Department of Computer Science & Engg.
Motilal Nehru National Institute of Technology Allah
B.Tech III(CSE & IT), End-sem Exam, Nov 2016

Duration: 3 HRS.
Max. Marks: 60

Subject: Data Structures
Subject code: CS-1301

Note:Paper is printed on both sides. Attempt any Six questions. Each question carries equal weight. Feel free to assume any missing data but categorically mention it under the heading 'Assumption for this question'

1. [5x2=10 marks]Answer the following subparts with brief explanation why your answer hold
   (a) Explain why binary search cannot be performed on a linked list.
   (b) We know that two stack can be located as to allow them to grow towards each other, thereby making efficient use of a common memory area. Can two queues, or a stack and a queue make use of common memory area with the same efficiency?
   (c) Define a heap. How can it be used to represent a priority queue?
   (d) If a program runs in approximately A/M+B unit of time and uses C+M locations in memory, what choice of M gives minimum time * space?
   (e) Draw the diagram of a graph that is connected but not rooted.

2. (a) [6 marks] Insert the following sequence of elements into an AVL tree, starting with an empty tree: 10, 20, 15, 25, 30, 16, 18, 19. Delete 30 and then 18 in the AVL tree that you got. Clearly show the tree that results after each insertion and deletion, and make clear any rotations that must be performed.
   (b) [4 marks] Define tree. Two binary tree are mirror similar if they are both empty or if they are both nonempty and the left subtree of each is mirror similar to the right subtree of the other. Write an algorithm to determine if two binary tree are mirror similar.

3. (a) [6 marks] A Manager wants to represent a list of her clients' records (by their ID). For each client we would like to mark whether he is a man or she is a woman. Suggest a data structure that supports the following operations in O(log n) time in the worst case, where n is the number of persons (men and women) in the data structure when the operation is executed:
   - Insert(k,c) - Insert a new client c with id = k to the data structure, at first mark the client as a woman.
   - Update(k) – Update client with ID = k to be a man.
   - FindDiff(k) – Find the difference between the number of women and the number of men (|#of women - #of men|) among all the clients with ID smaller than k.

   (b) [4 marks] Insert the following keys in an array of size 17 using the modulo division method. Use the double hashing to resolve the collision.Take h'(k)=Key mod 7 as the second hash function
   94, 37 , 29, 40, 84, 88, 102, 63, 67, 120, 122

4. (a) [5 marks] Show the steps of sorting of the following array elements using Quicksort where first element is always selected as pivot element during PARTITION procedure.
   3 2 1 5 8 12 16 11 9 20

(b) [5 marks] Analyze the complexity of quick sort by recurrence relation.

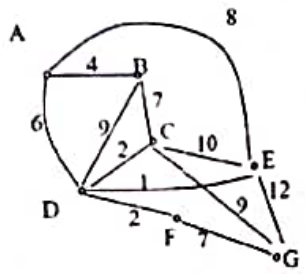
5. (a) [2.5 marks]Transform the following Infix expression into equivalent postfix expression using stack data structure.
4^2*3-3+8/4/1+1

(b) [2.5 marks] Draw the expression tree and evaluate the postfix expression getting from question 5 (a) with necessary steps.

(c) [2.5 marks] 100 Soldiers are standing in a circle in an order 1 to 100. No.1 has a sword. He kills immediate next person and gives sword to next to next the entire soldiers do the same until only 1 survives. Which number will survive at the end? Show all the steps.

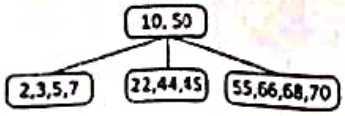
(d) [2.5 marks] For the implementation of above problem, which data structure is used efficiently and why?

6. (a) [5 marks] For the following graph, indicate the minimum spanning tree that Kruskal's algorithm would find: You must show the forest of trees in each step of the algorithm.

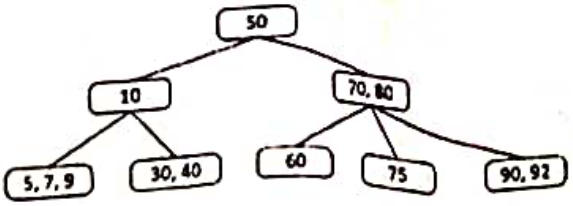


(b) [5 marks] Does Prim's algorithm work for negative edges? Provide reasoning why or why not.

7. (a) [4 marks]Given the following B-Tree of order m = 5, show each corresponding B-Tree after Insertion of 17, 6, 21, 67, in this order. Use comma (,) to separate the data in a node.



(b) [4 marks] Given the following 2-3-4 B-Tree, show each corresponding B-Tree after Deletion of 92, 90, 75, 60, 10 in this order. Use comma (,) to separate the data in a node.



(c) [2 marks]Differentiate between B-Tree and B+ Tree data structure.

8. (a) [5 marks] Prove that $\log_2(n!) = O(n \log n)$.

(b) [5 marks] Write a short note on importance of Data structure in software development.

*** All The Best ***