TACC
TEXAS ADVANCED COMPUTING CENTER
WWW.TACC.UTEXAS.EDU

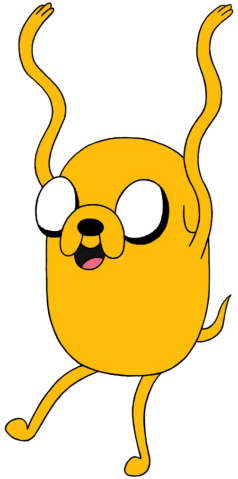
TEXAS
The University of Texas at Austin

Hack@TACC REU Coding Challenge
-DAY 1-

PRESENTED BY:

Introductions - Icebreaker

Charlie Dey (*TACC*)



Je'aime Powell (*TACC*)

Computational Thinking Objectives

The student will …

- Learn the about the concept of “computational thinking”
- Practice algorithm implementation through abstraction
- Learn about the concept of pseudo code
- Apply computational thinking to the equation for a straight line

Back when mathematicians were computers and computers were calculators...

- Initially all programming was dedicated to translating math formulas.
- The work lead to the language FORmula TRANslation.

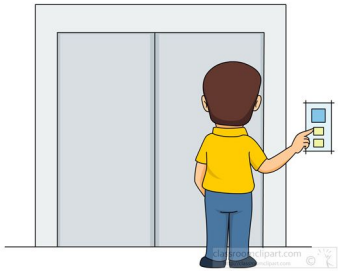
“Computational Thinking is the translation of ideas into computer code” ~Victor Eijkhout

Mathematical Thinking

- Number of people an elevator takes per day
- Speed (velocity) of an elevator
- Distribution of people in an elevator

Computational Thinking

- If there are X # of people expected to use elevators, how many should be installed?
- If someone at floor 0 presses the call button and there are available cars on floors 5 and 9, which car should respond?



The Process of Forming Logic (Think teaching a 3 year-old)

How would you tell a three(3) year old family member to get your keys out of the drawer in your room ?

Requirements, Logic, Algorithms, and Parameters

Requirements - what elements are needed before the job can be taken on

Logic - a system or set of principles underlying the arrangements of elements in a computer or electronic device so as to perform a specified task [an order in which to do a task]

Algorithm - a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer [logic + calculations = algorithm]

Parameters - a limit or boundary that defines the scope of a particular process or activity [limits set on an algorithm = parameters]

Making a PB&J Sandwich

Requirements - what elements are needed before the job can be taken on

Parameters - a limit or boundary that defines the scope of a particular process or activity [limits set on an algorithm = parameters]

Logic - a system or set of principles underlying the arrangements of elements in a computer or electronic device so as to perform a specified task [an order in which to do a task]

Algorithm - a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer [logic + calculations = algorithm]

Finding a definition in a dictionary

Requirements - what elements are needed before the job can be taken on

Parameters - a limit or boundary that defines the scope of a particular process or activity [limits set on an algorithm = parameters]

Logic - a system or set of principles underlying the arrangements of elements in a computer or electronic device so as to perform a specified task [an order in which to do a task]

Algorithm - a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer [logic + calculations = algorithm]

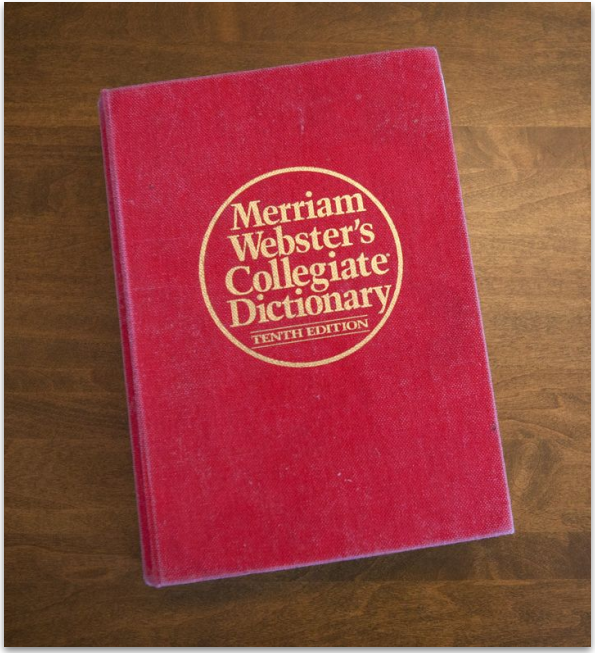
Given (Input):

- Dictionary
- Word (string)

Find (Output):

- Definition

Define your algorithm



Sorting

Requirements - what elements are needed before the job can be taken on

Parameters - a limit or boundary that defines the scope of a particular process or activity [limits set on an algorithm = parameters]

Logic - a system or set of principles underlying the arrangements of elements in a computer or electronic device so as to perform a specified task [an order in which to do a task]

Algorithm - a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer [logic + calculations = algorithm]

Given:

A bag of potatoes

Problem:

Sort the bag of potatoes from smallest to largest

Algorithm:????

What would we need to solve for “y”

Requirements - what elements are needed before the job can be taken on

Parameters - a limit or boundary that defines the scope of a particular process or activity [limits set on an algorithm = parameters]

Logic - a system or set of principles underlying the arrangements of elements in a computer or electronic device so as to perform a specified task [an order in which to do a task]

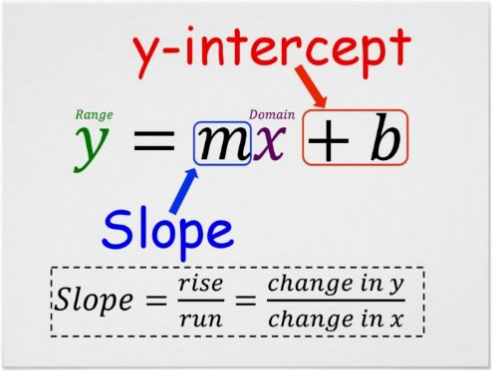
Algorithm - a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer [logic + calculations = algorithm]

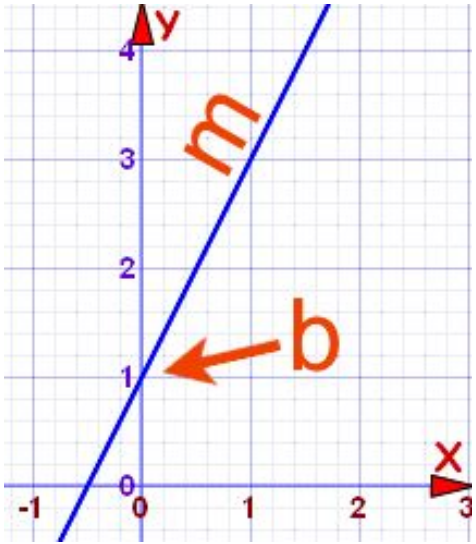
Problem (function):
y=mx+b

Define the **Input** (parameters)

Define the **Output** (parameters)

Define the **Algorithm**





Think outside the "Box"

Requirements - what elements are needed before the job can be taken on

Parameters - a limit or boundary that defines the scope of a particular process or activity [limits set on an algorithm = parameters]

Logic - a system or set of principles underlying the arrangements of elements in a computer or electronic device so as to perform a specified task [an order in which to do a task]

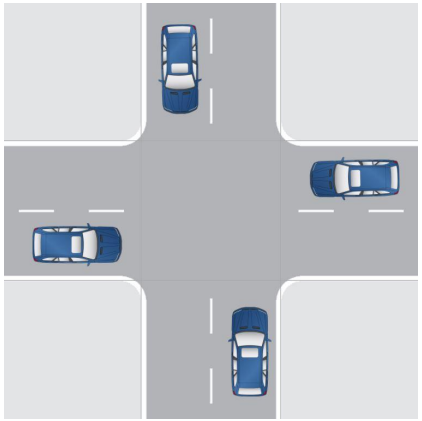
Algorithm - a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer [logic + calculations = algorithm]

Problem:

4 automated cars come to an intersection at the same time.

Who goes first?

Algorithm: ???



What decisions did you make?

Requirements - what elements are needed before the job can be taken on

Parameters - a limit or boundary that defines the scope of a particular process or activity [limits set on an algorithm = parameters]

Logic - a system or set of principles underlying the arrangements of elements in a computer or electronic device so as to perform a specified task [an order in which to do a task]

Algorithm - a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer [logic + calculations = algorithm]

What was the last meal you ate?

What were the defining parameters on why you chose that meal?

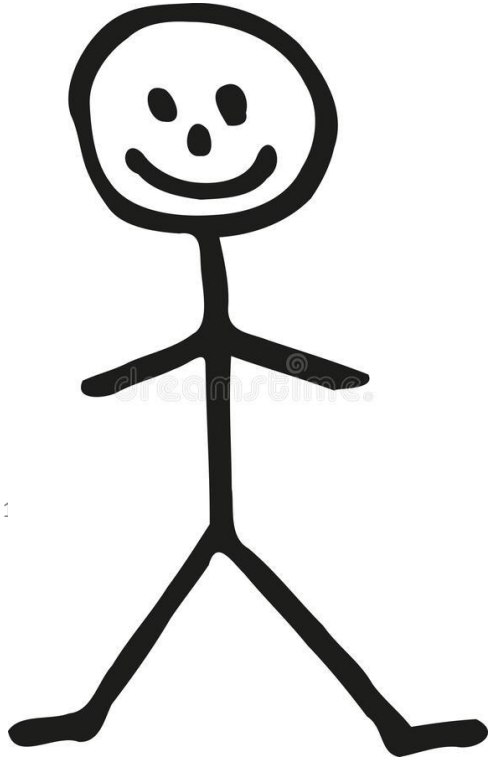
Where do we go from here?

Look at each problem you are going to tackle, and figure out the requirements - what is needed to solve? Figure out the logic on how to solve it, and apply the algorithm.

Think about a Scientific Process

Let's meet Joe.
Joe might get sick.
Joe will be sick for 5 days.
After 5 days, Joe gets better.
Once Joe gets better, Joe can no longer get sick.

How would we "code" Joe?



Task 1 - Code Joe

Variables to hold data

Mathematical Operations to do math :)

Conditionals to make decisions

Loops to repeat our process

Functions/Subroutines to reuse code

Objects or Classes to define our "things"

Let's meet Joe.

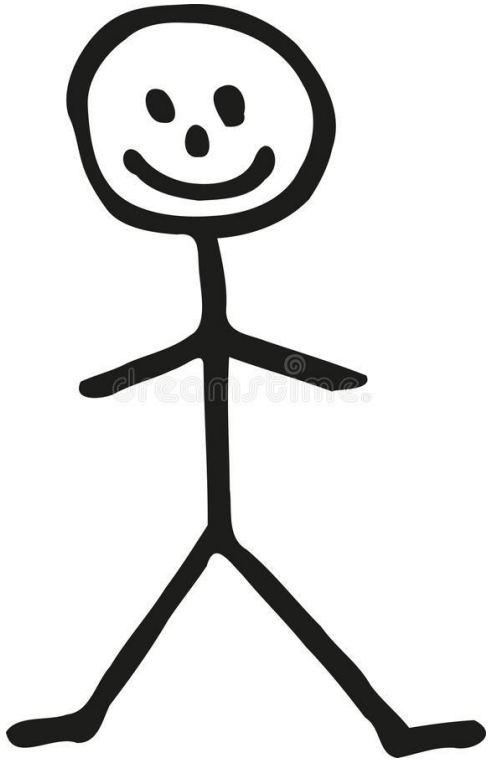
Joe might get sick.

Joe will be sick for 5 days.

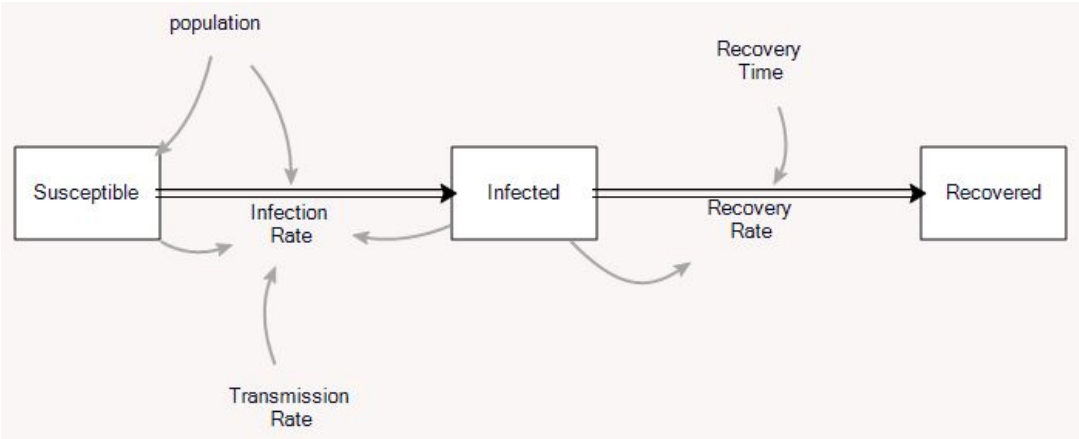
After 5 days, Joe gets better.

Once Joe gets better, Joe can no longer get sick.

Let's "code" Joe.



The SIR Model



Task 2 Code Joe and Jane

Let's meet Joe.

Joe has a friend, Jane

If Joe gets sick, Jane might get sick.

Modify your code, so when Joe gets sick that triggers Jane to roll a random number to see if she gets sick.

Loop through your code until both Joe and Jane get sick and they each get better.