DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular End Semester Examination – Summer 2022

SE **Branch : Computer Engineering/ CSE/ CSE(AI&ML)**

Course: S.Y B. Tech. **Semester :IV**

Subject Code & Name: BTCOC401 (Design and Analysis of Algorithm)

Max Marks: 60 **Date: 12/08/2022** **Duration: 3.45 Hr.**

Instructions to the Students:

1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks
Q. 1	**Solve Any Two of the following**		
A)	Define Algorithm? State the main characteristics of Algorithm	Knowledge	6
B)	Describe Asymptotic notations with expression	Understand	6
C)	Evaluate $9T(n/3) + n$	Evaluation	6
Q.2	**Solve Any Two of the following.**		
A)	Describe an algorithm for Merge Sort and find its time complexity	Understand	6
B)	Evaluate and write the algorithm for Quick sort describe its best and worst case with suitable example	Evaluation	6
C)	$\begin{bmatrix}6 & 7\\5 & 4\end{bmatrix}\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}$ Solve using Strassen's Matrix Multiplication, and Calculate its time complexity	Analysis	6
Q. 3	**Solve Any Two of the following.**		
A)	Draw a state space tree for finding four queens solutions	Understand	6
B)	Apply branch and bound technique to solve travelling salesman problem for the graph whose matrix is $\begin{matrix}\infty & 20 & 30 & 10 & 11\\ 15 & \infty & 16 & 4 & 2\\ 3 & 5 & \infty & 2 & 4\\ 19 & 6 & 18 & \infty & 3\\ 16 & 4 & 7 & 16 & \infty\end{matrix}$	Analysis	6
C)	Describe Graph Coloring Problem with suitable example	**Understand**	6
Q.4	**Solve Any Two of the following.**		
A)	Solve the Fractional Knapsack problem Given n = 5 objects and a knapsack capacity W = 60 profit= (30, 20 ,100,90,160) Weight = (5,10,20,30,40)	**Analysis**	6
B)	Solve an optimal Huffman code for the following set of frequencies a: 50 b: 25 c: 15 d: 40 e=75	**Analysis**	6
C)	Solve Job sequencing with deadlines n=4 , p=(100,10,15,27) and d =(2,1,2,1) find optimal solution	Analysis	6

Q. 5 Solve Any Two of the following.

A)	Calculate the shortest path by using Floyd's Warshall Algorithm $\begin{matrix} 0 & 4 & 5 \\ 2 & 0 & \infty \\ \infty & -3 & 0 \end{matrix}$	Application	**6**
B)	Calculate the longest common subsequence for X={ A,B,C,B,D,A,B} Y={B,D,C,A,B,A}	Application	**6**
C)	Differentiate between Dynamic Programming and greedy Approach	Analysis	**6**

***** End *****

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD -402 103

Winter Semester Examination – Nov - 2019

Branch: Computer Science & Engineering **Sem.:- IV**

Subject:- Design and Analysis of Algorithms (BTCOC401) **Marks: 60**

Date:- 26/11/2019 **Time:- 3 Hrs.**

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Instructions to the Students

1. Each Question carries 12 marks.
2. Attempt **any Five** Questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

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Q.1)a)Solve the following recurrence relation using master method.

(i) $T(n) = 4T(n/2) + n$

(ii) $T(n) = 4T(n/2) + n^2$

(iii)$T(n) = 4T(n/2) + n^3$

Q.1)b) Explain different asymptotic notations.

Q.2)a)Write Strassen's algorithm to multiply two 2X2 matrices. Apply Strassen's algorithm to multiply following matrices.

$$A = \begin{Bmatrix} 1 & 1 \\ 1 & 1 \end{Bmatrix} \qquad B = \begin{Bmatrix} 2 & 2 \\ 2 & 2 \end{Bmatrix}$$

Q.2) b) Write an algorithm for merge sort . Apply merge sort on following array

A= 5 1 2 6 3 7 9 4

Q.3) a) Write Huffman Coding algorithm . Obtain Huffman tree for following data.

