Edison the designer

All around us there are patterns. Some are a little bit irregular, like a zebra's stripes or the spiral of a pinecone. Other patterns are far more perfect, like the repeating designs on wallpaper or fabric in fashion. The more you look, the more you can see patterns everywhere. Including in computer programs!

Can you program Edison to drive in designer patterns?

To program Edison to make repeating patterns, there are a few things we need to learn:

- ☐ Part 1: What is a loop?
- ☐ Part 2: What are nested loops?
- ☐ Part 3: How do you program a pattern inside a pattern?

Is this your first time using Edison robots or EdScratch? Start with the activity *Let's get started with Edison and EdScratch* first! Ask your teacher for a copy.

Part 1: What is a loop?

To get a computer, like the Edison robot, to do what you want it to do you need to give very specific instructions. You need to write code that says exactly which actions you want to happen in exactly which order you want each action to happen.

Why is that?

When you write a program for your Edison robot in EdScratch, you are telling the robot what to do and in what order to do each thing. Each EdScratch block is one action you are telling the robot to take. The order you connect the blocks in your program tells the robot in what sequence to do each action. Edison will do the actions one at a time, starting with the top block.

Task 1: Drive in a square

Write a program for Edison using EdScratch so that your robot can drive in a square. Your program should only use blocks from the Drive category to control the motor outputs. Download your program and use activity sheet 1 to test your program. Make sure your program has Edison end in the exact same spot it started.

1. How many blocks do you have in your program not counting the start block?

_____

2. Look at the blocks in your program. What do you notice? Is there a pattern to the blocks?

_____

_____

_____

Task 2: Use a loop to drive a square

To get Edison to drive a square, you need to program the robot to drive each side of the square and turn at each corner of the square. You might have noticed that this makes a pattern in the code: drive the side, turn, drive the side, turn, drive the side, turn, drive the side, and turn one last time, back to the starting position.

Lots of programs have repetition, where a bit of code is used over and over. Repeating stuff is one thing that computers are really good at doing. Unlike a person, a computer doesn't get bored doing the same thing exactly the same way again and again.

Imagine you wanted to get Edison to do the same thing 100 times. Would you want to write out that program using 100 repeating blocks? Would you find that boring to write? Do you think you would be able to write the whole program without making a mistake?

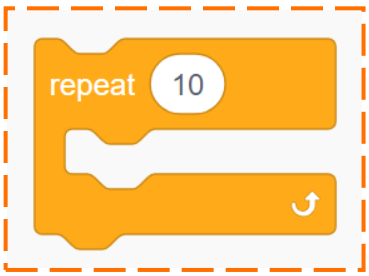
There is an easier and more efficient way to get a computer to repeat commands multiple times. You can get the code to repeat by using something called a **loop**.

Jargon buster

A **loop** is a special piece of code that tells a computer to repeat something multiple times. Loops are a type of **control structure** because loops control other bits of code in a program.

In coding, using loops lets us repeat other bits of code multiple times without having to write each command over and over.

In EdScratch, loop blocks are in the Control category in the block pallet. One of the loop blocks in EdScratch is the repeat block:



There are different types of loops. The repeat block is a **definite loop**.

Jargon buster

A **definite loop** is a type of loop which will repeat for a set number of times. The repeat block in EdScratch is an example of a definite loop. You tell the loop how many times to repeat using this block's input parameter.

Like all loop blocks in EdScratch, the repeat block wraps around other blocks.

Why is that?

Look at the shape of the repeat block. See how it has a shape a bit like a mouth? Other blocks can sit inside the opening of this block's 'mouth'. Any block that sits inside the repeat block is inside this loop. All blocks inside the loop will be repeated.

Remember, Edison will follow each EdScratch block one at a time. The robot will see the loop block first and know that any blocks inside that loop need to be repeated as many times as the repeat block's input parameter says. The robot will then do the action of each block inside the loop in order. When it gets to the bottom of the blocks in the loop, it will move back to the top of the loop and start again!

