EdBlocks lesson activities

Teachers guide and answer key
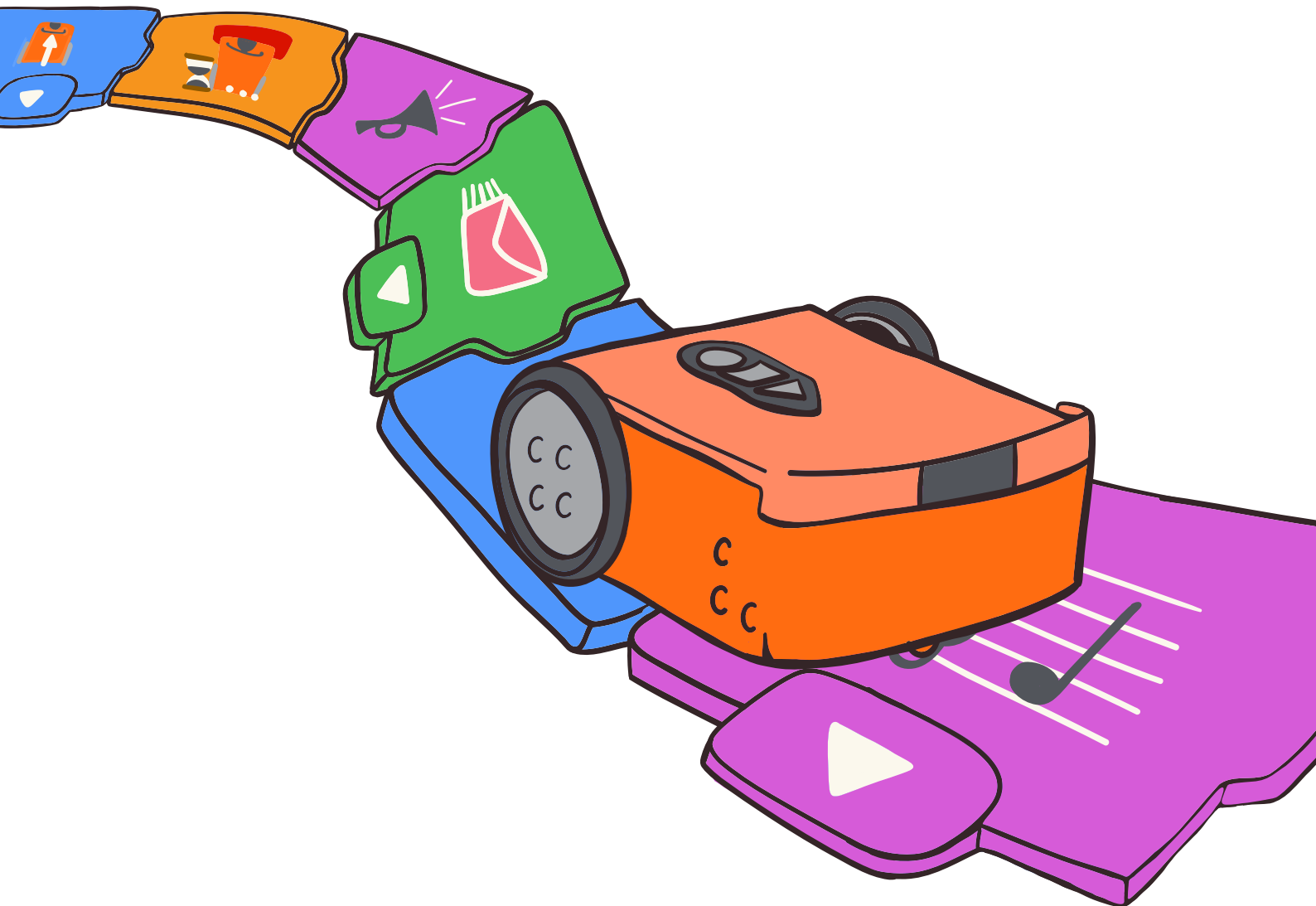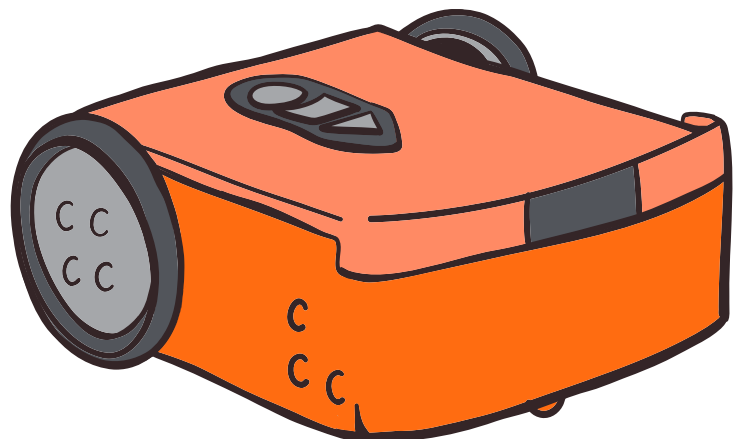
3.2.4.2.2 rev2

Contents

Before you start

Get Edison ready

Each Edison robot is packaged in a small orange box. Unroll the cardboard inside to take out Edison.

Edison V3 is designed to work with LEGO bricks on four sides. It features removable wheels and a skid, enabling projects involving multiple Edison robots or using the robot's motors for other creations.

To power up Edison V3, press the triangle button. This action triggers a chirping sound, and the red LED lights will begin flashing.

Look at the Edison V3 box for instructions and a barcode to kickstart your first adventure.

Getting to know Edison

Edison V3's top has a key pad which includes three buttons. The shape of the buttons and the number of presses will determine Edison's behavior.
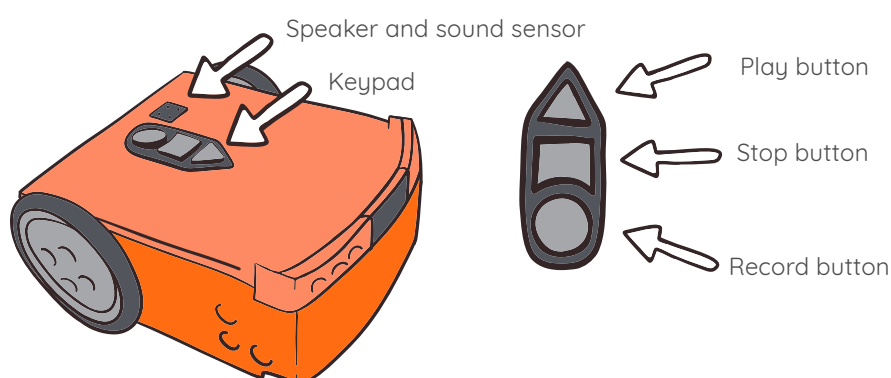
Play button (triangle button)

- 1 press = turn on (when off)
- 1 press = run program

Record button (round button)

- 1 press = download program via screen flasher
- 3 presses = scan barcode

Stop button (square button)

- 1 press = stop program
- Press 3 seconds = turn off

Speaker and sound sensor

Keypad

Play button

Stop button

Record button

Charging Edison V3

Using a USB-A power source

To power up Edison V3, you can use a USB-A power source like a computer's USB-A port, a USB-A wall adapter, or a USB-A power bank.

Once you have selected your power source, connect Edison's USB cable to the USB-A port on that source.

During charging, both LED lights on Edison V3 will flash simultaneously. When Edison is fully charged, the lights will stop flashing and remain on steadily.

It takes approximately 4 to 5 hours to charge Edison's battery to full capacity.

Once charging is finished, unplug Edison's USB cable from the device or power source. Neatly fold the USB cable and tuck it into the USB cable compartment.

Using EdCharger

1. Connect the EdCharger's USB cable to a USB-A power source, such as a computer's USB-A port, a USB wall adapter (minimum 1 amp/5 watts), or a power bank.

2. Position Edison V3 inside the charger, ensuring the clear top faces the EdCharger markings on its front.

3. While charging, both LED lights on Edison V3 will flash simultaneously. Once the battery is fully charged, the lights will cease flashing and remain lit.

4. Additionally, the EdCharger can serve as a storage unit for your Edison robots. It automatically oversees the charging process, ensuring Edison V3 is always prepared for action.

Programming Edison V3 in the EdBlocks language

EdBlocks is a super easy-to-use, fully graphical robot programming language. Using a drag-and-drop block-based system, EdBlocks is intuitive and fun, making it perfect for beginners, including younger users. You can dive in without any prior coding knowledge and start exploring programming effortlessly. The EdBlocks programming language app is at this URL: https://www.edblocksapp.com/

EdBlocks for Windows, Chromebook, Mac, Linux, Android

Running a test program is a great way to get started using EdBlocks. Follow these steps to test EdBlocks on your computer:

1. Open the EdBlocks app at https://www.edblocksapp.com/ using one of the following browsers Chrome, Edge, or Opera.
2. When EdBlocks opens click 'Menu' and select 'Load Demos.' Select the program called 'Test_ Program' which will load in the programming environment.
3. Plug the Edison V3 robot's USB cable in to the computer's USB-A port.
4. From the Edblocks app, press the 'Program' button (top right corner).
5. A popup window will appear asking to connect to Edison V3. Select 'Edison V3 – Paired' and click 'connect'.
6. The program will download to Edison V3 and you will hear the 'success' sound (the same tune Edison plays when you turn Edison on).
7. Disconnect Edison from the USB port and press the triangle button on Edison to run the program.

EdBlocks for iPad

If you are using an iPad to program your Edison, follow these steps to test EdBlocks on your iPad:

1. Open the Edblocks app at edblocksapp.com using one of the following browsers Chrome, Edge, or Opera.
2. When EdBlocks opens, you will see the programming environment. Click 'Menu' and select 'Load Demos.' Select the program called 'Test_Program' which will load in the programming environment.
3. Press the 'Program' button in the app (top right corner) and the screen flasher download box appears.
4. Place your Edison V3 over the outline and press Edison V3's round button one time, both LEDs will come on.
5. Press 'download program' in the download box, and the program will start downloading to Edison V3.
6. When the program has downloaded to Edison V3 you will hear the 'success' sound (the same tune Edison plays when you turn Edison on).
7. Press the triangle button on Edison to run the program.

EdBlocks resources

EdBlocks programming language app - https://www.edblocksapp.com/

Getting started with EdBlocks video - https://meetedison.com/robot-programming-software/edblocks/#edblocksvideo

Teacher's guide to EdBlocks lesson activities and student worksheets - https://meetedison.com/content/EdBlocks-teachers-guide-complete.pdf

Student worksheet set: 23 lesson activity worksheets - https://meetedison.com/content/EdBlocks-lesson-activities-complete-set.pdf

Block guide - https://meetedison.com/content/EdBlocks-block-guide.pdf

Troubleshooting

While Edison robots are designed to be user-friendly and intuitive straight out of the box, occasional issues, common to any computing device, may arise. Explore these troubleshooting tips to swiftly resolve any queries you might encounter.

Check the browser

Checking that Edison's USB cable is pushed all the way into your device's USB-A port. Then, check that the browser you are using to program Edison is Use Google Chrome, Microsoft Edge or Opera.

Check the connectivity status

If this error is visible 'There seems to be a network issue accessing the compiler' message after pressing the 'Program' button in the app, or if the program failed to download successfully, you will need to check the app's connectivity status.

The app need to access the compiler. The compiler is what converts the programs you see on the screen into a format that can be sent to the Edison robot inside the app.

To check your connection and thus ensuring that the app can access the compiler, open 'Menu' in the upper left-hand corner and select 'Help'. This will open a pop-up which includes the option to 'Run the connection checker'. Click this button to check your connection.

If the connection test result shows 'NO SERVER FOUND' then you may be behind a firewall, which is blocking access to the compiler.

To fix the problem, contact your network administrator and ask that them to unblock ports 80, 8080, 443 and 8443 and white list these addresses:

*   https://www.edscratchapp.com
*   https://www.edblocksapp.com
*   https://www.edpyapp.com
*   https://api.edisonrobotics.net
*   52.8.213.196
*   13.210.175.93
*   52.52.42.133

iPad screen flasher not downloading

The iPad screen flasher download uses the iPad's screen to flash the program's code to the line tracking sensor. A few things can affect how well this works.

*   Ambient Light – Move away from any bright direct and indirect sunlight.
*   Screen brightness setting – experiment with different brightness levels between 50% and 100%
*   Age of iPad – Older iPads have slower screens. Set the speed setting to 'reliable'

No USB-A port

If your computer only has USB-C ports you will need a USB-C to USB-A adaptor.

