## Linear Programming

### TEST – 01

**Q01.** Solve the following L.P.P.:

To maximize: $Z = 5x + 7y$

Subject to constraints: $x + y \leq 4$, $3x + 8y \leq 24$, $10x + 7y \leq 35$; $x, y \geq 0$.

**Q02.** An aeroplane can carry a maximum of 200 passengers. A profit of ₹1000 is made on each executive class ticket and a profit of ₹600 is made on each economy class ticket. The airline reserves at least 20 seats for the executive class. However, at least four times as many passengers prefer to travel by economy class than by executive class. Determine how many tickets of each type must be sold in order to maximize profit for the airline? What is the maximum profit?

**Q03.** Anil wants to invest at most ₹12000 in Bonds A and B. According to the rules, he has to invest at least ₹2000 in Bond A and at least ₹4000 in Bond B. If the rate of interest on Bond A is 8% per annum and on Bond B it is 10% per annum, how should he invest his money for the maximum interest? Solve the problem graphically. What is the importance of saving?

**Q04.** There are two factories located one at place P and the other at place Q. From these locations, a commodity is to be delivered to each of the three depots situated at A, B and C. The weekly requirements of the depots are respectively 5, 5 and 4 units of the commodity while the production capacity of the factories at P and Q are respectively 8 and 6 units. The cost of transportation per unit is given below:

| From / To | Cost (in ₹) | | |
|---|---|---|---|
| | A | B | C |
| P | 160 | 100 | 150 |
| Q | 100 | 120 | 100 |

How many units should be transported from each factory to each depot in order that the transportation cost is minimum? What will be the minimum transportation cost?

**Q05.** A dietician wishes to mix two types of foods in such a way that vitamin contents of the mixture contain at least 8 units of vitamin A and 10 units of vitamin C. Food 'I' contains 2 units/kg of vitamin A and 1 unit/kg of vitamin C. Food 'II' contains 1 unit/kg of vitamin A and 2 units/kg of vitamin C. It costs ₹50 per kg to purchase Food 'I' and ₹70 per kg to purchase Food 'II'. Formulate this problem as a linear programming problem to minimise the cost of such a mixture.

**Q06.** There are two types of fertilizers $F_1$ and $F_2$. $F_1$ consists of 10% nitrogen and 6% phosphoric acid and $F_2$ consists of 5% nitrogen and 10% phosphoric acid. After testing the soil conditions, a farmer finds that she needs at least 14 kg of nitrogen and 14 kg of phosphoric acid for her crop. If $F_1$ costs ₹6/kg and $F_2$ costs ₹5/kg, determine how much of each type of fertilizer should be used so that nutrient requirements are met at a minimum cost. What is the minimum cost? 'Excessive use of fertilizers may prove harmful for the land.' Comment.

**Q07.** A manufacturer has three machines I, II and III installed in his factory. Machines I and II are capable of being operated for at most 12 hours whereas machine III must be operated for at least 5 hours a day. She produces only two items M and N each requiring the use of all the three machines. The number of hours required for producing 1 unit of each of M and N on the three machines are given in the following table:

| Items | Number of hours required on machines | | |
|---|---|---|---|
| | I | II | III |
| M | 1 | 2 | 1 |
| N | 2 | 1 | 1.25 |

She makes a profit of ₹600 and ₹400 on items M and N respectively. How many of each item should she produce so as to maximize her profit assuming that she can sell all the items that she produced? What will be the maximum profit?

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**Answers of Linear Programming**
**TEST 01**

Q01. $x = \dfrac{8}{5}$, $y = \dfrac{12}{5}$, $Max.Z = \dfrac{124}{5}$

Q02. Executive class = 40, Economy class = 160, Max.Profit = ₹136000

Q03. Bond A = ₹2000, Bond B = ₹10000, Max.Profit = ₹1160

Q04. From factory P: 0, 5 and 3 units to depots A, B and C respectively. From factory Q: 5, 0 and 1 units to depots A, B and C respectively. Min.Transportation Cost = ₹1550

Q05. 2 kg of Food 'I' and 4 kg of Food 'II', and the minimum cost = ₹380

Q06. 100 kg of fertiliser $F_1$ and 80 kg of fertiliser $F_2$; Minimum cost = ₹1000

Q07. 4 units of each item, maximum profit = ₹4000.

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*theopgupta@gmail.com*