Try using a repeat block to make a program for Edison to drive a square. You should be able to write a program for Edison which uses only **three blocks** after the start block, including one repeat block. Download your program and use activity sheet 1 to test your program. Make sure your program has Edison end in the exact same spot where it started.

3. What value do you need to have in the input parameter in the repeat block to get Edison to drive a square?

   _____

4. Why do you need to have that be the value?

_____

_____

_____

Part 2: What are nested loops?

Writing programs using loops lets you be more efficient because you can get a computer to repeat actions without needing to write out the individual commands multiple times. You can also use more than one loop in a program, and you can use the loops in different ways: by **stacking** the loops together or **nesting** loops inside other loops.

Jargon buster

In block-based programming languages like EdScratch, adding blocks together is sometimes called **stacking** blocks and a program is sometimes called a **stack** or a **block stack**. That's why if you use multiple loops together in a program one after another, you can say you are **stacking** the loops.

You can also put a loop block inside another loop block. This is called **nesting** loops.

Why would you use loops in stacks or by nesting them together? Using multiple loops together in this way lets you write programs with repeating patterns. You can even write programs with patterns that repeat inside of other patterns.

Why is that?

Think about an alarm clock on a mobile phone. The alarm can be set to go off in the morning at 7:00 AM. You can set the phone to repeat that alarm every day. When the alarm goes off, it beeps on and off a set number of times. If you snooze the alarm, it stops for a certain amount of time, then comes back on, beeping on and off again for a set number of times.

Can you see how there are repeating patterns inside of other repeating patterns?

This is an example where using stacked and nested loops to write a program would be very helpful. That's because stacking and nesting loops lets you repeat whole sets of commands inside your program.

We use stacked and nested loops to do different things. By stacking loops, we can write programs to get Edison to do different sets of actions multiple times, then move on to a new set of

repeated actions. By nesting loops together, however, we can write programs to get Edison to repeat whole patterns multiple times.

Task 3: Drive the pattern

Just like a loop lets you repeat a pattern multiple times, nesting loops allows you to repeat multiple patterns! Programs that use multiple loops, especially nested loops, might seem a bit confusing at first. To understand what the program is going to do, you need to think about each action that is going to happen in sequence.

Don't forget

When you make a program for Edison in EdScratch, the robot will start with the top block and do each action one by one. Once it completes a block, it will move to the next block. This is true of all EdScratch programs – whether there are zero loops, one loop or multiple loops!

For this activity, you need to use activity sheet 2.

5. Look at the pattern on activity sheet 2. How would you describe the pattern?

_____

_____

_____

You need to write a program so that Edison will drive the pattern on activity sheet 2. Your program can have Edison go across the same line more than once, but the robot must touch all the lines.

Try writing an EdScratch program using a nested loop so that you get your Edison robot to drive the pattern on activity sheet 2.

Hint!

You can write a program that completes the activity sheet using just five EdScratch blocks!

Part 3: How do you program a pattern inside a pattern?

Lots of things that run using computer programs have repeating patterns. There are also many programs that have patterns that repeat inside of other patterns. These programs often use nested loops to repeat whole sets of commands inside a program.

Task 4: Drive a repeating pattern

Try using loops to write a program for your robot which makes Edison drive a design pattern. If that design has a pattern with a repeating pattern inside of it, try using a nested loop.

Look at activity sheet 3 and choose one of the designs to use. For this activity, you will need to create a workspace to test your program. Make a workspace that is large enough to test your program with Edison. You could draw the pattern onto a large sheet of paper or mark it out using dark coloured tape on the floor. Copy out the design onto your workspace. Then write a program in EdScratch that gets Edison to drive that design.

Hint!

Stuck? Try breaking down the pattern into smaller sections and writing code to get Edison to drive each part of the pattern. Link all of the chunks together to get Edison to drive the whole pattern. This can help you to find places where the code repeats. Make your program more efficient by replacing repeating code with loops.

If there is a pattern inside a pattern, be sure to try a nested loop!

Make it your own!

If you want, you can also design your own pattern to use for this activity. Make sure your design has a pattern repeating inside another pattern. Test your design by writing a program that gets Edison to drive your pattern.

