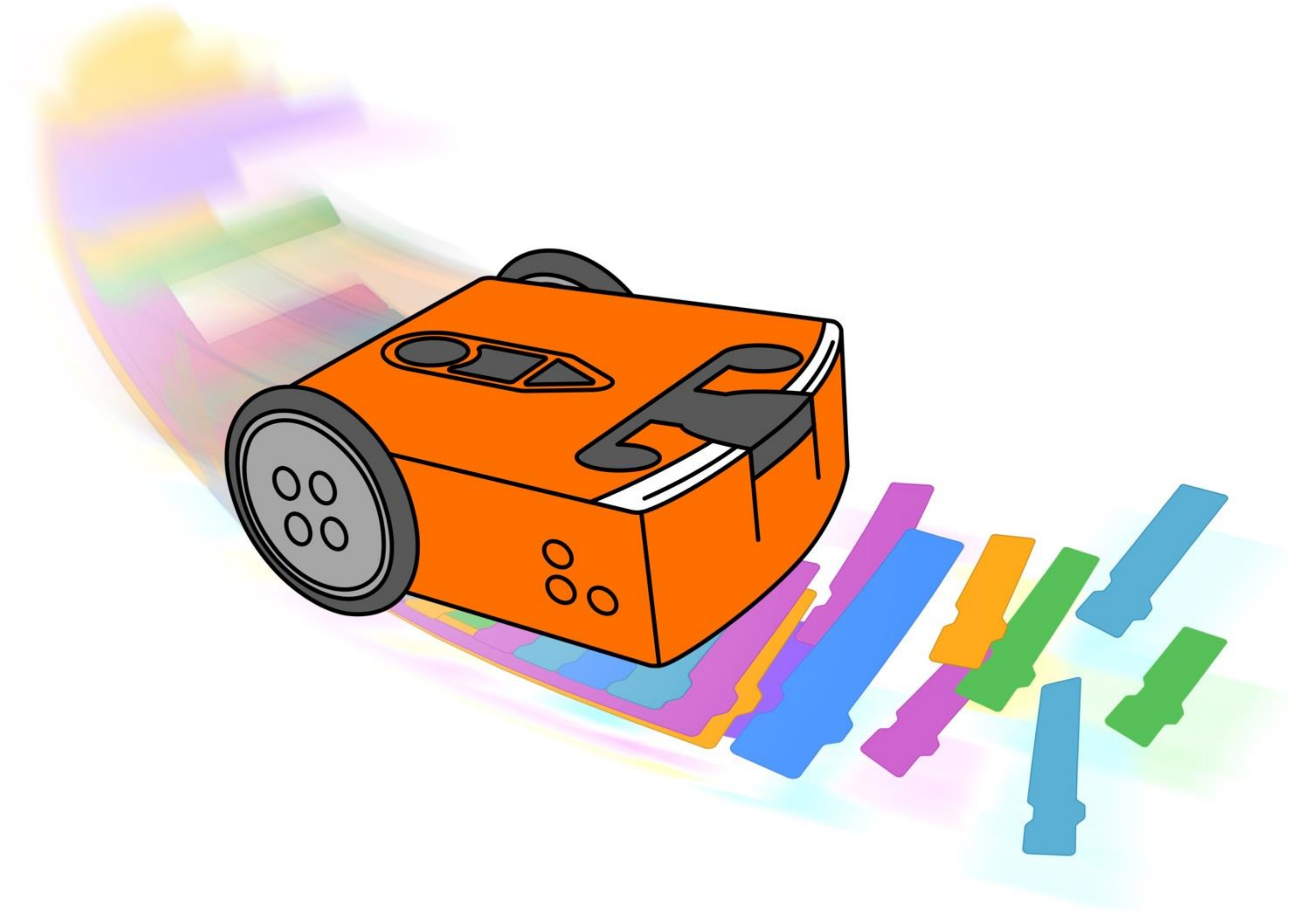
EdScratch lesson activities

Student worksheets and activity sheets



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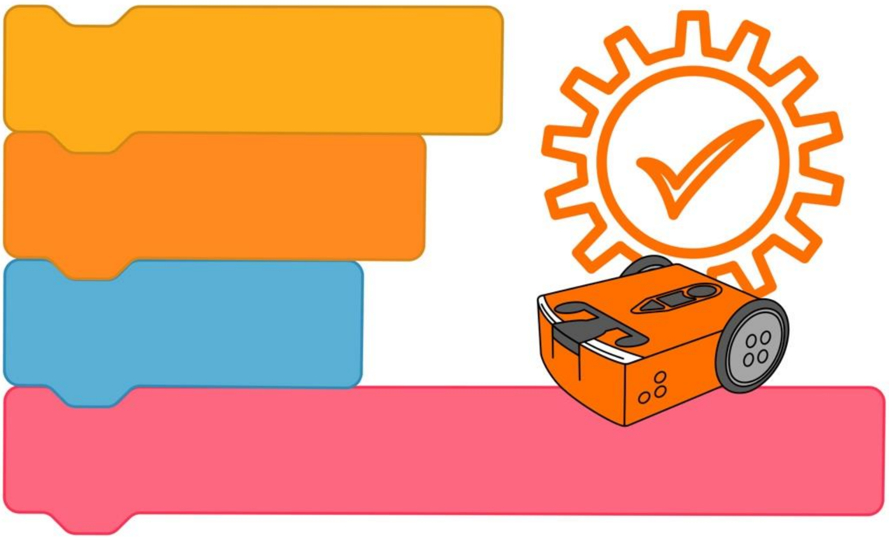
Unit 6: Inventor's time!



Edison

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U6-1.1 Let's explore the design-build-test cycle

One of the best things about learning computer science is that it isn't just about writing programs. You can use computer science to create all sorts of things, including different inventions using your Edison robots.

By now you know how Edison robots work and different things you can get Edison to do by programming the robot in EdScratch. That means you have the skills to be an inventor using Edison and EdScratch to make and program all sorts of creations.

What could you create? How could you build it? What would the computer program you need to run your creation look like?

Inventing something with Edison and EdScratch is a big task, but you can make it a lot more manageable by **decomposing** it into smaller pieces and doing each thing one at a time.

Jargon buster

In computer science, **decomposition** is the process of breaking a complex problem or system into parts that are easier to understand, manage and solve. Breaking a large problem into smaller, more doable tasks makes it easier to determine exactly what needs to happen and in what order each task needs to be done.

Breaking any major job up into smaller parts is one of the best ways of approaching it. If you get stuck or feel overwhelmed when tackling a project, take a minute to think about how you can use decomposition to break it down into smaller tasks.

When it comes to creating your own inventions with Edison, you can also use **iterative testing** through something called the **design-build-test cycle** to help you.

Jargon buster

The **design-build-test cycle**, which is also sometimes called the design-build-test-learn cycle, is a process where you design something, build it and then test it out to see what works and what needs to be improved. You then take what you learn from the test and apply that back to the design. Because it is a cycle, you keep repeating each step, applying what you learn to make the next cycle better, until you are happy with the outcome.

Making and testing many versions of something, applying what you learn and making changes each time, is known as **iterating** or **iterative testing** and is a common practice when developing new things in computer science. Technology companies use the design-build-test cycle and iterative testing all the time when they are coming up with new products.

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It's pretty unlikely that your first design will work perfectly. That's okay! By using iterative testing and working through the design-build-test cycle, you can keep refining your idea, applying what you learn and making improvements.

Remember that a major part of computer science is using computational thinking and a major part of computational thinking is problem-solving!

Don't forget

Computational thinking means thinking about a problem or task in a similar way to how a computer thinks. It is a way of logically working through problems, decomposing them into smaller pieces, finding patterns, and then using the information to come up with a step-by-step solution.

In other words, computational thinking is a way of planning, problem-solving and analysing information the same way a computer does.