Drive Troubleshooting

On occasion, you may need to straighten the drive of your Edison robot. If you are having trouble with how Edison is driving, such as the robot is not driving straight, you will need to perform a drive calibration on the robot.

Full instructions and the resources you need for your version robot can be found at: https://meetedison.com/edison-robot-support/drive-calibration/

Line tracking troubleshooting

If you are having trouble with a line tracking program, check the following:

- Only use non-glossy paper and, if laminating the paper, only use a matte-finish laminate.

- Edison will be best able to follow a line if that line is a very dark colour (such as black), approximately 1.5cm (0.6 inches) wide and found on a white background.

- Always start the robot on the white background, never on the line itself.

- Avoid running line tracking programs in very bright light, such as sunlight, as this can negatively affect the program.

- Double-check your program to ensure you have the line tracking sensor turned on.

Obstacle detection troubleshooting

If you are having trouble with an obstacle detection program, check the following:

- Ensure that your Edison robot's obstacle detection is properly calibrated using the barcode and instructions available at: https://meetedison.com/obstacle-detection-calibration/

- Edison will be best able to detect obstacles which are opaque but not too dark (e.g. not black) and at least as tall as Edison.

- Avoid running obstacle detection programs in very bright light, such as sunlight, as this can negatively affect the program.

- All of the Edison programming languages except for EdBlocks and the barcode require the obstacle detection sensor to be turned on to work. Double-check your program to ensure you have the obstacle detection sensor turned on.

Still not working?

You can find more troubleshooting ideas on our website at: https://meetedison.com/edison-robot-support/trouble-shooting/or you can contact us for support at, https://meetedison.com/edison-robot-support/contact-us/

Our team of friendly Technical Support Officers will do their best to help you out!

Activity 1 - Meet Edison

This initial activity is designed to allow students to become familiar with the Edison robot, including the various sensors and buttons on Edison.

How it works

The Edison robot is programmable, LEGO brick-compatible and has built-in sensors, lights and sounds. Edison is capable of several autonomous behaviours, which students will explore in future lessons. Developing an understanding of Edison's parts will help students use Edison in future, more challenging lessons.
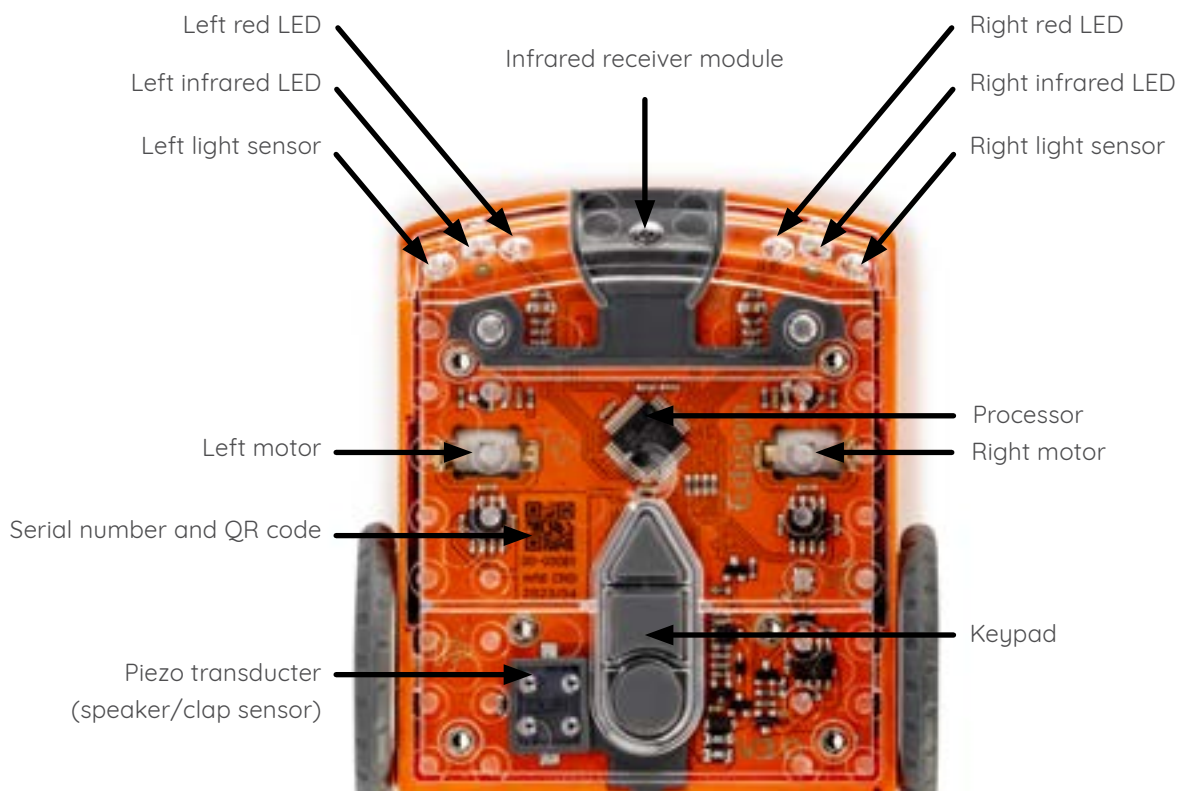
Tips and tricks

- It may be helpful to have students keep this activity sheet for their review of Edison's components in future lessons.

- All of the EdBlocks lesson activities contain information the students will need for the activity. Developing a good habit of reading the activity sheet and following its directions will help students work through future lessons independently. Reading this lesson and finding Edison's parts together may be helpful to begin to create this habit.
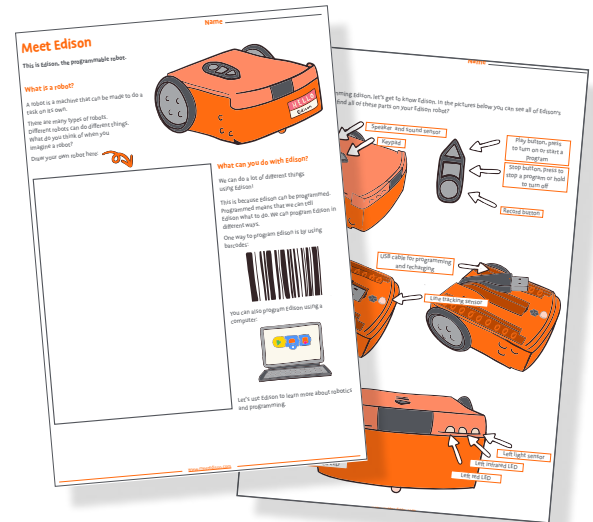
Activity extensions

1. Explore the many types of robots that exist in the world, such as robotic arms in manufacturing or Roomba-style robotic vacuum cleaners. Talk about what robots do to help people.

2. Discuss robots in pop culture, such as Disney's WALL-E and Star Wars. Explore the differences and similarities between real-world robots and fictional robots.

Left red LED
Infrared receiver module
Right red LED
Left infrared LED
Right infrared LED
Left light sensor
Right light sensor
Left motor
Processor
Right motor
Serial number and QR code
Keypad
Piezo transducter (speaker/clap sensor)

Activity 2 - Clap controlled driving

In this activity, students program Edison using a barcode which activates a pre-set program enabling them to drive Edison by clapping their hands.
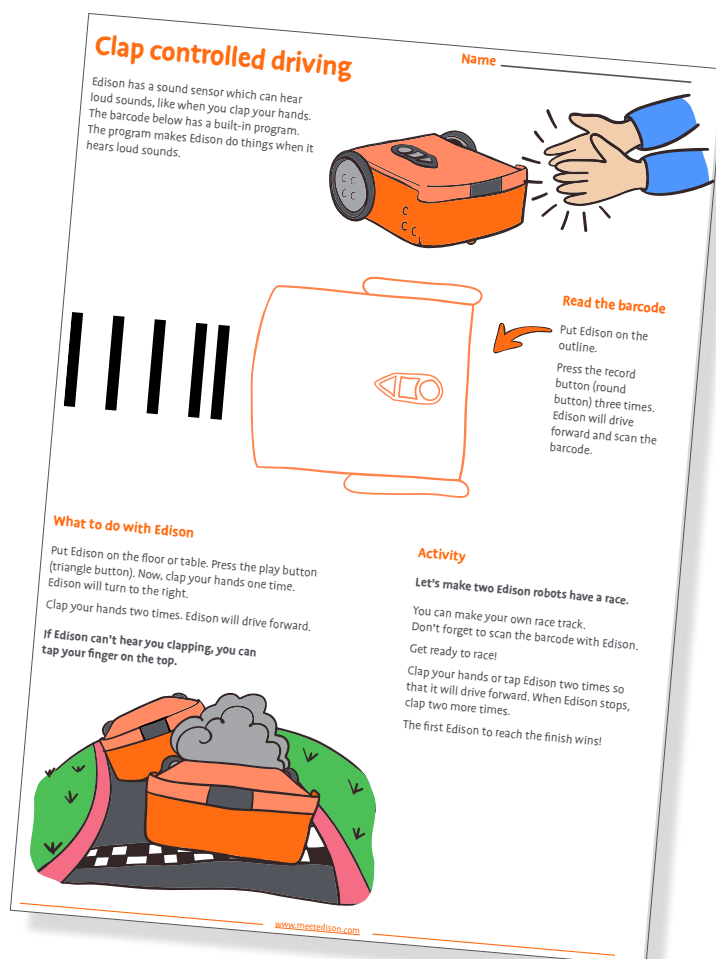
How it works

The clap controlled driving program uses the Edison robot's sound sensor to detect loud sounds like hands clapping. The pre-set program will turn Edison to the right when one clap is detected and drive Edison forward for a few seconds when two claps are detected.

Tips and tricks

- It may help to review Edison's components, emphasising the location of Edison's sound sensor before students begin the activity. You can refer to the images in activity one. For a more technically accurate guide, please download the Edison motherboard layout guide.

- The robots may struggle to detect sounds when there is a high level of background noise. Having students tap a finger near the sound sensor on their Edison will create the same effect as clapping.

Activity extensions

1. Build a physical race course with barriers and turns to navigate. This can create an additional challenge for students, requiring them to use the variable inputs of single and double claps to control Edison.
2. Make a race track with a left-hand turn, encouraging students to use creative problem-solving skills.
3. Experiment to learn what sounds other than clapping and tapping Edison can detect. Discuss if any of these sounds are practical to use to control Edison.

Clap controlled driving

Name _____

Edison has a sound sensor which can hear loud sounds, like when you clap your hands. The barcode below has a built-in program. The program makes Edison do things when it hears loud sounds.

Read the barcode

Put Edison on the outline.

Press the record button (round button) three times. Edison will drive forward and scan the barcode.

What to do with Edison

Put Edison on the floor or table. Press the play button (triangle button). Now, clap your hands one time. Edison will turn to the right.

Clap your hands two times. Edison will drive forward.

If Edison can't hear you clapping, you can tap your finger on the top.

Activity

Let's make two Edison robots have a race.

You can make your own race track. Don't forget to scan the barcode with Edison. Get ready to race!

Clap your hands or tap Edison two times so that it will drive forward. When Edison stops, clap two more times.