Characters	"a"	"b"	"c"	"d"	"e"
Frequency	6	11	19	35	50

Q.3) b) What are the different elements of greedy strategy ? Explain the steps to solve the problem by greedy strategy.

Q.4) a) Compute Longest Common Subsequence using Dynamic Programming approach for sequences X and Y if X =A, B, C, B, D, A, B and Y = B, D, C, A, B, A . What is the

length of LCS .

b) Compare Greedy Strategy , Dynamic Programming and Divide and Conquer approach.

Q.5)a) What is state space tree ?Using state space tree show that there exist an solution to 4-Queens problem .

b) Given n=6 weights, w={5,10,12,13,15,18} and M=30 .Find all possible subsets for which sum=M using sum of subsets algorithm.

Q.6) a) What is P class and NP class? Show relationship between them.

b) State the properties of Red- Black tree. Suppose that a node x is inserted into a red-black tree with RB-INSERT and then immediately deleted with RB-D ELETE . Is the resulting red-black tree the same as the initial red-black tree? Justify your answer.

**********Paper End**********

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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY LONERE – RAIGAD -402 103

Semester Examination – Summer - 2019

Branch: Computer Engineering **Sem.:- IV**

Subject and Subject Code:- Design and Analysis of Algorithms (BTCOC401)

Date:- 14/05/2019 **Marks: 60** **Time:- 3 Hrs.**

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Instructions to the Students

1. Each Question carries 12 marks.
2. Attempt **Any Five** Questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

Q.1. Attempt Any Three from the following questions. **(04*03=12)**

a) Define Big *O* notation? What is total time complexity of following code ?

```
int a,b,c,d,i.
{
        for (i = 0 ;i<=11; i++)
                {
                a  = a+b;
                }
        d= c+a;
}
```

b) Define algorithm. What is the need of algorithm analysis ? Which factors affect runtime of algorithm?

c) Solve the following recurrence relation using characteristic polynomial.

$$t_n = \begin{cases} n & \text{if } n=0 \text{ or } n=1 \\ t_{n-1} + t_{n-2}, & \text{otherwise} \end{cases}$$

d) Solve the following recurrence using master method. Verify solution using substitution method.

$$T(n) = 2T(n/2) + cn$$

Q.2.Attempt the following questions **(06*02=12)**

a) Write an algorithm of merge sort and illustrate the operation on an array using Merge Sort.

A={5 2 4 7 1 3 2 6}

b)Multiply following two matrices using Strassen's matrix multiplication algorithm.

$$\text{Matrix A} = \begin{Bmatrix} 1 & 2 \\ 2 & \\ 3 & 4 \end{Bmatrix} \quad \text{Matrix B} = \begin{Bmatrix} 5 & 6 \\ 6 & \\ 7 & 8 \end{Bmatrix}$$

Q.3. Solve the following questions **(06*02=12)**

a) What is Greedy method? Explain elements of Greedy method.

b) Construct an optimal instance of Huffman Code for the following set of frequencies using Greedy method.

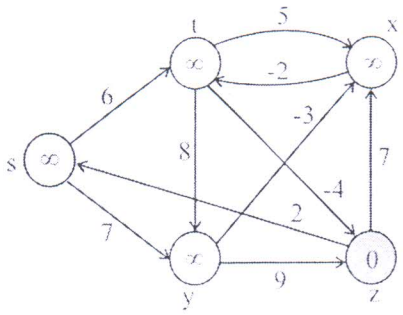
Characters	A1 "a"	A2 "b"	A3 "c"	A4 "d"	A5 "e"	A6 "f"
Frequency	45	13	12	16	9	5

Q.4. Solve the following questions: **(06*02=12)**

a) Determine longest common subsequence using dynamic programming approach for X and Y. What is the length of longest common subsequence?

X = < A, B, C, B, D, A, B > Y = < B, D, C, A, B, A >

b) Find the shortest path using Bellman Ford algorithm for the following graph. Note that vertex z is source vertex.



