WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 4th Semester Examination, 2021

CMSACOR08T-COMPUTER SCIENCE (CC8)

DESIGN AND ANALYSIS OF ALGORITHMS

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* questions from the following: $2 \times 4 = 8$

    (a) Clearly state two example NP-complete problems.

    (b) Write two differences between divide-and-conquer and greedy method.

    (c) Define Big-Omega (Ω) notation. Give an example bound relating to Ω.

    (d) What do you mean by time complexity and space complexity of an algorithm?

    (e) What is external sorting? Give an example.

    (f) What is heap? How can a heap be represented by an array?

    (g) What do you mean by 'correctness of an algorithm'?

   (h) When do we use branch-and-bound algorithmic technique?

GROUP-B

Answer any *four* questions from the following $8 \times 4 = 32$

2. (a) Why is *Quicksort* so called even when it requires $O(n^2)$ time in the worst-case?   2+3
   Apply the *Quicksort* algorithm to sort the list: E, X, A, M, P, L, E in alphabetical
   order.

   (b) Define decision tree. Suppose that you are given three different weights, P, Q and   1+2
   R. Draw a decision tree to compare the weights in descending order.

3. (a) Write the *Mergesort* algorithm to sort any given set of *n* integers and show how   4
   the algorithm works assuming the value of *n* is at least 14.

   (b) Describe how you will do the best-case, average-case and worst-case analyses for   4
   the *Mergesort* algorithm.

4. (a) Write an algorithm of *binary search*.   2

   (b) Relatively compare *linear search* and *binary search* with necessary examples.   4

(c) Show that the total number of comparisons in the worst-case of *Insertionsort* is $\Theta(n^2)$ for a list of *n* elements.   2

5. (a) Define the Longest Common Subsequence (LCS) problem and explain with an example.   3

   (b) What is *dynamic programming*?   2

   (c) Is the dynamic programming paradigm more efficient than recursive algorithm while solving the LCS problem? — Explain.   3

6. (a) With examples and illustration, explain the procedures involved in Prim's and Kruskal's algorithm to compute minimum spanning tree(s) of the following graph.   6
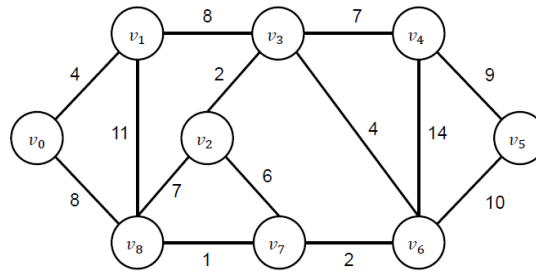
   (b) What are feasible solution and optimal solution?   2

7. (a) What do you mean by graph traversal? Give some examples and compare any two of them.   1+3

   (b) How is amortized analysis differentiated from worst-case analysis and average-case analysis? State the role of the credit balance function in computing the amortized cost of some algorithm.   2+2

8. (a) If $f(n) = 5n^2 + 6n + 4$, then prove that $f(n)$ is $O(n^2)$.   2

   (b) Critically comment on "In general, the *Greedy* strategy does not work for the 0-1 knapsack problem".   3

   (c) Solve knapsack problem for the following given parameters: 3

$n = 3$; knapsack capacity $m = 20$; profits $(p_1, p_2, p_3) = (25, 24, 15)$; and

weights $(w_1, w_2, w_3) = (18, 15, 10)$.

N.B. : *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within* 1 *hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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