Another big part of computer science is being creative and trying new things. You never know what you might be able to create until you try!

Task 1: Brainstorm

Before you can get started designing, building and testing something, you need to come up with some ideas. Coming up with ideas is all about being imaginative, using your creativity and thinking about possibilities.

Brainstorming is one way to kick-start your thinking to generate ideas. When you brainstorm, you are trying to get thoughts to flow freely. All ideas are acceptable, no matter what they are. Don't make decisions about whether the ideas are possible or judge the ideas while you are brainstorming.

Let's try brainstorming some Edison inventions. Using activity sheet U6-1, you need to come up with six different ideas of something you could create and program using Edison robots. You will only have 45 seconds for each idea before you need to move on to your next idea.

Capture your ideas however you like. You can draw something, write down the idea in words, or do a bit of both! You are not allowed to NOT come up with ideas, however. Remember, there are no 'bad' ideas during a brainstorming session!

Set a timer for 45 seconds and get started on your first idea. As soon as the timer goes off, reset it and move on to the next idea until you have all six ideas done.

After you finish brainstorming, analyse the ideas you came up with. Looking at all your ideas together, you may decide that some of your ideas are better than others. You can then choose one of these ideas to use and move on to designing your creation.

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Task 2: Design

Once you have at least one idea you think might work, you can start planning and designing. You will need to decompose your idea into smaller parts, design each part, and plan how to tackle each one. At a minimum, you should break your idea into two parts: the physical design using Edison and the program design.

There are lots of different tools you can use to help you design and plan. You can draw out sketches or diagrams, you can create a storyboard, or you can write up an overview. When you design your program, you will probably also want to use pseudocode to help you plan how the program will function. You can always use a mix of approaches too – whatever works best for you!

Using one of your ideas, work out a design for both the physical creation and the program.

Here are some of the things you should think about when designing:

- What will your creation do?
- What will your creation look like?
- What materials could you use to build your creation? How will you attach these to Edison?
- How will the program control Edison to make your creation work?

Remember, this design is just your first one. There's still a lot of learning to do! Your design might not be able to predict everything, and you might have some things you aren't sure about. If you have any questions about how parts of your creation or program can work, make a special note of these questions. These are the types of things you will want to pay close attention to when you build and test.

1. Give your project a name and write a brief description of your idea.

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2. What are the different parts you have decomposed your project into to help you design it? Remember, you should have at least two parts: the physical creation using Edison and the program design.

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3. Work out the design of your physical creation. Use extra space if you need.

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4. Design your EdScratch program for your creation. Use extra space if you need.

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Optional: What have you not been able to work out in your design? What questions do you need to pay extra attention to when you build and test? Note them in this space.

Mini challenge!

Is your idea possible? Can it be built? Can it be programmed? The only way to know is to try!

Try turning your idea into a reality by using your design as a guide to help you build and program your creation. Test your invention to see what works and what doesn't. Take what you learn from your test and apply it back into your design. Keep repeating the cycle, applying what you learn to make improvements to each iteration.

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U6-1.1a Challenge up: Invent an imaginary creature

Does it live under the bed and eat dirty socks? Is it mean and scary, or shy but nice? Does it have 23 legs and a lovely singing voice? Does it dart around or move like a snail?

In this challenge, it's all up to you!

