Badge 1: Coding Basics

Laptops, tablets, and smartphones are all computers. We use computers every day, and they help us in lots of ways.

What makes all those computers work? People write instructions telling the computer what to do. By exploring how computer scientists write programs, you'll learn how computers work, too!

Steps

1. **Create algorithms for a computer that follow a sequence**
2. **Use loops to improve your algorithm**
3. **Use events to make things happen**
4. **Learn about women in computer science**
5. **Create your own set of commands that use events**

Purpose

When I've earned this badge, I'll know how programmers write programs that make computers work and how people can use computers to help others.

What's a Programmer?

A long time ago, people—mostly women—were the first "computers," doing complicated math problems.

Today a **computer** is a machine that can follow directions. A laptop is a computer, but so is a smart watch.

For a computer to work, it needs to follow instructions that have been written in a **code** it understands.

Programming is when people code a sequence of instructions, or an **algorithm** for a computer.

Computer scientists are sometimes called programmers or coders.

1 Create algorithms for a computer that follow a sequence

How is writing a computer program like making a cake? When you make a cake, you follow the recipe carefully.

You also do each step of the recipe in a certain order. For example, you have to grease the cake pan before you put in the batter. If you don't, the cake will stick.

Writing a computer program is like making a cake. You write the directions for the computer to follow. The directions are called an **algorithm**.

When you write a computer program, you also make sure the directions, or steps, are in the right order. That's called a **sequence**.

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.

Debugging This is when a programmer finds and fixes errors (also known as bugs) in their code.

Event In the computer world, an event is an action that causes something to happen. When you're playing tag and you are "It," if you touch someone, that person becomes "It." Touching the person is an event.

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

Perseverance This is when something is challenging, but you don't give up. You keep trying. Learning to ride a bicycle is hard. You lose your balance a lot. You might fall down. When you keep trying to learn, even if it is hard, you have perseverance.

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.

2 Use loops to improve your algorithm

When you make a cake, you mix the ingredients by stirring—a lot!

When you repeat the same action over and over again, that's called a **loop**.

Programmers use loops to tell computers to repeat steps of their programs. Loops make code shorter, easier to write, and easier for a computer to understand.
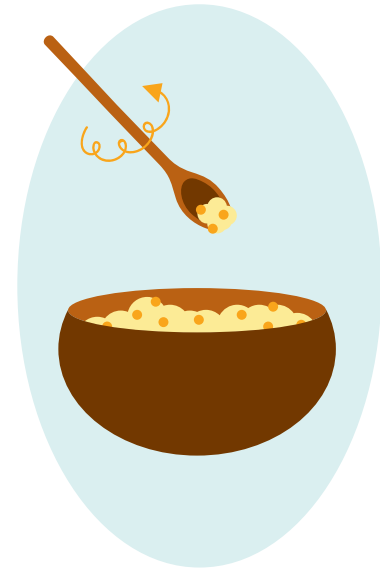
3 Use events to make things happen

When you bake a cake, you set the oven timer.
When it goes off, what do you do? You check to see if your cake's done!

When that timer goes off, that's an **event.** The buzz makes you check on your cake.

Programmers use events in their algorithms to make something happen. For example, a video game character might open a door, then jump to a new level. Opening the door is the event that makes the character jump.

4 Learn about women in computer science

Women have built computers, written programs, and imagined new and different ways for people to use computers.

Women wrote computer programs to send astronauts to space, to do hard math problems in a split second, and to design huge ships in just a few hours.

You can learn to be a computer scientist today! How could you use computers to change the world?

Computer Pioneers: GRACE HOPPER

Grace Hopper was born in 1906 in New York City. Ever since she was a child, she was interested in math and engineering. When she was 7, she took apart alarm clocks to see how they worked!

Grace wanted to study math and science in college but didn't get in the first time she applied. She showed perseverance, applied to college again, got in, and earned a PhD in mathematics from Yale.

Grace joined the US Navy Reserve during World War II. She worked with a team to create the first electronic computer in the US, called the Mark 1. The computers Grace developed were as big as entire rooms!

She also created the first computer language that helped computers understand words, not just numbers.

She also imagined that someday people would use computers all the time and that we'd be able to hold them in our hands. She was right!

Grace always wanted people to think of new ways to do things. She had a clock in her office that ran counterclockwise, or backwards, to remind people that there are lots of ways to do things.

Music Machine

In the 9th century, three Iraqi brothers invented the first programmable machine: a flute that could play music on its own. Air could travel through the flute and make sounds come from a pump, not a person.

Hundreds of years ago, this flute was described in a famous book called *The Book of Ingenious Devices*.

5 Create your own set of commands that use events

In computer code, events make things happen.

In the real world, events also make things happen.

▶ When the oven timer goes off, you check your cake.

▶ When the cake begins to cool, you take it out of the pan and put it on a rack.

▶ When it's completely cool, you frost it.

Can you create a set of commands that includes events? Remember, different events will trigger people (or computers) to do different things.

Add events to finish this story:

Today, I met a big dog on the way to school.

He _____**(verb)**, and I laughed out loud.

I _____**(verb)**, and the dog sniffed my hand and backpack.

The dog followed me to school. When I got to school, I _____**(verb)**, and the dog wagged his tail and barked.

I told my teacher about the dog. She came outside to see and noticed he had a collar with a tag. She _____**(verb)** his owner. I waited with the dog until his owner came to get him.

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

- Sharing what I've learned about Grace Hopper to inspire other girls to code.

- Doing a show-and-tell at school on how to create an algorithm for an everyday task.

- Encouraging others to persevere when projects are difficult.

I'm inspired to: