PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

Department of Applied Mathematics and Computational Sciences

MSc THEORETICAL COMPUTER SCIENCE V SEMESTER

CONTINUOUS ASSESSMENT TEST 2 Date: 29-10-2025

20XT54 - DESIGN AND ANALYSIS OF ALGORITHMS

Time: 1 Hour 30 min. **Maximum Marks: 40**

INSTRUCTIONS:

1. Answer **ALL** questions. Each question carries 20 Marks.
2. Subdivisions (a)(i) and (a)(ii) carries 2 marks each, subdivision (b) carries 6 marks each and subdivision (c) carries 10 marks each.
3. Subdivisions (a) and (b) will be with no choice and Subdivision (c) may be with choice but not in more than 1 question.
4. Course Outcome Table :

Qn.1	CO1

Qn.2	CO2

1) i) In order to lower the prohibitive running time of the knapsack problem, which is $\Theta(nW)$, we may divide W and all the wi's by a large number K and take the floor. That is, we may transform the given instance into a new instance with capacity floor(C/K) and item sizes floor(si/K), $1 \leq i \leq n$. What will be the running time of the algorithm when applied to the new instance? Will it always return optimal answer? **L6**

ii) Given the code to calculate binomial coefficient using dynamic programming.

Fill in the blank spaces

```
//memo is an array which is initialized to -1
procedure binomial(n,k,memo)
if k=0 or k=n
   return 1
if memo[n][k]!=_____
   return _____
return binomial[n][k]=binomial(n-1,k-1,memo)+binomial(n-1,k,memo)
```

L2

b) Solve the given travelling salesman problem using dynamic programming Can you estimate the time required to solve TSP using brute force and dynamic programming for 5 cities where the time for instruction is one microsecond.

	A	B	C	D
A	0	2	9	Inf

B	1	0	6	4
C	inf	7	0	8
D	6	3	inf	0

L4

c) Find optimal cost binary search tree for the following keys using dynamic programming

	0	1	2	3
pi		0.5	0.1	0.05
qi	0.15	0.1	0.05	0.05

L5

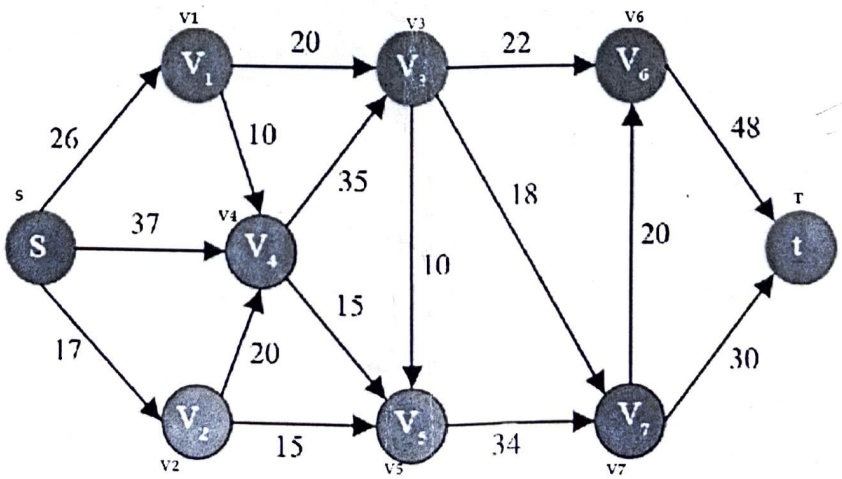
2.a) i) Prove or disprove : Given a flow network decreasing the capacity of an edge e by one will decrease the max flow by one **L6**

ii) A shipment from k warehouses (s1, s2, ..sk) has to reach a central facility center(t), but the warehouses are owned by different shipping companies. Each shipping company has to transport goods from si i=1 to k to common t, but they do not want to get into each other's way while driving. They want to find k edge disjoint paths (but they can pass through common vertex) if one exists. Brief how will you model and solve **L6**

b) Find the matching for the given string P=KMPKM to the text T=KMPPKMPKMPK using Knuth Morris and Pratt String matching algorithm

L2

c) Explain Ford Fulkersons' algorithm for finding maximum flow in a flow network and find maximum flow in the given network.



L3