What to do

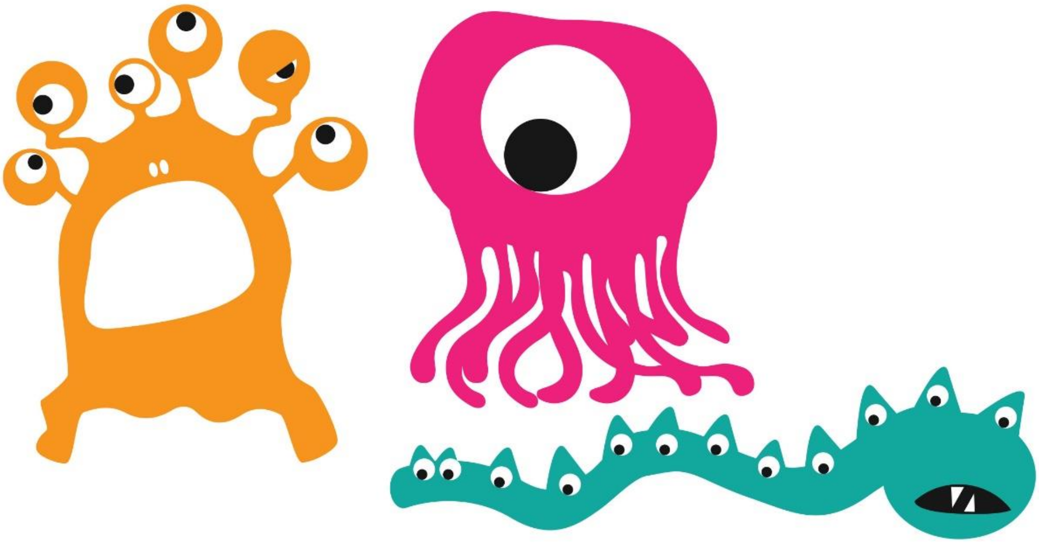
For this challenge, you need to use the design-build-test cycle to create and program an imaginary creature using your Edison robot and EdScratch. What your creature looks like and how it works is up to you, but your creature needs to be able to do the following things:

- □ move using Edison's motor outputs
- □ use at least one of Edison's sensors to trigger some sort of behaviour from your creature in response to something in its environment

Spend some time brainstorming different ideas. Once you have at least one idea you think might work, move on to designing. Decompose your idea into smaller parts, design each part and plan how to tackle each one. At a minimum, you should break your idea into two parts: the physical design using Edison and the EdScratch program design.

Work out a design for both the physical creation and the program. Build your creature and write your creature's EdScratch program. Test your invention to see what works and what needs improvement.

Apply what you learned from your test back to your design, create the next iteration of your build, and test again. Keep repeating the design-build-test cycle until you get your creature working just like you want.



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U6-1.1b Challenge up: Invent a cotton ball launcher

Grab a bag of cotton balls, then get ready, aim, and FIRE! It's time to build a cotton ball launcher. Will your cotton balls shoot straight up like rockets? Will you be able to hit a bullseye? Or will your cotton balls fly down the hallway?

In this challenge, it's all up to you!

What to do

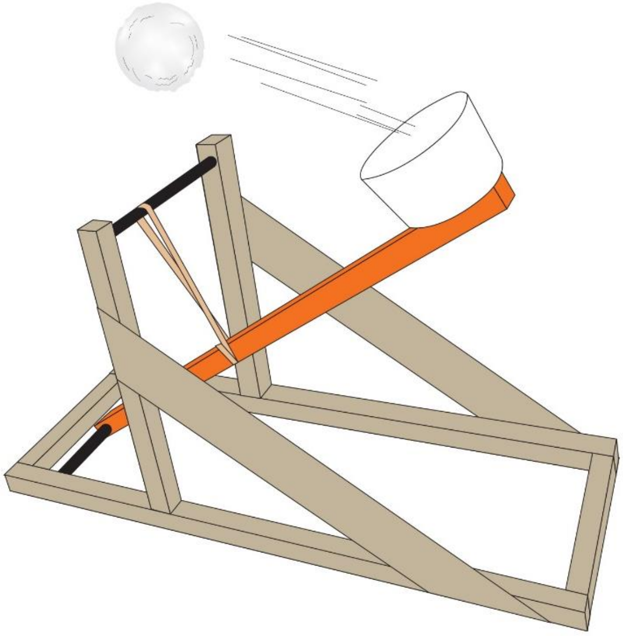
For this challenge, you need to use the design-build-test cycle to create and program a cotton ball launcher using your Edison robot and EdScratch. What your launcher looks like and how it works is up to you, but your launcher needs to be able to do at least one of the following things:

- □ throw a cotton ball as high as possible, or
- □ throw a cotton ball as far as possible, or
- □ throw a cotton ball as accurately as possible

Spend some time brainstorming different ideas. Once you have at least one idea you think might work, move on to designing. Decompose your idea into smaller parts, design each part and plan how to tackle each one. At a minimum, you should break your idea into two parts: the physical design using Edison and the EdScratch program design.

