

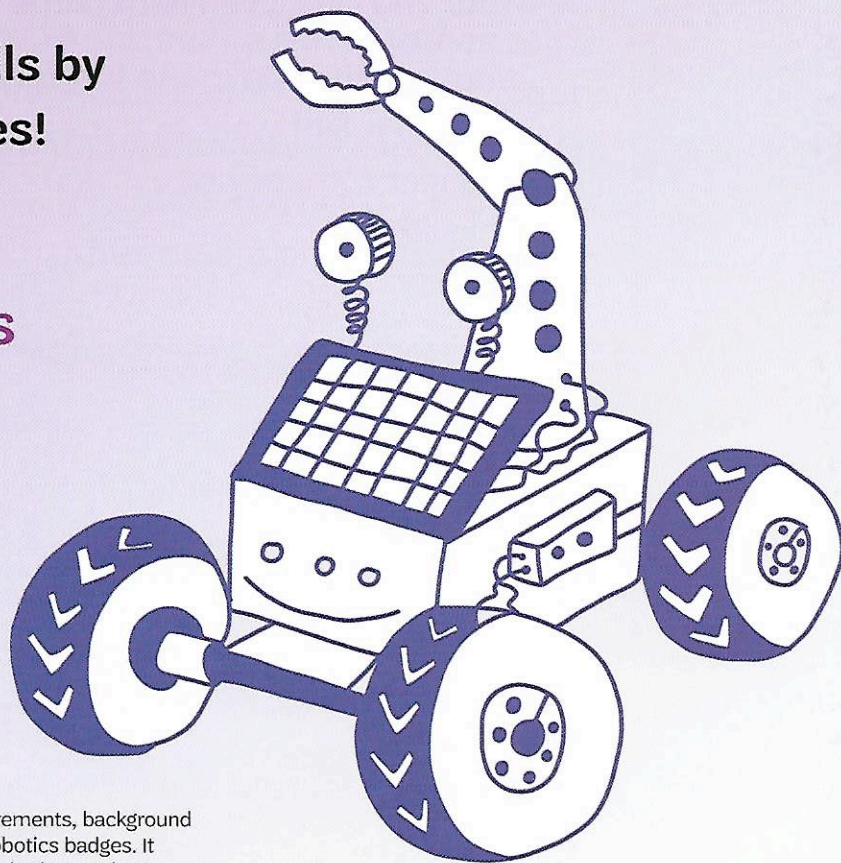
Junior Robotics

Develop your robotics skills by earning these three badges!

Badge 1:
Programming Robots

Badge 2:
Designing Robots

Badge 3:
Showcasing Robots



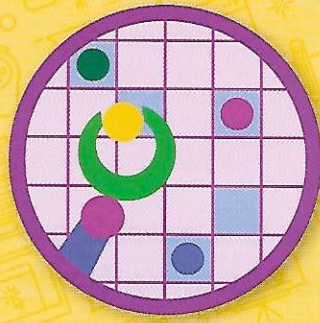
This Robotics badge booklet for girls provides the badge requirements, background information, and fun facts about robotics for all three Junior robotics badges. It does not include all of the information needed to complete the badges. Volunteers may access full meeting plans—including detailed activity instructions—on the Volunteer Toolkit (VTK), or by contacting their local council.

Welcome to the world of robots!

When you've earned these three badges, you'll know how to build a robot, program a robot, and share what you've designed with others.

Every day, a robotics engineer invents another robot that can do something new — like perform surgery, explore Pluto and, yes, even herd cattle.

What will they do in the future? If you can't wait to find out, you might want to think about becoming a robotics engineer someday so you can invent what our future looks like!



Badge 1:

Programming Robots

Robots are simple machines programmed to run automatically. Programmers are the engineers that create step-by-step instructions, or algorithms, that tell robots how to understand and respond to their environment. Start by engineering a machine that helps a robot to land then learn about the robot brain. After, create programs to instruct your friends before coding on a device.