The first Edison to reach the finish wins!

www.meetedison.com

Activity 3 - Avoid obstacles

In this activity, students program Edison using a barcode which activates a pre-set program enabling Edison to change directions while driving to avoid obstacles.
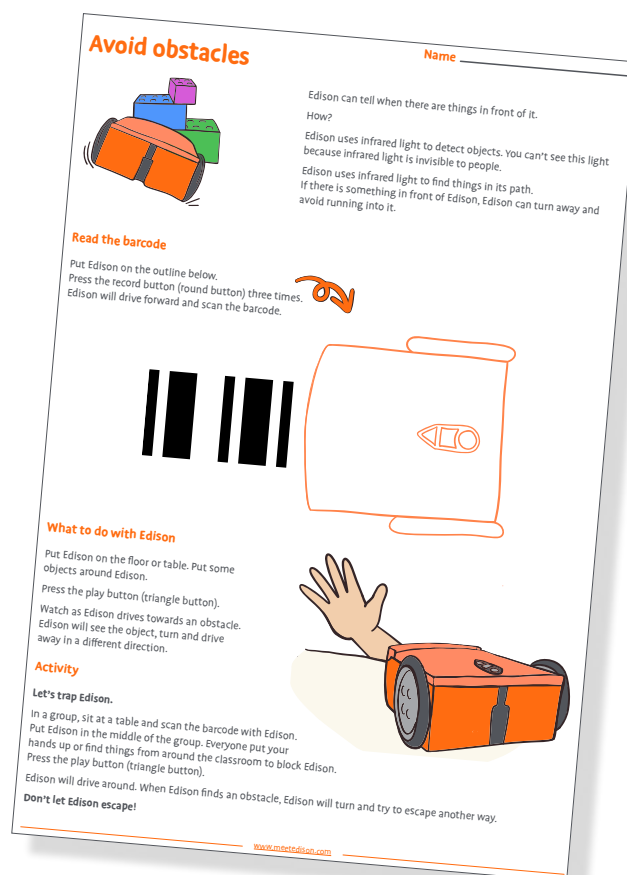
How it works

The avoid obstacles program uses the Edison robot's infrared (IR) light LEDs and IR sensor to detect objects directly in front of the robot. Once the pre-set program is activated, the Edison robot will drive forward, turning as needed to avoid obstacles it encounters.

Tips and tricks

- It may help to review Edison's components, emphasising the location of Edison's infrared light LEDs and sensor before students begin the activity.

- The obstacles need to be opaque but not too dark (e.g. not black) and at least as tall as Edison for the robot to detect them.

Activity extensions

1. Explore the concept of the electromagnetic spectrum, including visible and non-visible wave types. Learn more about infrared light, including its many common uses (e.g. in TV remote controls).

2. Discuss real-world applications of robotic obstacle avoidance, such as driverless cars' use of LIDAR laser remote sensing systems and camera sensor systems.

Avoid obstacles

Name _____

Edison can tell when there are things in front of it.

How?

Edison uses infrared light to detect objects. You can't see this light because infrared light is invisible to people.

Edison uses infrared light to find things in its path. If there is something in front of Edison, Edison can turn away and avoid running into it.

Read the barcode

Put Edison on the outline below.
Press the record button (round button) three times.
Edison will drive forward and scan the barcode.

What to do with Edison

Put Edison on the floor or table. Put some objects around Edison.

Press the play button (triangle button).

Watch as Edison drives towards an obstacle. Edison will see the object, turn and drive away in a different direction.

Activity

Let's trap Edison.

In a group, sit at a table and scan the barcode with Edison. Put Edison in the middle of the group. Everyone put your hands up or find things from around the classroom to block Edison. Press the play button (triangle button).

Edison will drive around. When Edison finds an obstacle, Edison will turn and try to escape another way.

Don't let Edison escape!

www.meetedison.com

Activity 4 - Follow a torch

In this activity, students program Edison using a barcode which activates a pre-set program enabling Edison to drive by following the light of a torch.
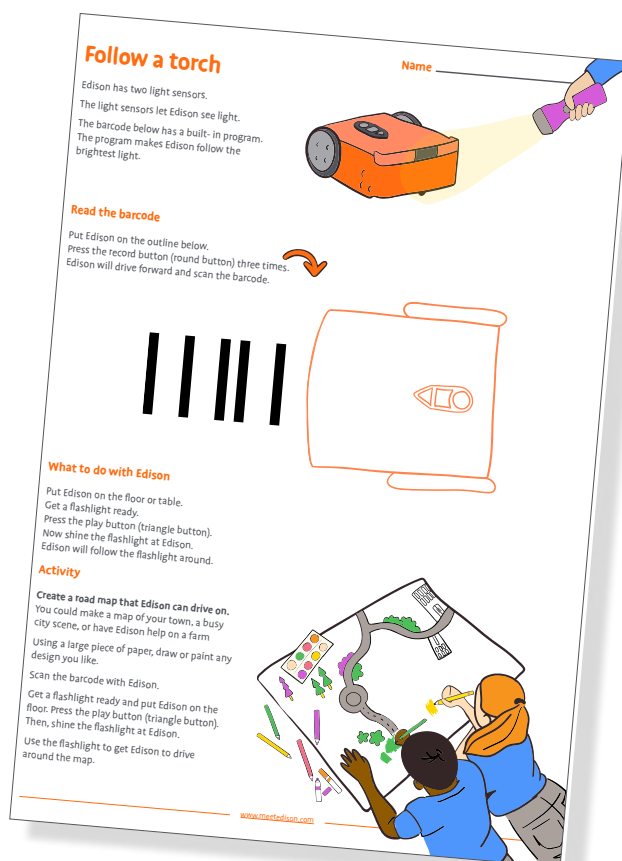
How it works

The follow a torch program uses the Edison robot's light sensors to detect differences in the levels of light between the robot's two sensors. Once the pre-set program is activated, the Edison robot will drive towards the higher light level.

Tips and tricks

- It may help to review Edison's components, emphasising the location of Edison's two light sensors.

- Edison's light detecting programs rely on reading the difference between the light input to the two sensors. If students are struggling with a light detecting program, remind them to point the light at only one of the two sensors, not straight at the front of Edison.

Activity extensions

1. Experiment with the levels of light difference needed between Edison's two sensors to make the program work.

2. Explore the concept of animal behaviours in robotics, including the topic of 'phototropism' (the orientation of a plant or other organism in response to light). The 'follow torch' activity is an example of the Edison robot mimicking positive phototropism (moving towards the light), similar to moths flying towards a bright light.

3. Introduce the concept of intelligence, including artificial intelligence. Discuss what this program demonstrates about the intelligence of both insects and robots.

4. Pose the question 'why is an insect which is attracted to light alive, but a robot which is attracted to light is not alive?'

Follow a torch

Name _____

Edison has two light sensors.
The light sensors let Edison see light.
The barcode below has a built-in program.
The program makes Edison follow the brightest light.

Read the barcode

Put Edison on the outline below.
Press the record button (round button) three times.
Edison will drive forward and scan the barcode.

What to do with Edison

Put Edison on the floor or table.
Get a flashlight ready.
Press the play button (triangle button).
Now shine the flashlight at Edison.
Edison will follow the flashlight around.

Activity

Create a road map that Edison can drive on.
You could make a map of your town, a busy city scene, or have Edison help on a farm
Using a large piece of paper, draw or paint any design you like.

Scan the barcode with Edison.

Get a flashlight ready and put Edison on the floor. Press the play button (triangle button). Then, shine the flashlight at Edison.

Use the flashlight to get Edison to drive around the map.

www.meetedison.com

Activity 5 - Line tracking

In this activity, students program Edison using a barcode which activates a pre-set program enabling Edison to drive by following a dark coloured line.
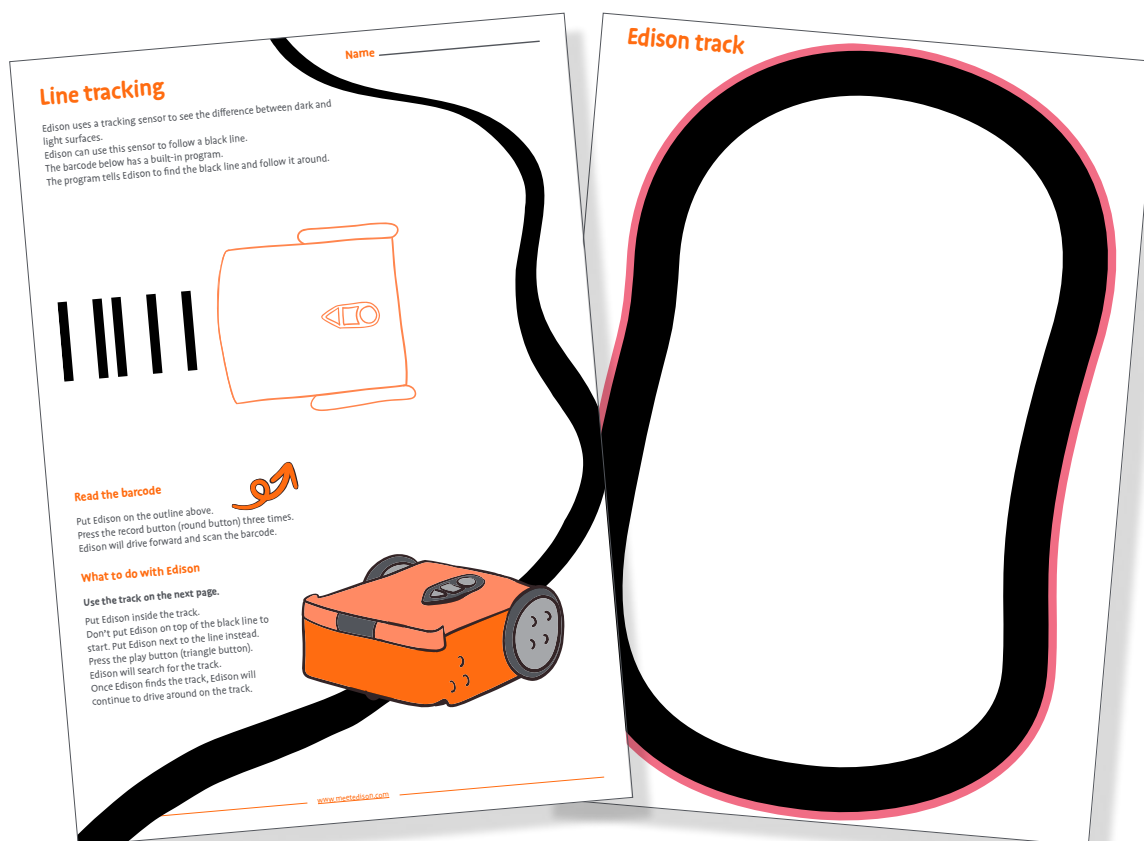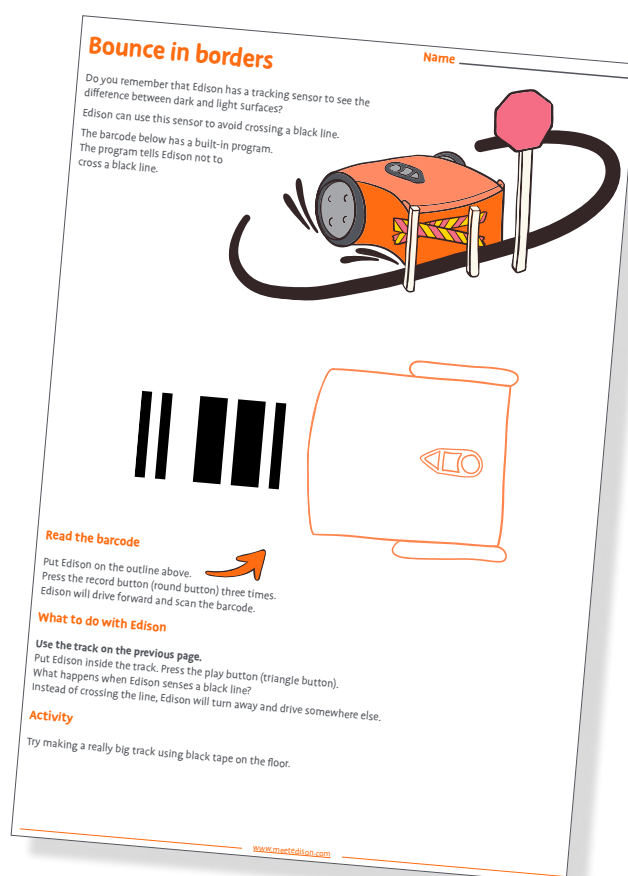
How it works

The line tracking program uses the Edison robot's reflected light sensor to detect differences between dark and light surfaces beneath the robot. Once the pre-set program is activated, the Edison robot will drive until it finds a dark coloured line, then follow that line.

Tips and tricks

- It may help to review Edison's components, emphasising the location of Edison's reflected light sensor, located on the bottom of the robot.

- Make sure students start by placing Edison next to the black line, not on top of it.

- Edison's line tracking programs rely on reading the difference between the amounts of light reflected off of the surface the robot is above. Dark coloured surfaces reflect less light because they absorb more light than light coloured surfaces. If students are struggling with a line tracking program, check that the line they are using is a very dark colour, such as black, and approximately 1.5cm (0.6 inches) wide. Also, make sure the background is white or another very light (i.e. highly reflective) colour.

