Roll No - 17103011 ①

Economics Assignment

1. Max. $Z = 6x_1 + 8x_2$

subject to $30x_1 + 20x_2 \leq 300$

$5x_1 + 10x_2 \leq 110$

$x_1, x_2 \geq 0$

Converting inequality to equality

$Z_{max} = 6x_1 + 8x_2 + 0S_1 + 0S_2$

$30x_1 + 20x_2 + S_1 = 300$

$5x_2 + 10x_2 + S_2 = 110$

C_i	Basic Var.	Quantity	6 X_1	8 X_2	0 S_1	0 S_2
0	S_1	300	30	20	1	0
0	S_2	110	5	10	0	1
	Z_i	0	0	0	0	0
	$C_j - Z_j$		6	8	0	0

pivot column → X_2

pivot ~~column~~ row = $\frac{300}{20} = 15$, $\frac{110}{10} = 11$

hence S_2 is replaced with x_2.

C_i	Basic Var.	Quantity	6 X_1	8 X_2	0 S_1	0 S_2
0	S_1	80	20	0	1	-2
8	X_2	11	1/2	1	0	1/10
	Z_j	88	4	8	0	4/5
	$C_i - Z_j$		2	0	0	-4/5

Now S1 is replaced with X_2.

pivot = 20

C_i	Basic Var.	Quantity	6 x_1	8 x_2	0 s_1	0 s_2
6	x_1	4	1	0	1/20	-1/10
8	x_2	9	0	1	-1/40	3/20
	Z_j	96	6	8	1/10	3/5
	$C_j - Z_j$		0	0	-1/10	-3/5

All $C_j - Z_j$ are either zero or negative. hence optimal solution is =

$$X_1 = 4, \quad X_2 = 9, \quad Z_j = 96$$

2.

$$Z_{min} = 5X_1 + 6X_2$$

$$2X_1 + 5X_2 \geq 1500 \quad \& \quad 3X_1 + X_2 \geq 1200$$

$$2X_1 + 5X_1 + A_1 - S_1 = 1500$$
$$3X_1 + X_2 + A_2 - S_2 = 1200$$

$$Z_{min} = 5X_1 + 6X_2 + MA_1 + MA_2 - 0S_1 - 0S_2$$

C_i	Var.	C_j Qty.	5 X_1	6 X_2	M A_1	M A_2	0 S_1	0 S_2
M	A_1	1500	2	5	1	0	-1	0
M	A_2	1200	3	1	0	1	0	-1
	Z_j	2700M	5M	6M	M	M	-M	-M
	$-(C_i - Z_j)$		5M-5	6M-6	0	0	-M	-M

Now A_1 is replaced with x_2 so A_1 is artificial variable which is replaced so it does not appear.

C_B	Var	C_j Qty.	5 X_1	6 X_2	M A_2	0 S_1	0 S_2
6	X_2	300	$2/5$	1	0	$-1/5$	0
M	A_2	900	$13/5$	0	1	$1/5$	-1
	Z_j	$900M+1800$	$\frac{3}{5}M+\frac{12}{5}$	6	M	$-6/5+M/5$	$-M$
	Z_j-C_i		$\frac{13}{5}M-\frac{13}{5}$	0	0	$-6/5+M/5$	$-M$

Now A_2 is replaced with X_1, A_2 gets eliminated.

C_j	Var.	C_j Qty.	5 X_1	6 X_2	0 S_1	0 S_2
6	X_2	$2100/13$	0	1	$-1/13$	$2/13$
5	X_1	$4500/13$	1	0	$1/13$	$-5/13$
	Z_j	$35100/13$	5	6	$-1/13$	-1
	Z_j-C_i		0	0	$-1/13$	-1

all $(Z_j - C_i)$ values are either zero or -ve hence optimal solution is reached -

$X_1 = \frac{4500}{13}$, $X_2 = \frac{2100}{13}$, $Z_j = 2700$