JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2025

B.Tech- VII Semester (CSE/IT)

COURSE CODE (CREDITS): 19B1WCI737 (3) MAX. MARKS: 35

COURSE NAME: Optimization Methods in Business Analytics

COURSE INSTRUCTORS: Meghna Dhalaria MAX. TIME: 2 Hours

Note: *(a) All questions are compulsory.*

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Use of Calculator is allowed

<table>
<tr><th>Q.No</th><th>Question</th><th>CO</th><th>Marks</th></tr>
<tr><td>Q1</td><td>A company wants to find the shortest possible route for its salesperson who must start from a city, visit all 5 cities exactly once, and return to the starting city. The travel cost (in km) between the 5 cities A,B,C,D, E is given below:

<table>
<tr><td></td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td></tr>
<tr><td>A</td><td>X</td><td>5</td><td>8</td><td>4</td><td>5</td></tr>
<tr><td>B</td><td>5</td><td>X</td><td>7</td><td>4</td><td>5</td></tr>
<tr><td>C</td><td>8</td><td>7</td><td>X</td><td>8</td><td>6</td></tr>
<tr><td>D</td><td>4</td><td>4</td><td>8</td><td>X</td><td>8</td></tr>
<tr><td>E</td><td>5</td><td>5</td><td>6</td><td>8</td><td>X</td></tr>
</table>

Using the above cost matrix, solve the Travelling Salesman Problem (TSP) using the Assignment Method (Hungarian Method).</td><td>3</td><td>[8]</td></tr>
<tr><td>Q2</td><td>A project schedule has the following characteristics:

<table>
<tr><th>Activity</th><th>Duration (days)</th></tr>
<tr><td>1–2</td><td>3</td></tr>
<tr><td>1–3</td><td>5</td></tr>
<tr><td>2–4</td><td>2</td></tr>
<tr><td>2–5</td><td>4</td></tr>
<tr><td>3–5</td><td>6</td></tr>
<tr><td>4–6</td><td>3</td></tr>
<tr><td>5–6</td><td>5</td></tr>
<tr><td>5–7</td><td>4</td></tr>
<tr><td>6–8</td><td>7</td></tr>
<tr><td>7–8</td><td>3</td></tr>
</table>

(a) Construct the network diagram.
(b) Compute the earliest event time and latest event time.
(c) Determine the critical path and total project duration.
(d) Compute total and free float for each activity.</td><td>3</td><td>[4]</td></tr>
<tr><td>Q3</td><td>Reshma wishes to mix two types of food P and Q in such a way that</td><td>2</td><td>[4]</td></tr>
</table>

	the vitamin contents of the mixture contain at least 8 units of vitamin A and 11 units of vitamin B. Food P costs Rs 60 / kg and Food Q costs Rs 80 / kg. Food P contains 3 units/kg of Vitamin A and 5 units / kg of Vitamin B while food Q contains 4 units kg of Vitamin A and 2 units/kg of vitamin B. Determine the minimum cost of the mixture.		
Q4	A project has the following activities and three time estimates (optimistic t_o, most-likely t_m, pessimistic t_p):	4	[4]

Activity	optimistic t_o	most-likely t_m	pessimistic t_p
1-2	1	7	13
1-6	2	5	14
2-3	2	14	26
2-4	2	5	8
3-5	7	10	19
4-5	5	5	17
6-7	5	8	29
5-8	3	3	9
7-8	8	17	32

(a) Construct the network diagram.
(b) Find the expected duration and variance of each activity.
(c) Compute the earliest and latest occurrence of each event.
(d) Determine the critical path and total project duration.
(e) Compute the variance and standard deviations of project length.

Q5	A logistics company distributes electronic components from three warehouses (W1, W2, W3) to four retail stores (R1, R2, R3, R4). The company has estimated the profit per unit (in ₹) earned from transporting the goods from each warehouse to each retail store as shown below:	3	[5]

	R1	R2	R3	R4	Supply
W1	45	32	28	40	120
W2	50	36	34	25	80
W3	42	38	30	35	100
Demand	60	40	100	100	

The objective is to determine the initial feasible allocation of goods from warehouses to retail stores using the Vogel's Approximation Method (VAM) such that the total profit is maximized.

Q6	Find the solution using Two phase method $Min\ Z = 5x_1 - 4x_2 + 3x_3$ Subject to $2x_1 + x_2 - 6x_3 = 20$ $6x_1 + 5x_2 + 10x_3 \leq 76$ $8x_1 - 3x_2 + 6x_3 \leq 50$ $and\ x_1, x_2, x_3 \geq 0$	3	[10]