

# Quiz 2A Q2

$$Q1) \begin{pmatrix} 1 & -\frac{1}{2} & 0 \\ 0 & \frac{1}{2} & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 30 \\ 60 \\ 20 \end{pmatrix} = \begin{pmatrix} 0 \\ 30 \\ 20 \end{pmatrix}$$

$$\min z = 30y_1 + 60y_2 + 20y_3$$

$$y_1 + 3y_2 + y_3 \geq 3$$

$$y_1 + 4y_3 \geq 2$$

$$y_1 + 2y_2 \geq 5$$

$$y_1 \geq 0$$

$$y_2 \geq 0$$

$$y_3 \geq 0$$

$$\begin{bmatrix} y_1 & y_2 & y_3 \end{bmatrix} = \begin{bmatrix} 0 & 5 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 0 & \frac{5}{2} & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 1 - \frac{1}{2} + \frac{5}{2} - \frac{3}{2} = 0 \end{bmatrix}$$

$$y_1 = 1, y_2 = \frac{3}{2}, y_3 = 0 \mid y_1 = 0, y_2 = \frac{5}{2}, y_3 = 0$$

$$\text{Coeff of } x_1 = y_1 + 3y_2 + y_3 - 3 = 0 + \frac{15}{2} - 3 = \frac{9}{2}$$

$$= \frac{0 + 9}{2} + 0 - 3 = \frac{3}{2} \quad x_2 = y_1 + 4y_3 - 2 = -2 \text{ (Not optimal)}$$

$$x_4 = y_1 - 0 = 1$$

$$x_5 = y_2 - 0 = \frac{3}{2}$$

$$x_5 = y_2 - 0 = \frac{5}{2}$$

$$z = 30 + 60\left(\frac{3}{2}\right) + 0 = 120$$

$$\begin{array}{c|cccc|c} & x_1 & x_2 & s_1 & s_2 & \\ \hline z & -2 & -3 & 0 & 0 & 0 \\ \hline s_1 & 1 & 1 & 1 & 0 & 20 \\ \hline s_2 & -1 & -1 & 0 & 1 & -20 \end{array}$$

$$R_1 - 2R_3, R_2 + R_3$$

$$\begin{array}{c|cccc|c} z & 0 & -1 & 0 & -2 & 40 \\ \hline s_1 & 0 & 0 & 1 & 1 & 0 \\ \hline x_1 & 1 & 1 & 0 & -1 & 20 \end{array}$$

$$R_1 + 2R_2, R_3 + R_2$$

$$\begin{array}{c|cccc|c} z & 0 & -1 & 2 & 0 & 40 \\ \hline s_2 & 0 & 0 & 1 & 1 & 0 \\ \hline x_1 & 1 & 1 & 1 & 0 & 20 \end{array}$$

$$R_1 + R_3$$

$$\begin{array}{c|cccc|c} z & 0 & 0 & 3 & 0 & 60 \\ \hline s_2 & 0 & 0 & 1 & 1 & 0 \\ \hline x_2 & 1 & 1 & 1 & 0 & 20 \end{array}$$

## Quiz 2.C

### Solution

Q2)

	$x_1$	$x_2$	$s_1$	$s_2$	R.H.V.
Z	5	-2	0	0	0
$s_1$	1	1	1	0	20
$s_2$	-1	-1	0	1	-20

$R_1 - 2R_3$

	$x_1$	$x_2$	$s_1$	$s_2$	R.H.V.
Z	7	0	0	-2	40
$s_1$	0	0	1	1	0
$x_2$	1	1	0	-1	20

$R_1 - 7R_3$

	$x_1$	$x_2$	$s_1$	$s_2$	R.H.V.
Z	0	-7	0	5	-100
$s_1$	0	0	1	1	0
$x_1$	1	1	0	-1	20

	$x_1$	$x_2$	$s_1$	$s_2$	R.H.V.
Z	0	-7	-5	0	-100
$s_2$	0	0	1	1	0
$x_1$	1	1	0	0	20

Q1) Feasibility

①

$$\begin{bmatrix} \frac{1}{2} & -\frac{1}{4} & 0 \\ 0 & \frac{1}{2} & 0 \\ -2 & 1 & 1 \end{bmatrix} \begin{bmatrix} 30 \\ 60 \\ 20 \end{bmatrix} = \begin{bmatrix} 15 - 15 + 0 \\ 30 \\ -60 + 60 + 20 \end{bmatrix} = \begin{bmatrix} 0 \\ 30 \\ 20 \end{bmatrix} \text{ Feasible.}$$