Work out a design for both the physical creation and the program. Build your launcher and write your EdScratch program. Test your invention to see what works and what needs improvement.

Apply what you learned from your test back to your design, create the next iteration of your build, and test again. Keep repeating the design-build-test cycle until you get your launcher working just like you want.



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U6-1.1c Challenge up: Invent a burglar alarm

You have been entrusted with a valuable treasure to protect. But there are sneaky thieves out to get it! How will you keep the treasure safe and sound?

In this challenge, it's up to you!

What to do

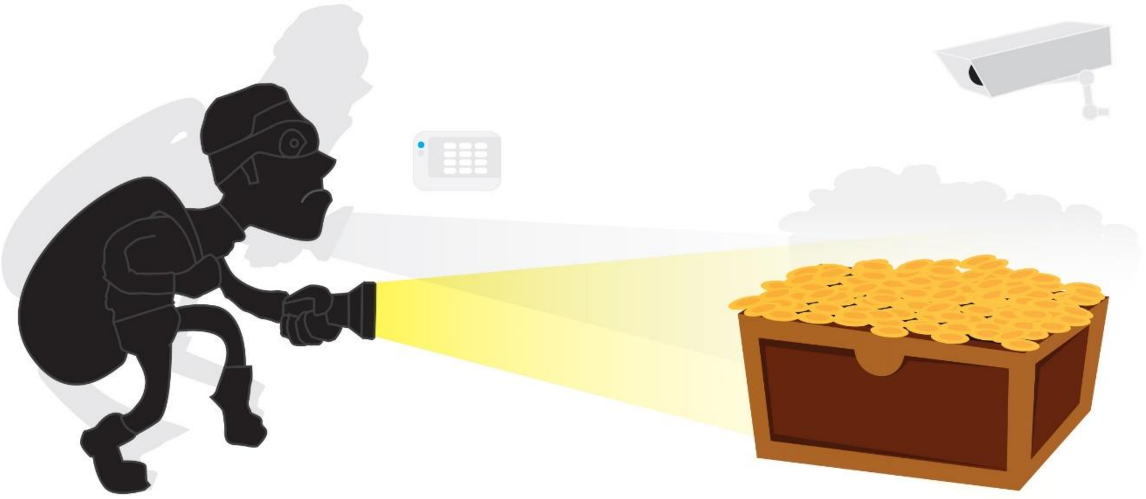
For this challenge, you need to use the design-build-test cycle to create and program a burglar alarm using your Edison robot and EdScratch. What your invention looks like and how it works is up to you, but your burglar alarm needs to be able to do the following things:

□ use at least one of Edison's sensors to trigger the alarm
□ do something to scare the intruder away

Spend some time brainstorming different ideas. Once you have at least one idea you think might work, move on to designing. Decompose your idea into smaller parts, design each part and plan how to tackle each one. At a minimum, you should break your idea into two parts: the physical design using Edison and the EdScratch program design.

Work out a design for both the physical creation and the program. Build your burglar alarm and write your EdScratch program. Test your invention to see what works and what needs improvement.

Apply what you learned from your test back to your design, create the next iteration of your build, and test again. Keep repeating the design-build-test cycle until you get your burglar alarm working just like you want.



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U6-1.1d Challenge up: Invent a mousetrap

Break out the cheese! Or do mice prefer peanut butter? Whatever you want to use as bait, it's time to get prepared to catch a mouse! What will set off the trap? How will you know if you have caught a mouse?

In this challenge, it's up to you!

