

There are three multi-part questions in this exam. Provide answers for each in the allocated time. Time is of essence, use it wisely! Use of Calculators, Smart-phones or any other electronic device is prohibited.

Q1. About sorting [3+1+1+1]

(a) Sort the following array of integers using **Insertion Sort**. Show trace at each pass/iteration. Identify the item/value to be swapped in each iteration by circling it.

Iteration	9	2	6	8	4	1	3	7	5
1									
2									
3									
4									
5									
6									
7									
8									
9									

(b) Estimate how many swaps/exchanges were made. Give a Big-Oh notation for the number of swaps.

(c) Assume you have an array full of identical values. What would be the run-time to sort it using Selection Sort? Give an estimate for number of swaps and checks/comparison.

(d) Imagine you were given an array of size 2^n elements, which may have been pre-sorted in ascending order (of-course we cannot be sure of this!). You are required to sort it in ascending order using either Selection sort or Insertion sort. We need to sort the array in fastest possible way, which algorithm you would deploy and why?

Q2. About trees [2+2+3]

(a) Write a recursive method to traverse a binary tree using in-order traversal.

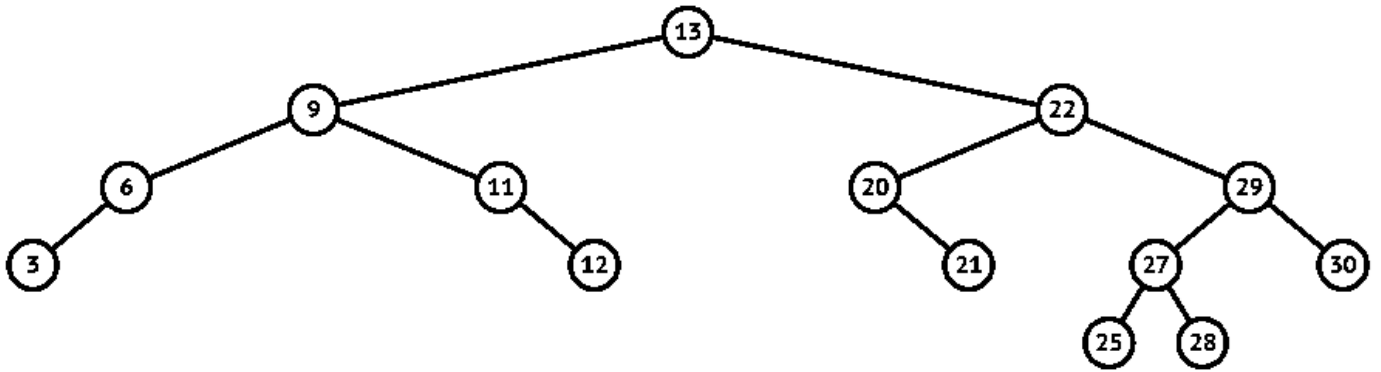
(b) What is the best, average and worst run time for searching an element in a Binary Search Tree. Illustrate/show a scenario where the search would give an $O(n)$ time.

(c) Apply the following removal calls to this AVL Tree that stores an integer value in each node. Re-draw the tree balancing after each call (if necessary) and identify each rotation after the operation.

remove (11)

remove (21)

remove (12)



Q3. About basic data structures [1+1]

(a) Given an array of Strings of size 2^n . What data structure / algorithm would be used to reverse the elements in this array?

(b) Show the contents of the queue of type integers after each call.

Call	Output/Return value	Contents of the Queue
enqueue (3)		
enqueue (6)		
front ()		
dequeue ()		
dequeue ()		
dequeue ()		
enqueue (1)		
enqueue (2)		
isEmpty ()		
dequeue ()		

Empty space