Sl. No.

C4-R4 : ADVANCED ALGORITHMS

NOTE :
1.   **Answer question 1 and any FOUR from questions 2 to 7.**
2.   **Parts of the same question should be answered together and in the same sequence.**

**Time : 3 Hours**   **Total Marks : 100**

1.   (a)   What do you mean by reduction to second problems ? Give a definition of an NP-Complete problem.

(b)   Define time complexity and space complexity of an algorithm.

(c)   State the Masters theorem for solving recurrence. Apply the Masters theorem to solve the following recurrence :

$$T(n) = 2T(n/2) + n$$

(d)   Compare backtrack and branch and bound design approach.

(e)   Differentiate between Radix sort and Bucket sort.

(f)   Prove that the height of a heap with n nodes is equal to $[\log_2 n]$.

(g)   What do you mean by stable sorting ? Explain with example.

                                                                        (7x4)

2.   (a)   Explain Dijkstra's Algorithm, Trace it using an example.

(b)   Write a recursive algorithm to find Factorial of numbers. Write recurrence equation for it. Solve the recurrence equation and find out the complexity.

(c)   Explain any two Amortized analysis approach.

                                                                        (6+6+6)

3.   (a)   Explain Divide and Conquer based matrix multiplication and compare it with traditional approach of matrix multiplication.

(b)   Apply activity selection process of greedy approach to get maximum activities to be conducted for given activities (i) with start time (S_i) and finish time (F_i).

i	1	2	3	4	5	6	7	8	9	10	11
S_i	1	3	0	5	3	5	6	8	8	2	12
F_i	4	5	6	7	8	9	10	11	12	13	14

(c)   What is polynomial time reducibility ? Give example(s).

                                                                        (6+8+4)

4. (a) For string matching working module $q=11$, how many spurious hits does the Rabin-Karp matcher encounter in the text $T=3141592653589793$, when looking for the pattern $P=26$?

(b) Which algorithm is used for computing the greatest common divisor of two integers ? Find out GCD (27, 31) using extended Euclid algorithm.

(c) Write Insertion sort Algorithm and explain it with an example.

(6+6+6)

5. (a) Consider the chain of matrices A1, A2, …. A4 with the dimension given. Give the optimal parenthsization to get the product of given matrices. A1(5×4), A2(4×6), A3(6×2) and A4(2×7).

(b) What is sorting technique ? List out three algorithms for each comparison and non-comparison based sorting techniques. Compare merge sort and quick sort.

(9+9)

6 . (a) List out algorithm design approaches with its features.

(b) What is Bin Packing Problem ?

(c) What are the possible factors which affect complexity of any algorithm ?

(6+6+6)

7. (a) Apply Prim's algorithm to find out the minimum spanning tree on given graph. Start from vertex A.
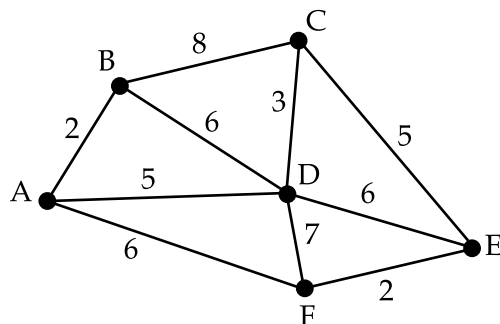
(b) Write the 2-approximation algorithm for Vertex Cover Problem. Discuss, how it is 2-approximation ?

(9+9)

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