***Simplex method for solving linear programming problems in a low condition MIN***

Introduction:

In the previous case, we used the "simplex" method to solve linear programming models whose constraints are all in the form of less than or equal to "≤". The beginning of the initial solution that is commensurate with the pre-activity stage. We noticed that these variables are the same as the elements of the initial solution, on the basis that the decision variables ''x\_i'' are equal to zero, but the question that arises is what to do if the direction of the constraints is greater, equal, or equal to , and the mathematical model of a linear programming problem was mixed? To solve this type of problem, dummy variables and synthetic variables are used.

1- Dummy (additional) variables and artificial variables in the objective function: When adding dummy or additional variables, these variables must also appear in the objective function, just as it happened when we added the difference variables in the case of the “≤” constraint, and why it is necessary to output the variables The artifacts of the solution, this means that we can assume a high cost for these variables, and it is worth mentioning here and in the case of problems that aim to reduce costs, the variables with the lowest cost are the most preferred to be included in the solution, and the variables that are associated with a high cost must be removed from the solution quickly, or not Enter it into the solution at all, and instead of putting a numeric value for the artificial variables (1000, 2000, 5000, 10000...etc) we use the number ''M'' to represent a very large number.

The necessary steps to initialize the constraints in the appropriate manner to place them in the matrix can be summarized as follows (Muhammad and Suleiman, 2008, pp. 131-132):

- If the formula set for one or more constraints includes the presence of a negative number or value on the left side, we multiply the constraint by: (-1) and change the direction of the relationship for the aforementioned constraint, and this will solve the problem of negativity;

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2- Steps to solve linear programming problems using the simplex method in case of maximizing “Max”:

MaxZ=∑\_(j=1)^n▒〖C\_i X\_i 〗

∑\_(j=1)^n▒a\_ij x\_j≤b\_i

x\_j≥0,b\_i≥0

i=1,……………….,m

For any linear model whose technical constraints are all less than or equal to (≤) the following steps must be followed: (Ali, 2015, pp. 51-56)

The first step: converting the constraints of the linear model from the form of inequalities (inequalities) to the form of equations (equality). ".

If the left side of the technical constraint is less than or equal to (≤) the right side, which is ∑\_(j=1)^n▒a\_ij x\_j≤b\_i, then in order for the two sides to become equal, we need to add to the left side the difference variable “S\_i”, i.e. ∑\_(j=1)^n▒a\_ij x\_j=b\_i So the linear model is of the form:

MaxZ=∑\_(j=1)^n▒〖C\_i X\_i 〗

∑\_(j=1)^n▒a\_ij x\_j≤b\_i

x\_j≥0,b\_i≥

i=1,……………….,m

becomes MaxZ=∑\_(j=1)^n▒〖C\_i X\_i 〗

∑\_(j=1)^n▒a\_ij x\_j=b\_i

x\_j≥0,b\_i≥0,S\_i≥0 ;

i=1,……………….,m

In order for all variables to be represented in all equations of the linear mathematical model, we add the difference with a coefficient of zero to the objective function. These variables do not add anything to the objective function, and therefore their coefficients are equal to zero, because these variables are not originally represented in the objective function.

And the objective function becomes:

MaxZ=∑\_(j=1)^n▒〖C\_i X\_i 〗+0S\_1+0S\_2+...…0S\_n

Dealing with equations is much better than dealing with relations of inequalities. The previous set of equations is called: "the standard formula for the linear programming problem" which consists of "m" of constraints and "n" of decision variables (Sayed and Latif, 2008, p. 315) .

The second step: it represents all the information of the linear model in the following table:

Solution b\_i Difference variables Fundamental variables (decision variables) Objective function

s\_1,s\_2,…s\_m x\_1,x\_2,…x\_n Objective function variables

0,0,…0 c\_1,c\_2,…c\_m Parameters of the variables of the objective function

solution base variables

b\_1 1,0,0,…0 a\_11,c\_12,…c\_1n Parameters of the technical constraints variables S\_1

b\_2 1,0,0,…0 a\_21, c\_22,…c\_2n S\_2

…………………………………………………………………

b\_m 0,0,0,…1 a\_m1,c\_m2,…c\_mn S\_n

The table can be simplified in symbols as follows:

b\_i/a\_ij b\_i ………………c\_n c\_2j c\_1 c\_j

……………………x\_n x\_2 x\_1 v\_b c\_j

∙ b\_1 ⋯…………a\_1n a\_12 a\_11 s\_1 ∙

∙ b\_2 ⋯…………a\_2n a\_22 a\_21 s\_2 ∙

∙ ⋯…

∙ b\_n ä………………a\_mn a\_m2 a\_m1 s\_n ∙

z\_n z\_2 z\_1 z\_i

〖...…………c〗\_n-z\_n c\_2-z\_2 c\_1-z\_1 c\_j-z\_i

where:

 c\_j : coefficients of variables in the objective function;

a\_ij: coefficients of variables in constraints

b\_i : constraints (resources) right end

v\_b: difference variables (written in the simplex table according to their order in the constraints)

The third step: It is represented in the stage of the initial solution or the search for the rule from which we proceed in the search for the optimal solution. For economic activity, it means that stage in which the economic enterprise has prepared all the means of production required to carry out its activity, but it has not yet started to practice this activity. If the institution has not yet started its activity, this means that the indicators of this activity (decision indicators) are at zero level x\_1=0,x\_2=0,…x\_n=0; That is, we make the activity counter at the zero level, so if the decision indicators in the objective function are equal to zero and the difference variables have zero coefficients, then the objective function in this case is equal to zero and it is proportional to the stage before the start of the activity.

With regard to technical constraints, if the decision variables are equal to zero, then when multiplied by their coefficients, the result will be all zero and the difference variables, which are (s\_1, s\_2,…s\_n), will remain equal to the amount of available resources, which are (b\_1, b\_2,…b\_n). If the model The linear is expressed as follows:

0s\_1+0s\_2+…+0s\_