No. of Printed Pages : 4

Sl. No.

C4-R4 : ADVANCED ALGORITHMS

DURATION : 03 Hours **MAXIMUM MARKS : 100**

Roll No. : | | | | | | |

Answer Sheet No. : | | | | | | |

Name of Candidate : _____ **; Signature of Candidate :** _____

INSTRUCTIONS FOR CANDIDATES :

- Carefully read the instructions given on Question Paper, Answer Sheet.
- Question Paper is in English language. Candidate has to answer in English Language only.
- **Question paper contains Seven questions. The Question No. 1 is compulsory. Attempt any FOUR Questions from Question No. 2 to 7.**
- **Parts of the same question should be answered together and in the same sequence.**
- **Questions are** to be answered in the **ANSWER SHEET** only, supplied with the Question Paper.
- **Candidate cannot leave the examination hall/ room without signing on the attendance sheet and handing over his/her Answer Sheet to the Invigilator. Failing in doing so, will amount to disqualification of Candidate in this Module/Paper.**
- After receiving the instruction to open the booklet and before answering the questions, the candidate should ensure that the Question Booklet is complete in all respects.

DO NOT OPEN THE QUESTION BOOKLET UNTIL YOU ARE TOLD TO DO SO.

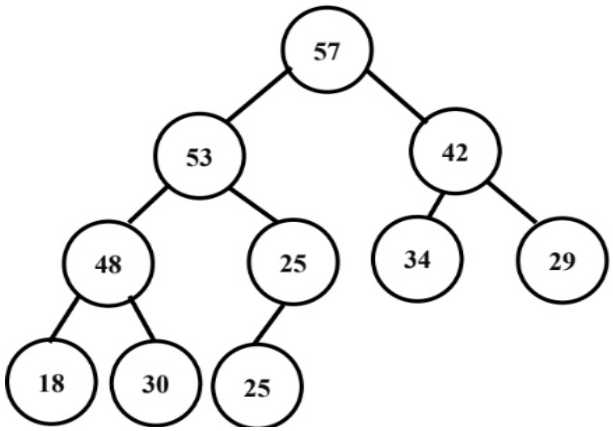
1. (a) Write down the properties of a good algorithm.

(b) What are the factors that influence the efficiency of the Greedy algorithm ?

(c) Solve the following recurrence relation :
$T(n) = T(n/2) + 1$, where $n = 2^k$ for all $k >= 0$

(d) Analyse quick sort algorithm for worst-case time complexity.

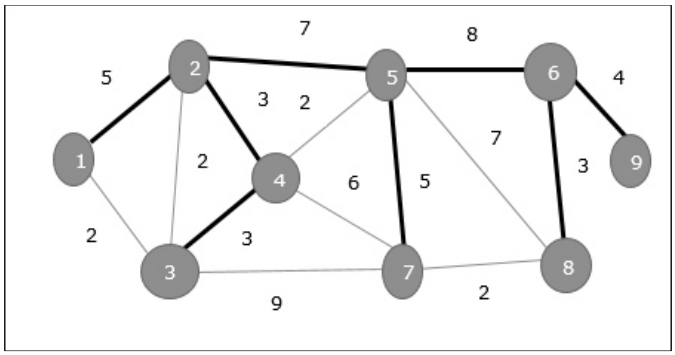
(e) Insert 55 in the max-heap below. Show all the changes to the heap. Redraw the heap and leave the nodes whose value did not change and show values only in the modified nodes. Show the array that stores the above heap. Start at index 1.



(f) What are the limitations of the Naïve string-matching algorithm ?

(g) Shell sort is an advanced version of insertion sort. Justify this statement. **(7x4)**

2. (a) Use Prim's algorithm to find out minimum spanning tree for the following graph :



(b) Solve the recurrence relation using tree method $T(n) = T(n/3) + T(2n/3) + cn$, where 'c' is a constant and 'n' is the input size.

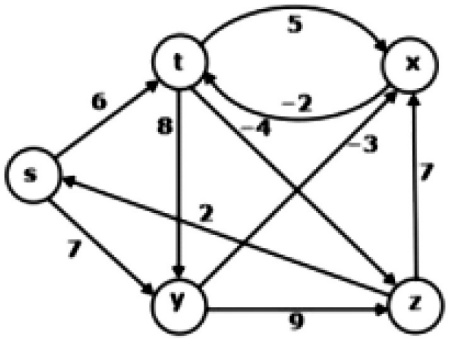
(c) What is connection between optimal and feasible solution? Support your answer with example. **(5+8+5)**

3. (a) What do you mean by asymptotic analysis of an algorithm ? Discuss different asymptotic notations with the help of proper examples.

(b) Discuss Strassen's method for matrix multiplication. Analyse its complexity with the help of recurrence relation.

(c) How do you categorize Parallel systems using Flynn's Taxonomy ? Write down the properties of each category. **(6+6+6)**

4. (a) Apply Bellman Ford algorithm on the following graph and find the shortest path from source node. Give its time complexity.



(b) What do you mean by stable sorting ? Discuss radix sort with the help of proper example. Also, analyze the algorithm in terms of its time & space complexity.

(c) Discuss Huffman encoding and its application. **(7+6+5)**

5. (a) What are the key ingredients of dynamic programming ? Describe them in brief.

(b) Apply dynamic programming algorithm on the following four matrices to find the lowest cost parenthesization matrices using matrix chain multiplication.

Table 1: Initial matrices with dimensions given

A	B	C	D
4 × 5	5 × 3	3 × 2	2 × 7
P_0 P_1	P_1 P_2	P_2 P_3	P_3 P_4

(c) What are the most common techniques used in amortized analysis ? Discuss each of them with suitable example. **(4+7+7)**

6. (a) (i) Summarize the key differences between Prim's and Kruskal's algorithms for finding the Minimum Spanning Tree (MST) in tabular form.

(ii) Write down the steps to be followed for Fractional Knapsack Problem using Greedy algorithm.

(b) Define approximation algorithm. Describe in brief the approximation algorithm for the Vertex Cover problem.

(c) Write down the steps to calculate Hash Value in Rabin-Karp. Explain it with an example. **(8+5+5)**

7. Differentiate between :

(a) Breadth first search and Depth first search

(b) Divide & Conquer and Dynamic Programming

(c) NP Complete and NP Hard **(6+6+6)**

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SPACE FOR ROUGH WORK