University of Engineering & Management, Kolkata

End Semester Examination, January, 2022

Programme Name: B.Tech in CSE/CST/CSIT/CSBS/CSE(A.I.M.L)/CSE(I.O.T) **Semester: 3rd**

Course Name: Data Structure & Algorithm

Course Code: PCCCS301

Full Marks: 100 **Time: 3 Hours**

GROUP – A (20 marks)

Answer the following questions. Each question is of 2 marks. **10 x 2 = 20**

1. i) Explain the concept of time complexity.
ii) Define Big – O notation.
iii) Explain realloc( ) with an example.
iv) Define overflow.
v) Define Tower of Hanoi problem.
vi) Define external and internal path length.
vii) Define complete binary tree.
viii) Contrast between the best case scenarios of linear search and binary search operations.
ix) Contrast between sorting algorithms which are in-place and which are not in-place.
x) Name two sorting algorithms each of which requires two recursive calls to execute.

GROUP – B (30 marks)

Answer the following questions. Each question is of 5 marks. **6 x 5 = 30**

2. Explain tail recursion. Write a recursive C function to find factorial of a number.

3. Consider the following traversals and construct the binary tree:
In-order: 2 * 6 + 3 / 4 – 2 8
Post-order: 2 6 * 3 4 2 – 8 / +

4. Given a hash table T with 25 slots that store 2000 elements. Calculate the load factor for T.

5. A. Calculate time complexity of the following function:

```
A(){
int i=1, s=1;
while(s<=n)
{i++;
 s=s+i;
printf("UEMK")}}
```

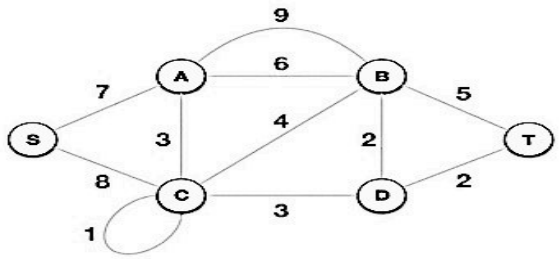
OR

B. Explain growth of a function. Explain the properties of an efficient algorithm.

6. A. Construct a binary tree for the given string
T = (A (B (E (F (I (J))), C (G (K)),D (H(L))))).

OR

B. Apply Kruskal's algorithm to find the minimal spanning tree for the following graph:



7. A. What is a heap? What are the different types of heaps? Explain with examples.

OR

B. Which sorting algorithms do not have difference in their best and worst case time complexities and why?

GROUP - C (50 Marks)

Answer the following questions. Each question is of 10 marks **5 x 10 = 50**

8. i) Define Linked List and its types. **5 + 5**

ii) Write down an algorithm to insert an element after a specific element in circular linked list.

9. Write an algorithm for sorting a list of numbers in ascending order using selection sort technique. What is the time complexity involved in finding out the minimum number in a list of given numbers?

10. A. i) Explain the relationship among asymptotic notations. **5 + 5**

ii) Write an algorithm having worst case time complexity as O(log n).

OR

B. i) Write an algorithm of your choice and analyze concepts of time and space complexity. **5 + 5**

ii) Show that $4n^2 = O(n^3)$.

11. A. i) What is a circular linked list? Give example. **3 + 7**

ii) Write an algorithm that adds two polynomials using a singly linked list.

OR

B. Explain the terms infix expression, prefix expression, and postfix expression. Convert the following infix expressions to their postfix equivalents:

a) (A – B) + C * D / E – C

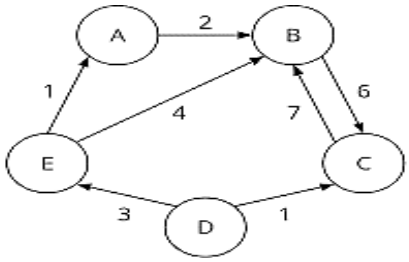
b) (A * B) + (C / D) – (D + E)

12. A. i) Show the result of inserting 12, 10, 15, 4, 1, 17, 3, 13, and 8 into an initially empty B tree with order 3. **6 + 4**

ii) Show the result after deleting 12, 13, and 15 in sequence from the above tree.

OR

B. Apply Floyd Warshall's algorithm to the following graph and find shortest path between all pairs.



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