JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

Supplementary Examination- 2026

B.Tech- VII Semester (CSE/IT)

COURSE CODE (CREDITS): 19B1WCI737 (3) MAX. MARKS: 75

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>Find dual from primal conversion

$Min\ Z = 2x_1 + 4x_2 + 3x_3$

Subject to $3x_1 + 4x_2 + x_3 \geq 11$
$-2x_1 - 3x_2 + 2x_3 \leq -7$
$x_1 - 2x_2 - 3x_3 \leq -1$
$3x_1 + 2x_2 + 2x_3 \geq 5$
$and\ x_1, x_2, x_3 \geq 0$</td><td>2</td><td>[5]</td></tr>
<tr><td>Q2</td><td>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:

<table>
<tr><th></th><th>R1</th><th>R2</th><th>R3</th><th>R4</th><th>Supply</th></tr>
<tr><td>W1</td><td>45</td><td>32</td><td>28</td><td>40</td><td>120</td></tr>
<tr><td>W2</td><td>50</td><td>36</td><td>34</td><td>25</td><td>80</td></tr>
<tr><td>W3</td><td>42</td><td>38</td><td>30</td><td>35</td><td>100</td></tr>
<tr><td>Demand</td><td>60</td><td>40</td><td>100</td><td>100</td><td></td></tr>
</table>
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.</td><td>3</td><td>[10]</td></tr>
<tr><td>Q3</td><td>Find the solution using Two phase method

$Min\ Z = 3x_1 + 5x_2$

Subject to $x_1 + 2x_2 \geq 8$
$3x_1 + 2x_2 \geq 12$
$5x_1 + 6x_2 \leq 60$</td><td>2</td><td>[10]</td></tr>
</table>

	and $x_1, x_2 \geq 0$		
Q4	A project schedule has the following characteristics: (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.	3	[10]

Activity	Duration (days)
1–2	3
1–3	5
2–4	2
2–5	4
3–5	6
4–6	3
5–6	5
5–7	4
6–8	7
7–8	3

Q5 A project has the following activities and **three time estimates** (optimistic t_o, most-likely t_m, pessimistic t_p): — 3 — [10]

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.

Q6 A company wants to assign five workers (A, B, C, D, and E) to five different tasks (A, B, C, D, and E). The profit (in ₹) associated with assigning each worker to each task is given in the following table. An entry marked as 'X' indicates that the corresponding assignment is not possible. — 3 — [10]

	Task A	Task B	Task C	Task D	Task E
Worker A	8	2	X	5	4
Worker B	10	9	2	8	4
Worker C	5	4	9	6	X
Worker D	3	6	2	8	7

	Worker E	5	6	10	4	3		
	Determine the optimal assignment of workers to tasks using the Hungarian Method such that the total profit is maximized.							
Q7	One kind of cake requires 200g of flour and 25g of fat, and another kind of cake requires 100g of flour and 50g of fat. Find the maximum number of cakes that can be made from 5kg of flour and 1 kg of fat assuming that there is no shortage of the other ingredients used in making the cakes? Solve using Graphical Method.						2	[10]
Q8	Find the solution using simplex Big M method $Max\ Z = 3x_1 + 2x_2$ Subject to $2x_1 + x_2 \leq 2$ $3x_1 + 4x_2 \geq 12$ $and\ x_1, x_2 \geq 0$						2	[10]