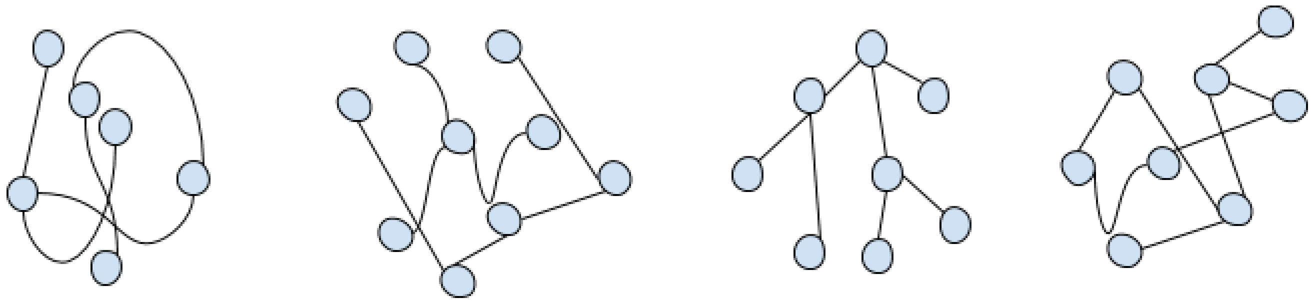
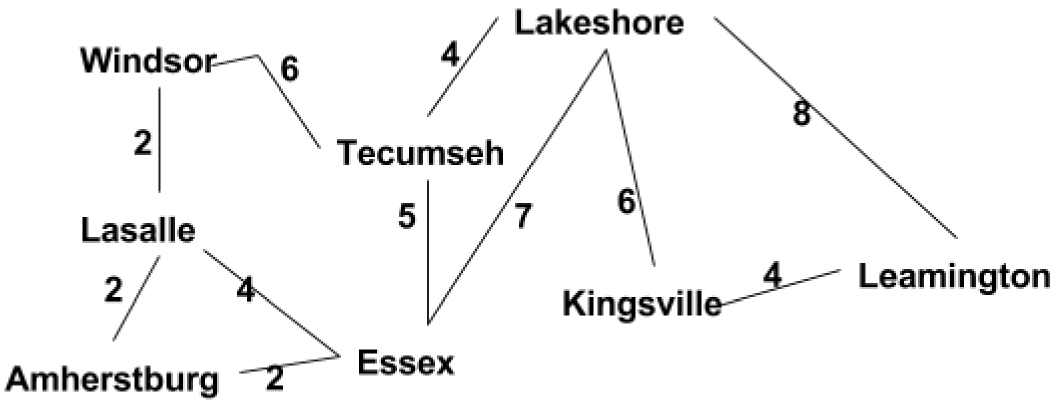
Graphs and Trees Worksheet 1

Q1) Which of these graphs are trees, and if not why?



(a) (b) (c) (d)

Q2) The roads represented by this graph are all new unpaved roads. The lengths of the roads between pairs of towns are represented by edge weights. Use Dijkstra's algorithm to find the shortest path between (Windsor, Kingsville) (Amherstburg, Leamington)



Q3) Use a binary tree to represent the following algebraic expressions:

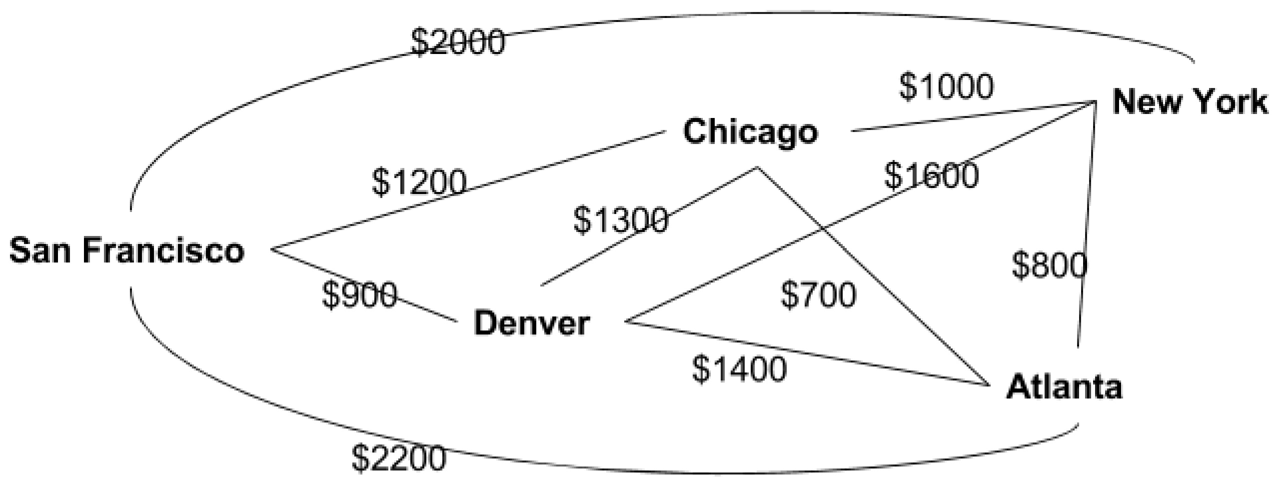
a + b / c
a + b - c
(a - b) / ((c * d) + e)
(a + (b - c)) * ((d - e) / (f + g - h))

For each tree traverse the tree using inorder, preorder and postorder method

Note: Operands are always leaf nodes. The operations with the highest priority have the maximum depth. The brackets are not part of the trees.

Q4) Let Data a one dimensional array of integers **{5, 6, 8, 9, 12, 17, 20, 22, 31, 43, 47}.** Data is a sorted array apply binary search algorithm over data and draw the constructed binary search tree.

