



CODESPARK

A C A D E M Y

Introduction to Computer Science
Grades K-5



presented by
 codeSpark

HOUR
OF
CODE

Edition

codeSpark Teacher's Guide

Dear Intrepid Teacher,

Thank you for your interest in teaching computer science to your kids! Knowledge of computer science and “algorithmic thinking” is increasingly necessary for success in our digital world. This skill is becoming a critical component of 21st century literacy. codeSpark created codeSpark Academy with The Foos as an introduction to the “ABCs of Computer Science.”

While it's important to prepare kids for the modern workplace, computer science is about much more than getting a job in high tech. Research shows that computer science helps students improve in core areas like math, logic, and even reading comprehension. Often people think of programming or coding as computer science but that is just one element. At its core, computer science is the study of how to use logical thinking to identify, simplify and solve complex problems. Not 0's and 1's.

Studies from MIT and Tufts University show that students as young as five can learn complex computer science concepts, especially when artificial barriers like programming syntax are out of the way.

codeSpark has created a unique and powerful approach to teaching computer science built on cutting edge research and hundreds of hours of prototype testing. codeSpark's learning games are designed with no words so even pre-readers and ELL students can play and learn from our powerful curriculum.

By playing our games, your students will improve their critical thinking skills, and improve in other disciplines, all while having a lot of fun!

-- The codeSpark Team

Have questions or feedback? Email us at info@codespark.org

Get our app here – <http://thefoos.com>



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Download the full 10 lesson curriculum
on the [Teacher Dashboard](#)

OVERVIEW

Computer Science for K - 5



Teacher Overview:

Our lesson plans provide a fun, flexible and engaging introduction to foundational computer science concepts. They target students in K – 5th grade, but we’ve successfully tested with students as old as 8th grade.

All lesson plans are meant to be highly adaptable. You will be the best judge of what your students need to spend more time on and what they seem to enjoy the most.

In addition, all lessons include both an activity with our game, *codeSpark Academy with the Foos*, and an “unplugged” activity that does not require a computer or other connected device.

Materials:

- Our game, *codeSpark Academy with The Foos*. Download it at thefoos.com. Available for FREE on iPad, iPhone, Android Devices and web (e.g. major browsers Chrome, Safari, IE, etc.)
- Props as needed: see lesson for specifics

No experience is necessary, but we recommend you review the lesson and play a few levels of the game prior to teaching it for the first time.

Note: This Hour of Code curriculum gives you approximately **1 hour of lessons**.

If you sign up for our “Foosletter” at thefoos.com, we will notify you when we expand the curriculum and release new versions of the game.

You can also download our **full 10 lesson curriculum** at dashboard.thefoos.com.



OVERVIEW

Computer Science for K - 5



What Is Computer Science?

Computer Science, or “CS” boils down to solving problems with very specific sets of instructions because computers only do exactly what they are told to do. We think of computers as smart but in reality we need to tell them what to do! They can’t anticipate what we want from them; only computer scientists can come up with precise instructions computers need in order to act. Learning to think like a computer scientist or programmer helps children break down problems, think in logical sequences, and use precise language to give instructions.

The first lesson focuses on identifying common objects that only work when given the proper instructions. Then we will put this idea to work by programming the Police Foo – the first character players meet in our game.

OVERVIEW

Computer Science for K - 5



Who Are The Foos?

The Foos are lovable and cute characters recently discovered by scientists. They are very small and live deep inside every computer, including smartphones, tablets and the computers in your class!



Each Foo can walk, jump, throw, eat and navigate their world, called “Fooville.” Some Foos have special abilities that make them unique, for example:

- **Police Foo** - can chase and capture the Glitch
- **Chef Foo** - can make many kinds of food
- **Ninja Foo** - can shrink or grow bigger
- **Astronaut Foo** - can travel in four different directions
- **Construction Foo** - can make crates and also blow them up

But, just like computers, the Foos only do what they are told. Students must learn to give them specific commands, or program the Foos, in a specific order.

Look out! The blue character with the white horns is the **Glitch**. He is a force of chaos in Fooville. Sometimes he makes a mess, sometimes he throws things around and sometimes he appears unexpectedly.



OVERVIEW

Computer Science for K - 5



Tips and Tricks

To launch the Hour of Code experience, press the “Hour of Code” button on the bottom left of the home screen.



You can also select the “Teachers” button on the top left.

OVERVIEW

Computer Science for K - 5



On the next screen you can select which experience you'd like for your students.

