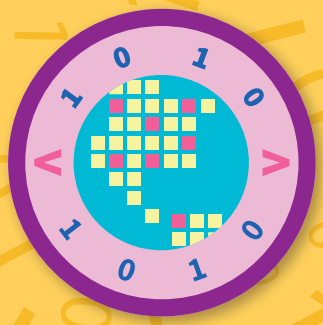


Badge 1: Coding Basics

From tablets and laptops to microwave ovens, cars, and even stoplights, we use computers every day to help us in all sorts of ways. But how do the computers know what to do? People write instructions for them! When you learn to "talk to computers" by writing code, you'll be able to tell computers what to do!

Steps

1. **Create algorithms for a computer that follow a sequence**
2. **Use loops to improve your algorithm**
3. **Keep your code interesting with conditionals**
4. **Create your own set of commands that use conditionals**
5. **Learn about women in computer science**

Purpose

When I've earned this badge, I'll know how programmers use sequence, loops, and conditionals to write computer programs and how people can use computers to help others.

What's a Programmer?

- A **computer** is a machine that can remember information and follow directions. At first, computers only did math and filled entire rooms. Today, they're much smaller. A laptop is a computer, and so is a smart watch.
- **Code** is a special language created by people to tell a computer what to do. For a computer to work, it needs instructions that have been written in a code it understands. There are hundreds of different computer languages, many created by women!
- **Programming** is writing a set of instructions in code. A program tells a computer to do something, like keep a calendar or search for a photo online.
- **Computer programmers** are sometimes called coders. Without coders, computers wouldn't know what to do.

STEP 1

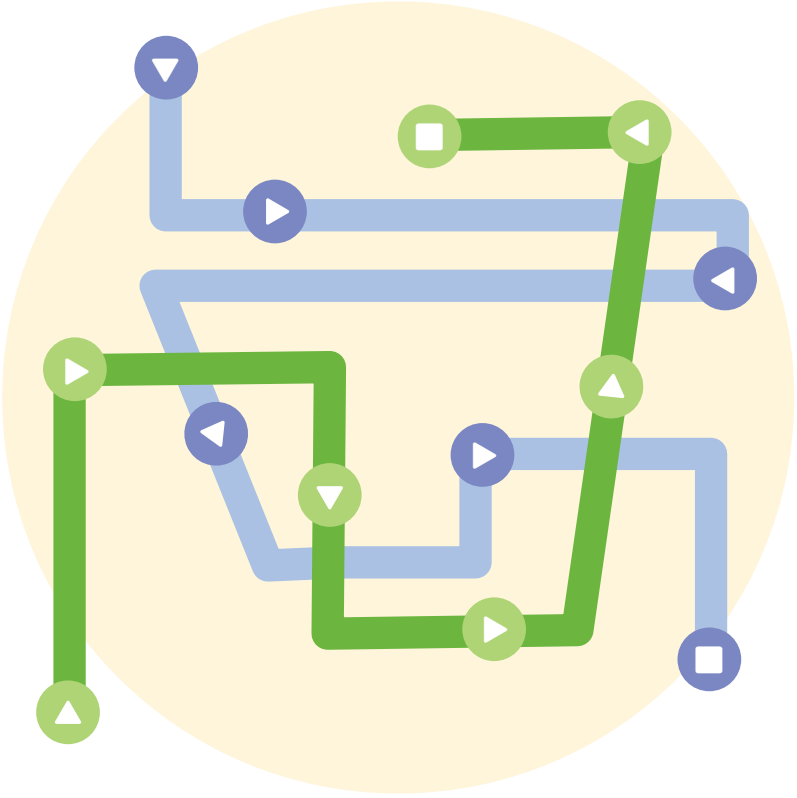
Create algorithms for a computer that follow a sequence

Giving directions to someone can be tricky. Giving directions to a computer is even trickier.

Why? A computer can only do exactly what you tell it to do, in exactly the order you tell it. A computer can't ask questions or figure out what to do on its own if your directions are unclear.

The directions that programmers write is called an **algorithm**. The order of the directions is called a **sequence**.