Steps

1. Learn how robots work
2. Discover the robot brain
3. Learn about programming
4. Try simple programming
5. Code a robot

Purpose

When I've earned this badge, I will know how to create a program that could be run by a robot.

STEP

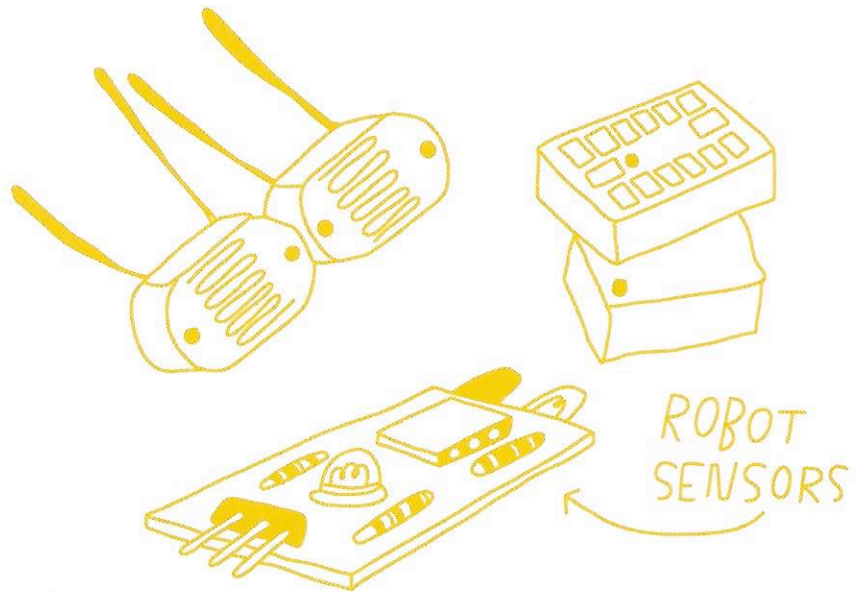
1 Learn how robots work

A robot is a machine that does a task or a number of tasks automatically. Robots help to solve common or complicated problems that humans don't want to or can't do. They are made up of many different pieces, like gears, levers, sensors, and wires, that protect them and give them directions on how to act, move, and respond to different situations. Learn about the Mars Rovers and simple machines as you create a "Safety Lander" that can land a Rover without damaging the robot.

Robots On the Move

Robots that move on their own are called mobile robots. They have wheels or legs and can move from one place to another. These are commonly used in space or deep sea exploration. These places are too difficult or dangerous for humans to explore.

Since the robot serves as a human's eyes and ears, it's important for the robot to be able to move around easily. That's why mobile robots are equipped with lots of sensors and programmed to climb over obstacles or go around them. If a robot got stuck at every rock, soft surface or obstacle, they wouldn't be able to do much exploring!



STEP

2 Discover the robot brain

Without instructions to tell them what to do, robots are just simple machines. Computer engineers, or programmers, create algorithms, or sets of step-by-step instructions, that are coded into the robot's "brain" so they can move and act automatically. The computer or robot brain works similarly to our brains, with parts that help us to see, understand, and react to our environment. Relay messages with your fellow Juniors to discover how robots send and receive messages between different parts of their body.

WORDS TO KNOW

Prototype - A prototype is a hand-built model of an idea. The word prototype comes from two Latin words: *proto* (which means first) and *typus* (which means model). Once you get an idea for a new robot or a new invention, you can build a prototype to see how your idea might look, feel and work in real life. You can also test your prototype and see what is working and what isn't. A prototype can be a model that's made from common objects, like cardboard and wire. It can also be a simple sketch of your idea that you can show to people to see what they think about your design.

Algorithm - This is a set of step-by-step instructions for how to do something. A recipe is an algorithm. It tells you the steps you need to take to bake a cake or cook some food. When your friend gives you directions to her house, those directions are an algorithm, too. She's telling you what you need to do to get to where she lives.

