SVKM'S NMIMS

MUKESH PATEL SCHOOL OF TECHNOLOGY MANAGEMENT& ENGINEERING

Academic Year: 2022-2023

Program: B Tech / MBA Tech

Year: II Semester: IV

Stream: Computer Engineering

Subject: Design and Analysis of Algorithms

Time: 3 hrs (10:00am to 1:00pm)

Date: 27/Apr/2023

No. of Pages: 3

Marks: 100

Final Examination / Re-Examination

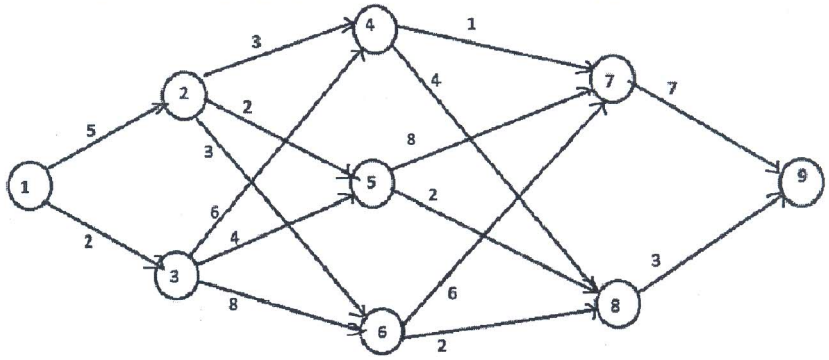
Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover of the Answer Book, which is provided for their use.

1) Question No. _1___ is compulsory.
2) Out of remaining questions, attempt any __4___ questions.
3) **In all ___5_ questions to be attempted.**
4) All questions carry equal marks.
5) **Answer to each new question to be started on a fresh page.**
6) **Figures in brackets on the right-hand side indicate full marks.**
7) **Assume Suitable data if necessary.**

Q1		Answer briefly:	[20]
CO-2,3; SO-1; BL-2	a.	Describe the difference between divide & conquer and greedy algorithms.	5

CO-1; SO-1; BL-2	b.	Define the Time and Space Complexity of an algorithm. Compute the time complexity of the following function.
		p = 0;
		for (i = 1 ; p <= n ; i++)
		{
		p = p + i;
		}
			5

CO-2; SO-6; BO-2	c.	Demonstrate the effect of various methods of Pivot selection in quick sort.	5
CO-3; SO-1; BL-2	d.	Discuss the Use cases for the greedy method.	5
Q2 CO-3; SO-1; BL-4	a.	Define algorithm. Explain the characteristics of a good algorithm. List four types of the standard algorithm. What did you mean by algorithm analysis? Why is it important?	[10]
CO-4; SO-6,7; BL-2,4;	b.	Explain State-Space Tree and how a backtracking algorithm works. Explain it with an example.	[10]
Q3 CO-1; SO-1;	a.	Find the recurrence relation of the given code and solve that recurrence relation using the substitution method.	[10]

<table>
<tr>
<td>BL-1</td>
<td></td>
<td>
Test(int n)
{
if (n>0)
{
printf (“%d”,n);
Test(n-1);
Test(n-1);
}
}
</td>
<td></td>
</tr>
<tr>
<td>CO-3; SO-2;
BL-6</td>
<td>b.</td>
<td>
Construct Huffman code for the following data
<table>
<tr><td>Character</td><td>X</td><td>Y</td><td>Z</td><td>U</td><td>V</td></tr>
<tr><td>Probability</td><td>0.4</td><td>0.1</td><td>0.2</td><td>0.15</td><td>0.15</td></tr>
</table>
1) Encode the text XYXZXYXUV using Huffman code
2) Decode 1001010
Also, discuss its time complexity
</td>
<td>[10]</td>
</tr>
<tr>
<td>Q4
CO-2; SO-6; BO-5</td>
<td>a.</td>
<td>Perform the operation of quick sort on the following list of numbers and discuss its asymptotic analysis. <20, 33, 10, 8, 27, 58, 6, 66, 11, 49></td>
<td>[10]</td>
</tr>
<tr>
<td>CO-4;
SO-1;
BL-3</td>
<td>b.</td>
<td>
Apply dynamic programming to find the shortest path from 1 to 9 for the following multistage graph (Use the backward approach).


</td>
<td>[10]</td>
</tr>
<tr>
<td>Q5
CO-3;
SO-2;
BL-5</td>
<td>a.</td>
<td>Discuss the algorithm of Knapsack of greedy approach.
Consider the following instance of the knapsack problem: n = 3, m = 35, (p1, p2, p3) = (25, 24, 15) and (w1, w2, w3) = (15, 15, 10). Evaluate optimal solutions using a greedy approach. Explain its complexity</td>
<td>[10]</td>
</tr>
<tr>
<td>CO -4;
SO-1;
BL-3</td>
<td>b.</td>
<td>Develop an algorithm to find the shortest path using the bellman ford algorithm. Also, write its limitations and its complexity</td>
<td>[5]</td>
</tr>
<tr>
<td>CO-4; SO-6,7; BL-2,4</td>
<td>c.</td>
<td>What is Backtracking? Why is this called Backtracking? What is an Exhaustive Search?</td>
<td>[5]</td>
</tr>
</table>

Q6 CO-1; SO-1; BL-5	a.	Find asymptotic upper and lower bounds for T (n) in each of the following recurrences. Assume that T (n) is constant for $n \leq 2$. Make your bounds as tight as possible, and justify your answers. (a) T (n)=4T (n/4) + 5n (b) T (n)=4T (n/5) + 5n (c) T (n)=5T (n/4) + 4n (d) T (n) = 25T (n/5) + n^2 (e) T (n)=4T (n/5) + log n	[10]
CO-4; SO-1; BL-2	b.	Identify the Longest Common Subsequence from the following strings : X = ACBAED Y = ABCABE Explain its algorithm and time complexity	[10]
Q7 CO-2; SO-6; BL-3	a.	Interpret the algorithm for Multistage Graph(backward reasoning) using Dynamic Programming and discuss its complexity.	[10]
CO-1; SO-1; BL-2	b.	Describe NP and NP-Complete problems	[5]
CO-2; SO-6; BL-3	c.	Show the working of merge sort on the following list of numbers. <72, 53, 21, 34, 7, 64, 57>	[5]