

Algorithm Design and Development

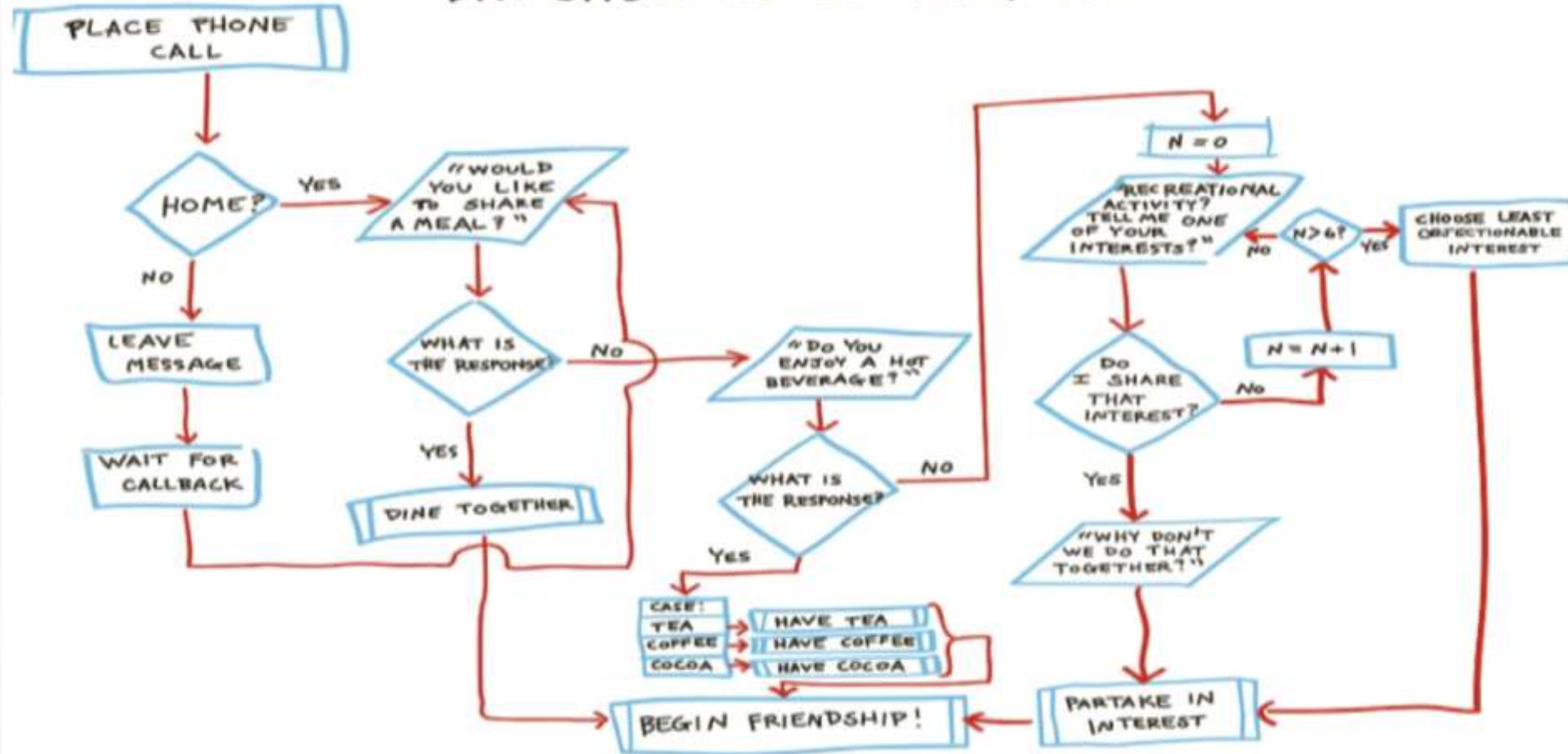
With: Rodrigo Daboin Sanchez

Recall: what is an algorithm?

- ◇ Process or set of rules to follow when solving a problem
 - ◇ How to make a PB&J?
 - ◇ How to read a book?
 - ◇ How to walk?
 - ◇ How to make a new friend?

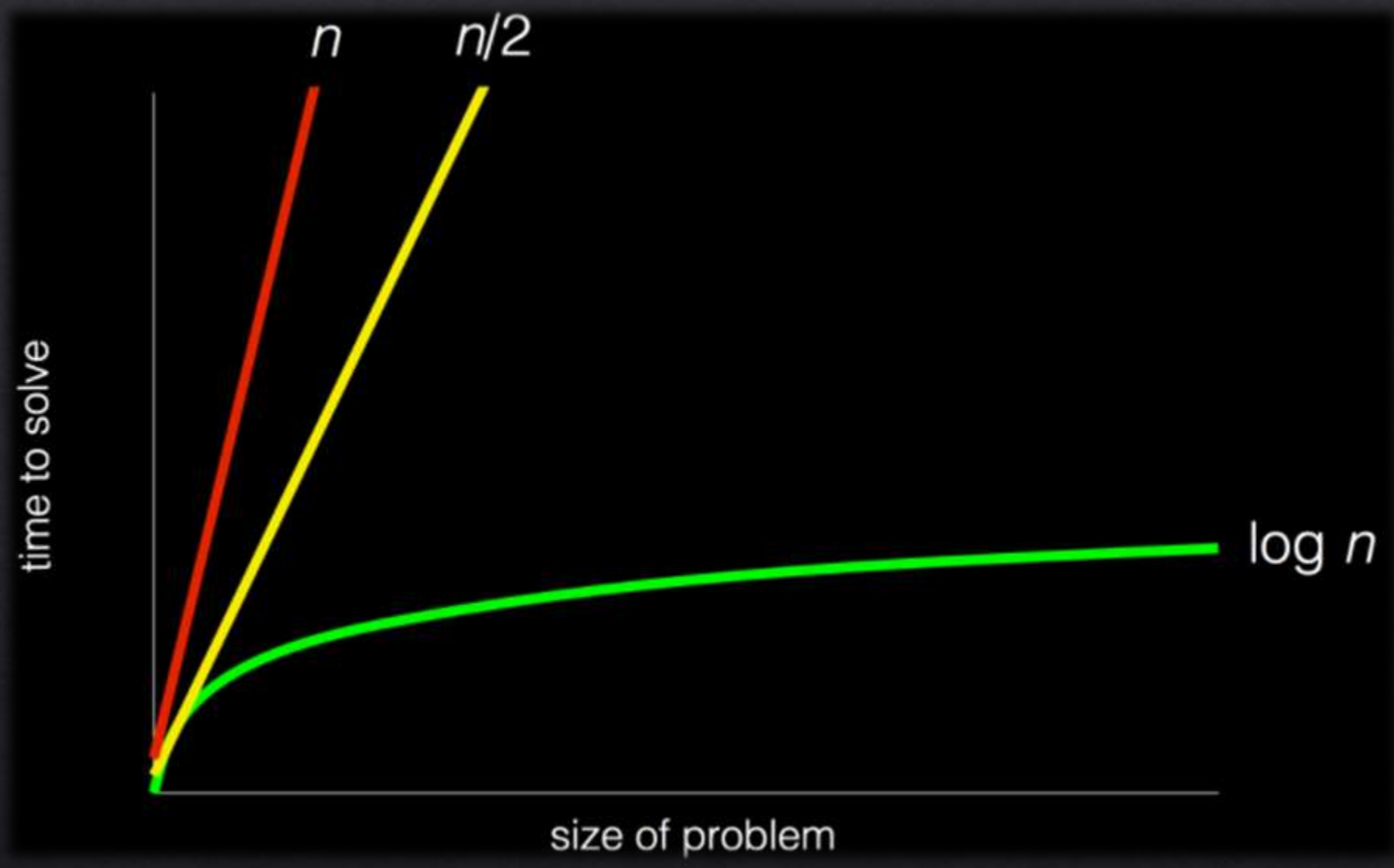
THE FRIENDSHIP ALGORITHM

DR. SHELDON COOPER, Ph.D



Last time

- ◆ Correctness, efficiency
- ◆ Searching, sorting
- ◆ Arrays, linked lists, trees, hash tables



Correctness vs. Efficiency

- ◆ Running time (upper bounds, lower bounds)
 - ◆ Big O, etc.
- ◆ What's an example of two algorithms that are correct, one of which is more efficient than the other?

Searching and sorting

- ◇ Generally we're talking about data sets here
 - ◇ Linear search vs. Binary search
 - ◇ Bubble sort vs. Merge sort

6 5 3 1 8 7 2 4

6 5 3 1 8 7 2 4

Bubble vs. Merge, Pros and Cons

- ◆ Which is correct?
- ◆ How can we describe their efficiency with big O?
- ◆ Which is more efficient?
 - ◆ Is this always true?

Merge sort

◇ 1 2 3 4 5 6 7 8

◇ 1 2 3 4 - 5 6 7 8

◇ 1 2 - 3 4 - 5 6 - 7 8

◇ 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8

◇ 1 2 - 3 4 - 5 6 - 7 8

◇ 1 2 3 4 - 5 6 7 8

◇ 1 2 3 4 5 6 7 8

Bubble sort

◇ 1 2 3 4 5 6 7 8

◇

◇ Done!



crucial
by Micron

47J6

4G85

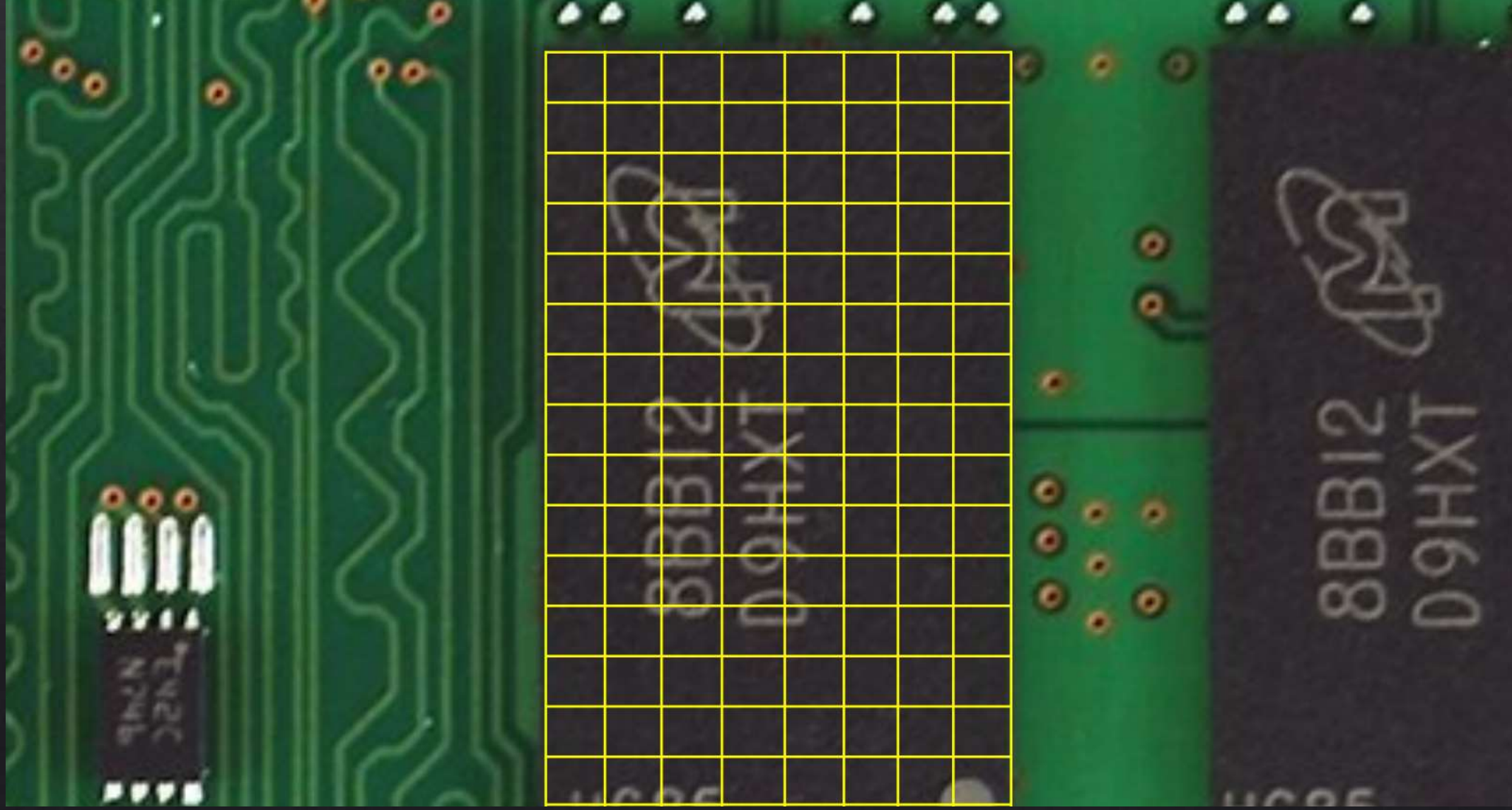
4G85

4G85

8BB12
D9HXT

8BB12
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WJ KH-13
94V-0



8BB12
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8BB12
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M	a	r	i	a			

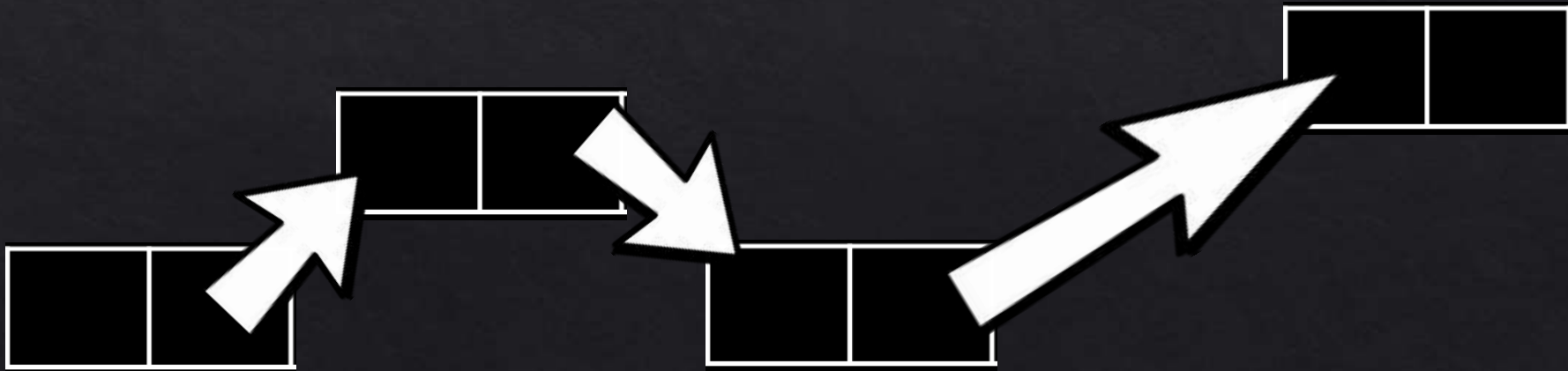
Arrays

- ◆ Can store data in contiguous blocks of memory.
- ◆ What type of algorithms might we be able to implement with arrays (pros and cons?)



