



Topic: STEM

Badge: Coding For Good 1: Coding Basics

Suggested Supplies: Computer or phone with internet access

Programmers write code for computers to solve all types of problems from telling the time to researching disease. But for computers to do anything, they need clear and precise instructions on how to perform a task.

Learn how to write code for computers and explore some of the incredible women of computer science.

Steps:

Step 1: Use functions to create a self-portrait

Computers are great at following directions. In fact, that's all they can do! When you write a computer program, you have to tell the computer exactly what to do, step-by-step, because it can't figure the steps out by itself.

The instructions for a computer are called an algorithm. The part of the algorithm that tells the computer to do something specific are called functions. To make writing programs easier and more efficient, programmers write more general algorithms and then add details in the functions, which can be more easily switched out.

For example, you could write an algorithm for doing your chores that had sections for your bedroom and pet care. The functions could be `makeBed()`, `tidyDesk()`, `putawayClothes()` for the bedroom and `feedCat()`, `scoopLitterbox()`, and `brushCat()` for pet care.

Computers don't speak human languages. They have their own languages, like **JavaScript**, with their own grammar rules, called **syntax**. Computers can only understand algorithms written with correct syntax, so programmers have to learn the rules for each programming language. The chores functions above are written with JavaScript syntax.

What would it be like if you had to give detailed directions for people to do something, the way you have to for computers? When would that be a good thing? When would that be bad?

WORDS TO KNOW

Algorithm a series of specific instructions. By creating a sequence of instructions that can be applied to many circumstances, you're creating an algorithm.

Argument a part of a code that makes a function more specific and reusable in a number of different ways: it adds details to the function that are changeable. In many programming languages, arguments are represented as a list separated by commas inside the parentheses.

Boolean expression a statement that can either be true or false, and nothing else.

Code a series of instructions that make up a program directing a computer to do something.

```
function getAllTermIndexes($term,
    $fileLength = strlen($fileCon
    $index = new Index($term);

    $matches = array();
    preg_match_all("/(<=\\b)".$t
    , $fileContent, $matches,
```

Computer an electronic machine that can store and process data. A computer has hardware, which is the machine itself, and software, which is a set of instructions.

Control flow computers read programs line by line. But when a decision has to be made, the computer doesn't read all the

statements—it makes a choice as to which statements to execute. The choosing of what to execute and what to ignore is control flow. An IF statement is one way to direct the control flow for a computer.

Function one of the basic building blocks of a program. It's a type of instruction similar to a verb: a function does something. In JavaScript, as in most coding languages, it has a special form: the name of the function followed by '()'. For example, turnLeft() and drawEye() are two examples of functions. The () tells the computer to "do" the named function. "Doing" a function is typically described as "calling" a function or a "function call."

IF statement this tests whether some "condition" is true or false. The program then executes the code in the true branch if the condition is true. Often, but not always, there is a second branch which executes when the condition is false.

JavaScript a computer programming language.

Programmer a person who writes algorithms to create programs or code for computers.

Pseudocode a way to plan a computer program using human-friendly language. It's not actual programming, but a

written description of the key elements of an algorithm or program. It's used as a quick way of thinking about a program without completely writing it out in code.

Sequence the order in which the computer performs the steps the programmer writes.

Software the end product of written computer code.

Syntax the rules for how a program is written. These rules have a purpose similar to written grammar: it's a standard format for writing code that the computer understands. In programming, the syntax needs to be exactly correct for a computer to know what to do. For this reason, programmers often use pseudocode to help them flesh out ideas without the burden of being too exact.

X-Y coordinates when programmers put images on screens, they use a grid that represents the screen. Each square in the grid has a reference number like an address. This number is a square's location and can be written as a pair of numbers: the first number is the X (horizontal position), and the second one is the Y (vertical position). The grid's numbers start with the top left corner square as (0,0), which is called the origin.

Step 2: Write code to create a portrait

Functions make algorithms more specific, but sometimes that's not enough. Enter arguments! Functions tell the computer to do a specific task. Arguments tell the computer more about the task, like how or where to do it.

For example, in the chores function, `makeBed()` could be made even more specific by adding in arguments to tell you which rooms to tidy: `makeBed("guest room", "my room")`

Just like functions, for the computer to understand your arguments, you have to use correct syntax. In JavaScript, the arguments go inside the function's parentheses and are separated by commas.