Does your pattern need nested loops?

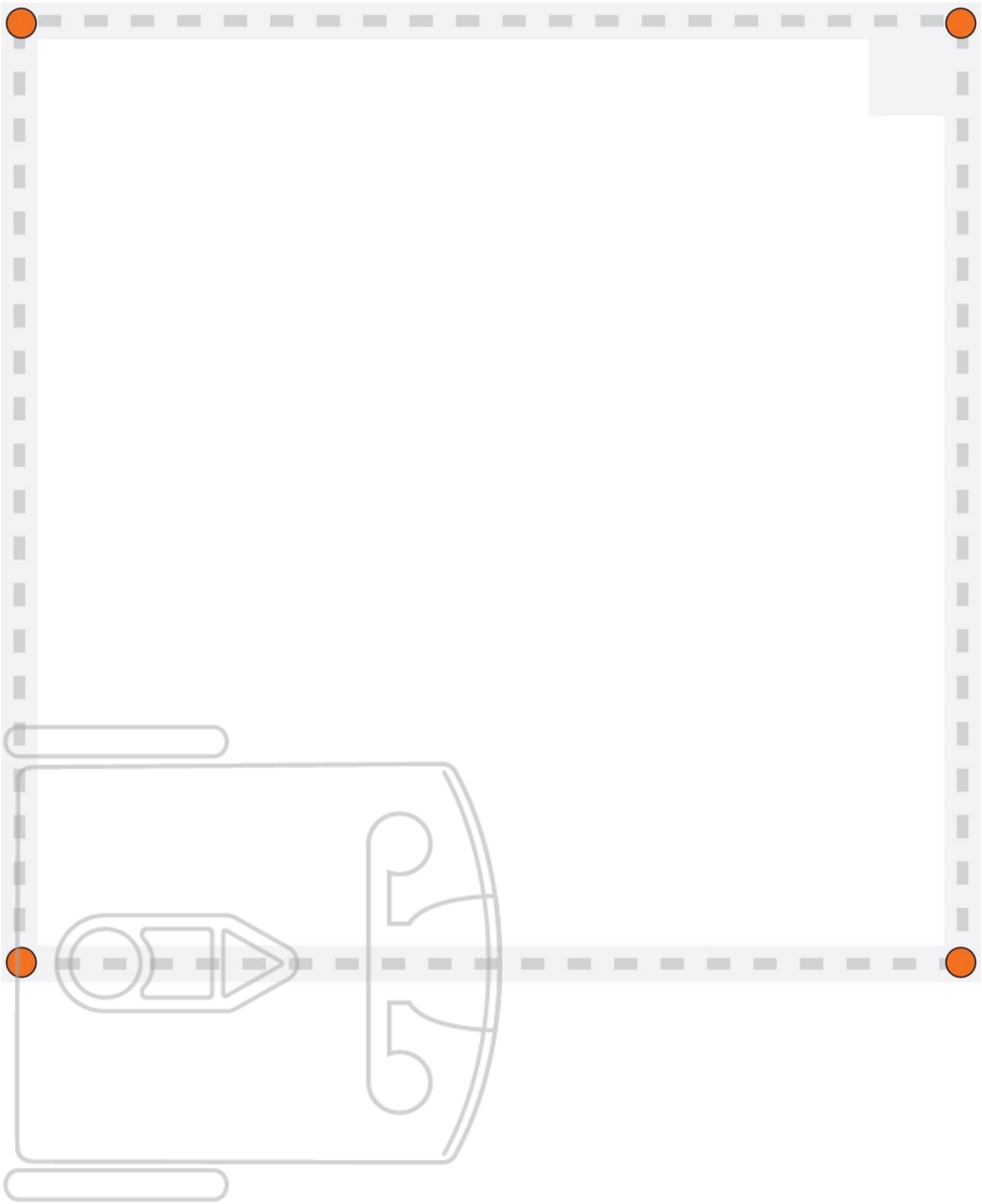
Bonus challenge!

Now you can program Edison to drive in clever patterns. If you attach a pen to your robot, you will be able to get Edison to draw those patterns too!

