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Q1.

Section : 1 of 1 Question : 1 of 7 Marks for this Question : 10

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Joyce and Marvin run a day care for pre-schoolers. They are trying to decide what to feed the children for lunches. They would like to keep their costs down, but also need to meet the nutritional requirements of the children. They have already decided to go with peanut butter and jelly sandwiches, and some combination of graham crackers, milk, and orange juice. The nutritional content of each food choice and its cost are given in the table below.

Food items	Calories from Fat	Total calories	Vitamin C (mg)	Protein (g)	Cost (\$)
Bread	10	70	0	3	5
Peanut butter	75	100	0	4	4
Strawberry jelly	0	50	3	0	7
Graham cracker	20	60	0	1	8
Milk	70	150	2	8	15
Juice	0	100	120	1	35

The nutritional requirements are as follows. Each child should receive between 400 and 600 calories. No more than 30 percent of the total calories should come from fat. Each child should consume at least 60 milligrams (mg) of vitamin C and 12 grams (g) of protein. Furthermore, for practical reasons, each child needs exactly 2 slices of bread (to make the sandwich), at least twice as much peanut butter as jelly, and at least 1 cup of liquid (milk and/or juice). Joyce and Marvin would like to select the food choices for each child which minimize cost while meeting the above requirements. Formulate a linear programming model for this problem.

Food items	Calories from Fat	Total calories	Vitamin C (mg)	Protein (g)	Cost (\$)
Bread	10	70	0	3	5
Peanut butter	75	100	0	4	4
Strawberry jelly	0	50	3	0	7
Graham cracker	20	60	0	1	8
Milk	70	150	2	8	15
Juice	0	100	120	1	35

Q2.

A tin box company has four factories that supply to 5 warehouses. The variable cost of manufacturing and shipment of one ton of product from each factory to each warehouse are shown in the matrix given below. Factory capacities and warehouse requirements are shown in the margin. After several iterations the solution obtained is also shown.

Factories	Warehouses (Cost in Rs. per unit)					Capacity
	A	B	C	D	E	
W	17	9	10	10	14	75
X	13	6	11	11	12	45
Y	5	17	9	12	12	30
Z	15	20	11	14	6	50
Req	40	20	50	30	40	200

Is this an optimal solution? How do you know?

Warehouses (Cost in Rs. per unit)							
Factories	A	B	C	D	E	DMY	Capacity
W	17	9	14 25	10 30	14	0 20	75
X	13 10	6 20	11 15	11	12	0	45
Y	6 30	17	9	12	12	0	30
Z	15	20	11 10	14	6 40	0	50
Req	40	20	50	30	40	20	200

Q.3

Section : 1 of 1
Question : 3 of 7
Marks for this Question : 10
100%

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A ready-made garments manufacturer has to process 7 items through two stages of production, i.e. Cutting and Sewing. The time taken for each of these items at different stages are given in hours below, find the optimal sequence and total elapsed time.

Item	1	2	3	4	5	6	7
Cutting time	5	7	3	4	6	7	12
Sewing time	2	6	7	5	9	5	8

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Q5.

Section : 1 of 1
Question : 5 of 7
Marks for this Question : 10
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McBurger orders ground meat at the start of each week to cover the week's demand of 300 kg. the fixed cost per order is 20. *It cost about 0.03/kg/day to refrigerate and store the meat.*

- Determine the inventory cost per week of the present ordering policy
- Determine the optimal inventory policy that McBurger should use, assuming zero lead time between the placement and receipt of the order.

Q6.

Section : 1 of 1 Question : 6 of 7 Marks for this Question : 10

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Six salesmen are to be allocated to six sales regions. The earnings of each salesman at each region are given below. How can you find an allocation, so that the earnings will be maximum?

	1	2	3	4	5	6
A	15	35	0	25	10	45
B	40	5	45	20	15	20
C	25	60	10	65	25	10
D	25	20	35	10	25	60
E	30	70	40	5	40	50
F	10	25	30	40	50	15

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	1	2	3	4	5	6
A	15	35	0	25	10	45
B	40	5	45	20	15	20
C	25	60	10	65	25	10
D	25	20	35	10	25	60
E	30	70	40	5	40	50
F	10	25	30	40	50	15

Q4.

Section : 1 of 1 Question : 4 of 7 Marks for this Question : 10

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The widening of a road network requires relocating 1700 ft of 13.8 KV overhead line. The following table summarizes the activities of the project. Construct the associated project network, determine the critical path and find the duration of critical path.

Activity	Predecessors	Duration (days)
A: Job review	—	1
B: Advise customers of temporary outage	A	1
C: Reconfigure wires	A	1
D: Set up job	A	1
E: Secure poles and material	C, D	3
F: Distribute poles	E	3
G: Pole location coordination	D	1
H: Re-make	G	1
I: Dig holes	H	1
J: Frame and set poles	F, I	4
K: Cover old conductors	F, I	1
L: Pull new conductors	J, K	2
M: Install remaining material	L	2
N: Tag conductor	L	2
O: Trim trees	D	2
P: De-energize and switch lines	B, M, N, O	0
Q: Emerge and switch new line	P	1
R: Clean up	O	1
S: Remove old conductor	O	1
T: Remove old poles	E	2
U: Return material to stores	R, T	2

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	Activity	Predecessor(s)	Duration (days)
A:	Job review	—	1
B:	Advise customers of temporary outage	A	1
C:	Requisition stores	A	1
D:	Scout job	A	1
E:	Secure poles and material	C, D	3
F:	Distribute poles	E	3
G:	Pole location coordination	D	1
H:	Re-stake	G	1
I:	Dig holes	H	3
J:	Frame and set poles	F, I	4
K:	Cover old conductors	F, I	1
L:	Pull new conductors	J, K	2
M:	Install remaining material	L	2
N:	Sag conductor	L	2
O:	Trim trees	D	2
P:	De-energize and switch lines	B, M, N, O	1
Q:	Energize and switch new line	P	1
R:	Clean up	Q	1
S:	Remove old conductor	Q	1
T:	Remove old poles	S	2
U:	Return material to stores	R, T	2

Q7.

Section : 1 of 1
Question : 7 of 7
Marks for this Question : 10
100%

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For the game having the payoff table given below, determine the value of the game using graphical method and determine the optimal mixed strategy for each player using minimax criteria.

Let x_1 and x_2 be the mixed strategies of Player 1 and Player 2 respectively.

Strategy		Player 2		
		1	2	3
Player 1	1	-3	1	2
	2	1	2	1

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