The screenshot displays the codeSpark Academy interface with a blue background. At the top, a blue ribbon banner reads "LIMITED TIME ONLY Available Until January 15, 2018". Below the banner are two main game options:

- Learn Coding**: 1 Player. The thumbnail shows a blue monster character in a workshop setting with the title "THE FOOS".
- Challenge Friends**: 1-4 Players. The thumbnail shows Snoopy and his doghouse in a snowy landscape with the title "SNOOPY SNOWBRAWL".

At the bottom left, there is a "Reset Student Progress" button with a circular arrow icon. At the bottom center, there is a "Get Your Certificate" button with a "HOUR OF CODE" logo. At the bottom, a horizontal banner features three sections: "Cat Broken Astronaut" with a character holding a hammer, "GAME MAKER" with a play button icon, and "PET PALS" with a blue monster character. Below the banner, the text "Learn More About codeSpark Academy" is visible. A small "Development Build" watermark is present in the bottom right corner.

GLOSSARY



Algorithm: Instructions to solve a problem or complete a task.

Command: Primary instructions that tells the computer what action to perform (e.g., run, jump, walk)

Computer Science: Solving problems with very specific sets of instructions because computers only do exactly what they are told to do.

Loop: A set of instructions that is repeated over and over again.

Pair Programming: Two students work together, where one person “drives” by controlling the touchscreen, mouse, or keyboard and the other person “navigates” by answering the driver’s questions and pointing out potential problems or mistakes.

Parameter: Details of instructions that adds more specific information about the command (e.g., direction, color, object to perform an action on)

Programming: Creating a sequence of instructions, or an algorithm, that makes a computer do something.

Sequence: The step-by-step order in which instructions should occur.

SNOOPY SNOW BRAWL LESSON

SEQUENCING & LOOPS

codeSpark Academy with The Foos



Time:

45-60 Min

Materials:

Tablets or computers with codeSpark Academy

Learning Goals:

Students will...

Understand that computers are powerful, but need help to work.

- They only do what they are told, in the specific order instructions are received.
- Figuring out what instructions to give computers can be tricky.

Practice sequencing with multiple commands and parameters.

Learn different strategies for programming in unstable environments.

- Writing code that can handle errors is useful when you can't predict what an opponent will do next.
- Loops can expand sequences without extending the number of individual commands.

Introduction:

Review the concepts of algorithm and sequence. Remind students that computers are powerful but need to be told instructions for what to do, in the specific order we want them to do it.

In computer science, we use the word **algorithm** to describe the instructions we give computers to solve problems. The specific order of those instructions is called a **sequence**.

SNOOPY SNOW BRAWL LESSON

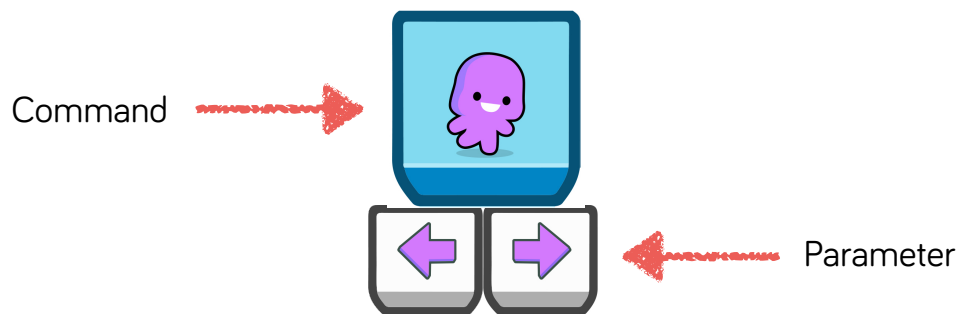
SEQUENCING & LOOPS

codeSpark Academy with The Foos



Explain that sequences must include **commands** that tell computers what action to do and **parameters** that add more specific information about how the action should be done.

This is an example of a command and parameter:



Ask students to help you write an algorithm for getting from your classroom to the playground. Write out the directions on the board and reinforce that the directions are a type of algorithm telling you the instructions for how to get from one place to another.

Circle the commands (e.g., walk) and underline the parameters (e.g., left, right) to highlight how the commands tell you *what* to do and the parameters tell you *how* to do it.

