Final Assessment Test – November 2024

VIT
Vellore Institute of Technology

Course: PMCA501L - Data structures and Algorithms
Class NBR(s): 3082/3158
Slot: C1+TC1
Time: Three Hours
Max. Marks: 100

➤ KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE

➤ DON'T WRITE ANYTHING ON THE QUESTION PAPER

Answer ALL Questions

(10 X 10 = 100 Marks)

1. a) Find the recurrence relation for the following code snippet.   [2]

```
Void print_data (int z)
{
if (z >0)
{
for(i=1;i<z; i=i*2)
{
printf("%d",i);
}
print_data(z-1);
}
}
```

   b) For the obtained recurrence relation use substitution method to find its time   [5]
       complexity.

   c) Verify the obtained time complexity using recurrence tree method.   [3]

2. Convert the following Infix expression to its prefix form. Represent your steps in
    a table form with three column approach that is current input, Stack content,
    Output. Also verify your answer through regular hierarchy checking procedure
    without using stack.

$$((a+b*c)+(d/e-f))*(x-y)$$

3. Consider the following structure definition.

```
struct employee
{
    char emp_id[20;
    char emp_name[50];
    char designation[50];
    double salary;
    employee* next;
};
```

Perform the following operations using doubly linked list.

a) Create N nodes. Get the value of N from the user. [2.5]

b) Insert node at the middle with appropriate position. [2.5]

c) Delete the last node. [2.5]

d) Find the nodes whose salary is above 60000 and move those nodes into a new [2.5] singly linked list and this is not necessarily a doubly linked list.

Display all the nodes after performing each operation.

4.   Assume a hash table of length 10 uses open addressing with hash function h(k)=k mod 10. As per hashing principle identify how the given inputs lead to the concept of collision. Resolve the collision through double hashing technique.

34, 42, 23, 52, 33, 46

46, 34, 42, 23, 52, 33

42, 46, 33, 23, 34, 52

5.   Apply heap sort method for the following input sequence to get the sorted output in descending order. Represent the step by step procedure in detail with suitable diagrams.

    46, 34, 42, 23, 52, 33,7,-2,111,77,55

6.   What is the difference between AVL and binary search Tree? How do you relate the available four "out-of-balance" cases with balance factor in a binary search tree? Check whether the rotations are required while inserting and deleting the following sequence of inputs.

Insert :   C, B, F, A, D, G
Delete :   F, G and C

7.   Find the minimum spanning tree for the following graph using Prim's method and verify your answer using Kruskal's method.
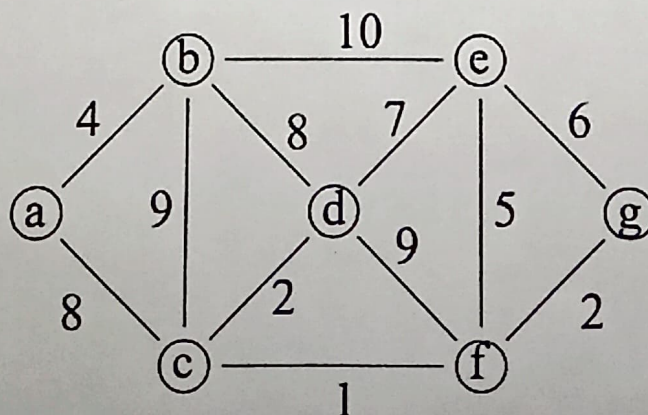
8. a) List the most common ways to represent the graphs. Among the listed types **[5]** justify which one is efficient over the other with a suitable example.

    b) Explain the following with an example **[5]**

    i)   Directed graph

    ii)   Weighted graph

    iii) Fully connected graph

    iv)   Bipartite graph

    v)   Dense Graphs

9.a) Apply a suitable divide and conquer technique to sort the following input sequence. Assume the PIVOT element is the last element of the given input.

    44,21,13,67,34,7,88,73,40,17,6

OR

9.b) Among the divide conquer based methods, quicksort has a worst case running time of $O(n^2)$ whereas merge sort has a worst case running time complexity of $O(n \log n)$, but quicksort is generally chosen over merge sort. Why? Explain your answer with a suitable example trace out.

10.a) Using backtracking find a suitable solution for placing n queens on an nxn chessboard so that no two queens face each other. The key requirement of solution insists not to have two queens on the same row or same column or same diagonal. Give Pseudo code for the same, if n=4 and n=8.

OR

10.b) Explain the role of backtracking and dynamic programming with suitable examples.

⇔⇔⇔ BI/K/TX⇔⇔⇔