Dual possible  $z = 150$

Min  $z = 30y_1 + 60y_2 + 20y_3$

②  $y_1 + 3y_2 + y_3 \geq 3$  — (i)

$2y_1 + 4y_3 \geq 2$  — (ii)

$y_1 + 2y_2 \geq 5$  — (iii)

$y_1 \geq 0$  — (iv)

$y_2 \geq 0$  — (v)

$y_3 \geq 0$  — (vi)

Then calculate  $y_1, y_2, y_3$

①

$$[y_1 \ y_2 \ y_3] = [2 \ 5 \ 0] \begin{bmatrix} \frac{1}{2} & -\frac{1}{4} & 0 \\ 0 & \frac{1}{2} & 0 \\ -2 & 1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & -\frac{1}{2} + \frac{5}{2} = 2 & 0 \end{bmatrix}$$

$y_1 = 1, y_2 = 2, y_3 = 0$

② Coeff of  $x_1 = y_1 + 3y_2 + y_3 - 3 = 1 + 6 - 3 = 4$

$x_4 = y_4 - 0 = 1$  optimal.

$x_5 = 2 - 0 = 2$

Q1)

# Quiz 2B

	$x_1$	$x_2$	$s_1$	$s_2$	R.H.V
Z	-4	-2	0	0	0
$s_1$	1	1	1	0	10
$s_2$	-1	-1	0	1	-10

$R_1 - 2(R_3), R_2 + R_3$

Z	-2	0	0	-2	+20
$s_1$	0	0	1	1	0
$x_2$	1	1	0	-1	+10

Q2) Feasible

$$\begin{pmatrix} \frac{3}{5} & -\frac{1}{5} & 0 \\ -\frac{4}{5} & \frac{3}{5} & 0 \\ 1 & -1 & 1 \end{pmatrix} \begin{bmatrix} 3 \\ 6 \\ 3 \end{bmatrix} = \begin{bmatrix} \frac{9}{5} - \frac{6}{5} + 0 \\ -\frac{12}{5} + \frac{18}{5} + 0 \\ 3 - 6 + 3 \end{bmatrix} = \begin{bmatrix} \frac{3}{5} \\ \frac{6}{5} \\ 0 \end{bmatrix} \text{ Feasible}$$

optimality

max  $z = 3y_1 + 6y_2 + 3y_3$   
s.t  
 $3y_1 + 4y_2 + y_3 \leq 2$   
 $y_1 + 3y_2 + 2y_3 \leq 1$   
 $-y_1 \leq 0$   
 $-y_2 \leq 0$   
 $-y_3 \leq 0$

$$[y_1 \ y_2 \ y_3] = [2 \ 1 \ 0] \begin{bmatrix} \frac{2}{5} & -\frac{1}{5} & 0 \\ -\frac{4}{5} & \frac{3}{5} & 0 \\ 1 & -1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{6}{5} - \frac{4}{5} + 0 & -\frac{2}{5} + \frac{3}{5} & 0 + 0 + 0 \end{bmatrix}$$

$y_1 = \frac{2}{5}, y_2 = \frac{1}{5}, y_3 = 0$

coeff of  $x_3 = -y_1 - 0 = -\frac{2}{5}$   
 $x_4 = -y_2 - 0 = -\frac{1}{5}$   
 $x_6 = 0$

Optimal

$$Z = 2\left(\frac{3}{5}\right) + \frac{6}{5} = \frac{12}{5} \quad \Bigg| \quad Z' = 3\left(\frac{2}{5}\right) + 6\left(\frac{1}{5}\right) = \frac{12}{5}$$