Activity extensions

1. Download the free EdMat from the www.meetedison.com website for an additional track for Edison to follow.

2. Explore the concept of how different colours have different light absorption and light reflection capabilities. Discuss real-world applications of using different coloured materials to either reflect light or absorb it, such as using dark cloth in a UV-absorbing shade sail.

Activity 6 - Bounce in borders

In this activity, students program Edison using a barcode which activates a pre-set program preventing Edison from crossing a dark coloured line.

How it works

The bounce in borders program uses the Edison robot's reflected light sensor to detect differences between dark and light surfaces beneath the robot. Once the pre-set program is activated, the Edison robot will drive until it encounters a dark coloured line. It will then turn around and drive a different direction without crossing that line.

Tips and tricks

- It may help to review Edison's components, emphasising the location of Edison's reflected light sensor, located on the bottom of the robot.

- Edison's line tracking programs rely on reading the difference between the amounts of light reflected off of the surface the robot is above. Dark coloured surfaces reflect less light because they absorb more light than light coloured surfaces. If students are struggling with a line tracking program, check that the line they are using is a very dark colour, such as black, and approximately 1.5cm (0.6 inches) wide. Also, make sure the background is white or another very light (i.e. highly reflective) colour.

Activity extensions

1. Download the free EdMat from the www.meetedison.com website for an additional track for Edison to bounce inside.

2. Create different size tracks and test how many Edisons can run the program inside each at the same time without pushing any other robot out. Work as a class to make hypothesises about how many Edisons each track will be able to take, test and then present the data.

Bounce in borders

Name _____

Do you remember that Edison has a tracking sensor to see the difference between dark and light surfaces?

Edison can use this sensor to avoid crossing a black line.

The barcode below has a built-in program. The program tells Edison not to cross a black line.

Read the barcode

Put Edison on the outline above.
Press the record button (round button) three times.
Edison will drive forward and scan the barcode.

What to do with Edison

Use the track on the previous page.
Put Edison inside the track. Press the play button (triangle button).
What happens when Edison senses a black line?
Instead of crossing the line, Edison will turn away and drive somewhere else.

Activity

Try making a really big track using black tape on the floor.

www.meetedison.com

Activity 7 - Sumo wrestle

In this activity, students program Edison using a barcode which activates a pre-set program enabling multiple Edison robots to engage in a sumo-style battle.

How it works

The sumo wrestle program uses two of Edison's other programs – bounce in borders and obstacle detection. For this program to work, you need to place at least two Edison robots need to on a white-coloured surface with a black-coloured outline. The obstacle detection part of the program helps an Edison robot find the other robots while the line detection program helps Edison detect the dark-coloured borderline.

Tips and tricks

- It may help to review Edison's components, emphasising the location of Edison's reflected light sensor and Edison's infrared light LEDs and sensor.

- You will need at least two Edison robots for this activity. Both need to scan the sumo wrestle program.

- Make sure the sumo ring is large enough for both robots to drive around inside, however, if the ring is too large it will take longer for the robots to find each other

- Edison's line tracking programs rely on reading the difference between the amounts of light reflected off of the surface the robot is above. Dark coloured surfaces reflect less light because they absorb more light than light coloured surfaces. If students are struggling with a line tracking program, check that the line they are using is a very dark colour, such as black, and approximately 1.5cm (0.6 inches) wide. Also, make sure the background is white or another very light (i.e. highly reflective) colour.

Activity extensions

1. You can use the EdMat as the sumo ring. You can download the free EdMat from www.meetedison.com

2. Explore the sport of sumo wrestling, including its cultural significance in Japan.
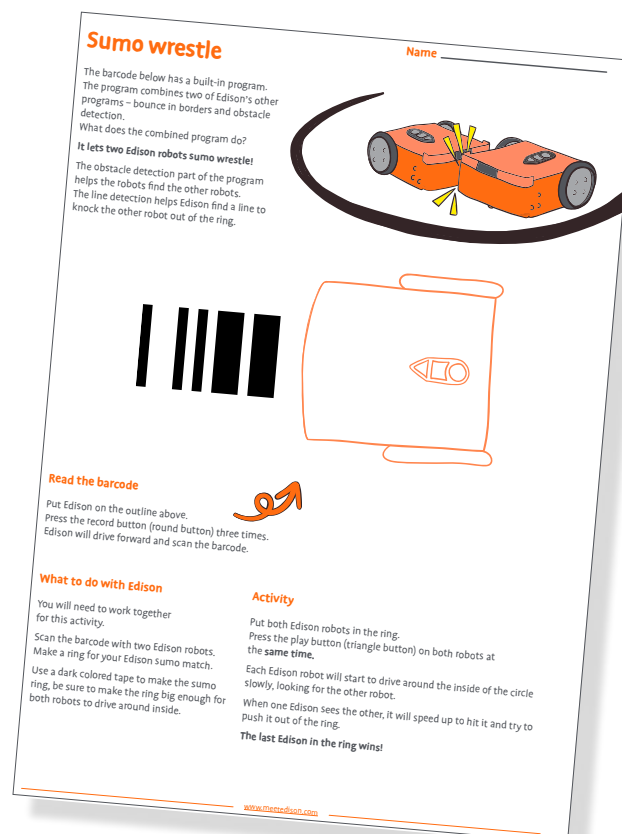
Activity 8 - Welcome to EdBlocks

This activity introduces students to EdBlocks, learn how Edison reads EdBlocks, and practice using EdBlocks offline.

How it works

EdBlocks is a robot programming language that has been created using Scratch 3.0 as a base.

The horizontal icon-based language is comprised of different types of blocks which each contain different programming instruction for the Edison robot. EdBlocks are read left to right, one block at a time.

Tips and tricks

- There are different types of EdBlocks which will be introduced over time. Having students first interact with EdBlocks offline is a good way to teach the basic concepts of EdBlocks and limit confusion around more advance block types.

- Most of the blocks in the activity have a clock symbol. Blocks with this symbol have a number field below the block which allows users to specify an amount of time for that action to occur. Understanding that this is a variable field inside EdBlocks is an important concept which students are exposed to during this activity.

- It may be helpful to introduce how EdBlocks works as a full class activity. A slide with the critical teaching information from this activity is included as an appendix at the end of this document for your use.
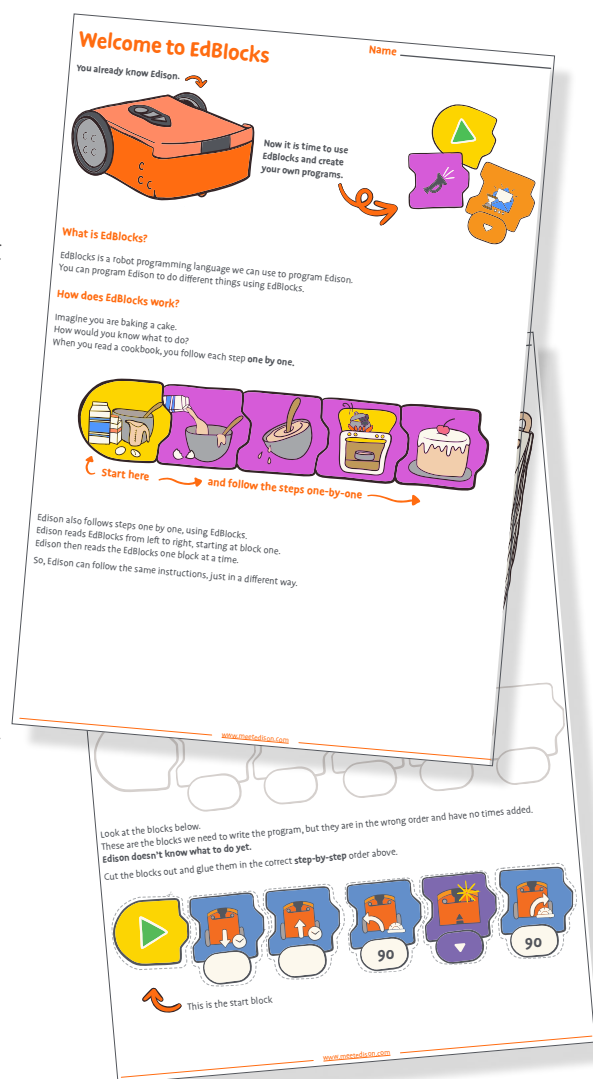
Activity extensions

Explore the idea that time is a variable in performing an action. Discuss how giving an amount of time for the robot to do an action is important.

- What would happen if we just told the robot to drive forward? How would it know how far to drive?

Talk with students about the importance of giving exact directions in the right order. Practice the concept through activities such as having the class direct you step by step on how to make a sandwich.

- Example: https://www.youtube.com/watch?v=RjHzD2sfWcQ

Answer key

Program order:
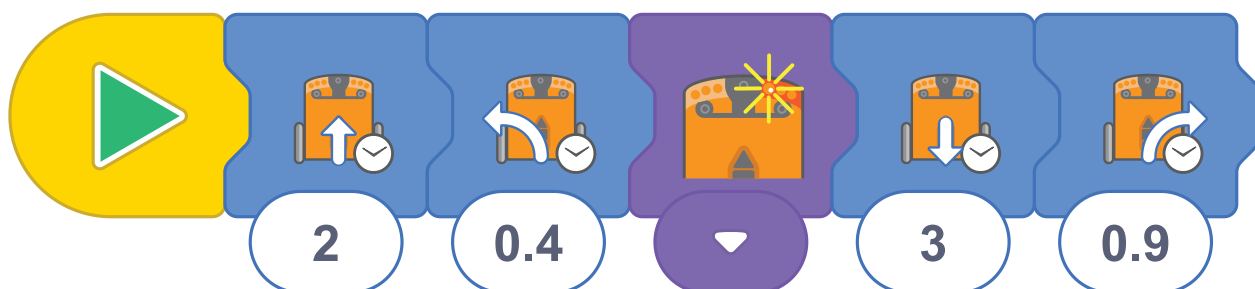
Activity 9 - Let's download a program

In this activity, students are introduced to EdBlocks inside the EdBlocks app (available online at www.edblocksapp.com) and learn how to download a program from EdBlocks to Edison.

How it works

The primary objective of this activity is to learn how to download a program. The program that this activity uses is a pre-set 'follow a torch' program which is functionally the same as the one students encountered previously using barcodes in Activity 4 'Follow a torch.'

Tips and tricks

- Practice steps 1,2,6,7, and 8 with students as these are the steps they will always need to download a program to Edison.

- Some devices, especially tablets, automatically lower the volume when they detect that an audio device, such as headphones, has been connected. Make sure the volume on the computer or tablet is still turned all the way up after the EdComm cable is plugged in.

- While a program is downloading to Edison, Edison makes a whirring sound. Once the program downloads successfully, Edison will make a chirping beep. Make sure students do not unplug the EdComm cable until after they hear the success sound beep.

- If the program fails while downloading, Edison will make a 'fail beep'. You can hear what the success and fail noises sound like at https://meetedison.com/edison-robot-support/trouble-shooting

- When many students are downloading programs at the same time, you may experience slower internet speeds, causing the program to take longer to create the 'program Edison' pop-up box and for the program to download to Edison. Remind students to listen for the success sound before unplugging the EdComm cable to ensure they wait until the program fully downloads.

- Blocks must be attached to the start block to be downloaded to Edison. Floating blocks not attached to a start block will not download to Edison.

- You can remove blocks you don't want by dragging them into the trash bin in the lower right corner.

Activity extensions

Discuss how students were able to get Edison to run the 'follow a torch' program first using barcode and now using EdBlocks. Explore the idea that this means that the same data can be represented in different ways.

Activity 10 - Let's drive

In this activity, students are asked to select and use EdBlocks inside the EdBlocks app (available online at www.edblocksapp.com) to complete the task of programming Edison to drive forward a set distance.

How it works

This activity introduces the important concept that everything you program Edison to do requires both an action and a duration.

