Enrollment No......................................

Faculty of Engineering
End Sem Examination May-2023
CS3CO13 / IT3CO06
Design & Analysis of Algorithms

Programme: B.Tech.   Branch/Specialisation: CSE - All / IT

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.

Q.1 i.   What is the complexity of following?   1
           for(i=n;i>=1;i=i/2)
           {print i;}
           (a) O(nlog √n)   (b) O(log n)   (c) O(1)   (d) O(√n)

     ii.   Which of the following is a property of an algorithm?   1
           (a) Finiteness   (b) Definiteness
           (c) Effectiveness   (d) All of these

     iii. Complexity of quick sort when array is already sorted is-   1
           (a) O(nlog n)   (b) O(n^2)   (c) O(1)   (d) O(√n)

     iv.   Which of the following method is used to solve divide and conquer   1
           recurrence relation?
           (a) Back substitution method   (b) Master method
           (c) Tree method   (d) All of these

     v.   How many edges are there in minimum cost spanning tree generated   1
           from graph with 'n' vertices?
           (a) n-1   (b) n/2 – 1   (c) n – 2   (d) n/2

     vi.   In Greedy method we get _____ feasible solutions.   1
           (a) One   (b) More than one
           (c) Zero   (d) Two

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

viii. Which of the following problems should be solved using dynamic programming? **1**
(a) Merge sort   (b) Binary search
(c) Longest common subsequence   (d) Quick sort

ix. Graph Colouring Problems solution can be represented as- **1**
(a) Address Space   (b) State space tree
(c) E-Node   (d) Dead node

x. The group of problems which are both in NP and NP-hard are known as- **1**
(a) NP-hard   (b) NP-Complete
(c) NP Real   (d) NP Subclass

Q.2 i. Write algorithm for bubble sort and also analyse the complexity for bubble sort. **4**

ii. Solve the following recurrence relations and find out the complexity- **6**
(a) $4T(n/2)+n^2$ (b) $T(n/2)+1$

OR iii. What do you mean by space and time complexity? What are the various asymptotic notations? Explain it. **6**

Q.3 i. Explain the concept of max. heap and min. heap with example. **4**

ii. Write recursive binary search algorithm. Also analyse the complexity for binary search. **6**

OR iii. How Strassen's matrix multiplication improved matrix multiplication efficiency from simple matrix multiplication? Also analyse its complexity. **6**

Q.4 i. Write basic algorithm for greedy technique. **3**

ii. Explain knapsack problem. Consider the following instance of the greedy knapsack problem: n=3,m=15, (p1,p2,p3) = (12,24,20), (w1,w2,w3) = (5,8,10). Find the optimal solution and maximum profit earned. **7**

OR iii. A networking company uses a compression technique to encode the message before transmitting over the network. Suppose the message contains the following characters with their frequency: **7**
character Frequency
a: 45, b:13, c:12, d:16, e:9, f:5
If the compression technique used is Huffman Coding, what will be the Huffman code for the above character?

Q.5 i. What do you mean by principle of optimality? Also write difference between greedy method and dynamic programming. **4**

ii. Explain reliability design and Design three stage systems with device type d1, d2, d3. The cost is Rs. 30, 15 and 20 respectively. The overall cost of system is to be not more than Rs. 105. The reliability of each device type is 0.9, 0.8, and 0.5 respectively. **6**

OR iii. Define multistage graph and find shortest path from S to T using forward approach. **6**
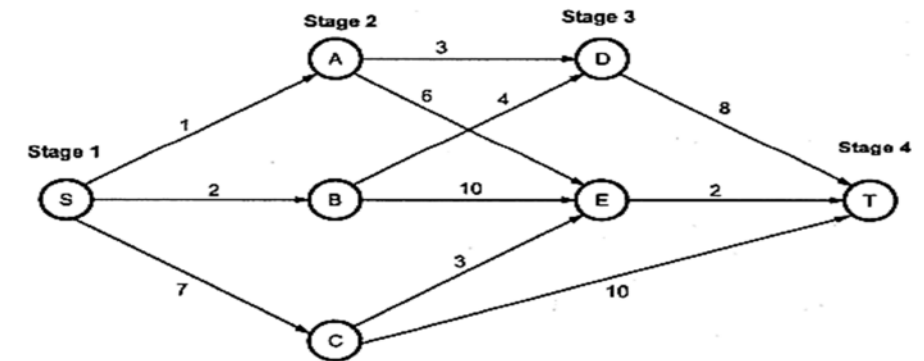
Q.6 Attempt any two:

i. Elaborate how backtracking technique can be used to solve the n-queen problem. Explain with an example. **5**

ii. Explain P, NP and NP hard problems with an example. **5**

iii. Explain the method of reduction to solve TSP problem using branch and bound? **5**

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Marking Scheme
IT3CO06 [T] Design and Analysis of Algorithms

Q.1	i)	B	1
	ii)	D	1
	iii)	B	1
	iv)	D	1
	v)	A	1
	vi)	B	1
	vii)	D	1
	viii)	C	1
	ix)	B	1
	x)	B	1

Q.2	i.	2 mark for algorithm and 2 mark for analysis	4
	ii.	3 marks for each	6
OR	iii.	2 marks for complexity and 4 marks for notations	6

Q.3	i.	2 marks for concept and 2 marks for example	4
	ii.	4 marks for algorithm and 2 marks for analysis	6
OR	iii.	4 marks for formula and explanation and 2 marks for analysis	6

Q.4	i.	3 marks for algorithm	3
	ii.	2 Marks for explanation,5 Marks for the numerical (steps modelling will be given even if answer is incorrect)	7
OR	iii.	5 marks for huffman tree and 2 marks for coding	7

Q.5	i.	2 marks for definition and 2 marks for difference	4
	ii.	1 mark for definition and 5 marks for solution	6
OR	iii.	1 mark for definition and 5 marks for solution	6

Q.6			
	i.	3 marks for explanation and 2 marks for example	5
	ii.	3 marks for definition and 2 marks for example	5
	iii.	5 marks for explanation	5

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