

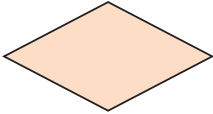
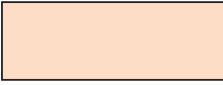



## Robotics Badges: Programming Robots 2

# Create an Algorithm Flowchart

### How Flowcharts Work:

- A **flowchart** is a diagram that represents an algorithm in the form of a map. In computer programming, it is a good way to show different paths the computer can follow.
- The **data**, or information, coming into a computer or a robot’s controller is called the *input*. The machine processes the data and figures out which path to take. Each path represents a different action. This action is called the *output*. A robot or computer may also process the input to produce more data. For example, if you ask a virtual assistant device to find the nearest ice cream shop, the output will be the name, address, or other information.
- On a flowchart, a decision is shown as a question the computer must answer. For a robot, the question usually relates to conditions that its sensors detect. For example, if you have a robot with a light sensor, the question can be, “Is it dark?” The robot’s answer determines which step comes next. The flowchart will show two paths leading from the question. In this case, it might be a command to stop if the answer is “Yes,” or a command to keep going if the answer is “No.”
- **Data** can also be in the form of a measurement, and there can be more than one path to move along depending on the answer. For example, you ask the robot for data, such as what the temperature is. Then you can program in different outputs depending on whether the answer is less than, greater than, or equal to 100 degrees.

FLOWCHART SYMBOL	NAME	WHEN TO USE IT
	<b>Start or stop</b>	The beginning and end points of the task
	<b>Input</b>	<b>Input</b> is data that is entered into a computer by a human operator or an electronic sensor.
	<b>Decision</b>	A question the computer must answer, usually based on input from its sensors.
	<b>Output</b>	<b>Output</b> is data that a computer produces or an action that a robot takes after it processes input using a computer program or other kind of control.
	<b>Direction of flow</b>	Connects the symbols.

(continued)

### How to Create an Algorithm Flowchart:

1. Take a list of step-by-step instructions for a robot to complete a task. Make sure the instructions are clear and without any gaps.
2. Draw an oval in the top right-hand corner of the page or board and write “Start” inside it. Draw an arrow from the oval going to the right. Then draw a symbol for the first step. Make it big enough to write in.
3. Write the action for that step inside the symbol. If it is a command, draw an arrow going to the next step. If it is a decision, draw one arrow for every possible answer and label each arrow. At the end of each arrow, draw the step that comes after it.
4. If you need to repeat a set of steps, you can use a shortcut such as a loop or a function.
  - A **loop** tells the program to go back and repeat a series of commands. To show it on your flowchart, just draw an arrow that goes back to the first step in the loop. Be sure to include a decision box at the end of the loop or it will repeat forever!
  - A **function** is a series of commands that is given a name. When you “call” the function, those steps are carried out. To show a function on a flowchart, draw a large box off to the side and write the series of steps inside it. Give the function a name (such as the letter “A” or the word “Sit”). Then in the main part of the flowchart, write “Call A” or “Call Sit” in a command box. Whenever the name of the function is called, the series of steps is performed.
5. Keep adding steps and arrows until the program is complete. When the flowchart is finished, act out the steps to see if the program works. If there is a “bug” in the program, try to fix it!

### Want More Challenge? Try this!

Instead of debugging your own program, play the role of a “quality assurance manager” for someone else’s code. When your flowchart is finished, switch with someone else and try to run each other’s programs. The best way to see if you made any errors is to see if someone else can make it work without any help from you!