In EdBlocks, some individual blocks contain both an action and a duration. For many of these blocks, the duration is time (in seconds) that the user can input. These blocks have a little clock symbol and a user input time box:
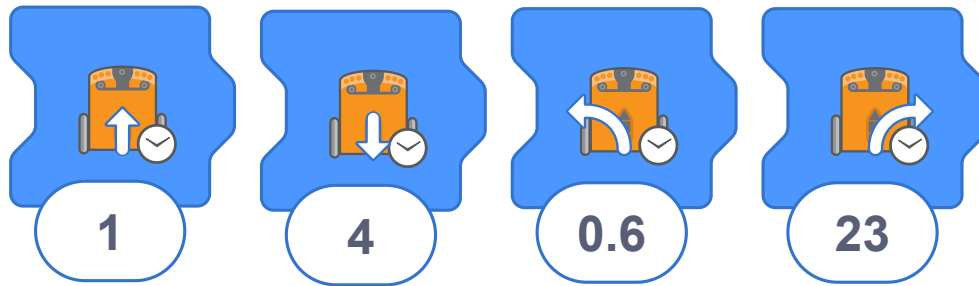
Other blocks only contain an action. The block 'turn right LED on' is an example of an action-only block. The duration of this block's action is controlled by what happens in the program after the block, for example, if another block tells the program 'turn right LED off':
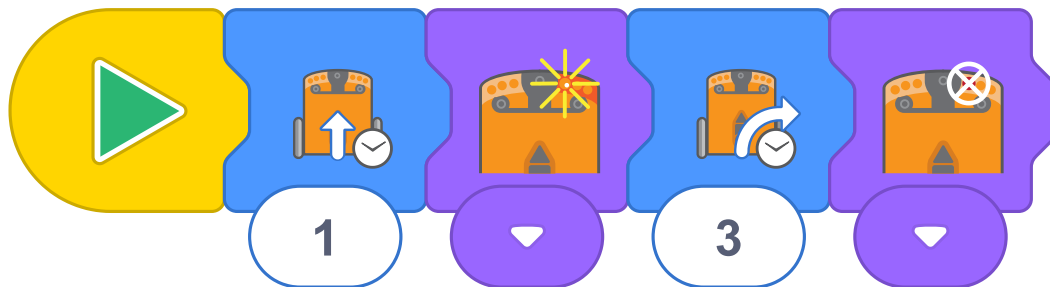
In this activity, to get Edison to drive forward a set distance, students need to select the action of 'drive forward' with the time controlled duration, then experiment with the amount of time they input to get Edison to drive the correct distance.

Tips and tricks

- Practice how to download a program with the students. Remind students to listen for the success sound before unplugging the EdComm cable to ensure the program fully downloads.

- There are several different 'drive forward' blocks in EdBlocks.
  For this activity, make sure students are selecting the time-controlled drive icon:

- Remind students they can change the time by clicking on the number and typing in their desired time, anything from 0.01 to 320. Time is in seconds.

Activity extensions

1. Practice decimals, especially the tens and hundreds places.

2. Create math word problems based on this activity:

- If Edison travels the track in 2.3 seconds and the track is 23 centimeters long, how fast is Edison moving?

Answer key

Approximately 1 second.

Please note: different Edison robots will travel at slightly different speeds, which may cause students to get slightly different results. Answers assume the activity sheet is printed on A4 paper.
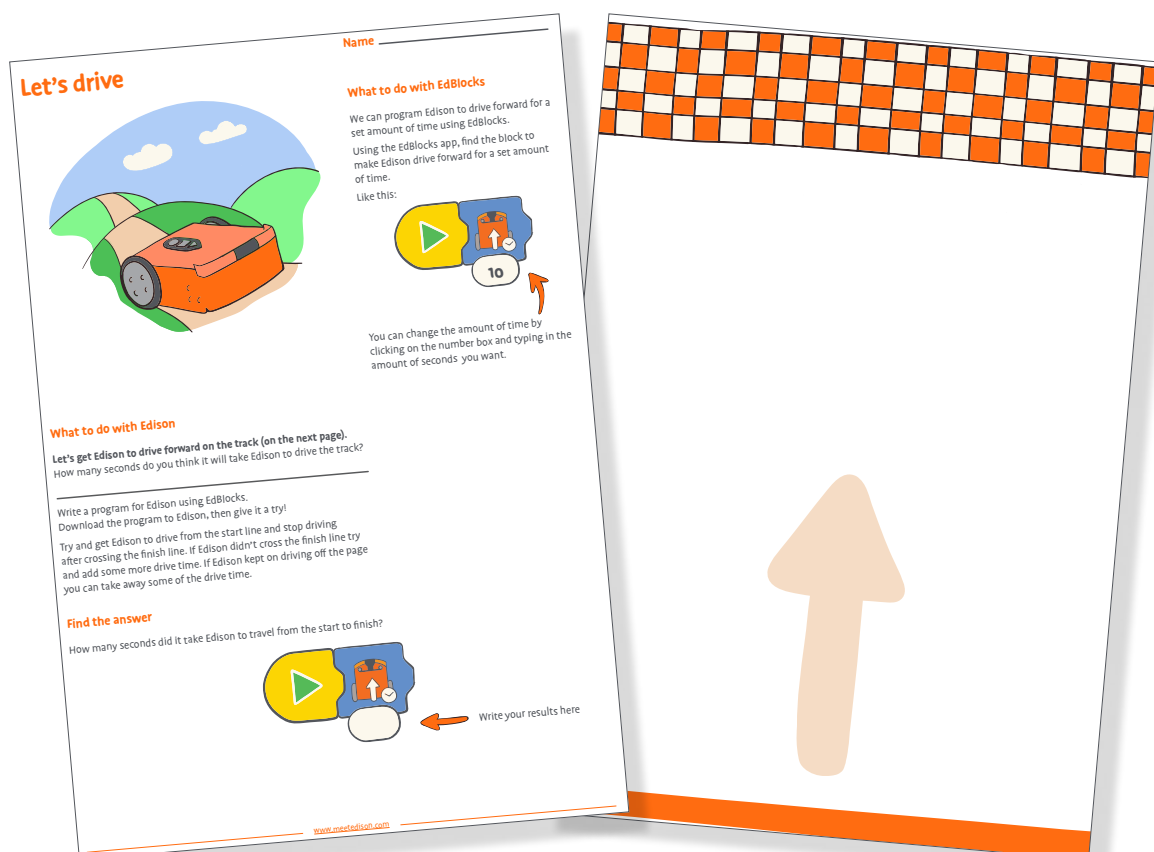
Activity 11 - Let's turn

In this activity, students explore new blocks inside the EdBlocks app and are given the task of programming Edison to make two different time controlled turns.

How it works

This activity reinforces the concept that everything you program Edison to do requires both an action and a duration. It further encourages students to experiment with the user-input time blocks as a means of programming Edison to carry out tasks.

Tips and tricks

- Remind students how to download a program and to remember to listen for the success sound before unplugging the EdComm cable.

- There are several different 'turn' blocks in EdBlocks. For this activity, make sure students are selecting the turn blocks which are time-controlled:
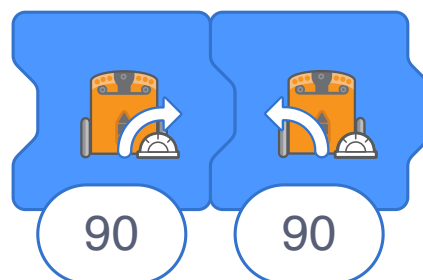
- Remind students they can change the degree by clicking on the number and typing in their desired angle.

Activity extensions

1. Review decimals, especially the tens and hundreds places.
2. Explore how geometry is displayed in this activity, especially how angles act as measures of turn.

Answer key

1. Turn right: 90 degrees
2. Turn left: 180 degrees

Please note: different Edison robots will travel at slightly different speeds, which may cause students to get slightly different results. Answers assume the activity sheet is printed on A4 paper.
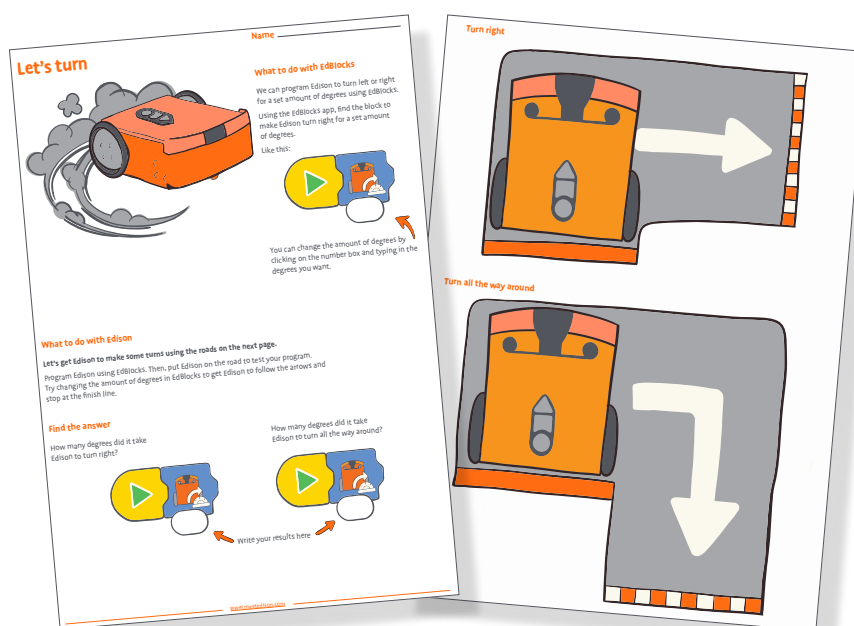
Activity 12 – Let's try a maze

In this activity, students write a multi-block program using different time controlled drive blocks.

How it works

This activity helps students connect what they are doing in EdBlocks as true programming. Students will need to select the correct icons and durations, test the program, then adjust the program to correct for issues.

Tips and tricks

- Remind students how to download a program and to remember to listen for the success sound before unplugging the USB cable.

- There are several different 'drive' blocks in EdBlocks. For this activity, make sure students are selecting the time-controlled blocks.

- Remind students they can change the time by clicking on the number and typing in their desired time, anything from 0.01 to 320. Time is in seconds.

Activity extensions

1. Have students create and then exchange mazes with each other, then write and test the programs to solve the mazes.

2. Explore programming as a job, learning what programmers do and in what industries programmers work.

Answer key

Please note: different Edison robots will travel at slightly different speeds, which may cause students to get slightly different results. Answers assume the activity sheet is printed on A4 paper.

This program finishes with the front of Edison just touching the finish line.
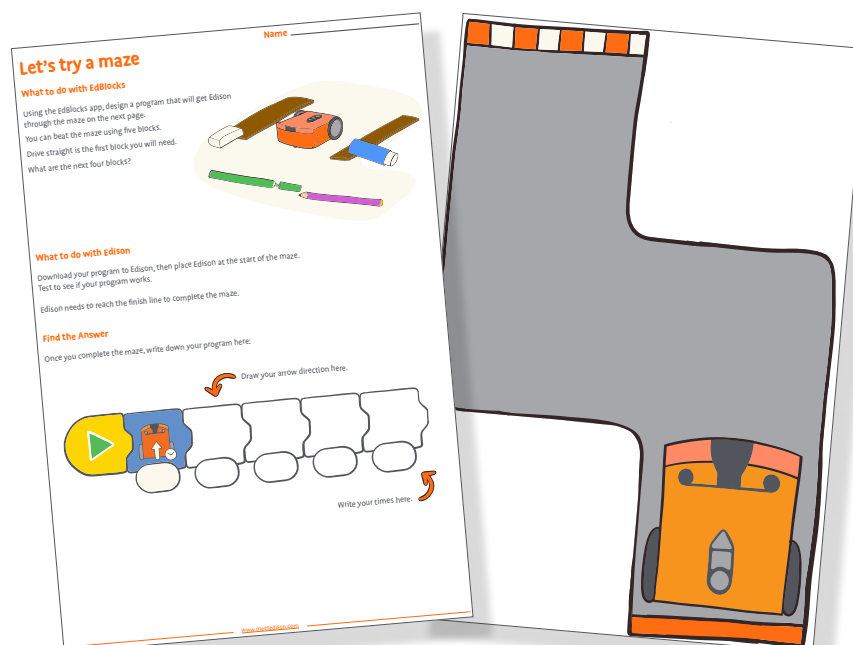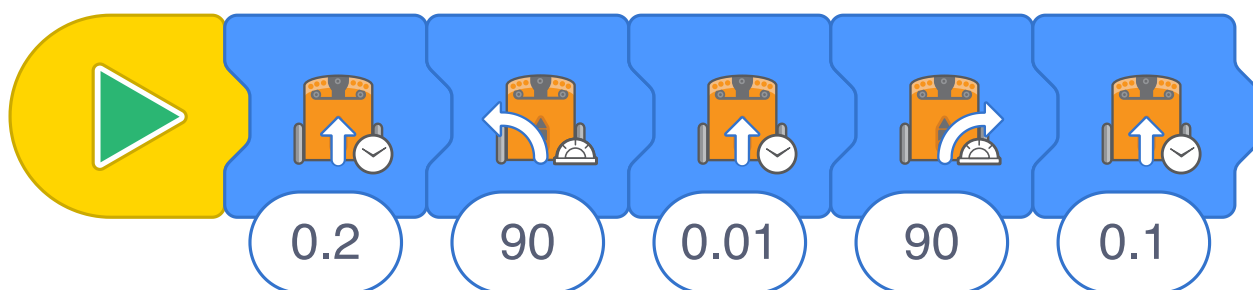
Activity 13 - Let's follow a line

In this activity, students continue to explore new blocks inside the EdBlocks app, including 'follow a line' and speed control.