ProTip: If students are brand new to coding, check out codeSpark Academy's Hour of Code Puzzles curriculum for an introductory lesson on sequencing and loops. The Puzzle curriculum is available in the same codeSpark Academy app as Snoopy Snowball -- no additional download or setup needed! Once students get comfortable with the basics, Snoopy Snowball is a fun way to practice their new coding skills and challenge their friends to a virtual snowball competition!

SNOOPY SNOW BRAWL LESSON SEQUENCING & LOOPS

codeSpark Academy with The Foos



Game Activities:

Overview of Snoopy Snowball



Snoopy Snow Brawl is a game where players code a team of birds to win a friendly snowball competition. They'll use walk, jump, and throw commands to knockout their opponents and dodge incoming snowballs. The last team standing wins!

SNOOPY SNOW BRAWL LESSON SEQUENCING & LOOPS

codeSpark Academy with The Foos



Tutorial and Training Levels



Have students first play through the tutorial and training levels to familiarize themselves with the different commands and parameters used in Snoopy Snow Brawl. These levels scaffold gameplay by first introducing the main coding concepts and then providing multiple opportunities for practice as the difficulty increases.

Students will:

- Learn sequencing and parameters
- Practice in a safe, no-risk environment

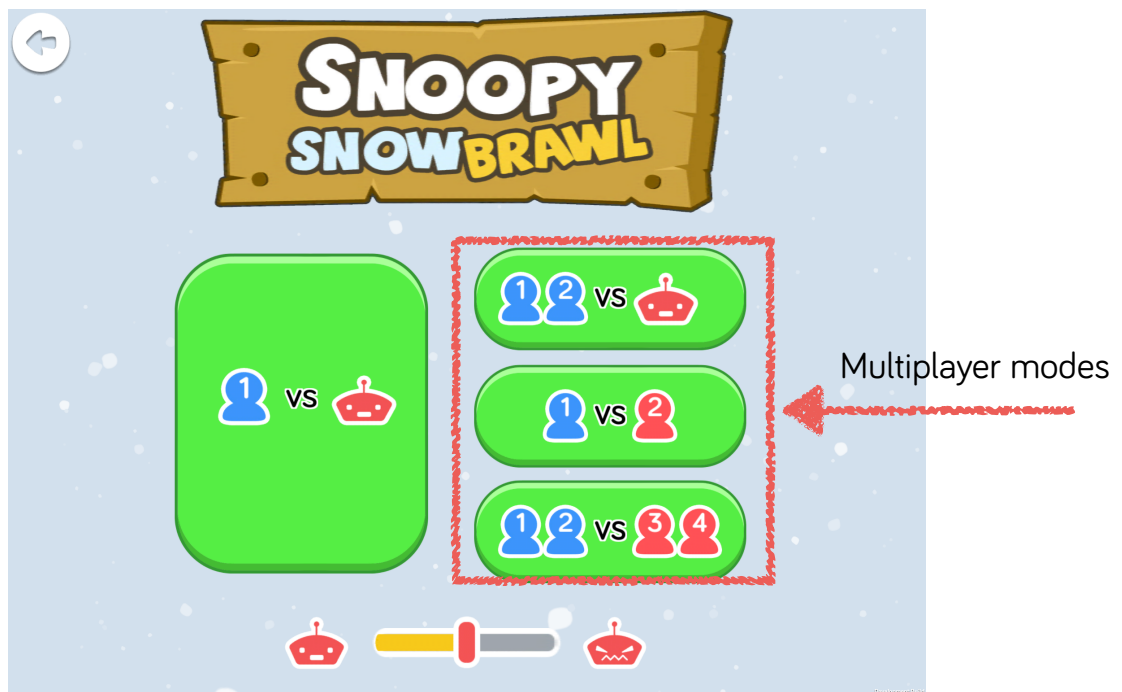
ProTip: The tutorial and training levels are in single-player mode, but if students are in pairs, Snoopy Snowball makes it easy to engage in *pair programming* and flip back and forth between being a driver on one turn and navigator on the next.

SNOOPY SNOW BRAWL LESSON SEQUENCING & LOOPS

codeSpark Academy with The Foos



Game Time!



Once students get comfortable playing against the computer in the training rounds, it's time to play Snoopy Snow Brawl! After playing the first round in single-player mode, the game will unlock multiplayer mode. Depending on your classroom configuration, students can continue using the single-player mode to play against the computer, or they can find a friend (or three!) and play together in multiplayer mode on the same device.

When students are down to their last bird, the loop command will appear. Encourage students to try out the loop command.