Sometimes the order of actions matters, and sometimes it doesn't. Imagine you're setting up a campground. You need to find a flat space and clear away rocks and sticks BEFORE you set up your tent. The sequence of your actions matters in this case.



WORDS TO KNOW

Algorithm This is a set of step-by-step instructions for how to do something. A recipe is an algorithm. It tells you all the steps you need to take to cook something. When a friend gives you directions to her house, that's an algorithm, too. She's telling you the steps you need to take to get to her house.

Conditional Programmers code conditional statements to get computers to react to different situations. They're written with IF/ELSE statements: IF something happens, THEN do this. ELSE, do something else.

Efficient programs These computer programs are written to respond quickly and take less memory and power.

ELSE statement In a conditional, when an IF action isn't met, the ELSE action will run.

IF statement In a conditional, something happens when the IF condition is met.

Loop This is when a set of instructions, or an algorithm, is repeated. When you take turns and follow the rules of a game over and over again, that's a loop.

Nested loop In coding, this is a loop within a loop, an inner loop within the body of an outer one. As long as the outer loop continues to run, it will trigger the inner loop each time until the outer loop finishes.

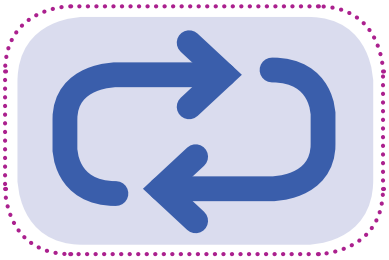
Sequence This is the order in which things happen. The routine you have for getting ready for school in the morning is a sequence. For example, you might write your sequence for getting ready like this: Wake up. Get dressed. Eat breakfast. Brush teeth. Walk to school bus.

STEP 2

Use loops to improve your algorithm

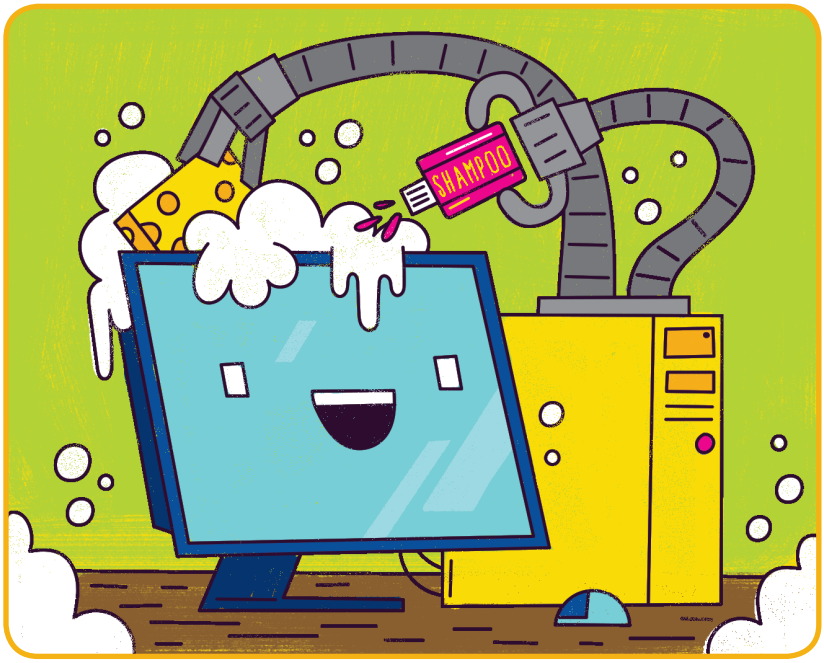
Have you ever read the directions on a shampoo bottle? They often say, "Apply shampoo to your hair. Lather, rinse, repeat." Lather means rub the shampoo around in your wet hair to make lots of bubbles. Rinse means use lots of water to wash the bubbles out. And repeat means—do it all again!

"Lather" and "rinse" are the steps in a hair washing **algorithm**. "Repeat" is a **loop**. It means do the same thing—lather and rinse—over and over again.



Lather is a **nested loop,** because you need to rub the shampoo around on your head in lots of different places—on the top, on both sides by your ears, and in the back. You repeat, or loop, lathering. That repeated action happens within the loop of washing your hair twice.

