Q.5	i.	Consider n=3 (w1, w2, w3) = (2,3,3) (p1, p2, p3) = (1,2,4) and m= 6 find optimal solution for given knapsack problem using dynamic programming approach.	**4**	2	2	6	1
	ii.	Explain the Floyd Warshall algorithm with suitable example. And also write algorithm.	**6**	1	1	6	1
OR	iii.	Find the optimal solution of the knapsack instance n=7, m=15- (p1,p2,p3,p4,p5,p6,p7)=(10,5,15,7,6,18,3), (w1,w2,w3,w4,w5,w6,w7)=(2,3,5,7,1,4,1)	**6**	2	2	6	1
Q.6		Attempt any two:					
	i.	Explain 8- queen problem and write an algorithm using backtracking to solve this problem.	**5**	1	1	7	1
	ii.	What is graph coloring problem? How it can be solved using graph coloring?	**5**	1	1	7	1
	iii.	Explain 15 puzzle problem using LC search.	**5**	1	1	7	1

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Total No. of Questions: 6 *Total No. of Printed Pages:4*

Enrollment No.....

Faculty of Engineering
End Sem Examination Dec 2024
EC3ET09 Design & Analysis of Algorithms

Programme: B.Tech. Branch/Specialisation: EC

Duration: 3 Hrs. **Maximum Marks: 60**

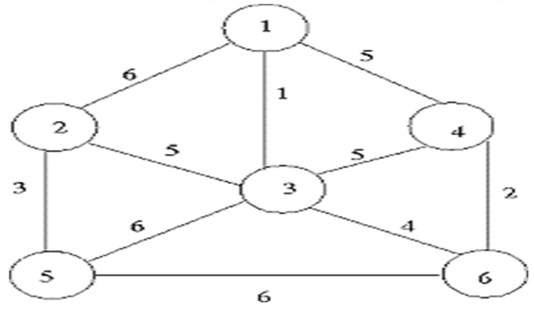
Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

			Marks	**BL**	**PO**	**CO**	**PSO**
Q.1	i.	The notation Ω(n)\Omega(n)Ω(n) represents: (a) The exact time complexity (b) The asymptotic lower bound (c) The asymptotic upper bound (d) The average-case complexity	**1**	1	1	2	1
	ii.	Which notation gives the asymptotic upper bound of a function? (a) Theta (Θ) (b) Big O (*O*) (c) Omega (Ω) (d) Small o (*o*)	**1**	1	1	2	1
	iii.	What is the space complexity of Radix Sort? (a) *O*(n log n) (b) *O*(n) (c) *O*(n+k) where k is the range of digits (d) *O*(1)	**1**	1	1	4	1
	iv.	Which of the following sorting algorithms does not compare elements directly? (a) Merge Sort (b) Quick Sort (c) Heap Sort (d)Radix Sort	**1**	1	1	4	1
	v.	In an optimal merge pattern problem, the goal is to: (a) Merge files in a way that minimizes the total number of merges (b) Merge files in a way that minimizes the cost of all merges (c) Maximize the size of the merged file (d) Minimize the time complexity of merges	**1**	1	1	5	1

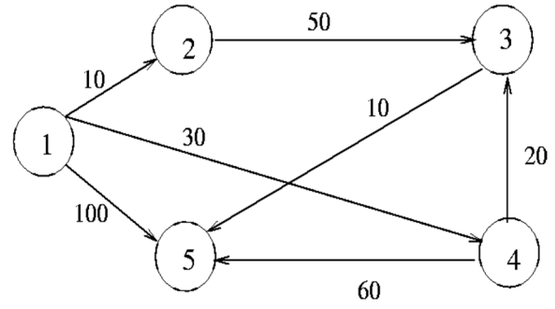
P.T.O.

vi.	Huffman coding is a method of: (a) Data sorting (b) File merging (c) Data compression (d) Matrix multiplication	**1**	1	1	5	1
vii.	In dynamic programming, the technique of storing solutions to subproblems to avoid redundant calculations is called: (a) Memorization (b) Greedy approach (c) Branch and bound (d) Divide and conquer	**1**	1	1	6	1
viii.	In the 0/1 Knapsack Problem, what does "0/1" signify? (a) Items can be included multiple times (b) Each item can either be included once or not at all (c) The knapsack can hold only one item (d) There are only two items to choose from	**1**	1	1	6	1
ix.	An NP-Hard problem is: (a) As hard as or harder than the hardest problems in NP (b) Always solvable in polynomial time (c) Solvable only by backtracking (d) A subset of NP problems	**1**	1	1	8	1
x.	The Traveling Salesman Problem (TSP) is often solved using branch and bound due to: (a) Its recursive nature (b) Its non-deterministic complexity (c) The exponential number of possible solutions (d) Its polynomial time complexity	**1**	1	1	7	1
Q.2 i.	Explain the difference between Big-O and Theta (Θ) notation.	**2**	1	1	2	1
ii.	Find complexity: (a) T(n)=5T(n/4) +n^3 (b) T(n)=T(n/3) +T(2n/3)+n (c) T(n)=T(n-1) +n	**3**	2	2	2	1
iii.	What are the time complexities of bubble sort and insertion sort in the best, average, and worst cases?	**5**	1	1	2	1

