QMM- Discussion 01

What is a mathematical model?

Defining a real-world problem in mathematical terms can be identified as mathematical modeling. The model is used to understand the system, make predictions about its behavior, and optimize its performance. The complexity of a problem can be determined by the number of variables, assumptions, and iterations involved in its solution. Extremely complex problems often require the use of computer models to simulate the behavior of the system.

What is Linear Programming?

It is a simple method that depicts complex relationships along linear functions and then finds the optimum points. Although real relationships are much more complex, we can simplify them to linear relationships. Linear programming is a way to find the best solution to a problem with a set of restrictions, where the objective is to either maximize or minimize a value. It is a mathematical modeling technique that uses linear functions to represent the relationships between the variables in the problem. Linear programming has been used in a variety of fields, including business, economics, engineering, and science.

Application of linear programming

Linear programming is a versatile tool that can be used to solve a wide variety of problems. It is a valuable tool for analysts and decision-makers who need to find the best way to use their resources.

The applications of linear programming are not limited to the professional world. We also use linear programming in our personal lives, often without realizing it. For instance, when we are driving from home to work, we are using linear programming to find the shortest route. We are also using linear programming when we are making decisions about how to allocate our time and resources.

Linear programming is a powerful tool that can be used to improve our lives in many ways. It can help us to make better decisions, save money, and be more efficient.

For instance, an Amazon driver has 7 packages to deliver in a day. The Amazon warehouse is situated at point A. The seven destinations are P,Q,R,S,T,U,V. The delivery person should decide on the shortest route among the places to save fuel and time. The method of selecting the shortest route is identified as linear programming.
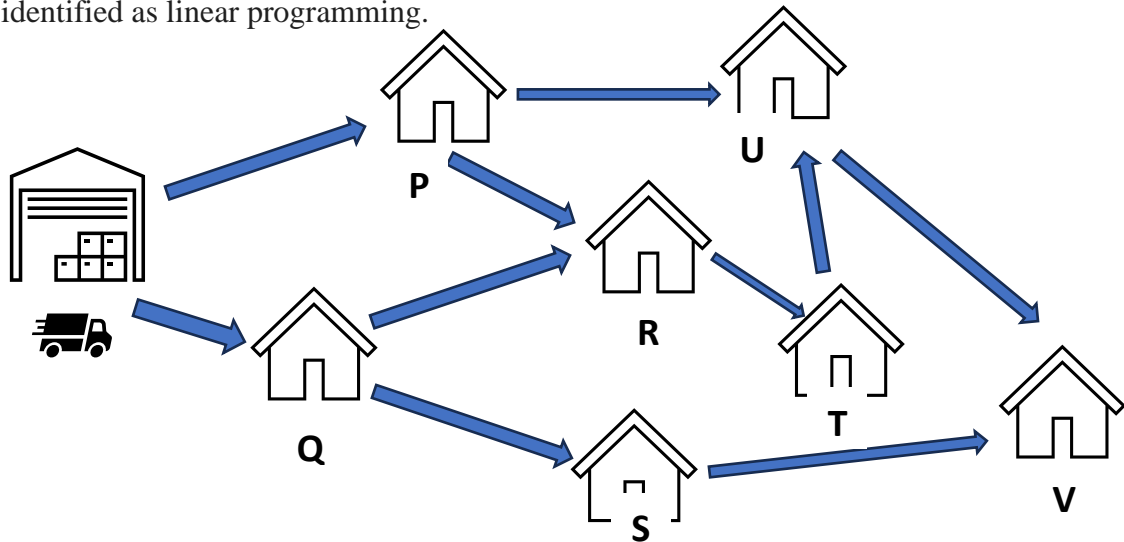

Figure 1: Deciding the shortest route for delivery

Steps of Linear programming

1. Understand the problem
   a. Find a method to get the least, most of some quantity

2. Describe the objective
   a. Identify clearly your goal. It is going to maximize the profit? Is it going to minimize the cost?

3. Identify the constraints

a. Define the limitations of the decision such as what is the minimum income profit expected by the company, Just two third of the company transportation resources can be used in a day.

4. Define the decision variables
   a. Here the problem is defined in mathematical values. So select the variables to identify how much from each variable. R= Number of cutting machines available in the factory

5. Write the objective function
   a. Write down the algebraic expression.

6. Write the constraints in decision variables
7. Add the non-negativity constraints

Reasons for wide application of LP

Mathematical models like linear programming (LP) are used widely because they offer a number of advantages, even though they are not perfect representations of the real world. These advantages include:

- **Optimization of resource allocation**

Linear programming is a mathematical technique that can be used to find the most efficient way to use limited resources. It can be used to solve a wide variety of problems, such as production planning, transportation scheduling, and inventory management. By finding the optimal solution to a problem, linear programming can help us make the most of our resources and achieve our goals.

- **Forecasting power**

Linear programming can be used to model and predict the outcomes of different decisions. This can help us to plan and make informed choices by understanding the potential consequences of our actions.

- **Easy to understand and implement**

The primary concepts of LP are easy and there are a number of software packages to resolve LP problems. Due to this availability and easiness, even people with limited mathematical knowledge can use it to solve their issues.

- **Applicability for a variety of problems**

To solve a broad variety of problems LP models can be used. For optimizing production, transportation, inventory, and many other types of problems LP model can be applied. This makes them versatile tools that can be applied to a wide range of real-world situations.

- **Identify key factors/variables.**

By applying the LP model, it is easy to understand the key variables of the problem. Through this the decision-makers can have a broader understanding of the problem and its dynamics.

- **Simplified decision-making**

Linear programming can be used to simplify complex problems by breaking them down into smaller, more manageable parts. This can make it easier to find the optimal solution to the problem and make difficult decisions.

- **Increased competitiveness**

Linear programming can be used to improve the efficiency of operations, which can make it more competitive in the market. By optimizing the operations, it can reduce costs, improve quality, and increase productivity. This can give a competitive advantage over rivals and help to achieve success.

- **To test different scenario**

LP models can be applied to assess different assumptions of the issue. This can be useful for understanding how the model's outcome might vary under different conditions.

References

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