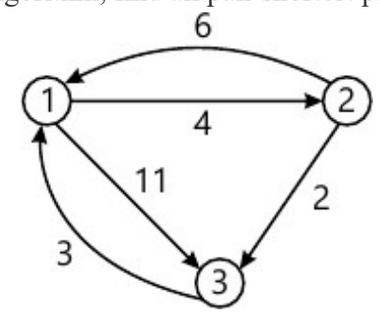
OR iii Using Floyd's algorithm, find all pair shortest path for the graph. **6**



Q.6 Attempt any two:

i. Explain Graph coloring in Backtracking with the help of an example. **5**

ii. Explain in detail n-queens problem with an example. **5**

iii. Briefly explain NP-Hard and NP-Completeness with the help of an example **5**

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

Enrollment No.....

Faculty of Engineering

End Sem (Even) Examination May-2022

CS3CO13 Design & Analysis of Algorithms

Programme: B.Tech. Branch/Specialisation: CSE

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.

Q.1 i. Which of the following is the complexity of? **1**

```
for(i=1;i<n;i+20)
{ print("Hello");
 }
```

(a) O(log n) (b) O(n) (c) O(1) (d) O(√n)

ii. Which of the following is not a possible Upper bound of nlogn? **1**

(a) $O(n^2)$ (b) O(n) (c) $O(2^n)$ (d) $O(n^{n)}$

iii. Algorithms like merge sort, quick sort and binary search are based on **1**

(a) Greedy algorithm (b) Divide and Conquer algorithm

(c) Hash table (d) Parsing

iv. What is the worst-case time complexity of Quick Sort? **1**

(a) O(nlog n) (b) O(log n) (c) O(n) (d) $O(n^2)$

v. Four Jobs with following deadlines and profits **1**

JobID	Deadline	Profit
J1	4	20
J2	1	10
J3	1	40
J4	1	30

Which of the following is maximum profit sequence of Jobs?

(a) J3->J1 (b) J3->J2 (c) J3->J2->J1 (d) J3->J2->J4

vi. The minimum number of record movements required to merge five files A (with 5 records), B (with 10 records), C (with 20 records), D (with 30 records) and E (with 30 records) is: **1**

(a) 105 (b) 205 (c) 175 (d) 265

P.T.O.

vii. Which of the following problems is NOT solved using dynamic programming? **1**
(a) 0/1 knapsack problem
(b) Matrix chain multiplication problem
(c) Edit distance problem
(d) Fractional knapsack problem

viii. Which of the following is/are property/properties of a dynamic programming problem? **1**
(a) Optimal substructure (b) Overlapping subproblems
(c) Greedy approach (d) Both (a) and (b)

ix. Graph Coloring is which type of algorithm design strategy? **1**
(a) Backtracking (b) Greedy
(c) Dynamic Programming (d) Divide and Conquer

x. A search technique where we keep expanding nodes with least accumulated cost so far is called___. **1**
(a) Hill climbing (b) Branch and bound
(c) Dynamic Programming (d) Divide and Conquer

Q.2 i. Explain space and time complexity in algorithms. **4**

ii. Solve the recurrences using Master's theorem: **6**
(a) $T(n) = 2T(n/2) + \sqrt{n}$
(b) $T(n) = 8T(n-2) + n^3/\log n$
(c) $T(n) = 3T(n-4) + n^2$

OR iii. Explain Asymptotic Notations. What is the upper bound of f(n)=n! ? **6**

Q.3 i. What is the significance of Divide and Conquer Strategy? **2**

ii. Sort the following using **8**
(a) Quick Sort (b) Merge Sort
38, 81, 22, 48, 13, 69, 93, 14, 45, 58, 79, 72.

OR iii. Explain Strassen's Matrix multiplication in detail. How is it better than normal 2x2 matrix multiplication in terms of complexity? **8**

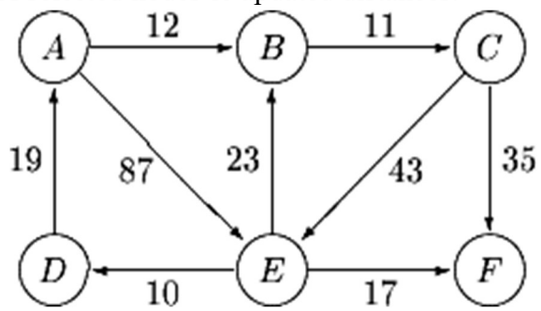
Q.4 i. Define Greedy Strategy. Differentiate between Optimal and Feasible solution. **4**

ii. A Knapsack capacity is 100.The weights and values of 5 objects is as follows: **6**