What to do

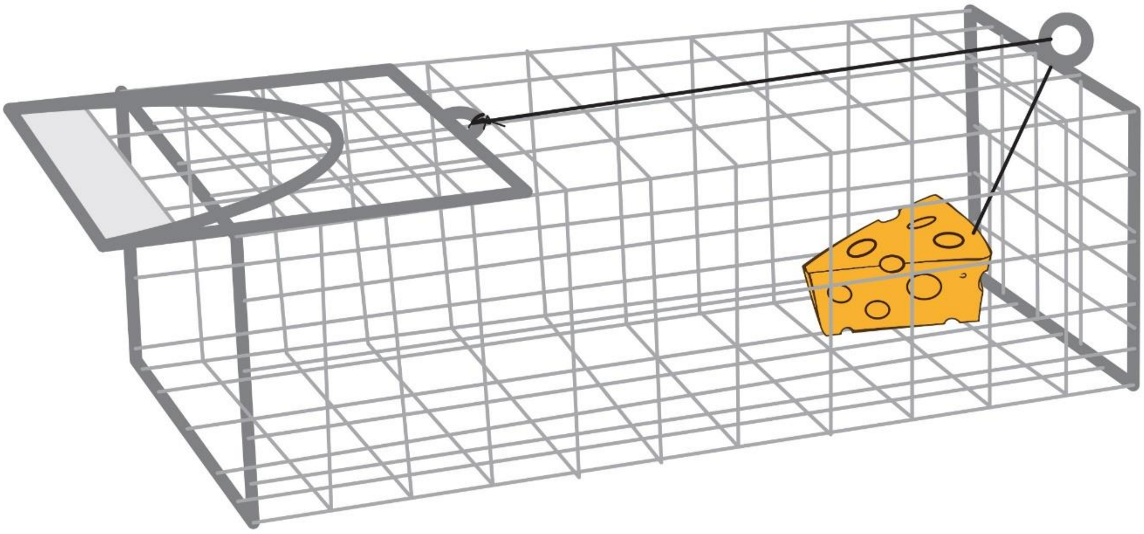
For this challenge, you need to use the design-build-test cycle to create and program a mousetrap using your Edison robot and EdScratch. What your invention looks like and how it works is up to you, but your mousetrap needs to be able to do the following things:

- □ use at least one of Edison's sensors to trigger the trap
- □ do something to alert you that the trap has been sprung

Spend some time brainstorming different ideas. Once you have at least one idea you think might work, move on to designing. Decompose your idea into smaller parts, design each part and plan how to tackle each one. At a minimum, you should break your idea into two parts: the physical design using Edison and the EdScratch program design.

Work out a design for both the physical creation and the program. Build your mousetrap and write your EdScratch program. Test your invention to see what works and what needs improvement.

Apply what you learned from your test back to your design, create the next iteration of your build, and test again. Keep repeating the design-build-test cycle until you get your trap working just like you want.



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U6-1.1e Challenge up: Invent a combination safe

Where do you keep your most valuable possessions? Why not put your belongings in a combination safe with a robotic lock! What will your safe look like? How will you enter the code to get into the safe? What will the code be?

In this challenge, it's all up to you!

