Simplex method

This method was first established by the British mathematician Dantizg in 1947. The basis of this method can be summarized in the following :

This method starts by finding a (possible) basic preliminary solution and then proceeding to find a (possible basic) optimal solution not obtained from the previous solution. This is done by replacing one of the non-basic variable for the basic variable in the first table ; this is called the Entering variable. This variable i.e. the Entering variable, is chosen on the basis of its contribution in improving the factor objective. The other variable that replaced one of the basic variables will be discarded, and hence called the Leaving that assures the possibility of obtaining a new solution. Obtaining this solution will enable us to iterate the previous process to determine a possible basic solution more optimal than that obtained in the previous stage. This process will come to its end when we reach one of the following cases :

1. Obtaining a final solution which will be an optimal solution.
2. Determining an infinite number of solutions.
3. The problem has no possible solution.

To illustrate this we prefer to solve the following example :

$$Max\ Z_1 = x$$
$$Max\ Z_2 = x + y$$
$$Subject\ to:$$
$$5x + 2y \le 22$$
$$y \le 6$$
$$x\ ,\ \ y \ge 0$$

الحل:

في البداية باستخدام طريقة السمبلكس نجد الحل الأمثل لكل دالة هدف على حدة

الحل للدالة الأولى:

$$Min U_1 = -x$$
$$s.t \quad 5x + 2y + \delta_1 = 22$$
$$y + \delta_2 = 6$$
$$x, y, \delta_1, \delta_2 \ge 0$$

الجدول(3-1)

	Basic	b_i	x ⇓	y	δ_1	δ_2
⇐	δ_1	22	5	2	1	0
	δ_2	6	0	1	0	1
	$-U$	0	-1	0	0	0

الجدول(3-2)

Basic	b_i	x_1	y	δ_1	δ_2
x_1	$4\cdot4$	1	$0\cdot4$	$0\cdot2$	0
δ_2	6	0	1	0	1
$-U$	$4\cdot4$	0	$0\cdot4$	$0\cdot2$	0

إذا الحل الأمثل هو $x = 4\cdot4 \quad , \quad y = 0 \quad , \quad Z_1 = 4\cdot4$

الحل للدالة الثانية:

$$MinU_2 = -x - y$$
$$s.t \qquad 5x + 2y + \delta_1 = 22$$
$$y + \delta_2 = 6$$
$$x, y, \delta_1, \delta_2 \geq 0$$

الجدول(3-3)

	Basic	b_i	x ⇓	y	δ_1	δ_2
⇐	δ_1	22	5	2	1	0
	δ_2	6	0	1	0	1
	$-U$	0	-1	-1	0	0

الجدول(3-4)

	Basic	b_i	x	y ⇓	δ_1	δ_2
	x	$4\cdot4$	1	$0\cdot4$	$0\cdot2$	0
⇐	δ_2	6	0	1	0	0
	$-U$	$4\cdot4$	0	$-0\cdot6$	$0\cdot2$	0

الجدول(3-5)

Basic	b_i	x	y	δ_1	δ_2
x	2	1	0	$0\cdot 2$	0
y	6	0	1	0	0
$-U$	8	0	0	$0\cdot 2$	0

إذا الحل الأمثل هو $x = 2 \quad , \quad y = 6 \quad , \quad Z_2 = 8$