**An introduction to linear programming**

Preface:

Linear programming is a method of operations research, and it was developed to face specific problems under certain circumstances and conditions, but its uses expanded thanks to the development of aids to include multiple fields. The first use of linear programming was in the military field, as it helped them distribute available resources between different operations. And in the form that led to an increase in the effectiveness of operations, but it developed after that as it became possible to use it in most areas of decision-making, whether of an economic, social or military nature, as it moved in all the activities of institutions such as planning, control and production, marketing and publicity, advertising and choosing investment opportunities, Purchasing policies, storage,...etc.

1- The historical development of linear programming: Linear programming was developed by: "George Dantzig" while the French mathematician "Jean Baptist Fourier" noticed its potential contributions since 1923, and in the year 1939 the Russian mathematician took an interest in "L.V.Katrovich" in the use of mathematics to solve planning problems, and it can be said that a lot of innovative work related to linear programming has been developed and increased due to the planning need of the US Air Force, which realized the important contributions of linear programming during World War II, in addition to that T.C. Koopmons contributed to introducing the contributions of linear programming models, and directing the concerns of economists (Mohamed and Suleiman, 2008, pp. 75-76).

The first use and application of linear programming was by the economist "George Stigler" at the beginning of the forties, and the aim of that application was to determine the components of the daily diet (Diet), which will provide the body with the minimum needs of vitamins, iron and other substances, and at the lowest possible cost ( Muhammad and Suleiman, 2008, p. 76), where he formulated at that time a model of a linear programming problem that had no known solution at the time, and George and his assistant, relying on the principles of economics and personal guessing of the components of daily food, were very close to those that are reached using the programming method Linearism as put by George Dantzig.

2- Definition of Linear Programming: Linear programming is defined as: “one of the quantitative methods that are used to help solve problems and make administrative decisions, and linear programming is called by this name because it uses the equation of a straight line in building a mathematical model that consists of two or more equations or helps to Determining alternatives for possible solutions and selecting the best among them” (Mahmoud and Issa, 2007, p. 34). The objective function, this function includes independent variables (decision variables) that are controlled by a set of limits or constraints, as the latter takes several forms related to the available resources, or to the various elements of production. with the quality of consumers” (Muhammad A., 2005, p. 5).

This means that the objective function, which is subject to constraints and determinants, is formulated in the form of equations or inequalities whose main basis is straight lines. The optimal solution is that alternative solution that achieves the objective function better than the other alternatives.

In linear programming issues, the objective function often includes one of the two goals, either “Profi Maximization” or “Cost Minimizaton”, which ultimately leads to efficient production and competitive pricing of products.

3- Uses of linear programming: The uses of linear programming are evident in practice as follows: (Mahmoud and Issa, 2007, page 35):

Determine stock levels and schedule production appropriately;

Determine investment portfolios of stocks and bonds in a way that maximizes return on investment and reduces the potential for loss;

- Increasing the efficiency and effectiveness of promotion by determining the best advertising method that maximizes returns and reduces costs;

- Reducing the cost of transportation associated with meeting the needs of customers by providing them with the required materials from the company's warehouses closest to their locations;

- Challenge the best human food meal that fulfills the requirements of the diet;

Determining the best meal for farm animals that contains the necessary materials and nutrients, and its cost is as low as possible.

4- Linear programming conditions (requirements): Linear programming requirements or hypotheses consist of a set of characteristics and conditions that must be present in the problem in order to be solved using the linear programming method, and these characteristics can be summarized as follows: (Salahuddin and Yusuf, 2000, pages 15 -19).

- The existence of a specific and clear objective function for the decision or problem that can be expressed in a mathematical way, and it is called after it is expressed in the objective fonctio, and it is mainly used in decisions aimed at maximizing the result or minimizing it. .;

- The presence of constraints binding on the objective function called "Constraints" so that these constraints are subject to alternative solutions, including the optimal solution;

- The objective function and constraints on the variables can be expressed by linear relations that include equality. It is known that the linear relationship is called an equation if its right and left sides are associated with an equal sign (=). As for the inequality, it is linked by a sign (greater than < or greater than or equal to ≤) or a sign (smaller). < or ≥ is less than or equal to);

- The existence of several alternatives to the decision or to solve the problem so that the decision-maker can compare them and then choose the best alternative;

- The values of the variables are known and eg