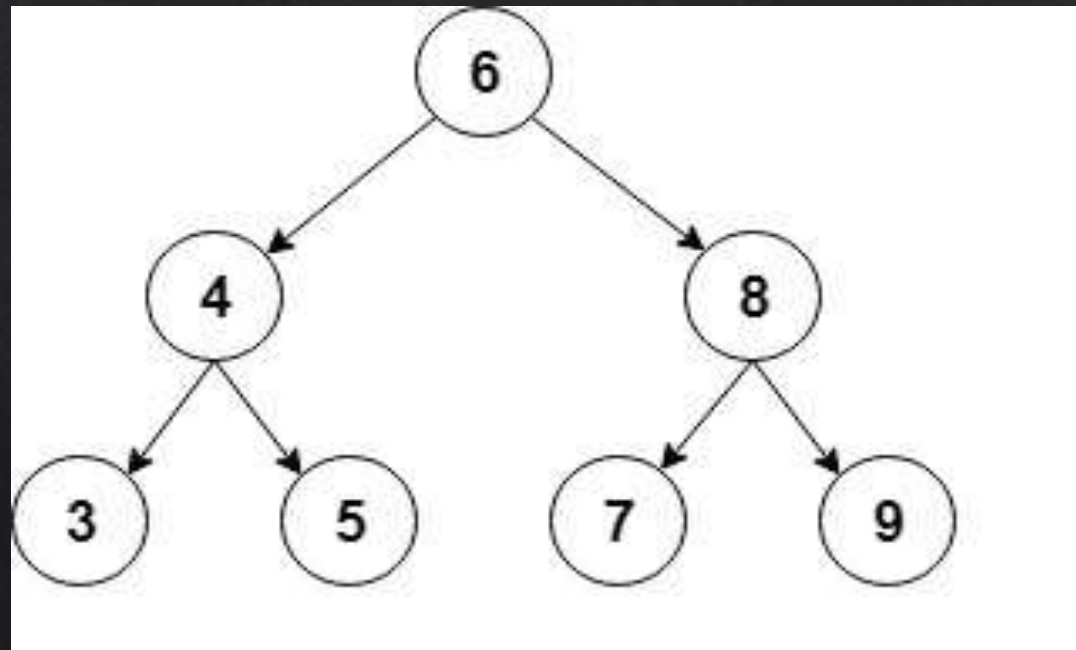
Linked lists

- ◆ Can store data non-contiguously in memory
- ◆ What type of algorithms might we be able to implement with linked lists (pros and cons?)



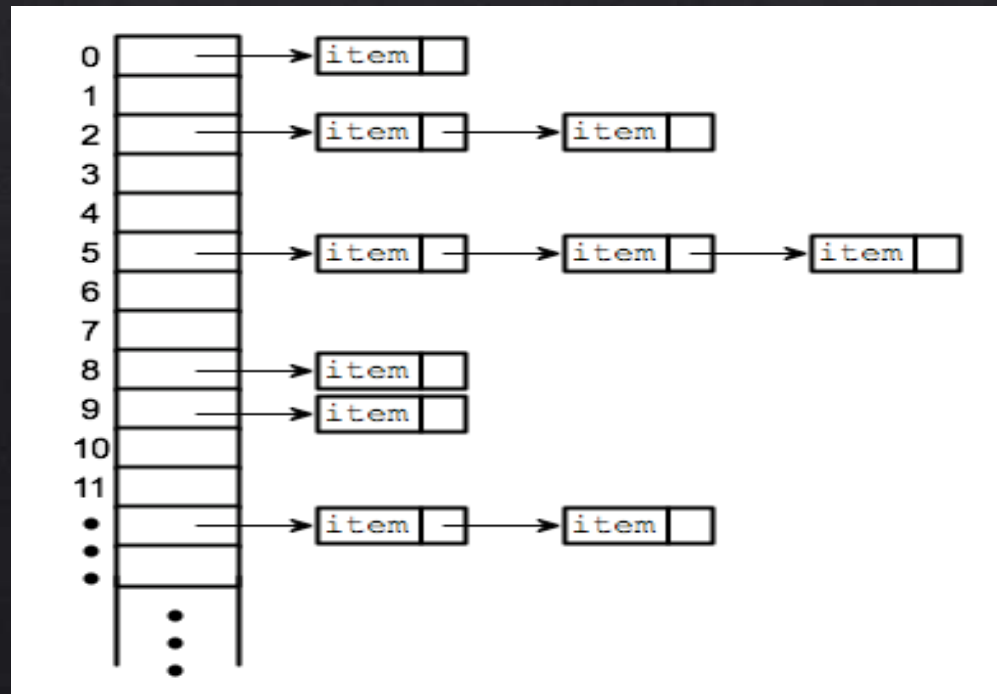
Trees

- ◆ Can store data non-contiguously while allowing for more flexibility with data set algorithms (binary search, etc.)



Hash Tables

- ◆ Can store data non-contiguously while allowing for different flexibility with data set algorithms (such as indexing into a growing array)



Shifting gears

- ◆ What other types of algorithms are useful in computer science?
 - ◆ We've seen examples of...
 - ◆ Data searching
 - ◆ Sorting
 - ◆ Data structure design in conjunction with potential algorithm implementations

Artificial Intelligence

- ◆ “Intelligence” demonstrated by machines
 - ◆ Algorithms are at the heart and soul of AI
- ◆ How can a machine know to react to different conditions in different ways?

TwixT

- ◆ We will consider an example of artificial intelligence within the context of a computerized board game (TwixT)
- ◆ The following demo is of a TwixT AI written by me a few years ago for a class project
- ◆ We'll pick apart how it works, the pros and cons of the design choices I made, and how it could be improved now