***Special cases and problems in the graph method***

Preface:

The application of the graphical method to linear programming models encounters four special cases, which are the absence of acceptable solutions (the inability to solve); That is, one of the constraints does not affect the solution, and there is more than one solution where the value of the objective function and the variables are more than one case. Also, there may be no solution for the model because there is no area for the solution, and the last case is that the solution area is not confined; That is, it is indefinite and open on one side.

There are four situations that appear when using a graph and solving linear programming problems are:

1- The case of the absence of acceptable solutions (unsolvable): This case means that there is no solution to the linear programming problem in a way that meets the needs of all the constraints. For the drawing method, this means that there is no possible solution, and this situation occurs if the problem includes conflicting constraints (Muhammad and Suleiman 2008, p. 101):

Let the following form:

MaxZ=x\_1+4x\_2

5x\_1+5x\_2≤20

x\_2≥6

x\_1,x\_2≥0

Finding the optimal solution by graphing:

Converting inequality into equations: by changing the sign of the constraint to the form (=):

For the first constraint: 5x\_1+5x\_2≤20, we delete the constraint sign (≥) and replace it with an (=) sign, so the constraint becomes:

5x\_1+5x\_2=20

For the second constraint: x\_2≥6, we delete the constraint sign (≤) and replace it with an (=) sign, so the constraint becomes:

x\_2=6

- Finding two coordinates for each entry: As we mentioned earlier, the coordinate consists of a value for: "x1" and a value for: "x2". "x2" and substituting in we get the value of "x1".

First constraint: + 5 x 2 = 20 5 x 1

x1 = 0 ⇒ 5x2 = 20 ⇒ x2 = 4 ⇒ (0 , 4)

x2 = 0 ⇒ 5x1 = 20 ⇒ x1 = 4 ⇒ (4, 0)

The second constraint: x2 = 6, a straight line parallel to the commas axis.

Drawing the constraints in the feature and defining the area of possible solutions: By defining specific coordinates in the previous stage in the feature and linking them, we get the graph of the constraints in the figure. We note that the first constraint is of the form (≤), and from it we accept the lower region as a region of possible solutions, and we reject the upper region in relation to the constraint. As for the second constraint, it is of the form (≥) as well as of the form greater or equal to (≤), and thus we accept the upper region as a region of possible solutions and it is rejected The lower region, from which the misleading region remains, as shown in the following figure:

We note from the above figure that there is no common possible solution area between the two constraints, and this means that there is no solution, and this problem appears clearly in the event that all available resources are not sufficient to meet the needs of the minimum value of one or more of the decision variables. In the above example, the minimum value of: " x2" is 6, and the minimum value of: "x1" is zero. Substituting these two values into the first constraint causes the constraint not to be fulfilled because the available resource amount of 20 is insufficient.

2- The case of lack of limits: This means that there are no limits on the solution, and this means that one or more of the variables of the problem can be added and then without violating any of the restrictions of the problem, noting that this case is a case far from reality, because we as individuals and institutions They are limited by the resources available to us at a particular moment in time. Nevertheless, the review of this case is complementary to the review of other cases that accompany the drawing method in solving linear programming problems. For the drawing method, this means that the solution area is open without end (Muhammad and Suleiman, 2008, p. 102 ):

Let's assume the following linear programming model:

MaxZ=3x\_1+6x\_2

6x\_1+2x\_2≥12

x\_2≤4

x\_1,x\_2≥0

Finding the optimal solution by graphing:

Converting inequality into equations: by changing the sign of the constraint to the form (=):

For the first constraint: 6x\_1+2x\_2≥12, we delete the constraint sign (≥) and replace it with an (=) sign, so the constraint becomes:

6x\_1+2x\_2=12

For the second constraint: x\_2≤4, we delete the constraint sign (≤) and replace it with an (=) sign, so the constraint becomes:

x\_2=4

- Finding two coordinates for each entry: As we mentioned earlier, the coordinate consists of a value for: "x1" and a value for: "x2". "x2" and substituting in we get the value of "x1".

First constraint: + 2 x 2 = 12 6 x 1

x1 = 0 ⇒ x2 = 6 ⇒ x2 = 4 ⇒ (0 , 6)

x2 = 0 ⇒ 6x1 = 12 ⇒ x1 = 2 ⇒ (2, 0)

The second constraint: x2 = 4, a straight line parallel to the commas axis.

Drawing the constraints in the feature and defining the area of possible solutions: By defining specific coordinates in the previous stage in the feature and linking them, we get the graph of the constraints in the figure. We note that the first constraint is of the form (≥), and from it we accept the upper region as a region of possible solutions, and we reject the lower region in relation to the constraint. As for the second constraint, it is of the form (≤) as well as of the form greater or equal to (≤), and thus we accept the lower region as a region of possible solutions and it is rejected The upper region, from which the misleading region remains, as shown in the following figure:

From the figure, we notice that the possible solution area is an open area, that is, the further we move away from the origin point, we will get an extreme solution, and this is what is called an indefinite solution.

3- The case of an excess: It is a common problem in many linear programming problems, and it is represented by the presence of an excess, where the excess constraint represents that constraint that does not affect the possible solution area, in other words, there are more important constraints than others, so the most important use means the use of less importance ( Muhammad and Suleiman, 2008, p. 103).

Let's assume the following linear programming model:

MaxZ=5x\_1+3x\_2

x\_1+x\_2≤30

〖2x〗\_1+x\_2≤40

x\_1≤45

x\_1,x\_2≥0

Finding the optimal solution by graphing:

Converting inequality into equations: by changing the sign of the constraint to the form (=):

For the first constraint: x\_1+x\_2≤30 we delete the constraint sign (≥) and replace it with a sign