Q5) A company plans to build a communications network connecting its five computer centers. Any pair of these centers can be linked with a leased telephone line. Which links should be made to ensure that there is a path between any two computer centers so that the total cost of the network is minimized? We can model this problem using the weighted graph shown below, where nodes represent computer centers, edges represent possible leased lines, and the weights on edges are the monthly lease rates of the lines represented by the edges. Use Kruskal's algorithm to design the communications network for this company



Q6)Insert the following elements **{14, 10, 17, 12, 10, 11, 20, 12, 18, 25, 20, 8, 22, 11, 23}** in an empty binary search tree.

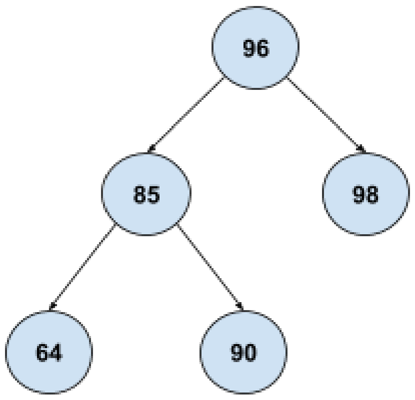
- Draw the constructed tree, what is the depth of the tree? What is the width of the tree? What is the height of the tree?
- Is it a balanced binary search tree, if not reorder the elements in such a way that when we insert the element in an empty binary search tree, the result is a balanced binary search tree.

Q7) Write a recursive algorithm to find the depth of any given binary tree.

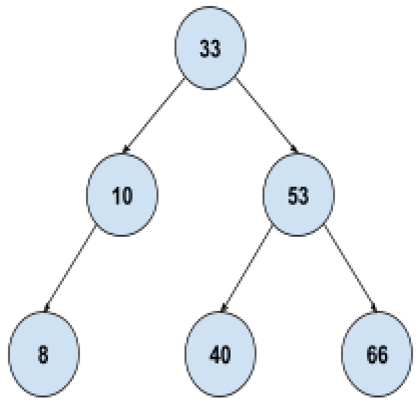
Q8) Write a nonrecursive algorithm to find the number of nodes, the depth, the number of leaf nodes in a binary tree

Q9) Given the following binary search trees a and b, for each tree answer the following

- Is it a complete tree or not?
- Insert the value 36 in Tree-a and 80 in Tree-b, is the result an AVL tree, if not apply appropriate rotation to make it an AVL tree



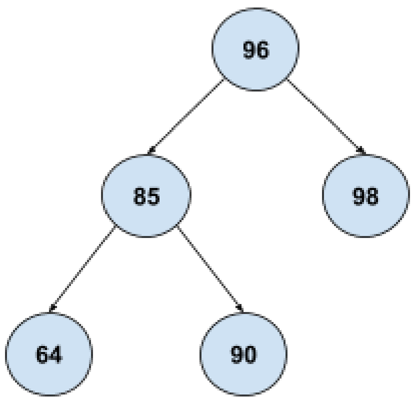
(a)



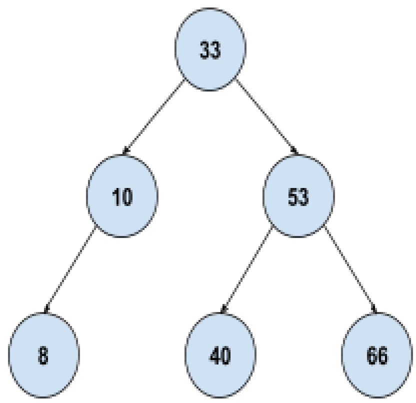
(b)

Q10) Given the following binary search trees a and b, for each tree answer the following

- Is it an AVL tree or not?
- Delete the value 85 in Tree-a and 33 in Tree-b, is the result an AVL tree, if not apply appropriate rotation to make it an AVL tree.

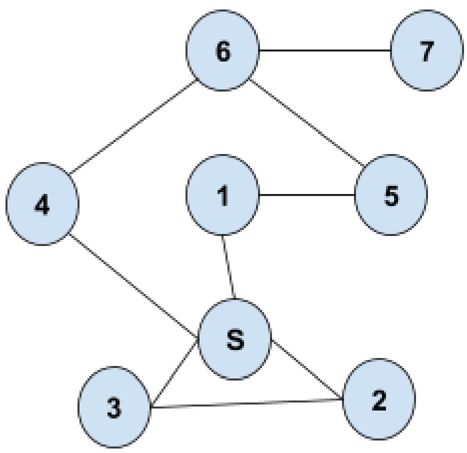


(a)



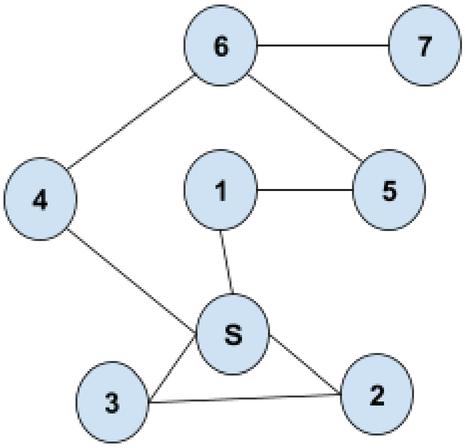
(b)

Q11) Show how depth first search works on the graph in Figure (a) starting from vertex S. You should show the distance from start d that BFS computes for each node and the stack that BFS stores.



(a)

Q12) Show how breadth first search works on the graph in Figure (a) starting from vertex S. You should show the distance from start d that BFS computes for each node and the queue that BFS stores.



(a)