DAY 1

What is an algorithm?

The most basic definition of an algorithm is:

_A set of steps to accomplish a task_

You may have an algorithm for how you get up and get ready for school, how to make a TV dinner, how to get from your house to a friend’s house, or how to make a peanut butter and jelly sandwich.

Let’s take the example of making a peanut butter and jelly sandwich, and explain the algorithm, to help understand the idea more:

1. Assemble two pieces of bread, a knife, a jar of your favorite jelly, and a jar of peanut butter.
2. Pick up the jar of jelly. Putting one of your hands around the top of the jar and the other holding the jar, twist the lid counter clockwise until you can remove the lid from the jar.
3. Set the lid down, and pick up the knife.
4. Put the knife in the jelly and turn the knife to get some jelly on the knife.
5. Remove the knife from the jar, and set the jar down on the counter/table.
6. Spread the jelly onto one slice of the bread, then clean off the knife.
7. Pick up the jar of peanut butter. Putting one of your hands around the top of the jar and the other holding the jar, twist the lid counter clockwise until you can remove the lid from the jar.
8. Set the lid down, and pick up the knife.
9. Put the knife in the peanut butter and turn the knife to get some peanut butter on the knife.
10. Remove the knife from the jar, and set the jar down on the counter/table.
11. Spread the peanut butter onto the other slice of the bread.
12. Put the knife in the sink, and put the two pieces of bread together, with the peanut butter and jelly sides touching each other. Put the sandwich on a plate and enjoy.

This seems like quite a lot of instruction, but only because most people already know how to make the sandwich, and are familiar with the tools. Step 12 talks about putting the pieces together. Imagine you have no prior knowledge of the tools used nor any prior knowledge of how to make a sandwich; the person making it could have put the bread together with the peanut butter and jelly on the outsides of the sandwich (backwards) if it was not explicitly stated.

ASSIGNMENT 1:

Pick from the following tasks below, with a minimum of 10 steps, and create an algorithm for the task as it has been done above for the peanut butter and jelly sandwich.

Choose one:

- How to make a grilled cheese sandwich
- How to leave to buy a gallon of milk in a grocery store
- How to cook a pizza or TV dinner
- How to get dressed before school
DAY 2

Today, let’s take a set of steps given to us on how to make a paper airplane. Below are the steps. Not all steps are necessary, but we know from before that if even if the simplest direction is left out, (like putting the peanut butter and jelly sides together) it can be a catastrophe.

ASSIGNMENT 2:

1. On paper, number and write down the steps you believe are needed to complete the task of making a paper airplane.
2. If possible (not required) try out your steps with a friend. You can have them pretend they know nothing, and using your algorithm, see how well they do.
3. Did the exercise leave anything out?
4. What would you have added to make the algorithm even better?
5. What if the algorithm had been only one step: “Fold a Paper Airplane”?
6. Would it have been easier or harder?
7. What if it were forty steps?
8. What was your favorite part about that activity?
Sometimes steps do not need to be completed in a specific order, for example we could have spread our peanut butter on the bread first instead of doing the jelly side first, and the final product would not be changed. Below

**ASSIGNMENT 3:**

**Problem 1:**

Sometimes you can have more than one algorithm for the same activity. The order of some of these steps can be changed without changing the final product. Use the letters on the images below to create two algorithms for making a paper airplane.

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A  B  C  D  E  F  G  H
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**Algorithm 1:**   

**Algorithm 2:**   

In the spaces provided, fill in the letters, in order, creating two algorithms that create the same thing.

**Problem 2:**

What we have been doing are linear algorithms that do not need any decision making at all (they do not branch off into other options). For example, we made a particular sandwich; peanut butter and jelly. What if I asked you to make a sandwich in general? The first thing you would have to do is make some choices, and probably make other choices along the way.

For example, you would need to know what type of sandwich, which type of bread, does the person want mayo on it or not. Imagine the algorithm of a subway sandwich maker. Assuming they are making a sub, they need decisions to be made in order to proceed, and as those decisions change, so does the sub (begins to branch off to different outcomes).
What I would like you to do is create a tic-tac-toe game board, and play it with a friend/sibling/guardian, or play against yourself. While you are playing, I would like you to detail each move, and why that move was made. There are only 9 blocks in a tic-tac-toe board, so you need to have 9 or fewer steps (moves) with reasoning for the moves (decisions). Below are a few examples.

1. Joe put an X in center. Joe likes the center because it touches many other blocks to make 3 in a row.
2. Joe’s opponent Jenelle puts an O in the top right corner, because she now has two lanes to get three in a row, whereas if she put the O in the middle of the row she would only have one option for three in a row, and Joe could block her easily.
3. Joe puts an X in the top left corner. He did this to block one lane from Jenelle, but also puts 2 X’s in a row so he is one away from winning.
4. Jenelle puts an O in the bottom right corner, because she must block Joe from using the diagonal to get three in a row.
5. Etc.

Follow the above example in making.

In case anyone forgot or does not know:

*The object of Tic Tac Toe is to get three in a row. You play on a three by three game board. The first player is known as X and the second is O. Players alternate placing X’s and O’s on the game board until either opponent has three in a row or all nine squares are filled. X always goes first, and in the event that no one has three in a row, the stalemate is called a cat game. Game board is drawn below:*