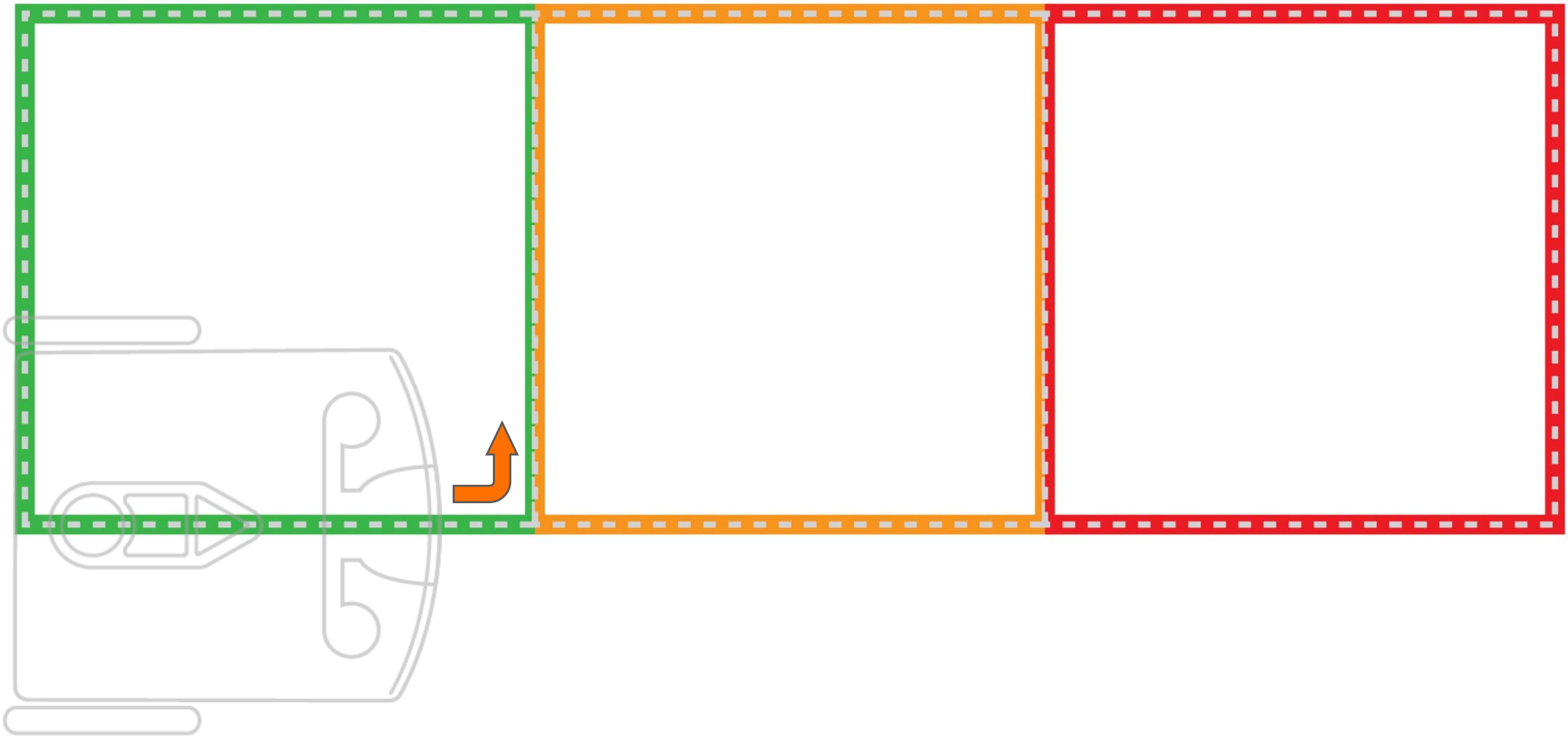
In this bonus challenge, you need to turn Edison into an artist by engineering a way to attach a pen to your Edison robot. You can use EdCreate parts or any other materials you like. Once you

