

Q.1 Min(Z) = $80x_1 + 60x_2$

$18x_1 + 12x_2 \geq 180$

$6x_1 + 9x_2 \leq 162$

$5x_1 + 10x_2 = 110$

Group - A -

Two Phases

$x_1, x_2 \geq 0$

Min(Z) = $R_1 + R_2$

$18x_1 + 12x_2 - S_1 + R_1 = 180$

$6x_1 + 9x_2 + S_2 = 162$

$5x_1 + 10x_2 + R_2 = 110$

$R_1 = 180 - 18x_1 - 12x_2 + S_1$

$R_2 = 110 - 5x_1 - 10x_2$

Min(Z) = $180 - 18x_1 - 12x_2 + S_1 + 110 - 5x_1 - 10x_2$

Min = $-23x_1 - 22x_2 + S_1 + 290$

~~Min(Z) = 0~~

Min(Z) + $23x_1 + 22x_2 - S_1 = 290$

x_j	x_1	x_2	S_1	S_2	R_1	R_2	R.H.S	Ratio
Z-j	23	22	-1	0	0	0	290	
R_1	18	12	-1	0	1	0	180	$10 \div 18$
S_2	6	9	0	1	0	0	162	27
R_2	5	10	0	0	0	1	110	22

	x_1	x_2	S_1	S_2	R_1	R_2	R.H.s	
	0	$20/3$	$5/18$	0	$-23/18$	0	60	
x_1	1	$2/3$	$-1/18$	0	$1/18$	0	10	15
S_2	0	5	$1/3$	1	$-1/3$	0	102	20.4
R_2	0	$20/3$	$5/18$	0	$-5/18$	1	60	9 $\div 2/3$

$$\begin{array}{r} * -23 \quad (1 \quad 2/3 \quad -1/18 \quad 0 \quad 1/18 \quad 0 \quad 10) \\ \quad \quad \quad 23 \quad 22 \quad -1 \quad 0 \quad 0 \quad 0 \quad 290 \\ \hline \boxed{0} \quad 20/3 \quad 5/18 \quad 0 \quad -23/18 \quad 0 \quad 60 \end{array} \quad (Z)$$

$$\begin{array}{r} * -6 \quad (1 \quad 2/3 \quad -1/18 \quad 0 \quad 1/18 \quad 0 \quad 10) \\ \quad \quad \quad 6 \quad 9 \quad 0 \quad 1 \quad 0 \quad 0 \quad 162 \\ \hline \boxed{0} \quad 5 \quad 1/3 \quad 1 \quad -1/3 \quad 0 \quad 102 \end{array} \quad (S_2)$$

$$\begin{array}{r} * -5 \quad (1 \quad 2/3 \quad -1/18 \quad 0 \quad 1/18 \quad 0 \quad 10) \\ \quad \quad \quad 5 \quad 10 \quad 0 \quad 0 \quad 0 \quad 1 \quad 110 \\ \hline \boxed{0} \quad 20/3 \quad +5/18 \quad 0 \quad -5/18 \quad 1 \quad 60 \end{array} \quad (R_2)$$

	x_1	x_2	S_1	S_2	R_1	R_2	R.H.s	Ratio
	0	0	0	0	-1	-1	0	
x_1	1	0	$-1/12$	0	$1/12$	$-1/10$	4	
S_2	0	0	$1/18$	1	$-1/18$	$-15/20$	57	
x_2	0	1	$1/24$	0	$-1/24$	$3/20$	9	

$$\begin{array}{r} * -20/3 \quad (0 \quad 1 \quad 1/24 \quad 0 \quad -1/24 \quad 3/20 \quad 9) \\ \quad \quad \quad 0 \quad 20/3 \quad 5/18 \quad 0 \quad -23/18 \quad 0 \quad 60 \\ \hline 0 \quad \boxed{0} \quad 0 \quad 0 \quad -1 \quad -1 \quad 0 \end{array} \quad (Z)$$

$$\begin{array}{r} * -2/3 \quad (0 \quad 1 \quad 1/24 \quad 0 \quad -1/24 \quad 3/20 \quad 9) \\ \quad \quad \quad 1 \quad 2/3 \quad -1/18 \quad 0 \quad 1/18 \quad 0 \quad 10 \\ \hline 1 \quad \boxed{0} \quad -1/12 \quad 0 \quad 1/12 \quad -1/10 \quad 4 \end{array} \quad (x_1)$$

$$\begin{array}{r} * -5 \quad (0 \quad 1 \quad 1/24 \quad 0 \quad -1/24 \quad 3/20 \quad 9) \\ \quad \quad \quad 0 \quad 5 \quad 1/3 \quad 1 \quad -1/3 \quad 0 \quad 102 \\ \hline 0 \quad \boxed{0} \quad 1/8 \quad 1 \quad -1/8 \quad -15/20 \quad 57 \end{array} \quad (R_2)$$

