Enrollment Number: _____ Roll Number: _____

JAMIA HAMDARD
Department of Computer Science & Engineering
School of Engineering Sciences & Technology
New Delhi – 110062

Examination: Supplementary Examination 2023

Sub: Design and Analysis of Algorithms Sub. Code: BTCSE – 404/BTCSEAI – 404

Max. Time: 3 hours Max. Marks: 75

Note: Follow proper numbering for answering the questions.

SECTION – A

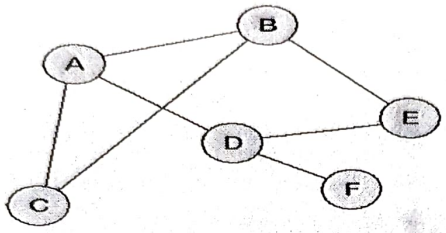
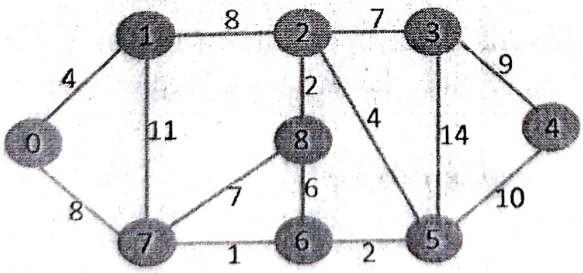
Attempt all questions. *7 x 5 = 35 Marks*

SL. NO	Questions	Marks	CO	BL
1.	Define "algorithm". Explain the importance of time-space tradeoff.	5	CO1	L1
2.	Which of the following asymptotic notations areReflexive, Symmetric, Transitive and Anti-symmetric in nature?	5	CO1	L2
3.	"In Branch & Bound technique, Upper bound & lower bound are used to for finding optimizing state-space search" Justify the statement and also explain how optimal the solution will be when compared with dynamic programming technique.	5	CO2	L4
4.	Design an algorithm for sorting the numbersin an array. Also perform the analysis of the algorithm to find the best-case and worst-case running time complexity.	5	CO2	L6
5.	Formulate the problem statement for: i. Maximum flow problem ii. Minimum Spanning Tree problem.	5	CO3	L6
6.	Write a short note on P, NP, NP-hard and NP-complete with example for each.	5	CO4	L2
7.	Is it possible to finding a near optimal polynomial time solution for NP-Complete problems? If Yes, Explain the technique used to find near optimal solution.	5	CO5	L4

SECTION – B

Attempt any four out of six questions. *4 x 10 = 40 Marks*

SL NO	Questions	Marks	CO	BL
1.	Solve any two of the following recurrence equations: i. $T(n) = \begin{cases} 2T(n-1)+1, & if\ n > 0 \\ 0 & if\ n = 0. \end{cases}$ ii. $T(n) = 3T\left(\frac{n}{9}\right) + n\sqrt{n}.$ iii. $T(n) = T(\sqrt{n}) + \log n.$	10	CO1	L3

<table>
<tr><td>2.</td><td>For given items with weights and costs and maximum capacity of the knapsack as 10, solve
i. Fractional Knapsack Problem
ii. 0/1 Knapsack Problem
<table><tr><th>Item</th><th>A</th><th>B</th><th>C</th><th>D</th></tr><tr><td>Weight (W)</td><td>4</td><td>3</td><td>4</td><td>2</td></tr><tr><td>Value (V)</td><td>20</td><td>24</td><td>24</td><td>12</td></tr></table></td><td>10</td><td>CO2</td><td>L3</td></tr>
<tr><td>3.</td><td>Write the algorithms for various graph traversal techniques. Also show the working of those algorithms on the given graph:
  </td><td>10</td><td>CO3</td><td>L2
L3</td></tr>
<tr><td>4.</td><td>Kunal, a tourist, is on a visit to our national capital. He is staying at Hotel Ashoka (A), New Delhi. He wishes to visit Zoo (Z), Lotus temple (L) and Connaught Place (C) and return back to the hotel. The distance matrix is as follows:
<table><tr><th>Distance</th><th>A</th><th>C</th><th>L</th><th>Z</th></tr><tr><td>A</td><td>0</td><td>20</td><td>17</td><td>30</td></tr><tr><td>C</td><td>15</td><td>0</td><td>32</td><td>16</td></tr><tr><td>L</td><td>28</td><td>18</td><td>0</td><td>21</td></tr><tr><td>Z</td><td>19</td><td>27</td><td>24</td><td>0</td></tr></table>Find all the tours for Kunal that are having minimum distance.</td><td>10</td><td>CO2</td><td>L3</td></tr>
<tr><td>5.</td><td>Find minimum spanning tree for the given graph using
i. Prim's Algorithm
ii. Kruskal's Algorithm
 
Also, Illustrate the real-life scenario where minimum spanning tree algorithms can be used?</td><td>10</td><td>CO3</td><td>L3
L4</td></tr>
<tr><td>6.</td><td>Differentiate the following:
i. Monte Carlo and Las Vegas Algorithms
ii. Tractable and Intractable Problems</td><td>10</td><td>CO4
CO5</td><td>L4</td></tr>
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