

Bihar Engineering University, Patna
End Semester Examination - 2023

Semester-IV

Subject: Design and Analysis of Algorithms

Time: 03 Hours

Full Marks: 70

Course: B.Tech.

Code: 105402

Instructions:-

- (i) The marks are indicated in the right-hand margin.
- (ii) There are NINE questions in this paper.
- (iii) Attempt FIVE questions in all.
- (iv) Question No. 1 is compulsory.

Q.1 Choose the correct answer of the following (Any seven question only): **[2 x 7 = 14]**

- (a) The fractional Knapsack problem can be solved by using
 - (i) Greedy method
 - (ii) Divided and conquer method
 - (iii) Dynamic programming
 - (iv) None of these
- (b) BFS on a graph $G = (V, E)$ has running time
 - (i) $O(|V| + |E|)$
 - (ii) $O(|V|)$
 - (iii) $O(|E|)$
 - (iv) None of the above
- (c) The minimum number of colors needed to color a graph having $n > 3$ vertices and 2 edges is
 - (i) 2
 - (ii) 3
 - (iii) 4
 - (iv) 1
- (d) Complexity the recurrence relation $T(n) = 8T\left(\frac{n}{2}\right) + n^2$ is
 - (i) $O(n)$
 - (ii) $O(n^2)$
 - (iii) $O(\log_2 n)$
 - (iv) $O(n^3)$
- (e) Travelling salesman problem belongs to
 - (i) P class
 - (ii) NP class
 - (iii) NP-hard
 - (iv) NP-complete class
- (f) Kruskal's algorithm uses _____ and Prim's algorithm uses _____ in determining the MST
 - (i) Edges, vertex
 - (ii) vertex, edges
 - (iii) Edges, edges
 - (iv) Vertex, vertex
- (g) Level order traversal of a rooted tree can be done by starting from root and performing
 - (i) Depth first search
 - (ii) Breadth first search
 - (iii) Pre-order traversal
 - (iv) In-order traversal
- (h) An algorithm is made up of two independent time complexities $f(n)$ and $g(n)$. Then the complexities of the algorithm is in order of
 - (i) $f(n) \times g(n)$
 - (ii) $\max(f(n), g(n))$
 - (iii) $\min(f(n), g(n))$
 - (iv) $f(n) + g(n)$
- (i) Which of the following standard algorithms is not a greedy algorithm?
 - (i) Dijkstra's shortest path algorithm
 - (ii) Kruskal algorithm
 - (iii) Bellman ford shortest path algorithm
 - (iv) Prim's algorithm
- (j) The node removal of which makes a graph disconnected is called
 - (i) Pendant vertex
 - (ii) Bridge
 - (iii) Articulation point
 - (iv) Coloured vertex

- Q.2 (a) Discuss the average, worst best time complexity of the algorithm. Give suitable examples. [7]
 (b) Write the algorithm for quick-sort and find its complexity. [7]

- Q.3 (a) Construct the Huffman coding tree for the text of characters with given frequencies : [7]

Characters	T	I	V	K	L	E	O	Z	P	R
Frequencies	43	38	16	8	56	12	41	13	22	6

- (b) State the general Knapsack problem. Write a greedy algorithm for this problem and derive its time complexity. [7]

- Q.4 (a) State master's theorem and find the time complexity for the following recurrence: [6]
 $T(n) = 2T(n^{1/2}) + \log n$

- (b) What is negative weight-cycle? Write Bellman-Ford algorithm to find single source shortest distance of a directed graph. [8]

- Q.5 (a) Find the minimum number of operation required for the following matrix chain multiplication using dynamic programming [7]
 $A (10 \times 20) * B (20 \times 50) * C (50 \times 1) * D (1 \times 100)$

- (b) Write Knuth-Morris-Pratt algorithm for string matching problem. [7]

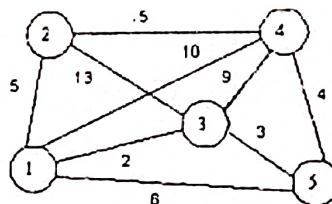
- Q.6 (a) Write an algorithm to find a minimum spanning tree (MST) for an undirected graph. Estimate the time complexity of your algorithm. [7]

- (b) Using greedy strategy. Schedule the following jobs within deadline so as to maximize the profit. Deadline and profits are mentioned as follow: [7]

Job i	1	2	3	4
Deadline d	3	2	3	1
Profit g	9	7	7	2

- Q.7 (a) Write an algorithm for n-queen's problem find its time-complexity and explain the algorithm using an example. [7]

- (b) Solve the single source shortest path problem for the following graph considering '1' as the source vertex using Dijkstra's algorithm. [7]



- Q.8 (a) Define the classes P and NP. [2]

- (b) Discuss what you mean by polynomial reduction.. [2]

- (c) Discuss diagrammatically the relation among P class, NP class, NP hard and NP complete. [2]

- (d) Describe Clique Decision Problem (CDP) [2]

- (e) Explain the max-flow min-cut theorem with an example. [6]

- Q.9 Write short notes on any two of the following: [7x2=14]

- (a) Asymptotic notations
 (b) Heap creation technique
 (c) Strassen's matrix multiplication
 (d) Divide-and-Conquer vs Dynamic programming.