- What does adding a loop do?
- What are the advantages of adding loops when there is only one bird left?

SNOOPY SNOW BRAWL LESSON

SEQUENCING & LOOPS

codeSpark Academy with The Foos



- Sequences are limited to seven commands per play. Is there a way to make your bird jump 9 times in one play?

Extra Challenge

In Snoopy Snowball, the environment is always changing, and just like the game Rock-Paper-Scissors, you can't exactly predict an opponent's next steps. Will she jump off the ice block? Walk a different direction? Throw a snowball or pick more up?

Challenge students to write code that can handle these unanticipated errors. Is there a way to anticipate what the other team will do on the next turn?

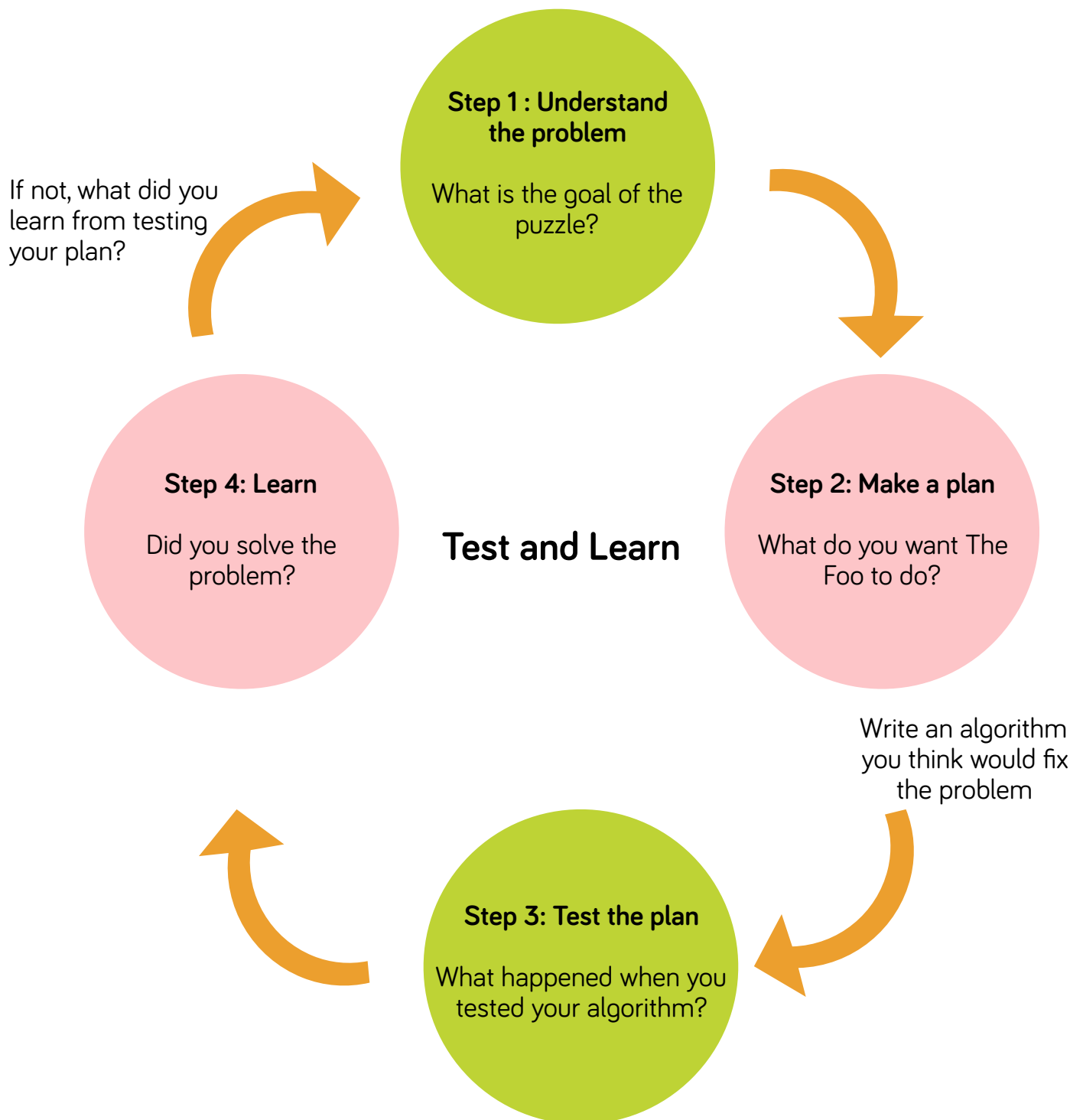
- Can you make your sequence work even if the opponent does something unexpected?
- Does throwing a lot of snowballs in the same direction work? How might you change strategies in case your opponent moves around? [hint: try changing the parameters of the throw command to launch snowballs in *different* directions]
- Do you notice any patterns in the way your opponent plays? Can you use those to figure out what they might do next?