Program - This is an algorithm that has been coded into something that can be run by a machine.

Debugging - Sometimes a programmer writes code for a robot — but the robot doesn't do what it's supposed to. That means there's something wrong with the code. Programmers say that there's a "bug" in the program. When they find and fix the problem, they call it "debugging."



STEP 3 Learn about programming

Programmers create algorithms that instruct robots on how to move and react. Do you think you could create a program to instruct a “robot” friend? Create a program on paper to help a fellow Junior, your “robot,” to build an image made of tangrams, and learn about algorithms and computer programming.

Meet the Nanorobots

Nanorobots are tiny robots. They are so small you need a microscope to see them! These teeny-tiny robots can be injected into a person's body and treat the patient from the inside. The nanorobots can travel through blood vessels and get rid of blockages that might cause heart attacks or strokes. They can find what's making the patient sick and deliver medicine exactly where it will help the most.

STEP 4 Try simple programming

Programmers translate their algorithms, sets of step-by-step instructions, into a special code that can be understood and run by robots. Create your own special coding language to create step-by-step algorithms for your robot to stack cups that could be run over and over again.

PROGRAMMING



3 WAYS YOU USE ALGORITHMS IN EVERYDAY LIFE

Algorithms are a series of directions for a robot to follow in order to make something happen. We actually use algorithms all the time in our lives.

Here are three ways you use algorithms.

1. Want to make a cake? Find a recipe. The recipe is a series of steps that tells you what ingredients to get, what steps to take to make the batter, how long to bake the cake, and so on. You'll get a perfect and tasty cake if you follow the directions in the correct order. A recipe is an algorithm.

2. Want to go to your new friend's house after school? Ask for directions. When someone gives you directions, they tell you step-by-step how to get from one place to another ("walk two blocks, turn left at the corner, go past the library, turn right, and my house is the yellow one at the end of the street"). Directions are an algorithm.

3. Want to put together a piece of furniture? Use the instruction manual. If your new bookcase was delivered in pieces, you need to assemble it yourself. You take each piece of information in order and act on it. If you do every step in the right order, you will have a sturdy bookcase. Instructions are an algorithm.



CODE

STEP

5 Code a robot

Engineers program their robots to move, act, and understand. Now is your chance to code on a device, like a tablet or computer, and complete an Hour of Code. Choose a game from the site and program your robot or character to complete the tasks. Remember, no matter what game you play, you could give the same instructions to a robot, just like you are giving instructions to the game's characters. Your algorithms could be coded into a robot!

Armed and Helpful

Say you make a new product, like a better skateboard or bike. Now, say you want to make a lot of them and sell them. You need to manufacture them. Manufacturing is when you use machines to make a lot of copies of something. It's how cars are made. It's also how washing machines, basketballs, cellphones, hairdryers and even certain kinds of candy and bubble gum are made.

When it comes to manufacturing, robots can help. The most common robot used in manufacturing is a robotic arm. It is stationed in place and programmed to do a single task in the process of making something. Robotic arms can weld things, hammer things, lift heavy stuff and shape hot metal.

Most robotic arms have seven segments and six joints. A robotic arm is similar to a human arm with a shoulder, elbow, wrist and finger joints. This gives a robotic arm flexibility and freedom of movement, which means it can turn, reach, grasp and do almost anything.

There are motors at each of the joints. There are also sensors that can be programmed to detect distance, movement and pressure. A computer program gives directions to the robot about where to move, how far to move and how fast to move. The robot may be sticking a label on a product on a label or painting a part. Even though this action may be repeated over and over again, the robot will never get bored!

Now that I've earned this badge, I can give service by:

- Sharing what I've learned about the human and robot brain.
- Creating algorithms to teach others about something I am good at.
- Encouraging others to learn how to code.

I'm inspired to:

