CSCI 230 – Data Structures and Algorithms

Fall 2019 Midterm Study Guide

1. Intro to Data Structures and Algorithms
   a. What is a data type?
   b. What is an Abstract Data Type?
   c. How do we use data types or ADTs?

2. Object Oriented Programming
   a. What is inheritance? Give an example.
   b. What is encapsulation? What is its difference with information hiding?
   c. What is polymorphism? Give an example

3. Algorithm Analysis
   a. Difference between algorithm and program
   b. Calculate the upper bound for the best, worst, average case of an algorithm.
   c. Calculate the time / number of operations T(n) for an algorithm.
   d. How much faster is an algorithm with O(f(n)) when we run it in a faster computer?
   e. Calculate the runtime big-Theta for an algorithm.
   f. Use the definition for Big-O, Big-Omega, Big-Theta to prove that a specific upper, lower, or runtime bound respectively, works.

4. List
   a. Reproduce all basic methods of the List ADT interface with ArrayList or LinkedList
   b. Any variation of standard operations to the list:
      i. Insert to a specific index / position
      ii. Remove from a specific index / position
      iii. Find duplicates
      iv. Find element e
      v. Print reverse
   c. Analysis of list operations
      i. Time
      ii. Memory

5. Stack
   a. Use a stack to implement a freelist.
   b. ArrayStack implementation
   c. LinkedStack implementation
   d. Analysis of stack operations
      i. Time
      ii. Memory

6. Queue
   a. Cyclic array implementation of ArrayQueue
   b. Linked Queue implementation
   c. Analysis of queue operations
      i. Time
      ii. Memory
7. Recursion
   a. Problem solving with recursion.
      i. Find the base case.
      ii. Find the recursion.
      iii. Write the whole program.
   b. Analysis of time complexity of recursive problems.