ProTip: Encourage students to use the Test and Learn Strategy to try different tactics to outsmart the other team! This will help develop their problem solving skills and persistence. You can also try out the strategy in other classroom activities as well!

SNOOPY SNOW BRAWL LESSON

SEQUENCING & LOOPS

codeSpark Academy with The Foos



SNOOPY SNOW BRAWL LESSON SEQUENCING & LOOPS

codeSpark Academy with The Foos



ProTip: The multiplayer component of Snoopy Snowball is a great way to encourage collaborative learning and provide opportunities for more advanced students to take leadership roles by playing with children who are new to coding.

Multiplayer Mode in the Classroom

The multiplayer mode offers more flexibility, where two students can play one-on-one against each other; on the same team against the computer; and/or together against another student or pair of students.

Here are some helpful hints on setting up your classroom for multiplayer mode:

One-on-One



Players plan their turns in secret, then watch the code run together. If you have tablets or laptops, having kids sit on either side of a table helps them from peeking when it isn't their turn. If you have desktop computers or are in a computer lab, kids can close their eyes, put their heads down, or turn around when it's not their turn.

SNOOPY SNOW BRAWL LESSON SEQUENCING & LOOPS

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Same Team



Two players can also play on the same team against a computer opponent. Players can sit next to each other - they won't need to hide the screen at all.

SNOOPY SNOW BRAWL LESSON SEQUENCING & LOOPS

codeSpark Academy with The Foos



Team vs Team



When in a three or four player game, if you have tablets or laptops, having the teammates sit on the same side of the table helps partners plan their turn in secret without letting the other team see their sequence.

Since students will finish the single-player training mode at different times, one way to make a smooth transition to multiplayer gameplay is to have students share devices during the training mode.

ProTip: When switching from single-player to multiplayer mode, make sure to have some students return their devices so there is only one device per group. This will help students focus on playing together without being tempted to start a different game on their own.

SNOOPY SNOW BRAWL LESSON

SEQUENCING & LOOPS

codeSpark Academy with The Foos



Debrief Discussion:

- How did loops help when there is only had one bird left? What strategies did you use to extend your sequence from seven commands to more in one play?
- Often students only put one command in a loop. Discuss how they can do more in less space by putting multiple commands in the loop.
- What strategies did you use to make your code do what you wanted, even if your opponent did something unexpected?
- When students get a lot of snowballs, they often stand still and throw them all in the same direction. Discuss how this strategy is useful for stopping their opponent from one option, but not necessarily the best tactic if their opponent moves around. How might they adjust their strategy to cover all the different options (i.e., up, down, left, right)?
- What was most challenging about playing against the computer/another team? How did you overcome these challenges?
- Players will often stop adding commands after they've thrown a snowball - even if they have space left. It is usually better to use all of the spaces and keep moving - towards the next opponent, the next snow pile, or towards a safer spot. Discuss the different ways students did or did not use all command spaces and how this affected the outcome of the game.

ProTip: Loops share a natural connection with multiplication (e.g., 3 jump commands in a 3-loop = 9 jumps total). Try challenging older students to use multiplication in Snoopy Snowball to see how far they can go in just one play!

SNOOPY SNOW BRAWL LESSON

SEQUENCING & LOOPS

codeSpark Academy with The Foos



Unplugged Activities:

Tic-Tac-Toe Algorithms (Entry Level - Beginners)

Tic-Tac-Toe is a simple game -- be the first to get three X's or O's in a row. But in this version, instead of players taking turns in pairs, children will play the game in a cooperative group format.

1. Make a large 3x3 grid out of masking tape or blue tape on the floor (this will be the game board). Write large X's and O's on white paper (using two different colors for X's and O's). Explain and model for students how the Tic-Tac-Toe game works by using the large X's and O's and the floor grid.
2. Divide the group in half and assign them to the X team or the O team. Have each team stand on one side of the game board. Explain that the X's will be standing to mark their spot on the game board and O's will be sitting.
3. Assign (or ask for volunteer) for one student to be the "coder" on each team. The "coder" will be the one to tell the other members on the team ("computers") where to play their move.
4. Determine which team goes first.
5. Have the "coder" tell the first "computer" where to go on the game board. (Note: the "computer" will be a new student on the team for each turn.)
6. Students repeat this process until one coder wins or the game ends in a tie.