Q.5. Solve the following questions **(06*02=12)**

a) Solve the following 15-Puzzle Problem.

1	2	3	4
5	6		8
9	10	7	11
13	14	15	12

b) How 4- Queens problem is solved by backtracking approach? Explain with the help of state space tree.

Q.6. Attempt any three Questions: **(04*03=12)**

a) Explain Class P, Class NP and Class NPC problems in detail.

b) Insert the following keys into empty B-Tree with minimum degree 2. Show the configuration of B-Tree after each insertion operation.
Keys: F S Q K C L H T V W M R N P A B X Y D Z E

c) What do you mean by Red Black Tree?. What are the characteristics of Red Black tree?

d) Explain Polynomial time reduction with example.

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	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE **Supplementary Winter-2023** **Course: B. Tech. Branch : Computer & Allied Engineering Semester :IV** **Subject Code & Name: BTCOC401 Design & Analysis of Algorithms** **Max Marks: 60 Date:16-01-24 Duration: 3 Hr.**		
	Instructions to the Students: 1. *All the questions are compulsory.* 2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in front of the question.* 3. *Use of non-programmable scientific calculators is allowed.* 4. *Assume suitable data wherever necessary and mention it clearly.*		
		(Level/CO)	Marks
Q. 1	Solve Any Two of the following.		12
A)	What is Algorithm? Explain criteria of Algorithms.	Remember	6
B)	What is Asymptotic Notations? Explain any three Asymptotic Notations.	Remember	6
C)	Define Max and Min Heap and write algorithm to insert into a heap.	Analysis	6
Q.2	Solve Any Two of the following.		12
A)	Write algorithm for Binary Search and calculate its time complexity.	Application	6
B)	Explain Quick Sort algorithm with its performance analysis.	Analysis	6
C)	Explain Strassen's Matrix Multiplication.	Remember	6
Q. 3	Solve Any Two of the following.		12
A)	Draw a state space tree for finding Four Queens problems solution.	Application	6
B)	Describe Graph Coloring Problem with suitable example	Analysis	6
C)	Explain Branch and Bound with suitable example.	Remember	6
Q.4	Solve Any Two of the following.		12
A)	Find an optimal solution to the knapsack instance n = 7, m = 15, (P_1 ,P_2, P_3 ,P_4 P_5 ,P_6 P_7) = (10,5,15,7,6,18,3), and (w_1, w_2, w_3, w_4, w_5, w_6, w_7) = (2,3,5,7,1,4,1).	Application	6
B)	What is Minimum Cost Spanning Tree? Explain with suitable example.	Remember	6
C)	Explain Job Sequencing with Deadlines.	Remember	6
Q. 5	Solve Any Two of the following.		12
A)	Analyze Floyd Warshals algorithm for Dynamic Programming.	Analysis	6
B)	Explain complexity class P and complexity class NP.	Remember	6
C)	Differentiate between Dynamic Programming and Greedy Algorithm.	Analysis	6

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular and Supplementary Summer Examination -2024

Course: B. Tech.

Branch : Computer Engineering and Allied

Semester :IV

Subject Code & Name: Design and Analysis Of Algorithms(BTCOC401)

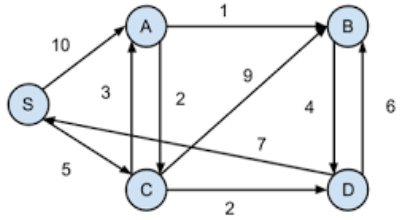
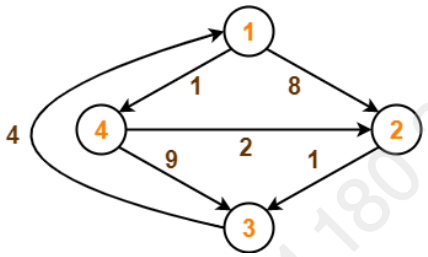
Max Marks: 60 **Date:12/06/2024** **Duration: 3 Hrs.**