Weight (Wi)	10	20	30	40	50
Values (Pi)	20	30	66	20	60

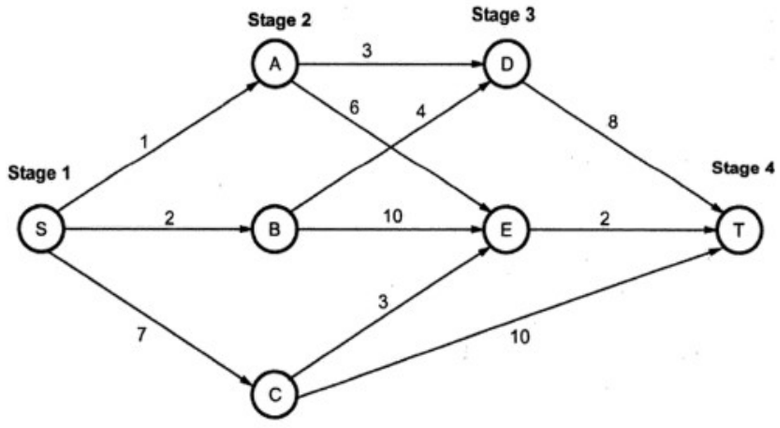
Solve the Knapsack problem using Greedy Strategy & find the maximum profit that can be obtained.

OR iii. Given a digraph with non-negative edge weights G=(V,E). Determine the distance and a shortest path from the source vertex 'A' to every vertex in the digraph using Dijkstra's Algorithm. Make a table to show order of selected nodes & updated distances. **6**



Q.5 i. What do you mean by Dynamic programming? Write any two benefits of using dynamic programming. **4**

ii. Consider a Multistage graph with 4 stages & find the path from source to sink using Forward approach with appropriate steps. **6**



P.T.O.

Marking Scheme
CS3CO13 Design & Analysis of Algorithms

Q.1 i. Which of the following is the complexity of? **1**

```
for(i=1;i<n;i+20)
{ print("Hello");
 }
```

(b) O(n)

ii. Which of the following is not a possible Upper bound of nlogn? **1**
(b) O(n)

iii. Algorithms like merge sort, quick sort and binary search are based on **1**
(b) Divide and Conquer algorithm

iv. What is the worst-case time complexity of Quick Sort? **1**
(d) $O(n^2)$

v. Four Jobs with following deadlines and profits **1**

JobID	Deadline	Profit
J1	4	20
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J4	1	30

Which of the following is maximum profit sequence of Jobs?
(a) J3->J1

vi. The minimum number of record movements required to merge five files A (with 5 records), B (with 10 records), C (with 20 records), D (with 30 records) and E (with 30 records) is: **1**
(b) 205

vii. Which of the following problems is NOT solved using dynamic programming? **1**
(d) Fractional knapsack problem

viii. Which of the following is/are property/properties of a dynamic programming problem? **1**
(d) Both (a) and (b)

ix. Graph Coloring is which type of algorithm design strategy? **1**
(a) Backtracking

x. A search technique where we keep expanding nodes with least accumulated cost so far is called___. **1**
(b) Branch and bound

Q.2	i.	Explain space complexity in algorithms	2 Marks	**4**
		Time complexity in algorithms.	2 Marks	
	ii.	(a)	2 Marks	**6**
		(b)	2 Marks	
		(c)	2 Marks	
OR	iii.	Asymptotic Notations	5 Marks	**6**
		Upper bound	1 Mark	
Q.3	i.	Significance of Divide and Conquer Strategy	2 Marks	**2**
	ii.	(a) Quick Sort	4 Marks	**8**
		(b) Merge Sort	4 Marks	
OR	iii.	Detailed explanation	6 Marks	**8**
		Comparison	2 Marks	
Q.4	i.	Definition	2 Marks	**4**
		Difference (at least 1)	2 Marks	
	ii.	As per solution	6 Marks	**6**
OR	iii.	Solution	4 Marks	**6**
		Table	2 Marks	
Q.5	i.	Definition	2 Marks	**4**
		Any two benefits	2 Marks	
	ii.	As per solution	6 Marks	**6**
OR	iii	As per solution	6 Marks	**6**
Q.6		Attempt any two:		
	i.	As per the explanation	5 Marks	**5**
	ii.	As per the explanation	5 Marks	**5**
	iii.	NP-Hard and NP-Completeness	2.5 Marks	**5**
		with the help of an example	2.5 Marks	