INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, NAGPUR
Department of Computer Science & Engineering
CSL205: Design and Analysis of Algorithms

Re-End Sem Exam
Duration: 3 hour

Date: 26 May, 2023 (Fri)

Semester – IV

Max. Marks: **60**

Important Instructions:

- This is a closed book, closed notes examination.
- This question paper comprises total 6 questions.
- All the questions are compulsory.
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Q.1 a) Cite out the basic difference between Greedy Knapsack and 0/1 Knapsack ? Show that 0/1 Knapsack should not be an optimal solution. (4M)

b) Design an algorithm for finding a^n using the binary representation of n. (4M)

Q.2 a) Two string P and Q are given, P = (M L N O M), Q = (M N O M). Apply LCS Algorithm, find and print the elements present in LCS. (5M)

b) Let n = 5 be the number of jobs, and profits are (p1, p2, p3, p4, p5) = (40, 35, 30, 25, 20) and deadlines are give as (d1, d2, d3, d4, d5) = (2, 1, 2, 4, 3). Find the schedule of jobs such that the profit is maximum. (5M)

Q.3 a) Find the optimal multiplication of the chain of five matrices M1 × M2 × M3 × M4 × M5 with dimension 10 × 20, 20 × 15, 15 × 30, 30 × 5, and 5 × 25, respectively. (5M)

b) Determine the cost and structure of an optimal binary search tree for a set of n = 5keys with the following probabilities: (7M)

i	0	1	2	3	4	5
p_i		0.15	0.10	0.05	0.10	0.20
q_i	0.05	0.10	0.05	0.05	0.05	0.10

Q.4 a) Consider the graph in **Figure 1**. Apply Kruskal's algorithm to construct the minimum spanning tree. Give the order in which edges are selected. Also, give the minimum total weight. (5M)

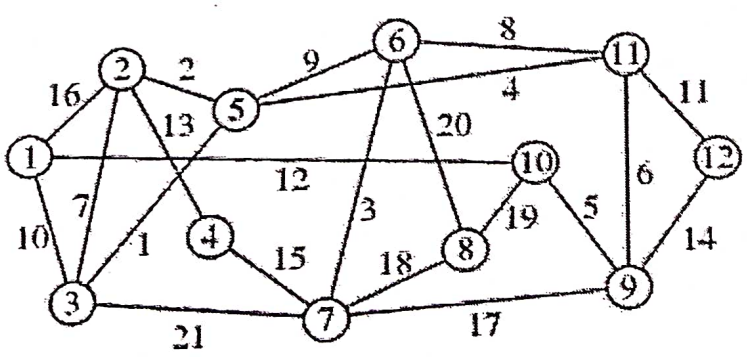

Figure 1

b) Consider the following parameters; (5M)

- m represents the number of resources, and n represents the number of projects
- The profit is represented as p(i, j) : j resources are allocated to project i.

Find the maximize profit on the allocation of various resources from the **Figure 2.**

Project \ Resource	1	2	3
1	2	8	9
2	5	6	7
3	4	4	4
4	2	4	5

Figure 2

Construct the multistage graph from Figure 2 and find the solution.

Q.5 a) Design the Backtracking algorithm for n-Queens Problem. Provide the one solution for the 4-Queens with suitable diagram. (6M)

b) Enlist the difference between deterministic and non-deterministic algorithm. Also, give the suitable example. (4M)

c) Prove that CLIQUE is NP Complete. (5M)

CLIQUE = { < G, k > | G is a graph with a clique of size k } i.e. CLIQUE is a subset of vertices that all are connected.

Q.6 A sequence of *n* operations is performed on the data structure. The ith operation costs *i* if *i* is the exact power of 2, and 1 otherwise. Use Aggregate analysis to determine the amortized cost per operation. (5M)

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Moderator I