***Stages of formulating a linear programming problem***

Introduction:

One of the common uses of linear programming is to determine the production mix, and this case occurs when there are two or more producers competing for specific amounts of resources (manpower, machines, raw materials, money, spaces, etc.), if the goal of the organization is to achieve The highest possible profit, you must determine the quantities that you will produce from each product or the so-called production mix in order to achieve that goal.

1- Conditions for formulating linear programming issues (maximization issue - reduction issue): after collecting the necessary information about the linear programming problem, and the decision-maker or linear programming expert imposed on the solution, “simplified issues are used in the classroom that include several variables that do not exceed Most often about four variables in order to facilitate dealing with the model, and solve the issue manually, and in practical life, computer programs are used to solve complex problems that contain large numbers of variables, because it is impossible to deal with these problems manually” (Muhammad and Issa, 2007, pg. 37), and management deals mostly with two types of issues: maximizing profits and minimizing costs, and the following is a statement of the mathematical model in each type of issue above.

1.1 The objective function: The mathematical formula for the objective function differs in profit maximization issues from that in cost minimization issues due to the difference in the objective in each of them. The following is an explanation of the method of formulating the objective function in its mathematical form in all issues.

A- Profit maximization problems: The objective function is denoted by the symbol “Z”. In front of this type of problem, a phrase denoting profit maximization “Maximi Z” is added, so that it appears in the following way:

MaxZ=c\_1∙x\_1+c\_2∙x\_2...c\_i∙x\_ic\_n∙x\_n

where:

 x\_i:(x\_1,x\_2…x\_n ) the number of units produced of the product;

 :c\_i:(c\_1,c\_2…c\_n): It is a numerical coefficient that represents the profit per unit of the product.

Example: An organization deals with two types of computers (Pentium 3 and Pentium 4) and wants to maximize its profits, as it earns 30 DZD on the first device, and 50 DZD on the second device. In this case, write the objective function:

MaxZ=30x\_1+50x\_2

It appears from the model that the institution sold "x1" of a Pentium 3 device to obtain a profit of 30 x\_1 DA, and sold "x2" a Pentium 4 device to obtain a profit of 50x\_1,

We note that the amount of total profit that the organization achieves from selling two devices changes whenever the value of “x1” and the value of “x2” change. The organization aims to achieve the largest possible amount of profits while adhering to the restrictions or conditions imposed on it. If the organization sold 100 devices of the first type and sold 200 device of the second kind, the profit it produces is:

Z = 30 x\_1 + 50 x\_2 = 30 x 100 + 50 x 200 = 13000 DZD

And if the establishment sold 200 devices of the first type, and sold 100 devices of the second type, then the amount of profit that it produces:

Z = 30 x\_1 + 50 x\_2 = 30 x 200 + 50 x 100 = 8000 DZD

It is clear from the foregoing that the institution can abide by the restrictions imposed on the sales process, and achieve the largest possible amount of profits.

B- Cost minimization issues: The objective function is denoted by the symbol "C". A phrase denoting "Minimize cost" is added in front of this type of problem, so that it appears in the following way:

Minc=c\_1∙x\_1+c\_2∙x\_2...c\_i∙x\_ic\_n∙x\_n

Example: An establishment owns two warehouses of ready-made goods in two different regions in order to meet customer requests in each region from the warehouse closest to the customer. If the cost of moving one unit from the first warehouse is 5 DZD on average.

Minc=5x\_1+7x\_2

It appears from the model that the establishment transferred "x1" a unit from the first warehouse at a cost of 5 x \_ 1 DA, and transferred "x2" a unit from the second warehouse at a cost of 7 x \_ 2 DA. The institution aims to reduce this cost to the least possible extent, while adhering to the restrictions and conditions imposed on it. If the institution transferred 10 units from the first warehouse, and transferred 200 units from the second warehouse, then the total transportation cost is:

Minc=5x\_1+7x\_2=5×100+7×100=1900 DZD

If the establishment transported 100 units from the first warehouse, and transferred 200 units from the second warehouse, the total transportation cost is:

Minc=5x\_1+7x\_2=5×200+7×100=1700 DZD

It is clear from the foregoing that the institution can meet the needs of customers from the two warehouses in a way that the total transportation cost is as low as possible.

2.2 Constraints: As we mentioned earlier, the constraints are represented in specific resources that compete for their exploitation and use in different fields. They are expressed in the problem of linear programming through the available resources, in the sense that we maximize or minimize the variables involved in the objective function in light of the constraints represented in limited resources.

A- With regard to the issue of maximizing profits: the task of the decision-maker is limited to planning to accomplish the task of obtaining the largest possible amount of profits, according to which the restrictions in these issues form limits that prevent the increase of profits indefinitely, because the limited resources do not qualify any party whatsoever to achieve an infinite amount From the profits, there must be a profit ceiling that does not exceed it to suit the limited resources of the institution, and the restrictions imposed on this type of issue ensure that the profits remain below this ceiling, and the restrictions are as follows:

a\_11 x\_1+a\_12 x\_2...a\_n x\_n≤b\_1

a\_21 x\_1+a\_22 x\_2...a\_n x\_n≤b\_2

⋮ ⋮

⋮ ⋮

⋮ ⋮

a\_(m\_1 ) x\_1+a\_(m\_2 ) x\_2...a\_m x\_n≤b\_m

Examples:

\* An establishment has only 250 units of the raw material, and it cannot increase or exceed this available quantity. This material is included in the composition of two products (x1, x2), where “x1” consumes two units of this material, and “x2” consumes 3 units of it.

The constraint is: 2x\_1+3x\_2≤250

\* An establishment has 1200 units of raw material and cannot increase or exceed this available quantity. This material is included in the composition of three products (x1, x2, x3), where “x1” needs 5 units, and “x2” needs 2 units, and "x2" needs 1 unit.

The constraint is as follows: 5x\_1+2x\_2+x\_3≤1200

\* Foundation has 72 units of raw material that can't zi