

**Sixth Semester B. Tech. (Computer Science and Engineering /
Data Science) Examination**

DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates :—

- (1) All questions carry marks as indicated against them.
- (2) Illustrate your answers with diagrams wherever necessary.

1.
 - (a) Find the compound interest for the principal amount Rs. 1000 and the interest given by a bank is 5%. Formulate the recurrence relation for the above and design its solution using substitution method. What would be the principal amount after 25th month ? 4(CO1)
 - (b) Solve the following recurrence using the Master theorem :
$$T(n) = 7T(n/2) + 18(n/2)^2$$
 3(CO1)
 - (c) Solve the following using recurrence tree method :
$$T(n) = 3T(n/2) + n$$
 3(CO1)
2.
 - (a) Define maximum sum sub-array problem. Implement DAC algorithm to find the maximum sum sub-array on the following data set.
Explain the real life application of maximum sum sub-array problem.
Data set = [-15, 45, -30, 95, 92, 8, -12, -22, 55, 75, 8]. 5(CO2)
 - (b) Explain the time complexity of Quick sort algorithm for best and worst case scenario.
Also discuss the variants of selecting pivot element for Quick sort and give its comparative analysis.
{123, 67, 85, 157, 100, 92, 82, 75, 23} 5(CO2)

3. (a) A document contains the letters "A" through "E" with frequencies as follows :

A	B	C	D	E
22	13	18	16	31

Construct the Huffman tree and codes for all letters Encode the following messages :

- CAB
- ADD
- BAD
- ACE

Decode the following message :

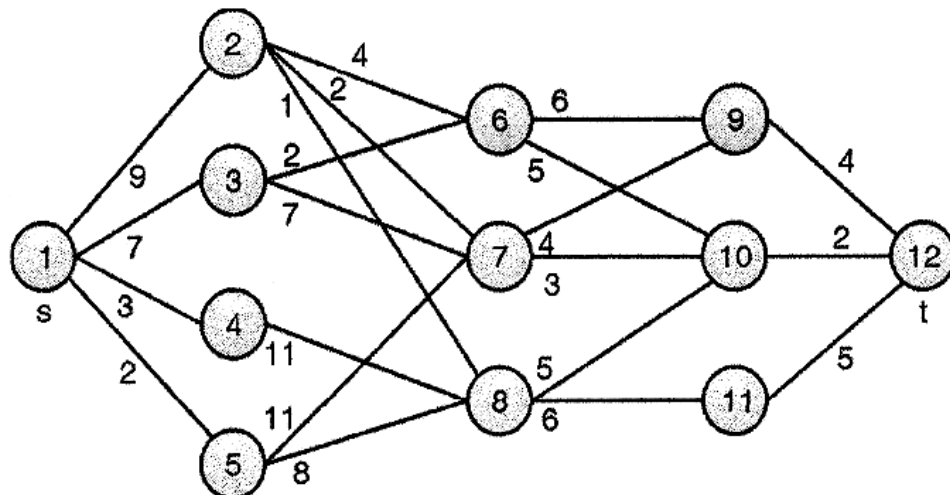
- 110011
- 1000110001

6(CO2)

- (b) Formulate the Knapsack problem with greedy method and find the optimal solution for $n = 7$, $m = 15$, $(p_1-p_7) = (10, 5, 15, 7, 6, 18, 3)$, $(w_1-w_7) = (2, 3, 5, 7, 1, 4, 1)$.

4(CO2)

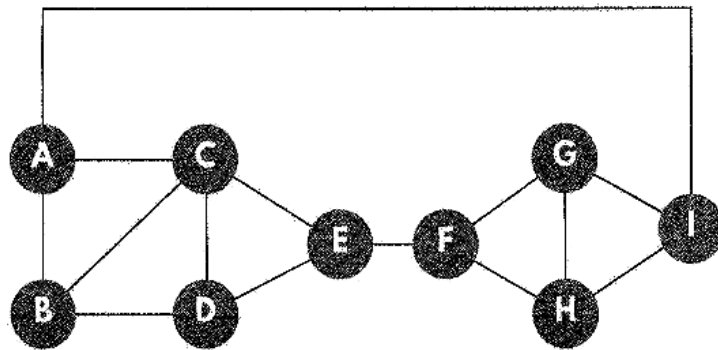
4. (a) Solve the following multistage graph problem using both forward and backward reasoning. Comment on the complexity of the algorithm.



7(CO3)

- (b) Design a suitable strategy to implement a spell checker. Design a solution using dynamic programming to perform string editing using minimum cost. Explain with example. 3(CO3)

5. (a) Consider the graph given below to check if it contains the Hamiltonian cycle or not using backtracking. Show the stepwise process for the same.



5(CO3)

- (b) Find all m-colors of a graph with undirected connections :
 $v_1 \rightarrow v_2, v_1 \rightarrow v_3, v_1 \rightarrow v_4, v_2 \rightarrow v_3, v_2 \rightarrow v_4, v_2 \rightarrow v_5, v_3 \rightarrow v_4, v_4 \rightarrow v_5$
 using backtracking technique. 5(CO3)

6. (a) Define NP and NP-Completeness. Differentiate between NP hard and NP complete problem. Write an example of Non Deterministic Polynomial time algorithm. 5(CO4)
- (b) Write the approximation algorithm for Traveling Salesman Problem. Demonstrate the use of approximation algorithm in improving the speed of the solution. 5(CO4)