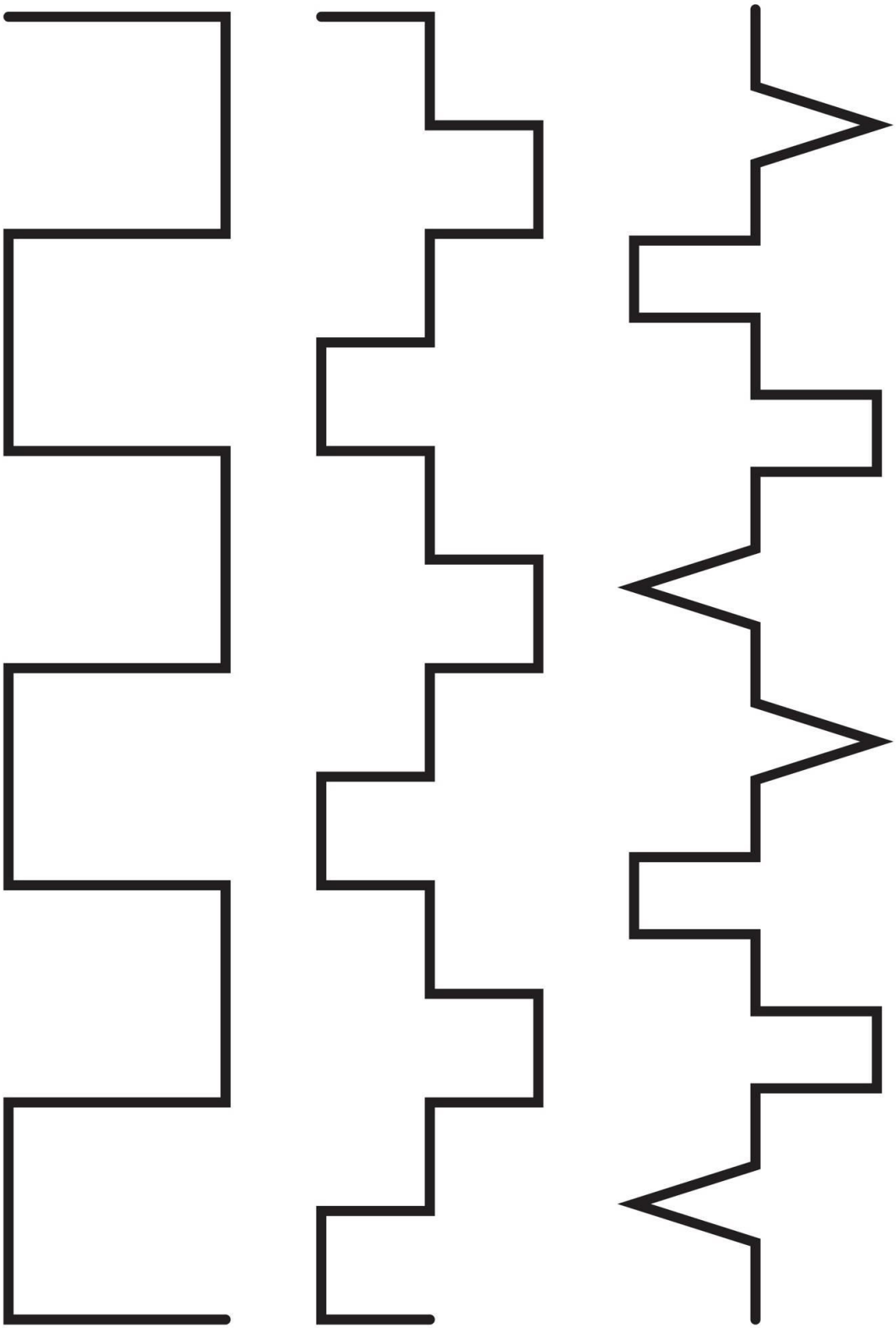
have built your pen attachment, download one of your design pattern programs into your robot and put Edison onto some paper. Try running the program to see your robot artist's masterpiece!

Activity sheet 1: Drive a square



Activity sheet 2: Repeating pattern





Activity sheet 3: Driving designs