How it works

This activity reintroduces Edison's ability to follow a line, using EdBlocks to create the program. Edison's drive motors can be set to run at different speeds. This allows the motors to turn faster or slower than normal, enabling different behaviors in the robot.

Tips and tricks

- There are three different 'follow a line' blocks in EdBlocks. For this activity, make sure students are selecting the time-controlled 'follow a line' block:

- Remind students they can change the time by clicking on the number and typing in their desired time, anything from 0.01 to 320. Time is in seconds.

- There are three speed blocks in EdBlocks, slow, normal and fast. The 'normal' block sets the drive motors to Edison's approximate default drive speed.
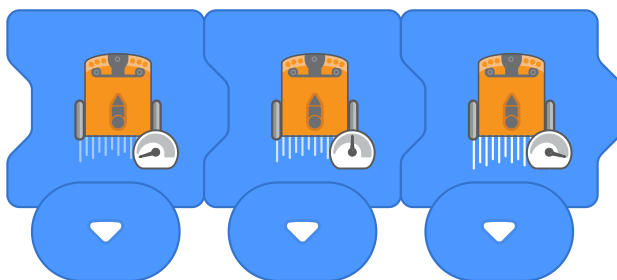
- Because Edison reads EdBlocks left to right, a speed block must be placed to the left of the drive blocks. A speed block will affect all drive blocks to the right of that speed block in the program until the speed is reset by another speed block or the program ends.

- Running the drive motors at a faster speed for prolonged periods can run down Edison's battery more rapidly.

Activity extensions

1. Find the other two 'follow a line' blocks in EdBlocks. Discuss what each block does and why each would be useful.

2. The block 'follow a line forever' has a different shape than the other two 'follow a line' blocks. Ask students why they think this is the case.

3. The block 'follow a line forever' uses the infinity symbol in its image. Explore the idea of infinity.

4. Have students make new programs with the other 'follow a line' blocks, then try their tracks again. Compare the different results.

Answer key

Please note: answers 2, 3 and 4 are example answers. Student results will depend on their experiences.

1.
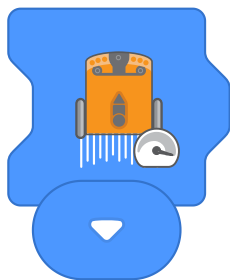
2. Example time: 6.5

3. Example track:
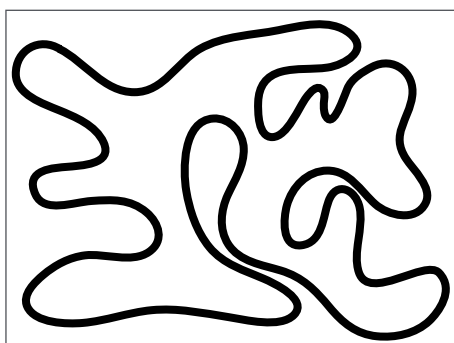
4. Example write up: The track lines were too close in some places. This made Edison go onto the wrong part of the track in these places. The track could be made better by having more space in between the track lines. Edison didn't finish the whole track. The program could have been improved by having a longer time.

Activity 14 - Let's stop at a black line

This activity introduces students to the 'wait until' group of blocks and experiment with Edison's tracking sensor.
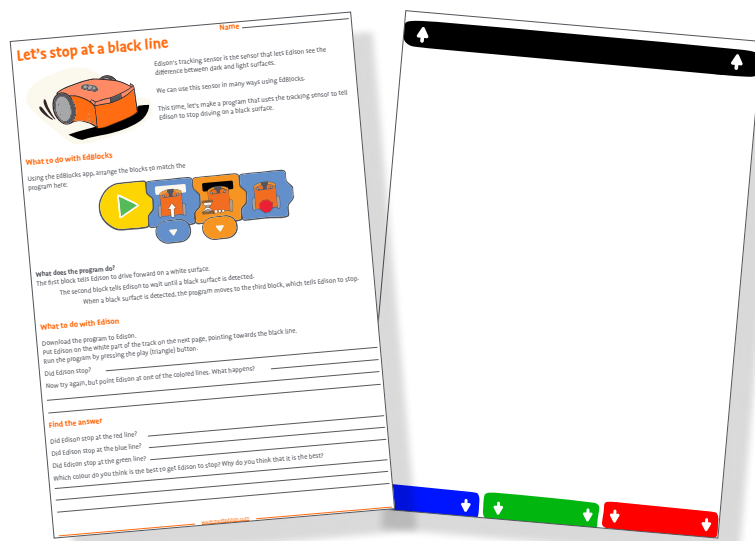
How it works

This activity uses Edison's built-in tracking sensor to allow students to program Edison with conditions. It also introduces the 'wait until' category of blocks, which can be used to make more complex programs where external inputs can influence Edison's program.

Tips and tricks

• This activity requires students to use a conditional drive block: the 'drive forward while on a white surface' block.
Remind students to use this block, not a time-controlled drive block:
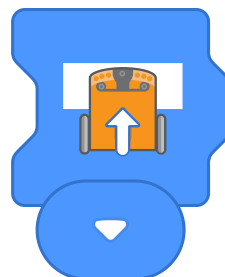
• Be sure to print the activity sheets are in full colour. Having low toner in your printer can make the coloured bars print in lighter shades, which may affect how Edison reads the bars.

Activity extensions

1. Explore the science behind Edison's line tracking sensor. Discuss how the blue and green coloured lines reflect only blue or green light, respectively. The red line only reflects red light. Because Edison's LED is red, all the red light shone onto this red line is reflected back to Edison. The blue and green lines reflect back no red light, so Edison detects these as non-reflective, same as the black line.

2. Hypothesise what other coloured surfaces will and will not reflect back the red LED light. Test and record the results. Present the result data as different types of charts and graphs.

Answer key

1. No

2. Yes

3. Yes

4. I think black is the best colour to use to get Edison to stop because it absorbs all colour light, so Edison will always stop.

Please note: answer 4 is an example answer. Student results will depend on their experiences.

Activity 15 - Let's make noise

In this activity, students explore more of the 'wait until' group of blocks and create programs which rely on user input.

How it works

This activity uses 'wait until' clap blocks to allow students to create a program using Edison's built-in sound sensor. Students will create a program that requires user input, in the form of hand claps, to progress.
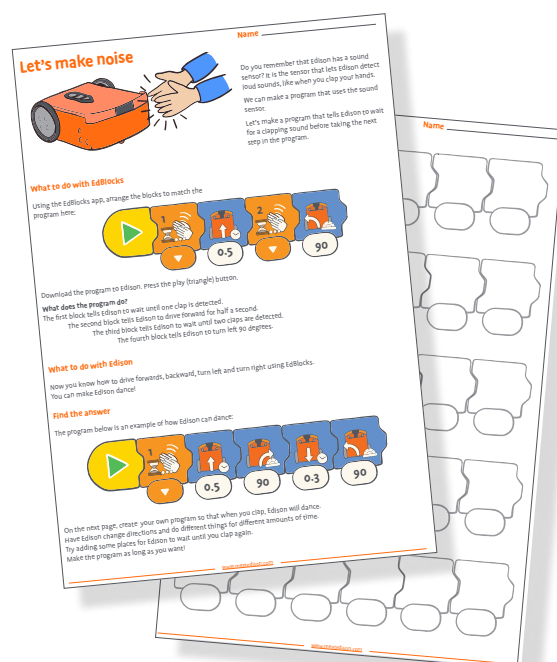
Tips and tricks

- It may help to review Edison's components, emphasising the location of Edison's sound sensor before students begin the activity.

- The robots may struggle to detect sounds when there is a high level of background noise. Having students tap a finger near the sound sensor on their Edison will create the same effect as clapping.

- Remind students that Edison reads EdBlocks one block at a time. Therefore, when a block tells Edison to 'wait until' a condition, Edison will wait until that condition is met before moving to the next block in the program.

Activity extensions

1. Introduce the idea of 'IF' statements. Pose the question 'if no clap is detected, what will Edison do?' Discuss how 'IF' statements could help in designing programs.

2. Play dominoes with Edison. Program multiple Edison robots with a program that has them drive forward once a clap is detected.

Dominoes example program and set-up example:
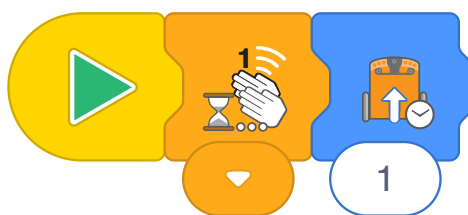
Queue up the Edison robots one behind the next with no more space between them than the Edison will cover during its 'drive forward' block. Tap on the first Edison and watch as it causes a domino effect when it bumps into the Edison in front of it. See example program and set-up images for examples.

Answer key

Please note: this program is an example answer. Student results will depend on their experiences.

Activity 16 - Let's use the lights

In this activity, students work with two new sets of blocks inside the EdBlocks app – lights and loops – and explore the time-controlled 'wait until' block.

How it works

This activity introduces students to the loops group of blocks in EdBlocks. Loops allow users to create iteration (or repetition) in their programs. In EdBlocks, any blocks inside a loop will repeat in left-to-right order for as long as the loop conditions are met.

This activity also introduces the time-controlled 'wait-until' block. This block allows the user to program Edison to wait until the specified amount of time has elapsed before continuing to the next block in the program.

In addition, this activity introduces Edison's LED lights. Students are introduced to the lights and learn how to control turning the lights on and off.

Tips and tricks

- There are several different 'loop' blocks in EdBlocks. For this activity, make sure students are selecting the infinite loop:

- You can put many EdBlocks into a single loop. The loop blocks will stretch to fit over several blocks already linked together when you drag the loop over an existing string of blocks. Alternatively, you can put down the loop block first and then drop blocks inside the loop block.

- The 'wait until' time block allows for user input to control the amount of time for which Edison will wait. Remind students they can change the time by clicking on the number and typing in their desired time, anything from 0.01 to 320. Time is in seconds.

- Unlike other blocks in EdBlocks, the LED lights operate in the background of the program. Once Edison's LED lights are turned on, they will stay on until they are turned off by the program, or the program ends.

- Edison's LEDs can be turned on and off individually or both together.

Activity extensions

1. Explore the other loop blocks in EdBlocks. Experiment making programs using the other loop blocks, testing how each allows external factors to influence the program.

2. EdBlocks allows loops to be stacked inside of each other. Try using stacked loops and the LED blocks to have Edison send out messages using Morse code. For example, if having both LEDs turn on represents a dash, and only one LED turn on represents a dot, then you can make a program that sends out an 'SOS' message:
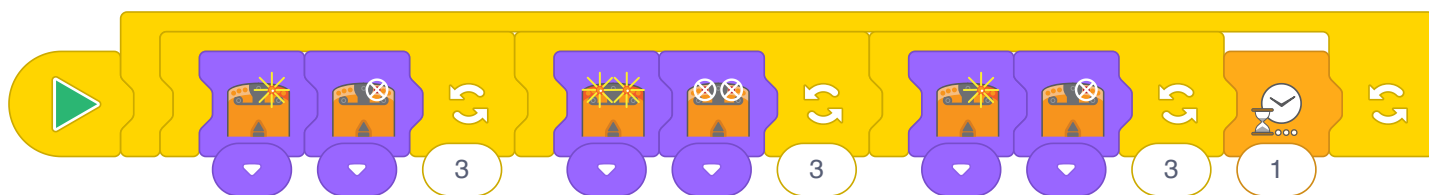
Learn more about Morse code as a class. Allow students to try sending out their own Morse code messages using lights and loops.

Answer key

1. The loop block allows a program to have blocks which repeat.

2. If there was no loop block in the lights program, the program would turn the lights on, wait for 1 second, then turn the lights off, wait for one second, then the program would end.