What to do

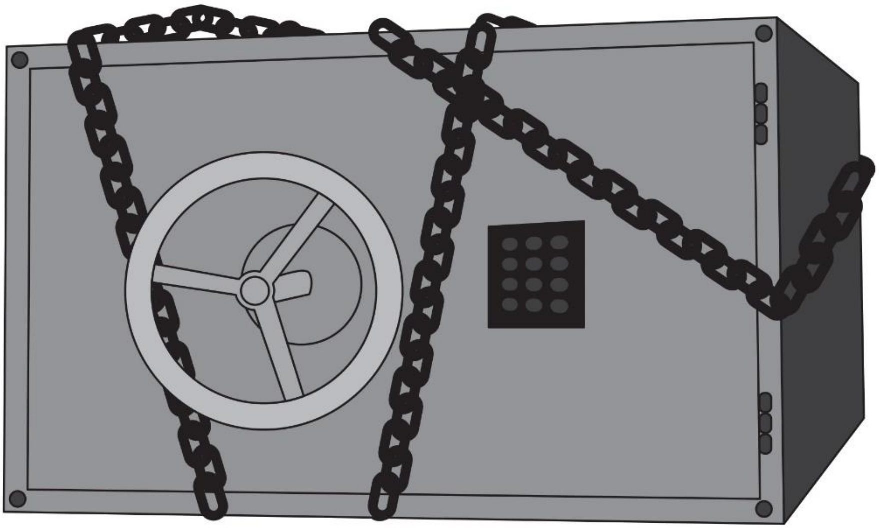
For this challenge, you need to use the design-build-test cycle to create and program a combination safe that uses your Edison robot as a lock. What your invention looks like and how it works is up to you, but your lock needs to open your safe only when the right combination is entered. Your lock should do one of the following things:

- □ only open for the right sequence of round button and triangle button presses, or
- □ only open for the right sequence of TV or DVD remote control button presses, or
- □ only open for the right sequence of IR messages from another Edison robot, or
- □ only open for the right combination of a mix of button presses, remote-control signals or IR messages

Spend some time brainstorming different ideas. Once you have at least one idea you think might work, move on to designing. Decompose your idea into smaller parts, design each part and plan how to tackle each one. At a minimum, you should break your idea into two parts: the physical design using Edison and the EdScratch program design.

Work out a design for both the physical creation and the program. Build your combination safe and write your EdScratch program. Test your invention to see what works and what needs improvement.

Apply what you learned from your test back to your design, create the next iteration of your build, and test again. Keep repeating the design-build-test cycle until you get your combination safe working just like you want.



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U6-1.2 Let's explore a haunted house

All of Edison's different sensors and outputs mean that there are lots of things you can do with Edison robots. Using EdScratch, you can program Edison to drive, play musical sounds, detect obstacles, follow black lines and much, much more.

You can also turn Edison into other things, building inventions with the robot and using Edison's sensors and outputs in different ways. You have seen, for example, how you can use the blocks in the Drive category in EdScratch not to drive Edison around, but instead to power creations using Edison's motors. Likewise, you can use Edison's various sensors to do things in unexpected ways.

In this project, you are going to work together, using everything you have learned about Edison and EdScratch to turn your robots into monster hunters. You will use your monster-hunting robots to help you detect and trap different ghouls in a haunted house.

About the haunted house

There are different types of monsters living in the haunted house. Luckily, each type of monster only hangs out in one room. Your job is to design, create, and program inventions using Edison to detect and trap all the different monsters, one room at a time.

One room in the haunted house has ghosts in it. These white ghosts hang out on a black floor. You will need to program an Edison robot to drive around the room with the ghosts and locate each one so that you can come in and remove each ghost.

There are two other rooms in the haunted house as well. What monsters are in each of these rooms? How will Edison help you detect, and even trap, these other creatures? That part is up to you!

Task 1: Detect the ghosts

Your haunted house has a room with ghosts in it. Your job is to clear this room of all the ghosts using an Edison robot to help you.

There are two major parts to this first task. One, you need to create a test space to represent the room and ghosts. Two, you need to program Edison to locate all the ghosts, alerting you each time a ghost is found, so you can come in and remove it.

The test space

You need to make a test space to represent the room and the ghosts. Your room needs walls and a black floor. You will need something to represent the ghosts as well, such as white masking tape. You need to have at least three ghosts in your room.

The program

Usually, we use Edison's line tracking sensor to detect black (non-reflective) on a white (reflective) background. This time you need to do just the opposite: find white 'ghosts' on a black surface.

