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Assignment Topic

Mathematical Linear Programming

Linear programming

Linear programming is a process that is used to determine the best outcome of a linear function. It is the best method to perform linear optimization by making a few simple assumptions. The linear function is known as the objective function. Real-world relationships can be extremely complicated. However, linear programming can be used to depict such relationships, thus, making it easier to analyze them.

What is Linear programming

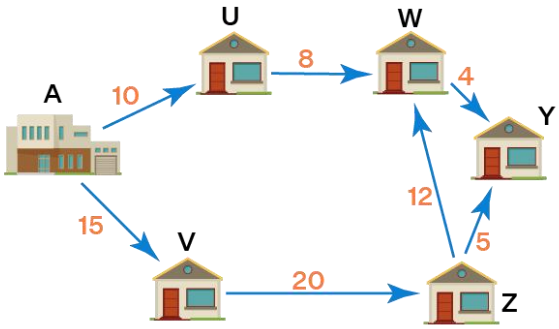
Linear programming, also abbreviated as LP, is a simple method that is used to depict complicated real-world relationships by using a linear function. The elements in the mathematical model so obtained have a linear relationship with each other. Linear programming is used to perform linear optimization so as to achieve the best outcome.

Definition of Linear programming

Linear programming can be defined as a technique that is used for optimizing a linear function in order to reach the best outcome. This linear function or objective function consists of linear equality and inequality constraints. We obtain the best outcome by minimizing or maximizing the objective function.

Example of Linear programming

Suppose a postman has to deliver 6 letters in a day from the post office (located at A) to different houses (U, V, W, Y, Z). The distance between the houses is indicated on the lines as given in the image. If the postman wants to find the shortest route that will enable him to deliver the letters as well as save on fuel then it becomes a linear programming problem. Thus, LP will be used to get the optimal solution which will be the shortest route in this example.



Importance of Linear programming

Linear programming is a mathematical technique that **determines the best way to use available resources**. Managers use the process to help make decisions about the most efficient use of limited resources – like money, time, materials, and machinery.

Mathematical programming

The branch of mathematics concerned with the theory and methods for solving problems on finding the extrema of functions on sets defined by linear and non-linear constraints (equalities and inequalities) in a finite-dimensional vector space.

Mathematical programming refers to mathematical models used to solve problems such as decision problems. The terms are meant to contrast with computer programming which solves such problems by implementing algorithms which may be designed specifically for a given problem. By mathematical programming, we consider declarative approaches. This means that a separation is considered between the representation of the problem through a mathematical model and its solving. The idea is that solving may be done through general methods, such as branching methods, using the mathematical model designed to capture the problem.

Explanation

Mathematical programming is a branch of operations research, which comprises a wide class of control problems the mathematical models of which are finite-dimensional extreme problems. The problems of mathematical programming find applications in various areas of human activity where it is necessary to choose one of the possible ways of action, e.g. in solving numerous problems of control and planning of production processes as well as in problems of design and long-term planning. The term "mathematical programming" is connected with the fact that the goal of solving various problems is choosing programs of action.

The mathematical formulation of the problem of mathematical programming is: To minimize a scalar function $\phi(x)\phi(x)$ of a vector argument on the set

$$\mathbf{X = \{x: q_i(x) \geq 0,\ i=1,\ldots,k;\quad h_j(x) = 0,\ j = 1,\ldots,m\},}$$

where $\mathbf{q_i(x)}$ and $\mathbf{h_j(x)}$ are scalar functions. The function $\boldsymbol{\phi(x)}$ is called the objective function, and also the quality criterion, the set X is called the feasible set, or the set of plans, a solution $x*$ $x*$ of the mathematical programming problem is an optimum point (or vector), a point of global minimum and also an optimal plan.