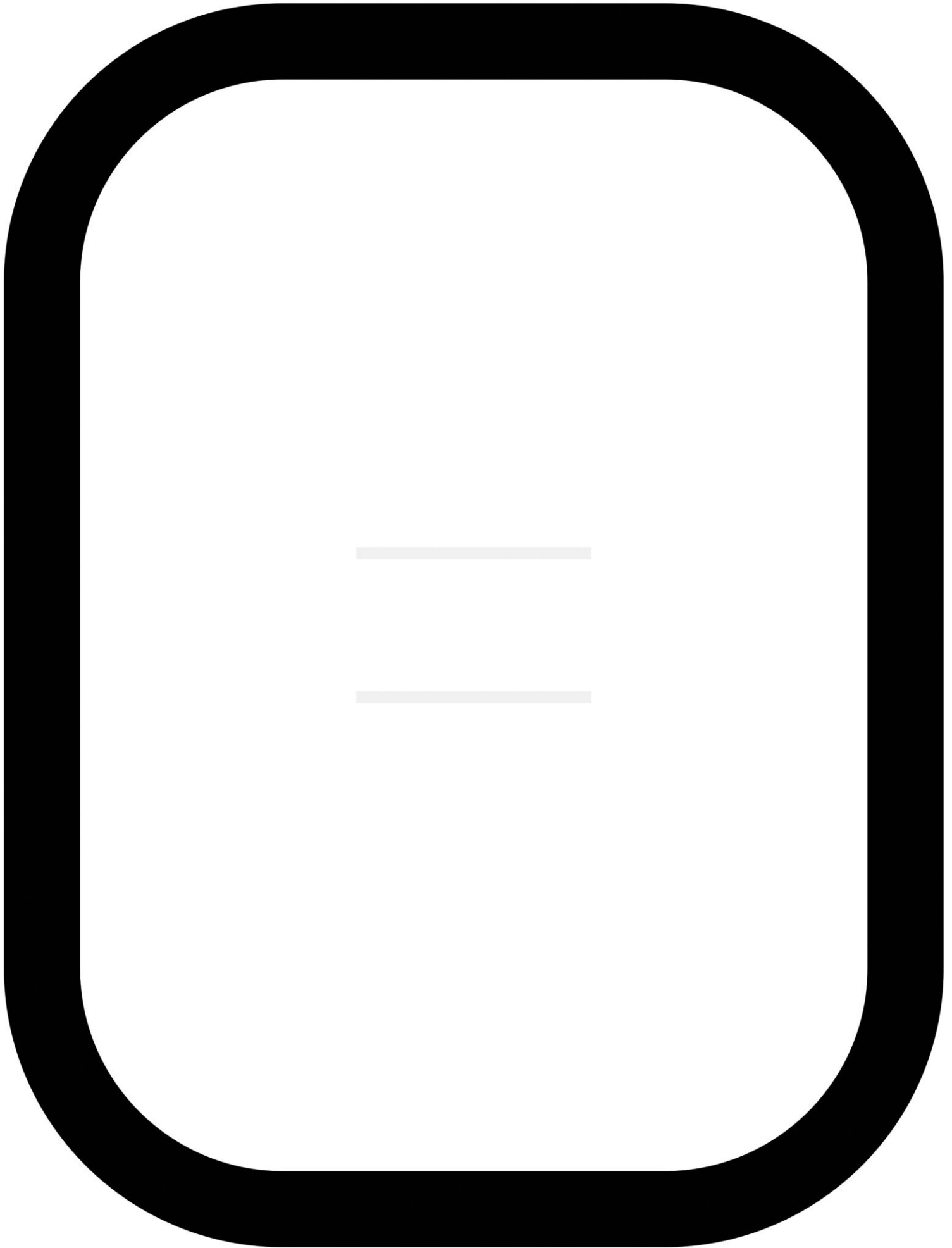
Activity sheet U1-3: TV remote controls

Drive forwards

Drive backwards

Spin left

Spin right

Turn left

Turn right

Play beep

Play tune