WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 4th Semester Examination, 2024

CMSACOR08T-COMPUTER SCIENCE (CC8)

Time Allotted: 2 Hours | Full Marks: 40

The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.

GROUP-A

1. Answer any ***four*** of the following: $2\times4=8$

(a) Point out some differences between Memorization approach and Tabulation approach in dynamic programming.

(b) Define the class NP-hard.

(c) Given $T(n)=3T(n/2)+n^2$, solve using Master theorem.

(d) Perform the PARTITION operation once (one time) on the following array as per the quick sort algorithm's requirement, assuming the last element of the array to be the pivot element. Show each step clearly.

$A=\{2, 8, 7, 1, 3, 5, 6, 4\}$

(e) Given $T=$ bacbababababacbb, $P=$ ababa. Find P in T with starting index/s.

(f) Suppose $T(n)=2T(n/2)+n$, $T(0)=T(1)=1$. Solve $T(n)$.

(g) If $f1(n)\in O(g1(n))$ and $f2(n)\in O(g2(n))$ then what is $f1(n)+f2(n)$?

GROUP-B

Answer any *four* from the following $8\times4=32$

2. (a) Define heap. What are the minimum and maximum numbers of elements in a heap of height h? (1+2)+2+3

(b) Is the sequence <23; 17; 14; 6; 13; 10; 1; 5; 7; 12> a heap?

(c) Compute the complexity the recurrence relation $T(n)=8T\left(\frac{n}{2}\right)+n^2$.

3. (a) Consider the following recurrence relation, where $k\le n$ 3+3+2

$$C(n,\ k)=\begin{cases}1 & ;\ \text{if } k=0 \text{ or } k=n\\ C(n-1,\ k-1)+C(n-1,\ k) & ;\ \text{otherwise}\end{cases}$$

Show that $C(n,\ k)$ has overlapping subproblems by drawing the recursion tree for $n=5$ and $k=2$.

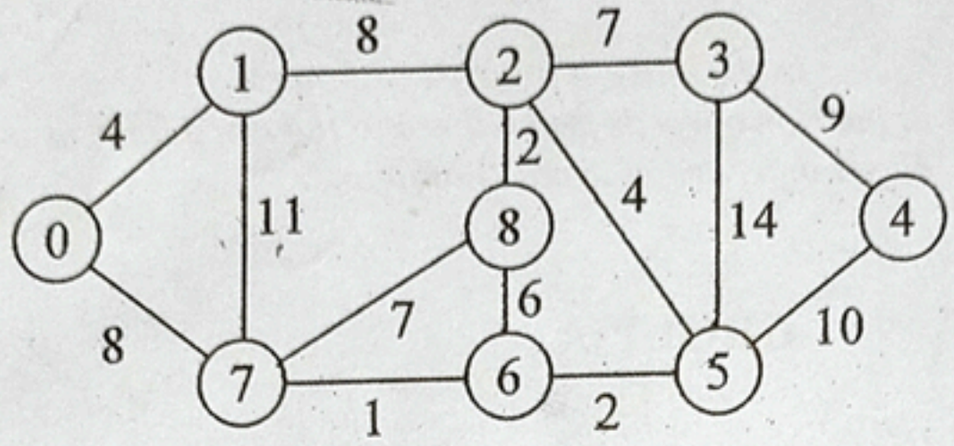
(b) Define the matrix chain multiplication problem and explain it with an example.

(c) State the Master Theorem.

4. (a) What is Spanning Tree of a Graph? 2+3+3

(b) Write Kruskal's Algorithm to find the minimum cost spanning tree of a graph.

(c) Given a weighted graph and a source vertex in the graph, find the shortest paths from the source to all the other vertices in the given graph. State the complexity of the algorithm.



5. (a) Briefly discuss the underlying principle of dynamic LCS algorithm. 2+3+3

(b) Write down the dynamic LCS algorithm.

(c) Given that $X = \langle A, B, C, B, D, A, B \rangle$ and $Y = \langle B, D, C, A, B, A \rangle$, find the LCS length and sequences.

6. (a) Solve fractional Knapsack problem for the following given parameters: 4+4

$n = 3$; Knapsack capacity $m = 20$; profits $(P_1, P_2, P_3) = (25, 24, 15)$ and weights $(w_1, w_2, w_3) = (18, 15, 10)$.

(b) Sort the following array using Bubble sort. Show the steps clearly.

$$A = [4, 2, 1, -6, 8, 0]$$

7. (a) Write Naive's Algorithm for String Matching. 4+(2+2)

(b) What is FSM? How FSM can be used find String matching in $O(m+n)$ running time?

——×——