WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 4th Semester Examination, 2022

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*** questions from the following: 2×4 = 8

   (a) Describe the characteristics of algorithm with an example.

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

   (c) What is feasible solution and optimal solution?

   (d) What is called external sorting?

   (e) Find the time complexity of the following recurrence relation:

   $$T(n) = 2T(n-1) + 1$$

   (f) Suppose you have to search an item from a list of data items arranged in random fashion then which searching algorithm you prefer to use and why?

   (g) What do you mean by stable sorting algorithm?

GROUP-B

Answer any *four* questions from the following

2. (a) Define big O, Ω, θ notations. 3

   (b) What is searching? Deduce the time complexity of binary search technique. 1+4

3. Define Red-Black tree. Create a red-black tree by inserting following sequence of numbers 8, 18, 5, 15, 17, 25, 40 and 80. Why a red node cannot have a red parent or red child in red-black tree? What is the maximum possible number of internal nodes in a red-black tree with black-height *k*? 2+2+2+2

4. (a) $T(n) = c$, when $n = 1$ and $T(n) = 2T(n/2) + c$ when $n > 1$. Solve the recurrence relation. 4

   (b) Apply quick sort algorithm to sort the list. E, X, A, M, P, L, E in alphabetical order. 4

5. (a) If $f(x) = a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \cdots + a_1 x + a_0$, where $a_0, a_1, \cdots, a_{n-1}, a_n$ are real numbers, then prove that $f(x)$ is $O(x^n)$. 3

(b) Critically comment on "In general, the Greedy strategy does not work for the $0-1$ Knapsack problem". 2

(c) Solve Knapsack problem for the following given parameters: $n=3$; knapsack capacity $m=20$; profits $(P_1, P_2, P_3)=(25, 24, 15)$; and weights $(w_1, w_2, w_3)=(18, 15, 10)$. 3

6. (a) Use Depth First Search (DFS) algorithm to find different depth first trees for the graph in Figure 1. 5

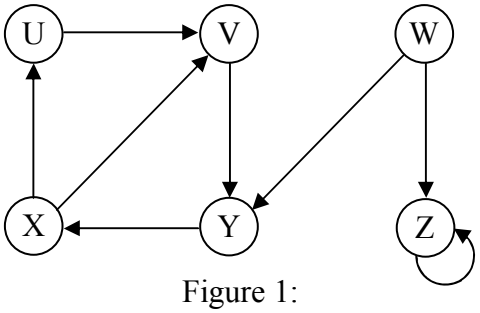

Figure 1:

(b) Estimate the time complexity of DFS algorithm. 2

(c) Which data structure is needed for Breadth First Traversal on a graph? 1

7. (a) Define minimum spanning tree with respect to a graph. 2

(b) Use Prim's algorithm to find a minimum spanning tree of the graph in Figure 2. 5

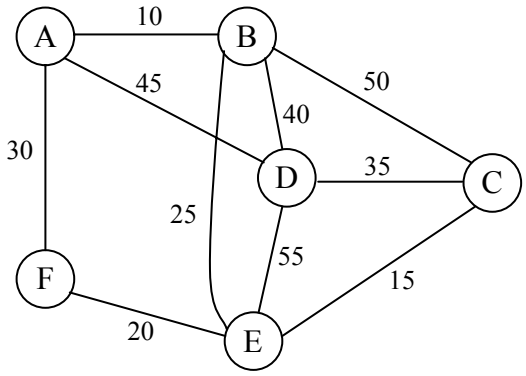

Figure 2:

(c) What do you understand by an optimization problem? 1

8. Write short notes on the following (any ***two***): 4+4

(a) Bucket Sort

(b) Recursion Tree

(c) KMP algorithm.

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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