National Institute of Technology Hamirpur
Department of Mechanical Engineering
End Semester Examination

B. Tech. VII Semester

Max. Marks: 50
Time: 3:00 Hrs

Sub.: Operations Research (ME-411)

Instructions: All questions are compulsory; weightage of marks are mentioned against the questions.

Q1 *Maximize* $Z = x_1 + 2x_2 + 3x_3 - x_4,$ **[10]**

subject to $x_1 + 2x_2 + 3x_3 = 15,$
$2x_1 + x_2 + 5x_3 = 20,$
$x_1 + 2x_2 + x_3 + x_4 = 10,$
$x_1, x_2, x_3, x_4 \geq 0.$

Q2 Five wagons are available at station 1, 2, 3, 4 and 5. These are required at five   **[10]** stations I, II, III, IV, and V. The mileages between various stations are given by the table below. How should the wagons be transported so as to minimize the total mileage covered.

	I	II	III	IV	V
1	10	5	9	18	11
2	13	9	6	12	14
3	3	2	4	4	5
4	18	9	12	17	15
5	11	6	14	19	10

Q3 Find the optimum solution to the following transportation problem in which the cells   **[10]** contain the unit transportation cost in rupees.

	W_1	W_2	W_3	W_4	W_5	Available
F_1	7	6	4	5	9	40
F_2	8	5	6	7	8	30
F_3	6	8	9	6	5	20
F_4	5	7	7	8	6	10
Required	30	30	15	20	5	100 (Total)

Q4   Solve the following 2×4 game by graphical method and find the two alternate   **[10]**
solutions:

		B			
		1	2	3	4
A	1	3	3	4	0
	2	5	4	3	7

Q5   Task A, B, C, ..., H, I constitute a project. The precedence relationships are: **[10]**
A < D; A < E; B < F; D < F; C < G; C < H; F < I; G < I;

Draw a network to represent the project and find the minimum time of completion of
the project when time, in days, of each task is as follows:

Task:	A	B	C	D	E	F	G	H	I
Time:	8	10	8	10	16	17	18	14	9

also identify the critical path.

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