You need to write a program so that Edison will drive around the test space. If Edison detects a ghost, the robot should stop moving, 'trapping' the ghost below it. Edison then needs to do something, like play a tune, to let you know that the robot has detected a ghost. This will be your

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cue to come in and remove that ghost from the room. Edison should wait until you have gotten the ghost it found out of the room, then go back to driving. Once Edison has detected all of the ghosts, the robot should signal to you that all the ghosts are gone, and the program should end.

Hint!

Edison's line tracking sensor works in a special way. Remember that the line tracker measures the amount of reflected light it detects from underneath the robot and stores that measurement as a value. The more light that is detected, the higher the value. Readings with high values are seen as 'reflective' to the robot.

When the line tracker first comes on, the sensor takes a reading of the reflected light coming from the surface below the robot. The robot uses this initial value to determine what is 'reflective'. In other words, the robot sets the first value the line tracker generates as the value of 'reflective' and uses this to determine if a new value is 'reflective' or 'non-reflective'. This is why you always start a program using the line detector on a white surface.

In your ghost hunter program, you also need to start your program on a white surface. Put Edison on a piece of white paper before you run your program, so that when you first start your program the robot can set the 'reflective' value. Your program should then have Edison wait until you do something, like press one of Edison's buttons, to move on to the rest of the program and start looking for ghosts. You will be able to use this time to move Edison from the white paper to the black surface of your test area.

Design your ghost hunting program, write it in EdScratch, then test it out using your Edison robot in your 'ghost room' test space. Note what works in your program and what needs to be improved. Apply your learnings to your program design, write your changes in EdScratch and test again. Keep iterating until you get Edison to run the program, successfully detecting all the ghosts.

Task 2: Create your other haunted house rooms

Your haunted house needs two other rooms with a different type of monster in each one. For each other room, you need to decide what type of monster is in that room, then create a test space to represent the room and the monsters. You also need to use the design-build-test cycle to create and program a way to detect and trap all the monsters in each room using at least one Edison robot and EdScratch.

Spend some time brainstorming different ideas about what monsters you want to use and how you will detect and trap them. Once you have at least one idea you think might work, move on to designing. Decompose your idea into smaller sections, design each part, and plan how to tackle each one. At a minimum, you should break your idea into three parts for each room: the test space, the physical creation using Edison robots, and the EdScratch program design.

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Room 1

Answer the questions and use this space to design the room, the monsters, and your trap. Once you have your design for each part, build your room, the monsters, and your monster hunting invention. Program your invention in EdScratch then test your creation in your room to see what works and what needs improvement.

Apply what you learned from your test back to your design, create the next iteration of your build and test again. Keep repeating the design-build-test cycle until you are able to detect and trap all the monsters.

1. What monsters are in this room? How many are there? Write a brief description of what is in the room and how you plan on detecting and trapping the monsters.

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2. What are the different parts you have decomposed your project down into to help you design it? Remember, you should have at least three parts: the test space, the physical monster hunter (to detect and trap the monsters) using Edison, and the program design.

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3. Design your room (test space). Use extra space if you need.

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4. Design your monster hunter (Edison creation). Use extra space if you need.

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5. Design your EdScratch program for your creation. Use extra space if you need.

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Room 2

Answer the questions and use this space to design the room, the monsters, and your trap. Once you have your design for each part, build your room, the monsters, and your monster hunting invention. Program your invention in EdScratch, then test your creation in your room to see what works and what needs improvement.

Apply what you learned from your test back to your design, create the next iteration of your build, and test again. Keep repeating the design-build-test cycle until you are able to detect and trap all the monsters.

6. What monsters are in this room? How many are there? Write a brief description of what is in the room and how you plan on detecting and trapping the monsters.

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7. What are the different parts you have decomposed your project down into to help you design it? Remember, you should have at least three parts: the test space, the physical monster hunter (to detect and trap the monsters) using Edison, and the program design.

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8. Design your room (test space). Use extra space if you need.

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9. Design your monster hunter (Edison creation). Use extra space if you need.

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10. Design your EdScratch program for your creation. Use extra space if you need.

Activity sheet U6-1: Six ideas

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