

Q. Construct the dual and solve the LPP:

$$\text{max } z = 3x_1 + 4x_2$$

s.t.,

$$x_1 + x_2 \leq 12$$

$$2x_1 + 3x_2 \leq 24$$

$$x_1 \leq 8$$

$$x_2 \leq 6$$

$$x_1, x_2 \geq 0$$

$$z = 3 \times 8 + 4 \times 0 = 24$$

$$x_1 = 8, x_2 = 5/3, z = 92/3$$

last row is same

Dual:

$$\text{min } w = 12u_1 + 24u_2 + 8u_3 + 6u_4$$

s.t.,

$$u_1 + 2u_2 + u_3 \geq 3$$

$$u_1 + 3u_2 + u_4 \geq 4$$

$$u_1, u_2, u_3, u_4 \geq 0$$

$$\text{std form: max } w^* = -12u_1 - 24u_2 - 8u_3 - 6u_4 + 0 \cdot s_1 + 0 \cdot s_2 - M A_1 - M A_2$$

$$u_1 + 2u_2 + u_3 - s_1 + A_1 \geq 3$$

$$u_1 + 3u_2 + u_4 - s_2 + A_2 \geq 4$$

$$u_1, u_2, u_3, u_4 \geq 0$$

simplex table will have 8

columns from 0₁ to 0₈

lecture 16

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IBFS:

$$\text{NB } u_1 = u_2 = u_3 = u_4 = s_1 = 0 = s_2$$

$$\text{BV } \begin{cases} A_1 = 3 \\ A_2 = 4 \end{cases}$$

				C _j	-12	-24	-8	-6	0	0	-M	-M	
	C _B	B	x _B	b	a ₁	a ₂	a ₃	a ₄	a ₅	a ₆	a ₇	a ₈	Ratio
	-M	a ₇	A ₁	3	1	2	1	0	-1	0	1	0	3/2
	-M	a ₈	A ₂	4	1	(3)	0	1	0	-1	0	1	4/3
					-2M	-5M	-M	-M	M	M	0	0	
					+12	+24	+8	+6					
R ₁ ← R ₁ - 2R ₂	-M	a ₇	A ₁	1/3	1/3	0	(1)	-2/3	-1	2/3	0	-2/3	1/3
	-24	a ₂	u ₂	4/3	4/3	1	0	1/3	0	-1/3	0	1/3	4
					-M/3 + 5	0	-M/3 + 8	2M/3	M	-2M/3	0	2M/3 - 1	
	-8	a ₃	u ₃	1/3	1/3	0	1	-2/3	-1	2/3	0	1/3	1
	-24	a ₂	u ₂	4/3	1/3	1	0	1/3	M	-1/3	0	1/3	4
					-M/3 + 5	0	-M/3 + 8	2M/3	M	-2M/3	0	2M/3 - 1	
					7/3	0	0	1/3	8	5/3	M-8	M-9/3	

optimal for dual

$$u_3 = 1/3, u_2 = 4/3, u_1 = 0, u_4 = 0$$

optimal for primal

Q. Find the dual and solve:

$$\min Z = x_1 - x_2$$

$$2x_1 + x_2 \geq 2$$

$$-x_1 - x_2 \geq 1 \quad] \rightarrow \text{LOL!}$$

$$x_1, x_2 \geq 0$$

Dual:

$$\max W = 2v_1 + v_2$$

s.t.

$$2v_1 - v_2$$

Q. Find the dual & solve:

→ From previous page (turn over)

$$\max Z = 2x_1 + 3x_2 + 4x_3$$

$$\text{s.t. } x_1 - 5x_2 + 3x_3 = 7$$

$$2x_1 - 5x_2 \leq 3$$

$$3x_1 - x_3 \geq 5$$

$$x_1, x_2 \geq 0, \quad x_3 \rightarrow \text{unrestricted}$$

$$\min W = 7v_1 + 3v_2 - 5v_3$$

s.t.

$$v_1 + 2v_2 \geq 2$$

$$-5v_1 - 5v_2 - 3v_3 \geq 3$$

$$3v_1 + v_3 \geq 4$$

$$v_2, v_3 \geq 0, \quad v_1 \text{ unrestricted}$$

Std form

$$\max W^* = -7v_1 - 3v_2 + 5v_3 + 0 \cdot s_1 + 0 \cdot s_2 + 0 \cdot s_3 + M \cdot A_1 - M \cdot A_2 - M \cdot A_3$$

s.t.

$$v_1 + 2v_2 - s_1 + A_1 \geq 2$$

$$-5v_1 - 5v_2 - 3v_3 - s_2 + A_2 \geq 3$$

$$-3v_1 + v_3 - s_3 + A_3 \geq 4$$

$$v_2, v_3 \geq 0$$

IBFS:

$$\text{NB } \begin{cases} v_1 = v_2 = v_3 = 0 \\ s_1 = s_2 = s_3 = 0 \end{cases}$$

$$\text{B.V. } \begin{cases} A_1 = 2 \\ A_2 = 3 \\ A_3 = 4 \end{cases}$$