DES221 Final Mock Exam

from James Dean and Google and The Peanuts

Name.....ID.....Section.....Seat No.....

Conditions: Open book, Open mind, Open snacks

Directions:

1. This exam has 17 pages (including this page).
2. Students are encouraged to dramatically sigh every 5 minutes.
3. Write your name, or your preferred superhero alias.
4. Reading the problem is optional but highly recommended.
5. Solutions can be written in English or Japanese.
6. Students may not escape through windows or air vents.

Problem 1

What are the maximum and minimum heights of a tree with 28 nodes?

Problem 2

Draw the expression tree and find the prefix and postfix expressions for the following infix expression:

$$(C + D + A \times B) \times (E + F)$$

Problem 3

Letter	α	β	γ	δ	ϵ	θ	κ	ω
Frequency	2	7	24	32	37	42	42	120

1. Draw the Huffman tree.
2. Encode $\beta\theta\omega\delta$.
3. Decode 0110100111100.

Problem 4

Create a binary search tree using the following data entered as a sequential set:

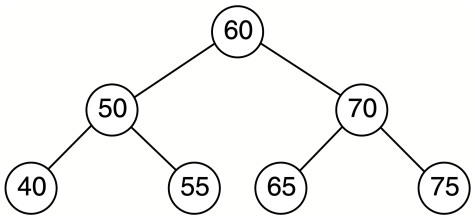
80 70 66 56 33 23 14 10 7

How many comparisons do you need to find 7 in this binary search tree?

What is the performance (Big-O) of finding 7 in this BST?

Problem 5

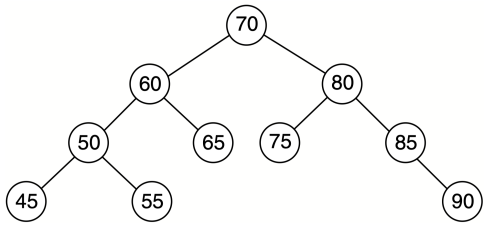
Insert 44, 66, and 77 into the binary search tree.



After inserting those three numbers, insert 66 into the binary search tree again.

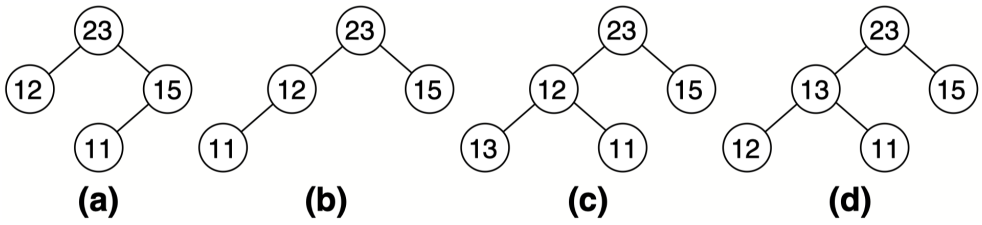
Problem 6

Delete the node containing 60 from the binary search tree.



Problem 7

Show which of the structures in the following are heaps and which are not.



Problem 8

Make a heap out of the following data read from the keyboard:

23 7 92 6 12 14 40 44 20 21

Problem 9

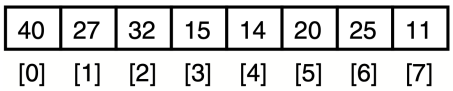
If a node is at index 25, what is the index of its right child? What is the index of its left child? Assume the indexes start from 0.

If a node is at index 37, what is the index of its parent?

Problem 10

Show the left and right children of 32 and 27 in the heap.

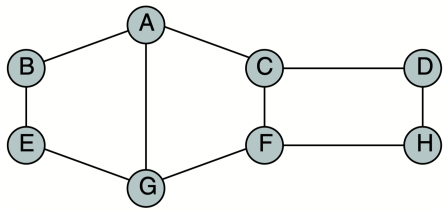
Also show the left children of 14 and 40.



What is the performance (Big-O) of finding the maximum in the heap?

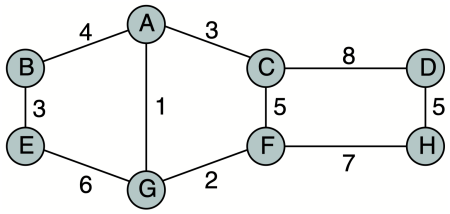
Problem 11

Give the depth-first traversal, breadth-first traversal of the graph, starting from vertex A.



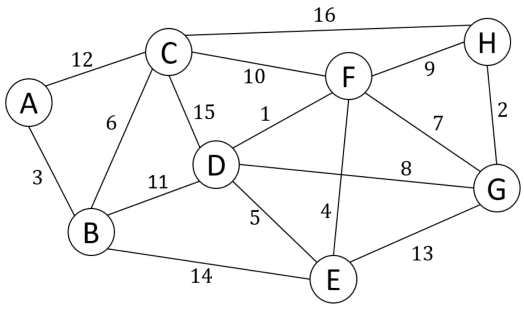
Problem 12

Give the adjacency matrix representation of the graph



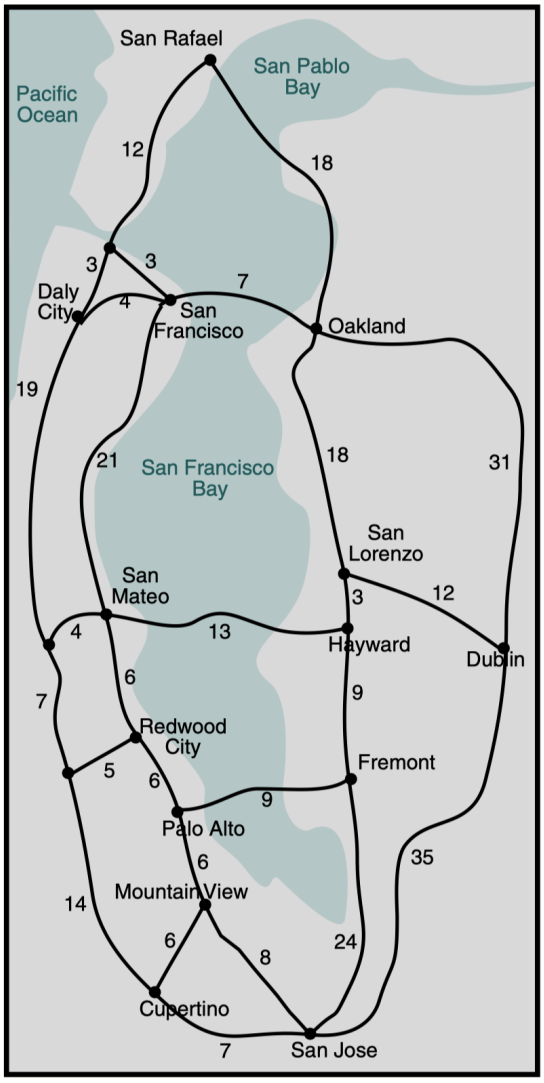
Problem 13

Find MST using Kruskal Algorithm.



Problem 14

A computer company in the Silicon Valley area needs to route delivery vehicles between cities on the shortest route. Having studied data structures, you recognize that this is an application for Dijkstra's shortest path algorithm. Find the shortest path from **San Francisco to San Jose**.



Problem 15

Create an AVL tree using the following data entered as a sequential set. Show the balance factors in the resulting tree:

7 10 14 23 33 56 66 70 80

Problem 16

Insert 44, 66, and 77 into the AVL tree. The result must be an AVL tree. Show the balance factors in the resulting tree.