3.
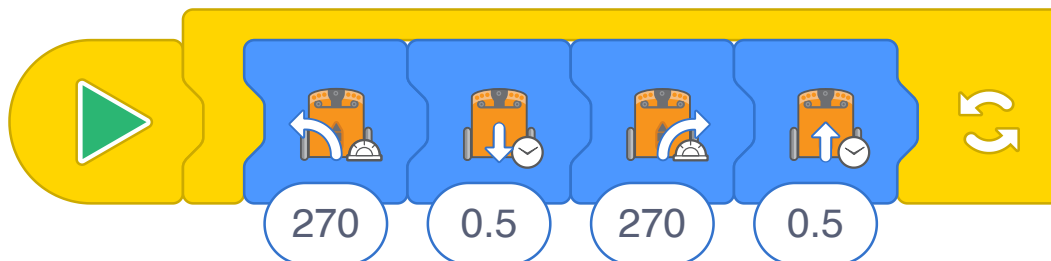
4. My program makes Edison spin left for 2.5 seconds, then drive backwards for .5 seconds, spin right for 2.5 seconds, then drive forwards for .5 seconds. When it loops for a while, it looks like Edison is doing a waddling dance.

Please note: answers 3 and 4 are example answers. Student results will depend on their experiences.

Activity 17 – Let's detect obstacles

In this activity, students learn more about how Edison's infrared light sensors work and program Edison to detect obstacles.

How it works

In this activity, students create a program which has Edison avoid driving into obstacles by using the robot's infrared (IR) light LEDs and IR sensor to detect objects directly in front of the robot. This activity further explores how the infrared light sensors work in Edison and gets students to test what obstacles can and cannot be detected.

Tips and tricks

- It may help to review Edison's components, emphasising the location of Edison's infrared light LEDs and sensor before students begin the activity.

- The obstacles need to be opaque but not too dark (e.g. not black) and at least as tall as Edison for the robot to detect them.

- This program will work best using the 'drive forward' block in EdBlocks. This block sets Edison's motors to 'forward' until a condition or another drive block tell the motors to do something else. Ensure students are using the correct block:
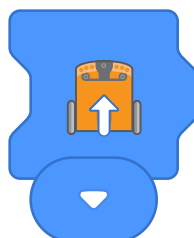
Activity extensions

1. Have students present their findings from the activity. Practice good presentation skills including planning out their presentation, having a visual and projecting their voice.

2. Create a master list of class results, having each student add their results to the main list. Share the class's results with other classes or schools using on line programs such a Google Classroom or a forum. Look at the similarities and differences between what different obstacles people tested. What does this tell us about what other schools have in their classrooms? What questions can we think of looking at other results? Practice engaging in good on line etiquette and safe on line sharing behaviors.

Answer key

Please note: this table is an example answer. Student results will depend on their experiences.

Object	Colour and Shape	Did Edison stop? Why or why not?
Water bottle	Clear, tall cylinder	No. The bottle is tall but does not reflect the infrared light.
Edison robot	Orange, short box	Yes, but only after the first Edison bumped into it. I think it is not quite tall enough.
Stapler	Dark yellow, long, medium-tall, sort of oval	Yes. The stapler was taller than Edison and must reflect enough light.
Textbook	Black with white stripes, large box-shaped	No. The book was taller than Edison, but the black colour absorbs the light.
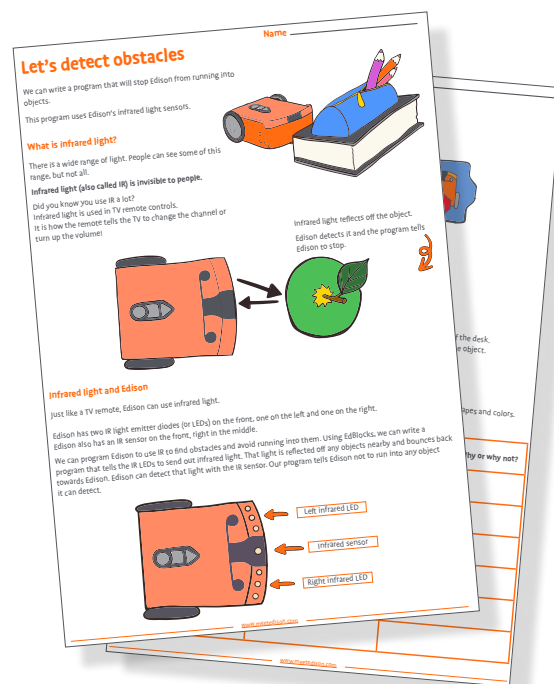
Activity 18 - Let's detect and avoid

In this activity, students explore more ways to create programs in EdBlocks which use Edison's infrared light sensors.
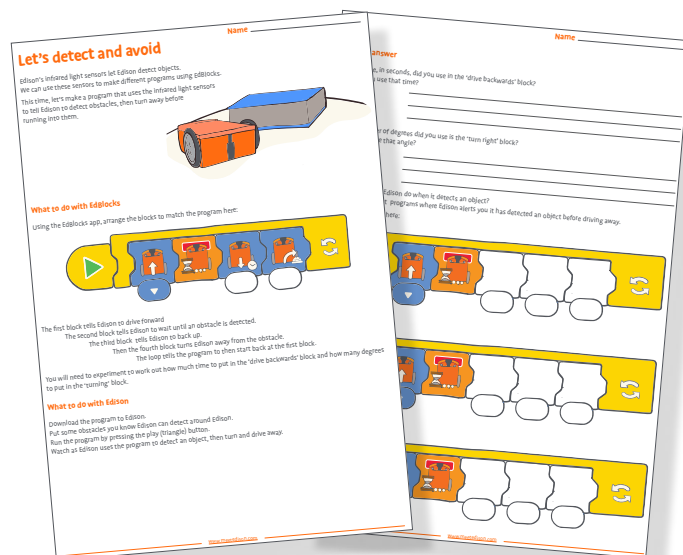
How it works

This activity reinforces students' understanding of Edison's obstacle detection abilities. In this activity, students create a program to have Edison avoid an obstacle once the robot detects the obstacle. The activity also challenges students to begin to use programming for creative problem-solving.

Tips and tricks

- It may help to review Edison's components, emphasising the location of Edison's infrared light LEDs and sensor before students begin the activity.

- The obstacles need to be opaque but not too dark (e.g. not black) and at least as tall as Edison for the robot to detect them.

- Encourage students to build on their prior learning by looking up which obstacles Edison was able to detect in activity 17.

Activity extensions

1. Discover more ways infrared light is used in the real world. Research different devices that use infrared light, how each uses IR and what benefit the devices have for people or the community.

2. Imagine different ways students might use Edison's IR sensors to create solutions for problems at school. For example, to act as hall monitor alarm systems if an obstacle (e.g. a person) is detected when there shouldn't be anyone.

Answer key

Please note: different Edison robots will travel at slightly different speeds, which may cause students to get slightly different results for answers 1 and 2. The explanations in answers 1 and 2 and all of answer 3 are example answers. Student results will depend on their experiences.

1. 0.3 seconds. This time was enough for Edison to back up away from the object and have enough space to turn.

2. 0.5 seconds. This was enough time for Edison to turn far enough away from the object to not run into it again.

3. A range of 90 degrees and above works best to avoid having to do too many turns.

Activity 19 – Let's stay in the borders

This activity has students use EdBlocks to create a new program utilising the Edison robot's reflected light sensor and challenges students to begin to consider how the concepts they are learning apply to real-world technology.

How it works

This activity uses the reflected light sensor to detect differences between dark and light surfaces beneath the robot. Students program Edison to stay within the borders of a dark line – same as the program they ran using a barcode in activity 6.

Tips and tricks

- It may help to review Edison's components, emphasising the location of Edison's reflected light sensor, located on the bottom of the robot.

- Remind students that Edison's line tracking programs rely on reading the difference between the amounts of light reflected off of the surface the robot is above. Check that the line they are using is a very dark colour, such as black, and approximately 1.5cm (0.6 inches) wide. Also, make sure the background is white or another very light (i.e. highly reflective) colour.

- Remind students that there are three speed blocks in EdBlocks, slow, normal and fast. The 'normal' block sets the drive motors to Edison's approximate default drive speed.

- Because Edison reads EdBlocks left to right, a speed block must be placed to the left of the drive blocks. A speed block will affect all drive blocks to the right of that speed block in the program until the speed is reset by another speed block or the program ends.

- Running the drive motors at a faster speed for prolonged periods can run down Edison's batteries more rapidly.

Activity extensions

1. Discuss how we can think of programming in terms of problems and solutions. Phrase the activity in this terminology. For example, 'the problem is we need to keep Edison from crossing a black line. How can we solve this problem?'

2. Examine how the 'problem' of keeping Edison from crossing a black line can be 'solved' in different ways using EdBlocks. Try creating different programs that all solve the same problem. See how many different solutions students can create. Discuss as a class the idea that all of the different solutions are valid so long as they all solve the problem.

Answer key

Please note: different Edison robots will travel at slightly different speeds, which may cause students to get slightly different results for answers 1 and 2. Answer 3 and 4 are example answers. Student results will depend on their experiences.

1. 0.3 seconds.

2. 180 degrees or 270 degrees, to add a little bit of randomness.

3. The normal speed block worked best. The slow speed block was boring to watch. The fast speed block would sometimes run over the edge of the black line before backing up.

4. I think it would be good for cars to have a program like this in real life. I think this because then you could have intersections change to be a colour the car would always see when the light is red. That way, cars would have to stop and couldn't go through intersections at a red light so that you would have fewer accidents.

Activity 20 - Let's make music

In this activity, students explore a new set of blocks inside the EdBlocks app, the music blocks, and create programs using Edison's sound capabilities.
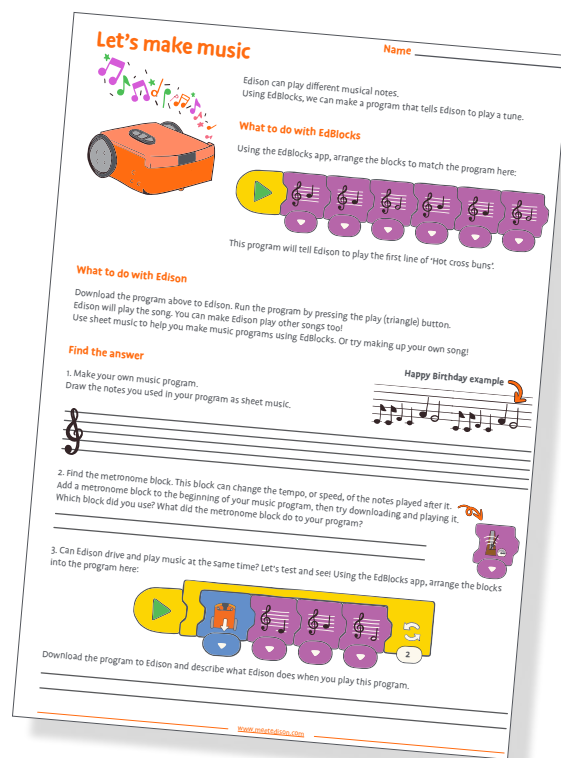
How it works

This activity uses Edison's buzzer.
This buzzer enables the robot to play a range of different musical notes and can also be used as a sound sensor to detect loud sounds, such as claps.

Tips and tricks

- Because Edison reads EdBlocks left to right, a metronome (tempo) block must be placed to the left of the music blocks. A metronome (tempo) block will affect all music blocks to the right of that tempo block in the program until the tempo is reset by another tempo block or the program ends.

- It may help to have some simple songs ready to use for students who aren't as familiar with music

Activity extensions

1. Play musical chairs with Edison. Have students create programs that will play music in a loop until the round button is pressed. See example program:
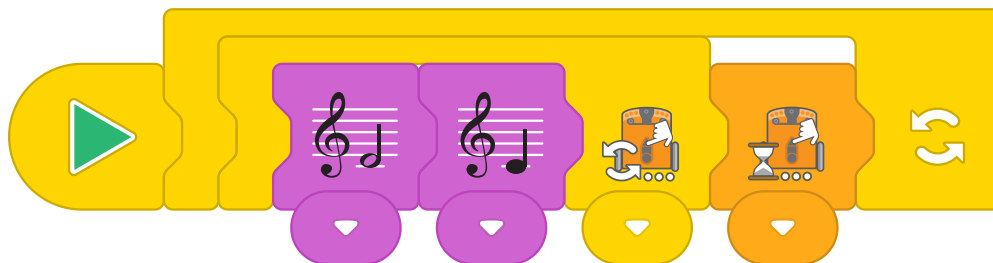
   Once a student presses the round button, the program will finish playing the notes, then wait until the triangle button is pressed again. Have students take turns being in charge of running their musical chairs program for a group.