Note: For younger students, the strategy of Tic-Tac-Toe is sometimes difficult to understand. To better help them understand how the game works, have the students physically reach out and touch their fellow teammate. Explain to them they cannot reach over the team's member to touch their own team member. They must be next to or adjacent. By physically connecting arms students will better understand the three in a row concept.

SNOOPY SNOW BRAWL LESSON

SEQUENCING & LOOPS

codeSpark Academy with The Foos



Tic-Tac-Toe Algorithms (Advanced)

Draw Tic-Tac-Toe on the board. If students are unfamiliar with the game, explain the objective: be the first player to get three X's or O's in a row.

1. Have students get in groups of four.
2. Hand out two pencils and paper to each group. Have students draw out their own tic-tac-toe grid.
3. Assign two students to be the “coders” and two to play “computers.” Each “coder” will work on the same team as one “computer.”
4. Designate one coder-computer pair as Team X and the other as Team O.
5. Have each coder write down instructions (eg. arrows giving directions to the square) for the first move and pass to his/her computer.
6. At the same time, the students playing the computers follow the instructions to play their move.
7. Students repeat this process until one coder wins or the game ends in a tie.

Tell the class you will be the X's and they are the O's. Play two or three rounds and then ask the class:

- Do you think there is a way to make sure you don't lose even if you don't know what the other player will do?
- How can we use algorithms to think through whether this is possible?

SNOOPY SNOW BRAWL LESSON

SEQUENCING & LOOPS

codeSpark Academy with The Foos



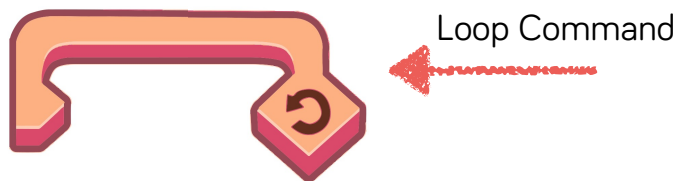
Debrief Discussion

- How would the Tic-Tac-Toe algorithm change if you didn't get to go first?
- How would you revise or improve your code?
- How might you use the strategies you discovered in the Tic-Tac-Toe activity in Snoopy Snowball?

Teacher Cheat Sheet

No snowballs, no problem: Walking or jumping on a snowball pile will restore a player's snowball stock. Look for sparkling snowflakes to see where more snowballs will appear on the next play. Players can also pick up an opponent's snowballs once the opponent is hit.

Loop command: Snoopy Snowball sequences are limited to seven individual commands in one play. When a player is down to one bird, the loop command will appear to help the player do more on one turn.



The power of snowballs: Snowballs can do more than knock out opponents. Use snowballs to break ice blocks and help teammates who are running low (i.e., teammates will catch friendly snowballs).

RUBRIC FOR STUDENT EVALUATION

	Unsatisfactory	Competent	Proficient	Excellent
Concepts	Puzzle levels are not completed.	Puzzle levels are completed with 1 star.	Puzzle levels completed with 2 stars.	Puzzle levels completed with 3 stars.
Execution	Code does not work or has major flaws preventing it from working correctly.	Code mostly works, or has minor flaws.	Code works in the way the student intended but is not the most efficient.	Program is functional, refined, and is executed in the most efficient way possible.
Grasp of Materials	Student cannot describe how their code should work and are unaware of their process.	Student can mostly describe how their code should work and some understanding of content.	Student can describe how their code should work and troubleshoot problems preventing their desired results.	Student can describe how their code works, how they wrote it, and help others troubleshoot their code.
Effort	Student shows minimal effort, does not use class time effectively, and work is incomplete. Student refuses to explore more than one idea.	Student does enough to meet minimum requirements. Student has more than one idea but does not pursue.	Completed work in an above average manner, although more could have been done. Student explores multiple solutions.	Completed work and exceeded teacher expectations. Student displays willingness to explore multiple ideas and solutions and asks questions.

Rubric adapted from: <http://www.edutopia.org/pdfs/blogs/edutopia-yokana-maker-rubric.pdf>



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