

Desmond Gerber (25709364)

Question 2!

$$\text{Max: } 4X_1 + 7X_2$$

$$\begin{aligned}\text{Constraints: } 4X_1 + 4X_2 &\leq 50 \\ 1X_1 + 5X_2 &\leq 25 \\ X_1, X_2 &\geq 0\end{aligned}$$

For Dual:

$$\text{Minimize: } 50U_1 + 25U_2$$

$$\begin{aligned}\text{Constraints: } 4U_1 + 1U_2 &\geq 50 \\ 4U_1 + 5U_2 &\geq 25 \\ U_1, U_2 &\geq 0\end{aligned}$$

Now:

$$\begin{aligned}4U_1 + 1U_2 - S_1 + 0S_2 + 1A_1 + 0A_2 &= 50 \\ 4U_1 + 5U_2 + 0S_1 - 1S_2 + 0A_1 + 1A_2 &= 25\end{aligned}$$

New objective function: $50U_1 + 25U_2 + 0S_1 + 0S_2 + 1A_1 + 1A_2$

Thus: 1st Tableau.

C_j		50	25	0	0	M	M	
	Solution Mix	U_1	U_2	S_1	S_2	A_1	A_2	Qty.
M	A_1	4	1	-1	0	1	0	50
M	A_2	4	5	0	-1	0	1	25

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Question 2.2

Max: $11X + 10Y$

Constraints:

$$\begin{aligned} 6X + 4Y &\leq 36 \\ 3X + 2Y &\leq 24 \\ 0X + 1Y &\leq 4 \\ X, Y &\geq 0 \end{aligned}$$

For Dual:

Minimize: $36U_1 + 24U_2 + 4U_3$

Constraints:

$$\begin{aligned} 6U_1 + 3U_2 + 0U_3 &\geq 36 \\ 4U_1 + 2U_2 + 1U_3 &\geq 24 \\ U_1, U_2, U_3 &\geq 0 \end{aligned}$$

Convert Constraints:

$$\begin{aligned} 6U_1 + 3U_2 + 0U_3 - S_1 + 0S_2 + 1A_1 + 0A_2 &= 36 \\ 4U_1 + 2U_2 + U_3 + 0S_1 - 1S_2 + 0A_1 + 1A_2 &= 24 \end{aligned}$$

New objective function:

Min: $36U_1 + 24U_2 + 4U_3 + 0S_1 + 0S_2 + 1A_1 + 1A_2$

Question 3

Minimize: $6y_1 + 2y_2$

Constraints: $5y_1 - 2y_2 \geq 22$

$$10y_1 + 1y_2 \geq 15$$

$$1y_1 + 7y_2 \geq 7$$

$$2y_1 + 3y_2 = 66$$

$$y_1, y_2 \geq 0$$

Convert constraints:

$$5y_1 - 2y_2 - 1s_1 + 0s_2 + 0s_3 + 1A_1 + 0A_2 + 0A_3 + 0A_4 = 22$$

$$10y_1 + 1y_2 + 0s_1 - 1s_2 + 0s_3 + 0A_1 + 1A_2 + 0A_3 + 0A_4 = 15$$

$$1y_1 + 7y_2 + 0s_1 + 0s_2 - 1s_3 + 0A_1 + 0A_2 + 1A_3 + 0A_4 = 7$$

$$2y_1 + 3y_2 + 0s_1 + 0s_2 + 0s_3 + 0A_1 + 0A_2 + 0A_3 + 1A_4 = 66$$

New Objective function:

Minimize: $6y_1 + 2y_2 + 0s_1 + 0s_2 + 0s_3 + MA_1 + MA_2 + MA_3 + MA_4$

Question 4

Minimize: $8X + 10Y$

Constraints:

$$\begin{aligned} 5X + 3Y &\leq 34 \\ 2X + 3Y &= 18 \\ 0X + 1Y &\geq 3 \end{aligned}$$

Convert constraints:

$$\begin{aligned} 2X + 3Y + 0S_1 + 0S_2 + 1A_1 + 0A_2 &= 18 \\ 5X + 3Y + 1S_1 + 0S_2 + 0A_1 + 0A_2 &= 34 \\ 0X + 1Y + 0S_1 - 1S_2 + 0A_1 + 1A_2 &= 3 \\ X, Y, S_1, S_2, A_1, A_2 &\geq 0 \end{aligned}$$

Out of 1st tableau \Rightarrow pivot column is Y
For ratios of 2nd Tableau

$$\frac{18}{2} = 9 \quad ; \quad \frac{34}{3} = 11\frac{1}{3} \quad ; \quad \frac{3}{1} = 3$$

\Rightarrow Pivot row would be with A_2 ; where Y moves to solution mix

\Rightarrow Pivot number will be $\frac{1}{1}$

For 3rd tableau

pivot column is S_2
ratios :

\Rightarrow Pivot row is A_1 .