12. Linear Programming

QUESTION 1:

If a young man rides his motorcycle at 25 km/hour, he had to spend Rs. 2 per km on petrol. If he rides at a faster speed of 40 km/hour, the petrol cost increases at Rs. 5 per km. He has Rs. 100 to spend on petrol and wishes to find what is the maximum distance he can travel within one hour. Express this as an LPP and solve it graphically.

QUESTION 2:

A dealer wishes to purchase a number of fans and sewing machines. He has only Rs. 5, 760 to invest and has space for at most 20 items. A fan and sewing machine cost Rs. 360 and Rs. 240 respectively. He can sell a fan at a profit of Rs. 22 and sewing machine at a profit of Rs. 18. Assuming that he can sell whatever he buys, how should he invest his money in order to maximise his profit? Translate the problem into LPP and solve it graphically.

QUESTION 3:

Solve the following linear programming problem graphically:
Maximise $Z = 60x + 15y$
Subject to constraints
$x + y \leq 50$; $3x + y \leq 90$; $x \geq 0$, $y \geq 0$

QUESTION 4:

A catering agency has two kitchens to prepare food at two places A and B. From these places 'Mid-day Meal' is to be supplied to three different schools situated at P, Q, R. The monthly requirements of the schools are respectively 40, 40 and 50 food packets. A packet contains lunch for 1000 students. Preparing capacity of kitchens A and B are 60 and 70 packets per month respectively. The transportation cost per packet from the kitchens to schools is given below :

Transportation cost per packet (in rupees)		
To	From	
	A	B
P	5	4
Q	4	2
R	3	5

How many packets from each kitchen should be transported to school so that the cost of transportation is minimum ? Also find the minimum cost.

QUESTION 5:

Every gram of wheat provides 0.1 gm of proteins and 0.25 gm of carbohydrates. The corresponding values for rice are 0.05 gm and 0.5 gm respectively. Wheat costs Rs. 4 per kg and rice Rs. 6 per kg. The minimum daily requirements of proteins and carbohydrates for an average child are 50 gms and 200 gms respectively. In what quantities should wheat and rice be mixed in the daily diet to provide minimum daily requirements of proteins and carbohydrates at minimum cost. Frame an L.P.P. and solve it graphically.

QUESTION 6:

A furniture firm manufactures chairs and tables, each requiring the use of three machines A, B and C. Production of one chair requires 2 hours on machine A, 1 hour on machine B and 1 hour on machine C. Each table requires 1 hour each on machine A and B and 3 hours on machine C. The profit obtained by selling one chair is Rs. 30 while by selling one table the profit is Rs. 60. The total time available per week on machine A is 70 hours, on machine B is 40 hours and on machine C is 90 hours. How many chairs and tables should be made per week so as to maximize profit? Formulate the problem as L.P.P. and solve it graphically.

QUESTION 7:

Two tailors A and B earn Rs 150 and Rs 200 per day respectively. A can stitch 6 shirts and 4 pants per day while B can stitch 10 shirts and 4 pants per day . How many days shall each work , if it is desired

to produce atleast 60 shirts and 32 pants at a minimum labour cost ? Solve the problem graphically.

QUESTION 8:

Write the non negativity constraints. When do they not hold good in a LPP.

QUESTION 9:

A dietician wishes to mix low calorie foods A and B in a way that, the foods contain atleast 40 units of vitamins , 50 units of minerals and 35 calories .
Two foods A and B are available at a cost of Rs 4 and Rs 3 per unit respectively.
One unit of food A contains 2 units of vitamins , one unit of minerals and 1 calories .
One unit of food B contains 1 unit of vitamins , 2 units of minerals and 1 calories.
Find what combination of A and B should be used to have least cost but satisfying all requirements

QUESTION 10:

A pharmaceutical company manufactures two types of drugs, A and B. The combined production of the packets of the two drugs should not exceed 1000 per week and the demand for packets of drug of type B is at most half of that for packets of drug of type A. Further, the production level of drugs of type A can exceed three times the production of drugs of other type by at most 500 units. If the company makes profit of Rs 10 and Rs 15 per packet of drug respectively on type A and B, how many of each should beproduced weekly in order to maximise the profit?

QUESTION 11:

Two trainee carpenters A and B earn Rs 150 and Rs 200 per day respectively. A can make 6 frames and 4 stools per day while B can make 10 frames and 4 stools per day . How many days shall each work ,

if it is desired to produce atleast 60 frames and 32 stools at a minimum labour cost ? Solve the problem graphically.

QUESTION 12:

A farmer mixes two brands P and Q of cattle feed. Brand P, costing Rs 250 per bag, contains 3 units of nutritional element A, 2.5 units of element B and 2 units of element C. Brand Q costing Rs 200 per bag contains 1.5 units of nutritional element A, 11.25 units of element B, and 3 units of element C. The minimum requirements of nutrients A, B and C are 18 units, 45 units and 24 units respectively. Determine the number of bags of each brand which should be mixed in order to produce a mixture having a minimum cost per bag? What is the minimum cost of the mixture per bag?

QUESTION 13:

An aeroplane can carry a maximum of 200 passengers. A profit of Rs 1000 is made on each executive class ticket and a profit of Rs 600 is made on each economy class ticket. The airline reserves at least 20 seats for executive class. However, at least 4 times as many passengers prefer to travel by economy class than by the executive class. Determine how many tickets of each type must be sold in order to maximise the profit for the airline. What is the maximum profit?

QUESTION 14:

A fruit grower can use two types of fertilizer in his garden, brand P and brand Q. The amounts (in kg) of nitrogen, phosphoric acid, potash, and chlorine in a bag of each brand are given in the table. Tests indicate that the garden needs at least 240 kg of phosphoric acid, at least 270 kg of potash and at most 310 kg of chlorine. If the grower wants to minimise the amount of nitrogen added to the garden, how many bags of each brand should be used? What is the minimum amount of nitrogen added in the garden?

QUESTION 15:

Fill in the Blanks:

(i)In a Linear programming problem Variables x and y are called _____variables.

(ii).Let R be the feasible region (convex polygon) for a linear programming problem and let $Z = ax + by$ be the objective function. When Z has an optimal value (maximum or minimum), where the variables x and y are subject to constraints described by linear inequalities, this optimal value must occur at _____of the feasible region.