Bihar Engineering University, Patna
End Semester Examination - 2023

Course: B.Tech. | *Semester-IV* | *Time: 03 Hours*
Code: 105402 | *Subject: Design and Analysis of Algorithms* | *Full Marks: 70*

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 Prism' 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) $f(n)$x 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 alogorithm?
(i) Dijkstra's shortest path algorithm
(ii) Kruskal algorithm
(iii) Bellmen 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 matix chain multiplication using dynamic programming **[7]**
A (10 x 20) * B (20 x 50) * C (50 x 1) * D (1 x 100)

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

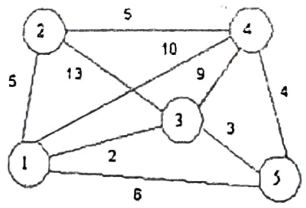
Q.6 (a) Write an algorithm to find a minimum spanning tree (MST) for an undirected graph. Estimate the time complexity of your algorithm. **[7]**

(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.