

Beginning Computer Science Workshop Handout

What is Computer Science?

Computer science is the art of breaking down problems, typically to make your life easier. You see it everywhere: cell phones, online shopping, television, cars, internet, games, and much more. It's like cooking. You follow a recipe that has a set of instructions and, at the end, you've made a delicious dish. The same goes for CS, where you write a set of instructions into the computer and the computer follows it to do all sorts of stuff. For example, you can play a videogame, show a movie, or send a text.

Reflection

How does Flappy Bird work? Do you feel like you understand it better after this workshop?

Before, while playing Flappy Bird, you knew that you could move the bird up and down, that "pipes" randomly come up on the screen, and that touching one would end the game. But now you know the code behind how this works! We can represent our bird as an **object**, which lets us give it certain **methods** and **attributes**.

Methods (also known as **functions**) are actions that work on an object. For our Flappy Bird, it has methods like **flap** that make it move up and down. **Attributes** are things that belong to an object. For example, humans have a name attribute, a height attribute, and an age attribute. Our Flappy Bird has attributes like "on click" and "when touching" that help us check when the user has clicked or when the Flappy Bird is touching a pipe.

Connecting CS concepts to other games

In Angry Birds, you launch birds at the enemies (Pigs). You can launch different types of birds with different powers (attributes) at different distances. How do they do this? It's not entirely like Flappy Bird, but they do have some similarities. In Flappy Bird, if the bird touches one of the pipes, the game ends. Similarly in Angry Birds, when the bird touches the structure, the structure has to move according to the game physics and some pigs vanish if the structure crushes them. Another feature similar to Flappy Bird is launching the birds. First the player pulls the sling back and when the player takes their finger off the screen the sling shoots and launched the bird in the air. What other similarities can you find?

Which of the following things use Computer Science? Look on the back for explanations when you finish!

Calculators:	True or False
Pokemon Go:	True or False
Spaceships:	True or False

Broader Implications of Computer Science

Artificial Intelligence

Artificial intelligence is studying the way human brains think, learn, decide, and work to solve problems. This information is used to make computers think and act just like humans. With artificial intelligence, humans can have conversations with computers. Artificial Intelligence is found in many different fields such as medical (like Baymax), business, education, environment (like Wall-E), manufacturing, and law. Specifically in the manufacturing field, robots are able to perform small tasks and can do the same jobs humans used to be doing. Another example of artificial intelligence is Siri. No, there isn't an actual person living in your phone but with computer science we were able to program a machine to respond to your questions as a human would.

Big Data

Big data is useful in so many different fields. Why? Because one of the things computers are really good at is processing large amounts of data and trying to find meaningful trends. One particular area that's being transformed by big data and the field that deals with it, data science, is biology. Specifically, large sequences of DNA and RNA provide key biological information: whether or not you'll have a disease, who you're related to, and so on. Thus, we can use techniques that are part of computer science to analyze lots of genetic data and gain interesting biological insights, which can even save lives.

Cybersecurity

With so much of our personal information on the Internet— our names, the area where we live, our daily habits, it's essential for both us and companies like Google and Facebook to keep our data secure. One of the ways in which we can do this is by using CS to *encrypt* our data, so that it becomes coded and not everyone can access it. Computer science also helps us detect when someone has been using software that we create for criminal purposes — we're vulnerable to cyberattacks from ordinary criminals, terrorist organizations, and even other countries. Lots of computer science research today is focused on preventing against these kinds of devastating cyberattacks that can attack our power grids, our money, and our personal data.

Explanations (from 1st page)

1. Calculators use code to decide whether to add, multiply, subtract, and divide. The type of button you pressed and the numbers you put in can be stored in **variables**, which are kind of like containers that can hold different values. Based on the **variable**, a calculator can decide which **function** (add, subtract, multiply, divide) to use on the inputs.
2. Pokemon Go uses computer science and maps to make the pokemon on your screen seem like they are in the real world. This is called **augmented reality**, which uses **computer vision** to see the world around you and **object recognition** to sense when you are looking at a pokemon.
3. Spaceships use computer science to navigate and control the whole system. Given **variables** such as the position and speed of the rocket (similar to Flappy Bird!) computers can decide if the rocket needs to speed up, slow down, or change direction.

Additional Resources

Hour of Code:	code.org/learn	(Great all around resource)
CodeCombat:	codecombat.com/play	(Informal Combat game CS Tutorials)
Codecademy:	codecademy.com/learn	(Formal Computer Science Tutorials)
Other projects:	scratch.mit.edu/starter_projects/	(Other projects to play around with)

You can access the workshop @ ParadigmShiftCS.org.

You can access a digital version of this handout @ bit.do/workshophandout (capitalization matters!).

Thank you so much on behalf of Team Science and Paradigm Shift!