2. Have students work together to have several Edison robots play a tune in a round. Use time-controlled 'wait until' blocks to program different Edisons to begin playing a tune (like Row, Row Your Boat) at different times. Experiment with time amounts in the 'wait until' blocks to get the Edison robots to play in time with one another.

Answer key

Please note: answers 1 and 2 are example answers. Student results will depend on their experiences. Guidance for what to look for with question 1 has been provided.

1. While the program can be whatever the student likes, you may want to see their program as well as their answer to confirm they have translated the notes from one format (the online program) to another (sheet music) correctly.

    Example:
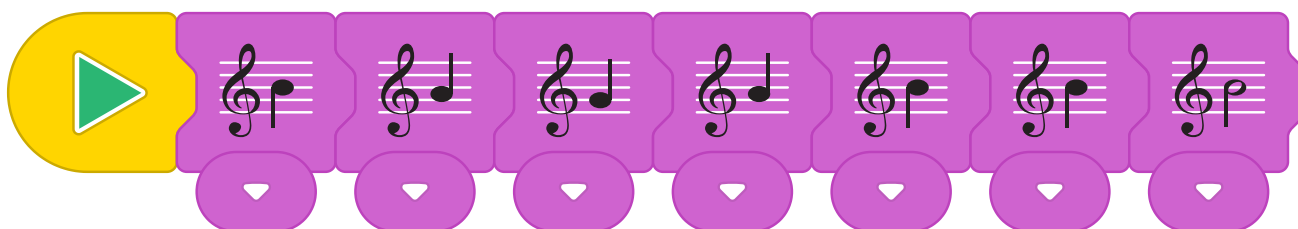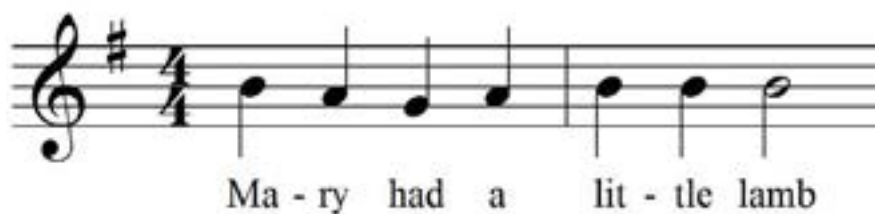
2. I used the 'fast' metronome block. It made Edison play the song faster, which sounded funny.

3. Edison drove backwards and played the notes at the same time. Edison played through the notes two times while driving backwards.

Activity 21 - Let's perform

In this activity, students begin to combine multiple types of blocks from EdBlocks to produce a creative program that employs Edison's light sensor.

How it works

This activity builds on the ability of the Edison robot's light sensors being able to detect differences in the levels of light between the robot's two sensors. By blocking out one sensor completely, students can trigger Edison to react when exposed to any light.

This programming task encourages the students to begin to combine different types of blocks together as well as tying their programs in EdBlocks back to the Edison robot's various sensors.
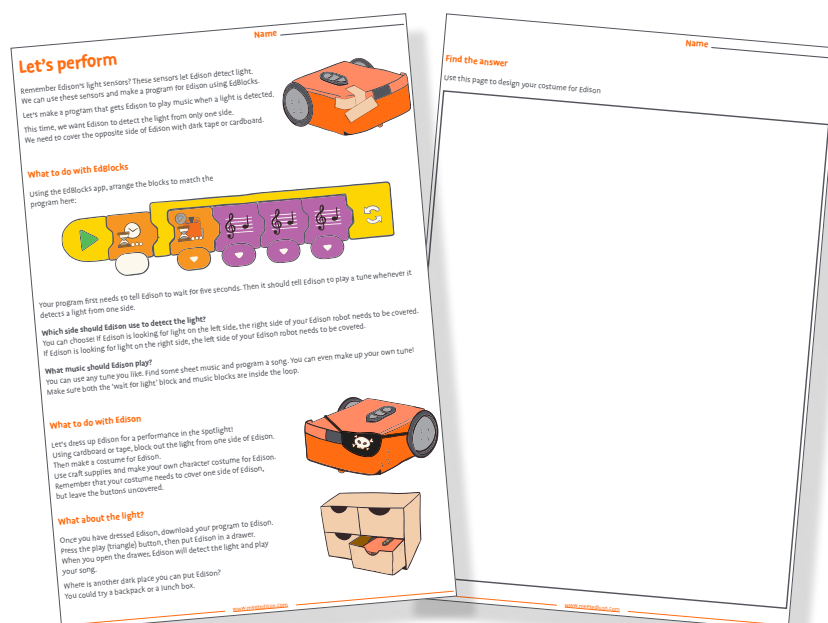
Tips and tricks

- It may help to review Edison's components, emphasizing the location of Edison's two light sensors.

- Edison's light detecting programs rely on reading the difference between the light input to the two sensors. In this activity, one of the two light sensors must be covered completely.

- Ensure students are selecting the light detection block in their program, compared to their Edison. If the right light detector is covered, their program needs to have the 'detect left light' block and vice versa.

- With only one light sensor exposed, any light will trigger the program. Including the time-controlled 'wait until' block enables Edison to be placed somewhere dark. If a student is struggling with having the music start too soon, increase the time in the 'wait until' block.

Activity extensions

1. Use this activity as a starting point to explore performance and theatre. Research different types of theatrical performances that include music, such as musical theatre and opera. Compare and contrast the similarities of this activity to the different types of theatre. Present the results in formats such as Venn diagrams.

2. Review the different costumes different students made. Explore the different materials students used and how they attached costumes to Edison. Discuss which costumes worked best in the experiment and what made them the most suitably designed solutions.

Answer key

Please note: Student results will depend on their experiences. The activity includes instructions to leave the buttons exposed and only cover one side – these criteria can be used to ensure students followed directions for marking if desired.

Activity 22 - Let's avoid the light

In this activity, students continue to explore how to use EdBlocks to create programs which harness the power of Edison's various sensors, connecting programming and robotics together.

How it works

This activity uses the Edison robot's light sensors ability to detect differences in the levels of light between the robot's two sensors to affect how Edison behaves. In this activity, the program tells Edison to avoid light from both sensors, which enables user input to control the robot's behaviour.

Tips and tricks

- It may help to review Edison's components, emphasising the location of Edison's two light sensors.

- Remind students that Edison's light detecting programs rely on reading the difference between the light input to the two sensors. If students are struggling with this program, remind them to point the light at only one of the two sensors, not straight at the front of Edison.

Activity extensions

1. Revisit the concept of animal behaviours in robotics, including the topic of 'phototropism' (the orientation of a plant or other organism in response to light). This activity is an example of the Edison robot mimicking negative phototropism (moving away from the light). Explore biological examples of negative phototropism, such as plant roots growing away from the light.

2. Encourage students to begin to think creatively about programming. Challenge them to write a program with EdBlocks which would help them win the cockroach game. For example, a student might write a program that combines the 'stay in borders' program from activity 19 and the 'avoid light' program from this activity to help their robot stay in the circle.

Answer key

Please note: answers are example answers. Student results will depend on their experiences. Guidance for what to look for with question 3 has been provided.

1. Charlotte.

2. Charlotte's program used the fast speed block.

3. Some insects, like cockroaches, run away from the light. In the game, all the Edison robots avoided the light. They behaved like cockroaches. That's why I think it is called 'the cockroach game.'

Activity 23 - Let's have a dance party

In this capstone activity, students learn to use start events and messaging, then create their own program using a range of block types.
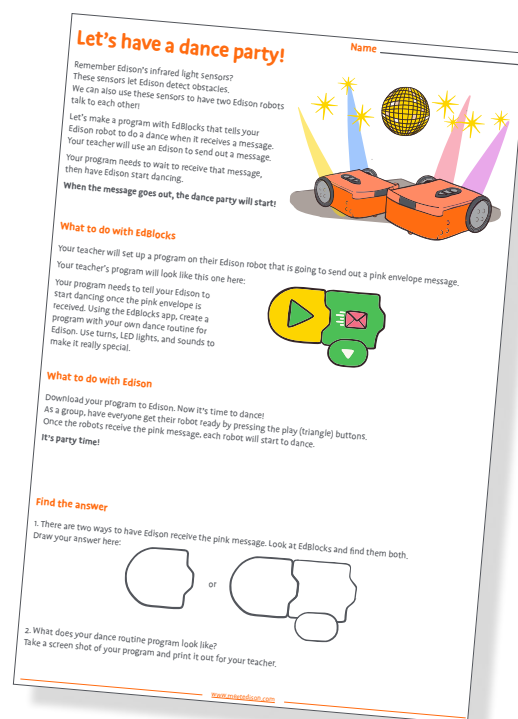
How it works

This activity introduces two of the most complicated block types in EdBlocks: messaging and start events. Because these types of blocks can be a challenge, this activity uses you as the teacher to participate, helping to simplify the student's initial exposure.

You will need to program one Edison to be the leader, sending out the pink message. The students will need their programs to react upon receiving that message, triggering their Edison robot's to 'dance.'

## Additional information: how messages and start events work

Messages: Edison robots can send and receive infrared messages to one another. In EdBlocks, the coloured envelopes are the blocks used for this messaging function. To use the messages, you need at least two Edison robots, and you will need to write a separate program for each robot. One robot will need to send one of the coloured messages out as a part of its program. The second robot will need to have a program that contains either a 'wait until' or 'start event' message block of the same colour. When the first robot's program progress to the 'send message' block, it will send out an infrared message. This will trigger the second robot to begin or continue its program from the message block in the second robot's program.

Start events: The 'start events' blocks allow a user to make a sub-program begin from a specific event while the main program is running. These blocks emulate the computer programming concept of 'interrupts.' Start events allow users to vertically layer programs, with secondary programs interrupting the main program when the start event is triggered.

To use a start event, simply add it to the working space in the EdBlocks app and drag and drop program blocks after it, as you would the normal start block. When you download your program to Edison, both the main program and the subprogram beginning with the new start event will download. When the play (triangle) button on Edison is pushed, Edison will run the main program. If the condition of the start event occurs, Edison will run the start event sub-program to completion, then return to the main program and continue the main program. This will happen whenever the conditions of the start event are met. If no blocks are attached to the main program, Edison will wait until the condition of the start event is met, then run the start event sub-program.

Tips and tricks

- This activity requires that one Edison robot be the 'leader' and send out the pink message:
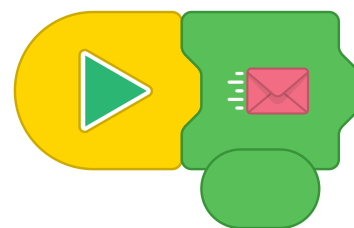
- Make sure that students' 'dance routine' programs start only once the pink message is received. To do this, students need to start their dance either after a 'wait until' pink message block or after the pink message start event:

- Edison's messaging uses infrared, which has a limited range, similar to a TV remote control. If any robots are not detecting the pink message, they may be too far away from the lead robot.

- In EdBlocks, messaging is restricted to the six pre-set channels depicted by the six coloured envelopes. Robots must use the same coloured envelope to send and receive. For example, if robot A sends the blue message but robot B has 'wait until green message' in its program, the message sent by robot A will not trigger robot B to continue its program.

- Explain to students what the message block is doing. In this activity, when the leader robot sends the pink message, that is the equivalent of that robot saying 'start!' to all the other robots. The other robots then know to move to the next block in their programs. Explain that the lead robot is not telling the other robots how to dance, only that they should move from their 'wait until' block to their dance blocks.

- Remind students that because Edison reads EdBlocks left to right, Edison will wait until a message block is received before continuing on to any blocks placed to the right of the 'wait until' message block.

Activity extensions

1. Explore the other start blocks. Try creating programs which use the different start blocks.

2. Try creating a program using the main start block and a subprogram using a start block. Experiment with how Edison switches from the main program to the subprogram when the start condition is triggered.

Answer key

Please note: answer 2 is an example answer. Student results will depend on their experiences.
A note on question 2: having students capture their programs with a screenshot tool is a good chance to practice additional computer programs and peripheral devices, including the printer.

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