



## School of Computer Science and Engineering

Winter Semester 2022-2023 Final Assessment Test

SLOT: G1

Programme Name & Branch : B.Tech CSE

Course Name & code: Design and Analysis of Algorithms BCSE204L

Class Number (s):

Exam Duration: 180 Min.

Maximum Marks:100

Q.No.	Question	Max Marks	CO	BL
1.	How does Karatsuba algorithm handle numbers with odd number of digits? Write the algorithm/program and show the stepwise execution of the same to multiply the two <b>binary numbers</b> – 10101 and 11. Analyse its time complexity.	10	CO1	BL3
2.	a) There are two knapsacks – one with a capacity of 8 and the weights and values of the items that can be used for filling it are (3,4,6,5) and (20,30,10,40) respectively and the other with a capacity of 20 and the weights and values of the items that can be used for filling it are (15,10,10) and (9,5,5) respectively. Validate the correctness of the statement “Greedy approach does not ensure an optimal solution for 0-1 Knapsack problem” using the given examples [5M]  b) Two different character encoding schemes E1 and E2 encode the characters R, G, B, Y as (0, 011,111,11) and (0,11,101,100) respectively. The string “RGRBYRR” is encoded using both the methods, transmitted and decoded in the receiver side. Which of the two is Huffman encoding? Justify your answer. [5M]	10	CO1	BL5
3	Given below is the pseudocode to implement Dynamic Programming technique for matrix chain multiplication. Explain the reasons for assigning these specific initial and final values for the ‘i’ loop and ‘k’ loop and the ‘j’ variable.		CO2	BL2

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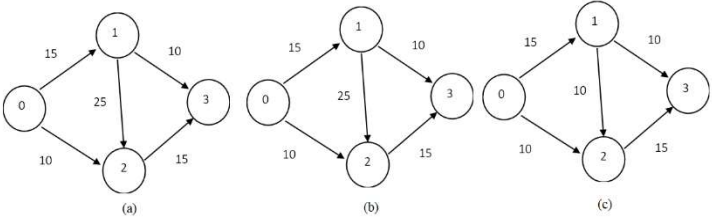
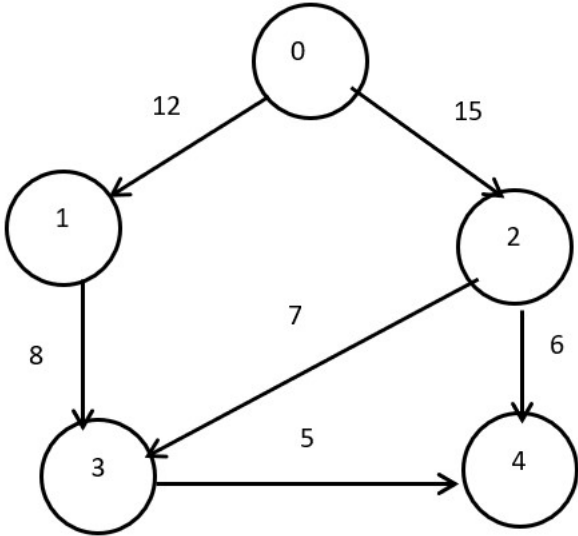
Matrix-Chain(p, n)
{
  for (i = 1 to n) m[i, i] = 0;
  for (l = 2 to n)
  {
    for (i = 1 to n - l + 1)
    {
      j = i + l - 1;
      m[i, j] = ∞;
      for (k = i to j - 1)
      {
        q = m[i, k] + m[k + 1, j] + p[i - 1] * p[k] * p[j];
        if (q < m[i, j])
        {
          m[i, j] = q;
          s[i, j] = k;
        }
      }
    }
  }
  return m and s;
}

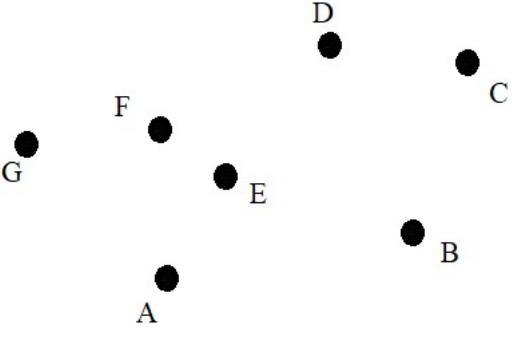
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Apply the same to fill the table given below and find the total number of scalar multiplications required to be done to multiply the following 5 matrices of ranks [4,10,3,12,20,7]. [5M+5M]

	0	1	2	3	4
0	0	120	264		
1		0	360	1320	
2			0	720	1140
3				0	1680
4					0

4	Write the code snippet / pseudocode for implementing backtracking technique to find the subset of elements from a given set, whose sum adds up to a given target value. Employ the same to find the first two subsets from the set [10,20,50,60,80] that sum up to the target 80.		CO2	BL3
5	Construct the Longest Prefix Suffix (LPS) table for the pattern "121231213". What is the length of the longest proper prefix and suffix that can be extracted from this pattern? What is the length of the proper prefix-proper suffix that can be extracted from the pattern "121231"? If the characters from indexes 0 to 6 of the pattern ("12123121") match with the text and the 7 <sup>th</sup> character does not match, which character in the pattern should the next comparison start from? Compare its time complexity with that of Naïve pattern-matching algorithm.	10	CO3	BL3
6.	"To find the maxflow using Ford Fulkerson algorithm, it is required to add the path flow along the reverse edges	10	CO4	BL4

	<p>also in the residual graph, as there may be a need to send the flow in the reverse direction, sometimes”.</p> <p>Following certain heuristics for the Ford Fulkerson algorithm, the first augmented path selected for the given three flow networks (a,b,c) are (0-1-3), (0-1-2-3) and (0-1-2-3) respectively. Proceed to calculate the maxflow for the 3 networks and determine which of the three scenarios help to justify the aforementioned statement.</p> <p>Consider source=0 and sink=3</p> 			
7.	<p>Apply Push-Relabel algorithm to find the maxflow for the graph given below. Source=0 and sink=4.</p> 	10	CO4	BL3
8.	<p>a) From the following set of line segments, find all the pairs that intersect, using a more efficient method than the Brute Force approach. [5M]</p> <p>{(2,8),(6,9)},  {(5,7),(10,7)},  {(3,5),(8,4)},  {(7,6),(12,12)},  {(9,10),(16,3)},  {(14,7),(17,9)}</p> <p>b) Apply Graham’s scan algorithm to find the convex hull of the following set of points. [5M]</p>	10	CO5	BL3

				
9.	Design a randomized algorithm for the hiring problem and perform probabilistic analysis to evaluate the computational complexity of the algorithm.	10	CO6	BL2
10.	Brief the various complexity classes and illustrate the conversion of SAT problem to 3-CNF-SAT problem.	10	CO7	BL1