Semester 4 Algorithm Question Paper

Computer Science Honours (West Bengal State University)

WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 4th Semester Examination, 2020

CMSACOR08T-COMPUTER SCIENCE (CC8)

DESIGN AND ANALYSIS OF ALGORITHM

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.

Answer Question No. 1 and any *four* from the rest

1. Answer any ***four*** questions from the following: 2×4 = 8

   (a) How does dynamic programming approach differ from the divide and conquer approach?

   (b) What are internal sorting and external sorting? Give example of each category.

   (c) What is amortized algorithm?

   (d) What type of searching is used in finding a word in dictionary? Why?

   (e) Define Big-Oh (O) notation.

   (f) Define recurrence tree, and give an example.

   (g) Write down the average case time complexity of Quick sort and Merge sort.

2. (a) Deduce the recurrence relation of binary search and solve it. 2+3

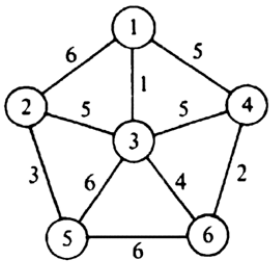
   (b) Write a short note on Master's Theorem. 3

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 largest possible number of internal nodes in a red-black tree with black-height k ? 2+2+2+2

4. (a) Why is the decision tree important? 2

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

   (c) Find the minimum cost spanning tree of the following graph using Prim's algorithm. Explain each step. 4



5. (a) As part of maintenance work, you are entrusted with the work of rearranging the library books in a shelf in proper order, at the end of the day. Which of the following will be the ideal choice for this purpose? Justify your answer. 2

(i) Bubble sort, (ii) Selection sort, (iii) Insertion sort, (iv) Heap sort.

(b) Write down the best, worst, and average case time complexity for each of the above-mentioned sorting techniques. $1\frac{1}{2}\times4=6$

6. (a) Explain KMP algorithm for Pattern Searching with a suitable example. 5

(b) Calculate ${}^{6}C_{2}$ using dynamic programming. Also, indicate where dynamic programming is used. 2+1

7. (a) Find the optimal solution using Greedy criteria for a knapsack having capacity 100 Kg for the following list of items having values and weights as shown in the table. Explain each step. 3

Item	Value	Weight
I_1	10	15
I_2	20	25
I_3	30	35
I_4	40	45
I_5	50	55

(b) Find the time complexity of the following recurrence relation: $2\frac{1}{2}$

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

(c) What is heap? How can a heap be represented by an array? $1+1\frac{1}{2}$

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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