



## Human Coding

Adapted from Coding Without Computers – DiscoverE.org

[https://www.discovere.org/sites/default/files/Coding%20Without%20Computers\\_2page\\_C.PDF](https://www.discovere.org/sites/default/files/Coding%20Without%20Computers_2page_C.PDF)

### Objectives

Students will:

- Write a program that a human “robot” will follow to complete a task
- Communicate with written directions
- Learn how computer engineers use symbols
- Learn how to debug or improve upon an initial code or plan

### Suggested Grade Level

4<sup>th</sup> – 12<sup>th</sup>

### Subject Areas

Coding and Programming

### Timeline

30 minutes

### Standards (NGSS)

- 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

### 21<sup>st</sup> Century Essential Skills

- **Learning Skills**
  - Critical Thinking, Analysis, Creativity, Collaboration, Communication
- **Literacy Skills**
  - Information, Technology
- **Life Skills**
  - Leadership, Initiative, Listening

*Confidential and Proprietary to the Space Foundation*

Revised 05/2021



## Background

Computer programming has increasingly become a sought-after career in the 21<sup>st</sup> century. It is the process of designing and building tasks for a computer to follow. The language a computer follows is called coding. Each code is a symbol that represents a specific action. A programmer will use code to write a sequence of instructions that will automate the performance of that specific task. Common tasks are: testing, debugging, building and managing computer programs. These actions lead to software development and engineering.

## Vocabulary

Engineer, Coding, Programming, Symbols, Debug

## Materials

- Stackable cups (plastic Solo cups work well) – enough for each team to have two sets of 6 (different colors)
- Pencils
- Paper
- White board and marker (optional)

## Lesson

1. Write the programming symbol key and draw the cup pyramid on the board (see bottom of lesson plan for diagrams) prior to starting this lesson.
2. Ask students to describe how robots (or computers) know what to do. You are looking for the answer that they are programmed, or coded, to follow step-by-step directions.
3. Explain to students they will be writing a code using the 6 arrow symbols on the board and that a human “robot” will use that code to build the pyramid.
4. Split the class into teams of 3 or 4. Each team should choose a “robot.” Send the robots to a waiting area while the rest of the team decides on the code. Robots can use their time to make sure they understand the rules.
5. Using the symbols, programmers need to work together to figure out the most efficient way (fewest number of commands) to get the robot to create the pyramid.
6. Have the robots return and “run the program.” The programmers are not allowed to talk to the robot at all. The robot must follow the symbols exactly. If the group notices a mistake, they must halt the program, send the robot back to the waiting area, and fix the mistake before bringing the robot back.



7. Compare their programs when all the groups are done in order to see how many steps each one used.
8. Build a higher pyramid or design a new pattern with the cups, and then repeat the process when each team chooses a new robot.

### **Extensions & Adaptations**

1. For primary level students, omit the second color of cups, and just focus on the pyramid with one set of cups.
2. For middle and high school students, have them increase the difficulty by creating other structures with their cups. Have them give directions to other groups to complete the code.
3. For middle and high school students, add the human coding element with physical movements added to the cup stacking.
4. Find additional challenges by searching for “cup stacking coding” on YouTube.

### **Resources**

- [https://www.discovere.org/sites/default/files/Coding%20Without%20Computers\\_2\\_page\\_C.PDF](https://www.discovere.org/sites/default/files/Coding%20Without%20Computers_2_page_C.PDF)