Programmers use loops to tell computers to repeat actions in their programs. Loops make programs shorter, easier to write, and easier for computers to understand.



STEP 3 Keep your code interesting with conditionals

Computers are great at doing the same thing over and over again. To make them even more useful, programmers have figured out how to get computers to react to different situations. They write programs that say if one thing happens, do this. If it doesn't, do that. These computer commands are called **conditionals**, and you write them using an **IF/ELSE statement**.

For example, if you didn't have the option to wear different jackets to match the weather, you'd always have to wear the same coat. But, with a conditional, you can give options: IF it's snowing, wear a warm coat. ELSE wear a light jacket. By writing code that includes conditionals, such as determining different coats depending on the weather, programmers can make code more flexible and more interesting.

STEP 4 Create your own set of commands that use conditionals

Being a leader means you have to make lots of decisions. So, when you're a leader, it's a good idea to prepare for what could happen and how you would react to all kinds of situations and surprises.

For example, if you're planning a camping trip, what will you do if it rains? Are any of your friends allergic to certain foods? What kinds of meals should the troop plan?

Programmers do the same thing when they write conditionals in their code. They think about different situations in the program and tell the computer what to do IF that situation comes up.

The Power of Imagination

Women have played a key part in the history of coding. For example:

Ada Lovelace wrote the first computer program when she was only 17 years old. She created the code for the first mechanical computer, invented by Charles Babbage in the early 1800s.

Grace Hopper and her team created some of the first electronic computers, like Mark 1, in the 1940s. The computers were huge—the size of whole rooms. Grace predicted that someday people would be able to hold a powerful computer in their hands.

In the 1970s, **Raye Montague** was the first person to figure out how to design a ship using a computer—then she designed one in less than 24 hours!

Computer Pioneers

In the 1960s, **Margaret Hamilton** worked with a team at MIT and NASA to create the computer programs that astronauts used in the Apollo 11 space flight.

Margaret's program told the computer what to do if something went wrong. The day the Apollo 11 astronauts were trying to land on the moon, the computer got confused when it had too many things to do at once. Margaret's code told the computer to land the spaceship and ignore error messages. That saved three astronauts and helped them to land on the moon.

She also came up with the idea of "computer software." "Hardware" means the machine—the keyboard, the screen, the different parts of the computer you can touch. "Software" means the programs that make the computer do things.

After working for NASA, Margaret started her own computer software business.

STEP 5

Learn about women in computer science

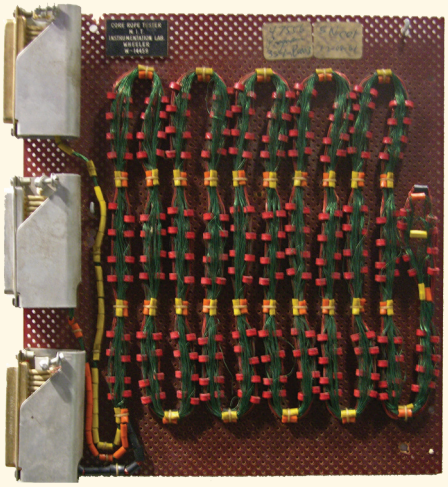
Part of being a leader is thinking ahead, imagining what problems might come up, and figuring out how to solve them. The first computer program was written by a woman, and women have been leading the way ever since! Their leadership and creativity have shaped the world of computer science in many ways. They've designed and built new kinds of computers, invented new programming languages, and even used computers to design ships and send people to the moon!

What kinds of problems would you like to solve with the help of computers?

Building Computers Is Women's Work

Part of what makes a computer a powerful tool is its memory. Today, we can store lots of code on tiny pieces of circuitry in phones and computers, but computer memory used to be much bigger.

For example, NASA needed people with very specific skills to build the Apollo 11 computer memory out of copper wires and magnets. Expert seamstresses carefully threaded the copper wires through and around the magnets. This created a core rope memory that contained Margaret Hamilton's "in case of emergency" programs.



Core rope memory sample used by NASA in the 1960s.

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

- Coding a computer program that can help other people.
- Creating step-by-step algorithms to teach someone else a new skill.
- Sharing what I've learned about women in computer science at school.

I'm inspired to: