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Mathematical Formulation of L.P.P. Problems

SUBJECT : (Mathematics)
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CHAPTER NAME : L. P. P.

Website: www.odmegroup.org
Email: info@odmps.org
Toll Free: 1800 120 2316
Sishu Vihar, Infocity Road, Patia, Bhubaneswar- 751024

Mathematical Formulation of LPP

Problem formulation is the process of transforming the verbal description of a decision problem into a mathematical form. There is not any set procedure to formulate linear programming problems. The following algorithm will be helpful in the formulation of linear programming problems.

ALGORITHM For Mathematical Formulation of LPP

STEP-I

In every LPP certain decisions are to be made. These decisions are represented by decision variables. These decision variables are those quantities whose values are to be determined. Identify the variables and denote them by $x_1, x_2, \ldots$

STEP-II

Identify the objective function and express it as a linear function of the variables introduced in Step I.

STEP-III

In an LPP, the objective function may be in the form of maximizing profits or minimizing costs. So, after expressing the objective function as a linear function of the decision variables, we must find the type of optimization $i.e.$ maximization or minimization. Identify the type of objective function.

STEP-IV

Identify the set of constraints, stated in terms of decision variables, and express them as linear inequations or equations as the case may be.

Example 1

Two tailors A and B earn ₹ 300 and ₹ 400 per days respectively. A can stitch 6 shirts and 4 pairs of trousers while B can stitch 10 shirts and 4 pairs of trousers per day. To find how many days should each of them work and if it is desired to produce at least 60 shirts and 32 pairs of trousers at a minimum labour cost, formulate this as an LPP.

Example 2

A toy company manufactures two types of dolls; a basic version of doll A and a deluxe version of doll B. Each doll of type B takes twice as long to produce a one of type A and the company would have time to make a maximum of 2000 per day if it produces only the basic version. The supply of plastic is sufficient to produce 1500 dolls per day(both A and B combined). The deluxe version requires a fancy dress of which there are only 600 per day available. If the company makes a profit of ₹ 3 and ₹ 5 per doll respectively on doll A and doll B; how many of each should be produced per day to maximize profit?

Example 3

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

Assignments

1. An airline agrees to charter planes for a group. The group needs at least 160 first-class seats and at least 300 tourist class seats. The airline must use at least two of its model 314 planes which have 20 first-class seats and 30 tourist class seats. The airline will also use some of its model 535 planes which have 20 first-class seats and 60 tourist class seats. Each flight of a model 314 plane costs the company ₹ 100,000 and each flight of a model 535 plane costs ₹ 150, 000. How many of each type of plane should be used to minimize the flight cost? Formulate this as an LPP.

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