OR	iv.	What is selection sort? Explain with the help of example.	**5**	1	1	2	1
Q.3	i.	Write an algorithm for heap sort and analyze its time complexity.	**2**	1	1	4	1
	ii.	Write an algorithm for quick sort and sort the following list using quick sort- 65 70 75 80 85 60 55 50 45	**8**	2	2	4	1
OR	iii.	Explain Strassen's matrix multiplication. Determine time complexity of Strassen's matrix multiplication.	**8**	1	1	4	1
Q.4	i.	Explain Job sequencing with deadline. Write a greedy algorithm to the Job sequencing with deadlines.	**3**	2	1	5	1
	ii.	What is difference between Prim's algorithm and Kruskal's Algorithm for finding the minimum spanning tree of a graph? Execute both Prim's and Kruskal's algorithm on the following graph-	**7**	2	2	5	1



OR	iii.	Find single source shortest path from source to remaining all nodes using Dijkstra's algorithm. (source node =1).	**7**	2	2	5	1



Marking Scheme
EC3ET09 Design and Analysis of Algorithms

Q.1 i) B. The asymptotic lower bound **1**

ii) B. Big O (***O***) **1**

iii) C. *O*(n+k) where k is the range of digits **1**

iv) D.Radix Sort **1**

v) B. Merge files in a way that minimizes the cost of all merges **1**

vi) C. Data compression **1**

vii) A. Memorization **1**

viii) B. Each item can either be included once or not at all **1**

ix) A. As hard as or harder than the hardest problems in NP **1**

x) C. The exponential number of possible solutions **1**

Q.2 i. Explain the difference between Big-O and Theta (Θ) notation. **2**
Min 2 difference 1 mark for each

ii. Find complexity: **3**
a) T(n)=5T(n/4) +n^3
b) T(n)=T(n/3) +T(2n/3)+n
c) T(n)=T(n-1) +n
1 mark for each

iii. What are the time complexities of bubble sort and insertion sort in the best, average, and worst cases? **5**
2.5 mark for bubble sort 2.5 mark for insertion sort

OR iv. What is selection sort explain with the help of example **5**
2.5 mark for selection sort and 2.5 mark for example

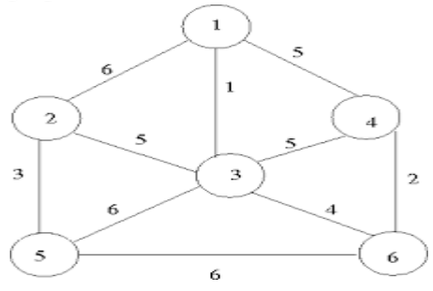
Q.3 i. Write an algorithm for Heap Sort and analyze its time complexity **2**
1 mark for algorithm and 1 mark for time complexity.

ii. Write an algorithm for Quick sort and sort the following list using quick sort 65 70 75 80 85 60 55 50 45 **8**
4 mark for algorithm and 4 mark for solution

OR iii. Explain Strassen's matrix multiplication. Determine time complexity of strassen's matrix multiplication. **8**
4 mark for explanation and 4 mark for time complexity

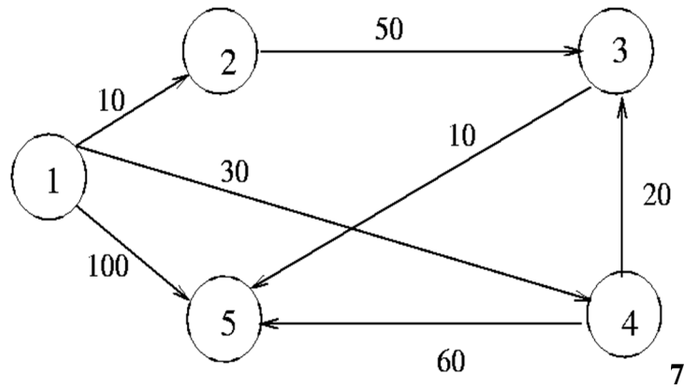
Q.4 i. Explain Job sequencing with deadline. Write a greedy algorithm to the Job sequencing with deadlines. **3**
1 mark for explanation and 2 marks for greedy algorithm

ii. What is difference between Prim's algorithm and Kruskal's Algorithm for finding the minimum spanning tree of a graph .Execute both Prim's and Kruskal's algorithm on the Following graph. **7**



Min 3 difference 1 mark for each total 3 mark
2 Marks: Execute Prim's algorithm on the given graph.
2 Marks: Execute Kruskal's algorithm on the given graph.

OR iii. Find single source shortest path from source to remaining all nodes using Dijkstra's algorithm. (source node =1) **7**



7 marks for correct solution

Q.5 i. Consider n=3 (w1,w2,w3)=(2,3,3) (p1,p2,p3) = (1,2,4) and m=6 find optimal solution for given knapsack problem using dynamic programming approach. **4**

4 marks for solution

ii. Explain the Floyd Warshall Algorithm with suitable example. And also write algorithm. **6**

3 marks for explanation and 3 marks for algorithm

OR iii. Find the optimal solution of the knapsack instance n=7,m=15 (p1,p2,p3,p4,p5,p6,p7)=(10,5,15,7,6,18,3), (w1,w2,w3,w4,w5,w6,w7)=(2,3,5,7,1,4,1) **6**

6 marks for solution

Q.6 Attempt any two:

i. Explain 8- queen problem and write an algorithm using backtracking to solve this problem. **5**

2.5 marks for problem and 2.5 marks for algorithm

ii. What is graph coloring problem how it can be solved using graph coloring. **5**

2.5 marks for explanation and 2.5 marks process

iii. Explain 15 puzzle problem using LC search. **5**

5 marks for explanation

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