The Simplex Method

Q1] Niki holds two part time, Job I & Job II, she never wants to work more than a total of 12 hr a week. She has determined that for every hour she works at Job I, she needs 2 hr of preparations time, and for every hour she work at Job II, she need 1 hr of preparation time, and she cannot spend more than 16 hr for preparation. If she makes $40 an hour at Job I, and $30 an hour at Job II, how many hour should she work per week at each Job to maximize her income?

Solution:-

Let

x_1 = The number of haues per week Niki will work at Job I

x_2 = The number of hourr per week Niki will work at Job II

Maximize

$$z = 40x_1 + 30x_2$$

Subject to

$$x_1 + x_2 \leq 12$$
$$2x_1 + x_2 \leq 16$$
$$x_1 \geq 0 \; ; \; x_2 \geq 0$$

Let us take x_3 and x_4 as slack variable

$$\text{Max } z = 40x_1 + 30x_2 + 0x_3 + 0x_4$$

$$x_1 + x_2 + x_3 + 0x_4 \leq 12$$

$$2x_1 + x_2 + 0x_3 + x_4 \leq 16$$

$$\begin{bmatrix} 1 & 1 & 1 & 0 \\ 2 & 1 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 12 \\ 16 \end{bmatrix}$$

Basic variable	CB	XB	C_j 40 x_1	30 x_2	0 x_3	0 x_4	MinRatio
x_3	0	12	1	1	1	0	12
x_4	0	16	2	1	0	1	8 ←
		Δ_j	−40	−30	0	0	

$R_2 \to R_2 \div 2$

$R_1 \to R_1 - R_2$

Basic Variable	CB	XB	C_j 40 x_1	30 x_2	0 x_3	MinRatio
x_3	0	4	0	1/2	1	8 ←
x_1	40	8	1	1/2	0	16
		Δ_j	0	−10	0	

$R_1 \to 2R_1$

$R_2 \to R_2 - \frac{1}{2} R_1$

Basic Variable	CB	XB	c_j 40 x_1	30 x_2	Min Ratio
x_2	30	8	0	1	
x_1	40	4	1	0	
		Δ_j	0	0	

$x_2 = 8$

$x_1 = 4$

$Z = 40x_1 + 30x_2$

$= 40(4) + 30(8)$

$= 400$

The Final Solution say that if Niki wor 4 hours at Job1 and 8 hours at Job11 she will maximize her income to $400