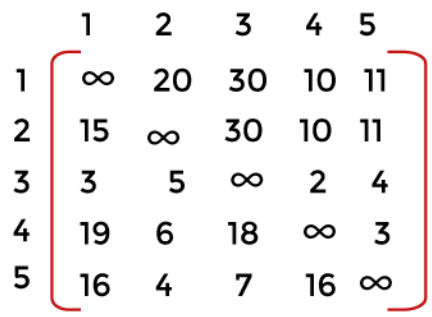
Instructions to the Students:

1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks
Q. 1	**Solve Any Two of the following.**		
A)	**Solve the following recurrences using Master Theorem.** **(i)** $T(n) = 16T(n/4) + n$. **(ii)** $T(n) = T(2n/3) + 1$ **(iii)** $T(n) = 3T(n/4) + n \log n$	**Apply**	**6**
B)	**What are different asymptotic notations? Explain with neat graphs. If f(n) = sqrt (n) and g(n)=n then prove that f(n) is Og(n).**	**Analyze**	**6**
C)	**What are the different properties of algorithm ? Which factors affect runtime of an algorithm ?**	**Understand**	**6**
Q.2	**Solve Any Two of the following.**		
A)	**Apply Strassen's matrix multiplication algorithm on following matrices.** $\begin{Bmatrix} 2 & 3 \\ 6 & 8 \end{Bmatrix} \quad \begin{Bmatrix} 1 & 2 \\ 3 & 6 \end{Bmatrix}$	**Apply**	**6**
B)	**What is best case and worst case time complexity for Merge Sort ? Apply Merge Sort on following array.** **A = { 13, 4, 22, 1,16, 9,0,2}**	**Apply**	**6**
C)	**Distinguish between Divide and Conquer and Dynamic programming approach .**	**Understand**	**6**
Q. 3	**Solve Any Two of the following.**		
A)	**Apply Huffman Coding algorithm on following data. Write the code for each character using Huffman Coding algorithm.**	**Apply**	**6**

Character	**a**	**b**	**c**	**d**	**e**	**f**
Frequency	**45**	**13**	**12**	**16**	**9**	**5**

<table>
<tr><td>B)</td><td>Apply greedy approach to solve following fractional knapsack problem if capacity of knapsack is 60 kg. Calculate maximum profit.
<table>
<tr><th>Item</th><th>Weight(in KG)</th><th>Value (Profit)</th></tr>
<tr><td>1</td><td>5</td><td>30</td></tr>
<tr><td>2</td><td>10</td><td>40</td></tr>
<tr><td>3</td><td>15</td><td>45</td></tr>
<tr><td>4</td><td>22</td><td>77</td></tr>
<tr><td>5</td><td>25</td><td>90</td></tr>
</table></td><td>Apply</td><td>6</td></tr>
<tr><td>C)</td><td>Caculate shortest path from node S to all nodes for following graph using Dijkstra’s algorithm.
 
</td><td>Apply</td><td>6</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>Q.4</td><td>Solve Any Two of the following.</td><td></td><td></td></tr>
<tr><td>A)</td><td>Apply Floyd Warshall’s algorithm on following graph.
 
</td><td>Apply</td><td>6</td></tr>
<tr><td>B)</td><td>Determine Longest Common Subsequence between X and Y if X=< x m j y a u z> and Y= <m z j a w x u>.</td><td>Apply</td><td>6</td></tr>
<tr><td>C)</td><td>Explain the following terms.
(i) P -problem (ii) NP problem (iii)NP complete problem</td><td>Understand</td><td>6</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>Q. 5</td><td>Solve Any Two of the following.</td><td></td><td></td></tr>
<tr><td>A)</td><td>How 4 –Queens problem is solved by backtracking approach ? Draw state space tree for 4- Queens problem?</td><td>Analyze</td><td>6</td></tr>
<tr><td>B)</td><td>Solve the following travelling salesman problem using branch and bound approach.</td><td>Apply</td><td>6</td></tr>
</table>

			
C)	**Compare and contrast backtracking and branch and bound approach.**	**Understand**	**6**
	***** End *****		