Introduction to Linear programming and Mathematical Problem solving

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FREQUENTLY ASKED QUESTIONS

Q-1. What do you mean by linear programming?

A-1. Linear programming can be defined as: "A mathematical method to allocate resources to competing activities in an optimal manner When the problem can be expressed using a linear objective function and linear inequality constraints"

Q-2. What does linear programming and its answer consists of?

A-2. A linear program consists of a set of variables, a linear objective function indicating the contribution of each variable to the desired outcome, and a set of linear constraints describing the limits on the values of the variables.The "answer" to a linear program is a set of values for the problem variables that results in the best — largest or smallest — value of the objective function and yet is consistent with all the constraints.

Q-3. What are the components of a linear Equations?

A-3. All of the equations and inequalities in a linear program must, by definition, be linear. A linear function has the following form :

$$a0 + a1\ x1 + a2\ x2 + a3\ x3 + \ldots + an\ xn = 0$$

In general, the a's are called the coefficients of the equation; they are also sometimes called parameters. The important thing to know about the coefficients is that they are fixed values, based on the nature of the problem being solved. The x's are called the variables of the equation; they are allowed to take on a range of values within the limits defined by the Constraints.

Q-4. What do you mean by feasible Decision Variables?

A-4. The variables in a linear program are a set of quantities that need to be determined in order to solve the problem; i.e., the problem is solved when the best values of the variables have been identified. The variables are sometimes called decision variables because the problem is to decide what value each variable should take.

The variables represent the amount of a resource to use or the level of some activity. For example, a variable might represent the number of acres to cut from a particular part of the forest during a given period. Frequently, defining the variables of the problem is one of the most crucial steps in formulating a problem as a linear program.

Q-5. What is the objective function in an LPP?

A-5. The objective of a linear programming problem will be to maximize or to minimize some numerical value. This value may be the cost of a project; it could also be the amount of product produced, the amount of profit that could be earned, or the amount of a particular product to be produced from a mix of products.The objective function indicates how each variable contributes to the value to be optimized in solving the problem. The coefficients of the objective function indicate the contribution to the value of the objective function of one unit of the corresponding variable.

Q-6. Write a general form Linear Programming Problem.

A-6. All LP problems have the following general form :

maximize or minimize $Z = \sum_{i=1}^{n} C_i X_i$

subject to $Z = \sum_{i=1}^{n} a_{j,i} X_i \leq b_j \quad j = 1,2,\ldots,m$

$X_i \geq 0 \; i = 1, 2, \ldots, n$

And

where X_i = the i^{th} decision variable

c_i = the objective function coefficient corresponding to the i^{th} variable,

$a_{j,i}$ = the coefficient on Xi in constraint j, and

b_j = the right-hand-side coefficient on constraint j.

Q-7. Explain the fundamental assumptions of linear programming.

A-7. A problem can be realistically represented as a linear program if the following assumptions hold:

1. Linearity
2. Divisibility
3. Certainty

4. Data Availability

Let us try to understand each of the assumptions. The constraints and objective function are linear.

a) This requires that the value of the objective function and the response of each resource expressed by the constraints is proportional to the level of each activity expressed in the variables.

b) Linearity also requires that the effects of the value of each variable on the values of the objective function and the constraints are additive.In other words, there can be no intera ctions between the effects of different activities ;
i.e.,thelevelofactivityX1should not affect the costs or benefits associated withthelevelofactivity X2.

Divisibility - the values of decision variables can be fractions. Sometimes these values only make sense if they are integers; then we need an extension of linear programming called integer programming.

Certainty - the model assumes that the responses to the values of the variables are exactly equal to the responses represented by the coefficients.

Data - formulating a linear program to solve a problem assumes that data are available to specify the problem.