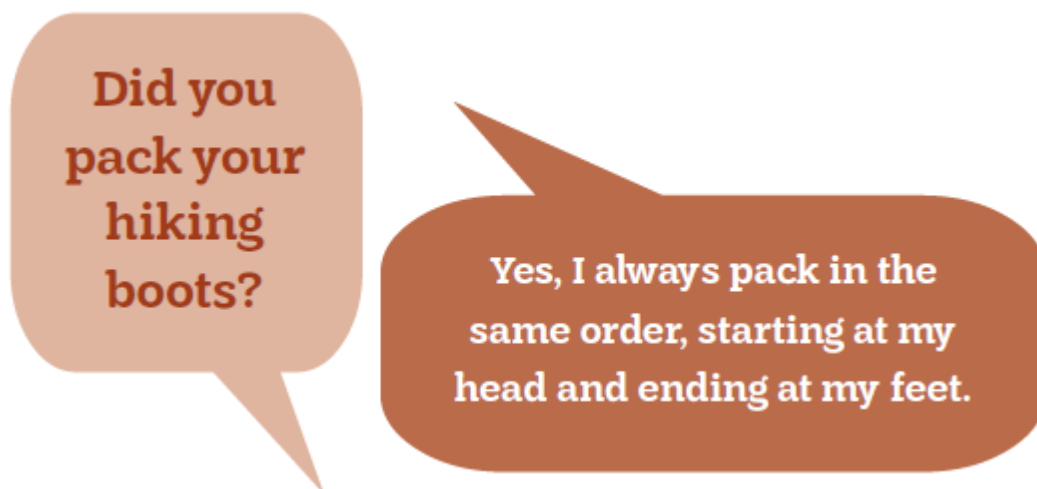
Unlike real life, arguments can make things easier and better in coding!

Step 3: Learn about computer logic

Imagine you're given a set of tasks with each task on a different sheet of paper. Now, imagine the sheets of paper are shuffled before they're handed to you—how do you know where to begin?

Just like you'd need help to figure out what tasks to prioritize, computers need to be told in what order to do their tasks. This is called control flow.

Control flow is the sequence in which the algorithms are done and the order of the different decisions computers can make, usually by reading code from the top to bottom.



CODE THAT SAVES LIVES!

Advances in technology have changed the way first responders, like paramedics, search and rescue teams, and firefighters, help people. For example:

- Cars have onboard emergency systems that use digital location and communication systems to call for emergency help after an accident,
- Firefighters use artificial intelligence programs to help them navigate their way through burning buildings,
- Paramedics diagnose heart attacks through programs that recognize speech patterns, and
- Search and rescue teams use drones and GPS to observe weather conditions and find exact locations in the wilderness.



Medicine has even started using artificial intelligence (AI), or computers that can learn from experience, to help diagnose illnesses.



- Computers can read mammograms in more detail than human doctors and detect breast cancer at early stages.
- AI is better than people are at diagnosing an eye disease that affects people with diabetes!
- Robots help people remember to take their medications after heart surgery and ask questions to monitor their recovery.

All of these technologies use computers that have been programmed by people like you!

Step 4: Explore “IF” statements

But what if you’re writing code and the computer has to make a choice? A computer uses Boolean logic to know how to react to different conditions, when a situation is either true or false. The program then executes the code in the true branch of the code if the condition is true.

Often, but not always, there is a second branch of code which executes when the condition is false. The condition is a Boolean expression.

To code a condition or a question so a computer can answer it, you can use an IF statement. An IF statement in code tests whether some “condition” is true or false.

You can use an IF statement to turn a Boolean expression into a question like this in pseudocode:

```
IF statement is TRUE
THEN say this
ELSE say that.
```

Here’s what that looks like in JavaScript syntax:

```
If (Boolean expression) {
    do something when true
} else {
    or do something else when false
}
```

Step 5: Use computer logic to create a quiz show

Now that you know how to code IF statements, you can write computer programs with all kinds of conditions! For example, you can write a set of questions using Boolean logic to teach others about something you know a lot about!

You can use this same idea to create questions about anything that can be answered with true or false. Depending upon the answer to your question, you can then change the control flow for a computer to give different responses.

This is control flow in action! One branch of code is executed, or the other is: Either the TRUE branch or the FALSE branch.

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