Q21 Max(z) = 20x₁ + 15x₂ + 18x₃

Group - A

Dual Simplex

$$\begin{aligned} 5x_1 + 10x_2 + 4x_3 &\leq 80 & y_1 \\ 15x_1 + 12x_2 + 5x_3 &\leq 125 & y_2 \\ 7x_1 + 21x_2 + 3x_3 &\leq 84 & y_3 \end{aligned}$$

$$\text{Min}(z) = 80y_1 + 125y_2 + 84y_3$$

$$\begin{aligned} 5y_1 + 15y_2 + 7y_3 &\geq 20 & *(-1) \\ 10y_1 + 12y_2 + 21y_3 &\geq 15 & *(-1) \\ 4y_1 + 5y_2 + 3y_3 &\geq 18 & *(-1) \end{aligned}$$

$$\text{Min}(z) = 80y_1 + 125y_2 + 84y_3$$

$$\begin{aligned} -5y_1 - 15y_2 - 7y_3 &\leq -20 \\ -10y_1 - 12y_2 - 21y_3 &\leq -15 \\ -4y_1 - 5y_2 - 3y_3 &\leq -18 \end{aligned}$$

$$\text{Min}(z) = 80y_1 + 125y_2 + 84y_3$$

$$\begin{aligned} -5y_1 - 15y_2 - 7y_3 + s_1 &= -20 \\ -10y_1 - 12y_2 - 21y_3 + s_2 &= -15 \\ -4y_1 - 5y_2 - 3y_3 + s_3 &= -18 \end{aligned}$$

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	y_1	y_2	y_3	S_1	S_2	S_3	R.H.s	Ratio
Z-cj	-80	-125	-84	0	0	0	0	
S_1	-5	-15	-7	1	0	0	-20	125/15 $\div (-15)$
S_2	-10	-12	-21	0	1	0	-15	
S_3	-4	-5	-3	0	0	1	-18	

$\frac{-80}{-5} = 16$ $\frac{-125}{-15} = 8.3$ $\frac{-84}{-7} = 12$

	y_1	y_2	y_3	S_1	S_2	S_3	R.H.s	
	$\frac{-115}{3}$	0	$\frac{-77}{3}$	$\frac{-25}{3}$	0	0	$\frac{500}{3}$	
y_2	$\frac{1}{3}$	1	$\frac{7}{15}$	$\frac{1}{15}$	0	0	$\frac{20}{15}$	
S_2	4	0	$\frac{-77}{5}$	$\frac{-4}{5}$	1	0	1	
S_3	$\frac{-7}{3}$	0	$\frac{-2}{3}$	$\frac{-1}{3}$	0	1	$\frac{-34}{3}$	$\frac{1}{-7/3}$

~~$\times 125$ ($\frac{1}{3}$ | 1 | $\frac{7}{15}$ | $\frac{1}{15}$ | 0 | 0 | $\frac{20}{15}$) (Z)
 $\frac{-80}{-5}$ | $\frac{-125}{-15}$ | $\frac{-84}{-7}$ | 0 | 0 | 0 | 0
 $\frac{-115}{3}$ | $\frac{-77}{3}$ | $\frac{-25}{3}$ | 0 | 0 | $\frac{500}{3}$
 $\times 12$ ($\frac{1}{3}$ | 1 | $\frac{7}{15}$ | $\frac{1}{15}$ | 0 | 0 | $\frac{20}{15}$) (S_2)
 $\frac{-10}{-5}$ | $\frac{-12}{-5}$ | $\frac{-21}{-5}$ | 0 | 1 | 0 | $\frac{-15}{-5}$
 $\frac{4}{-5}$ | $\frac{-77}{5}$ | $\frac{-4}{5}$ | 1 | 0 | 1
 $\times 5$ ($\frac{1}{3}$ | 1 | $\frac{7}{15}$ | $\frac{1}{15}$ | 0 | 0 | $\frac{20}{15}$) (S_3)
 $\frac{-4}{-5}$ | $\frac{-5}{-5}$ | $\frac{-3}{-5}$ | 0 | 0 | 1 | $\frac{-18}{-5}$
 $\frac{-7}{3}$ | $\frac{-2}{3}$ | $\frac{-1}{3}$ | 0 | 1 | $\frac{-34}{3}$~~