LP EXERCISES

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Maximize $3X_1 + 2X_2$

subject to

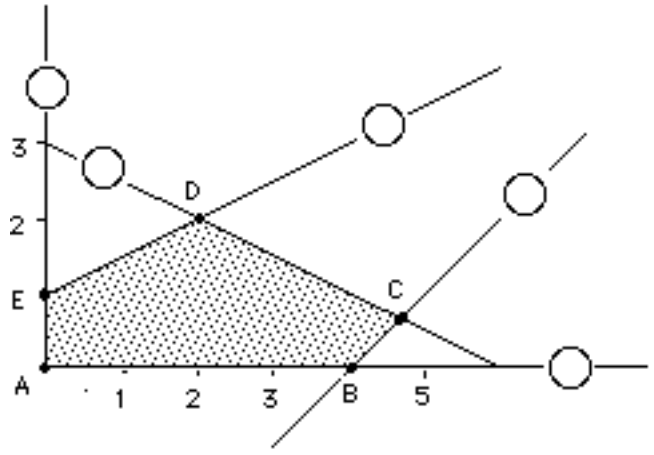
$X_1 + 2X_2 \leq 6$ 1

$X_1 - X_2 \leq 4$ 2

$-X_1 + 2X_2 \leq 2$ 3

$X_1 \geq 0$ 4

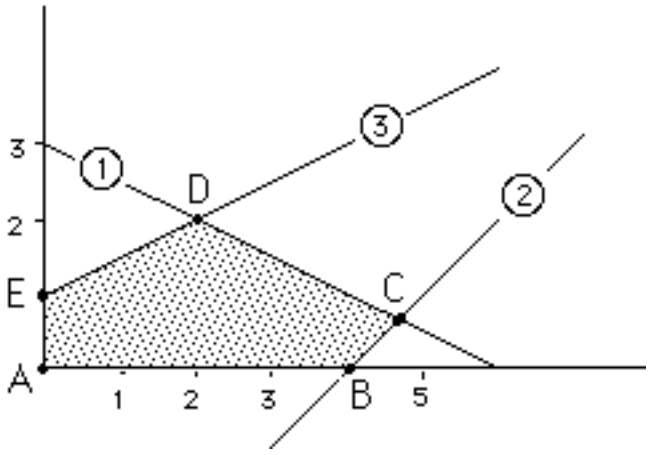
$X_2 \geq 0$ 5



Match the 5 constraints with the 5 edges of the feasible region

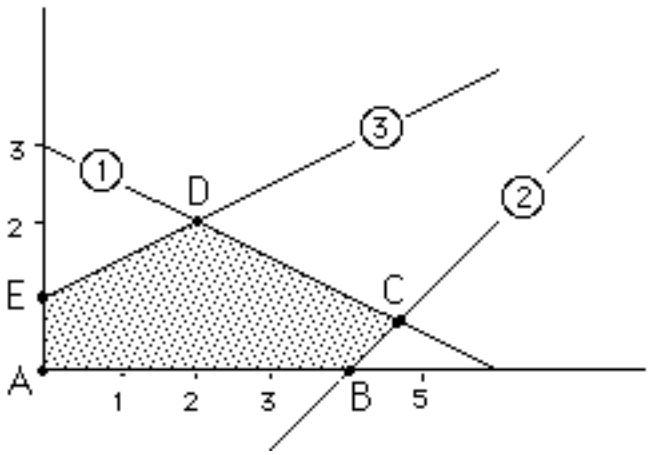
Which variables are basic at each of the extreme points: A, B, C, D, & E?

$$\text{Max } 3X_1 + 2X_2$$
s.t.
$$X_1 + 2X_2 + X_3 = 6$$
$$X_1 - X_2 + X_4 = 4$$
$$-X_1 + 2X_2 + X_5 = 2$$
$$X_j \geq 0,\ j=1,2,..5$$



How many basic solutions does this LP have? How many are feasible? ... infeasible?

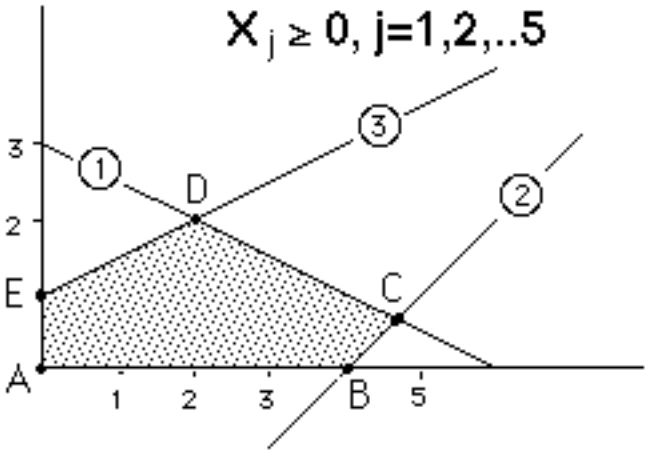
$$\text{Max } 3X_1 + 2X_2$$
s.t.
$$X_1 + 2X_2 + X_3 = 6$$
$$X_1 - X_2 + X_4 = 4$$
$$-X_1 + 2X_2 + X_5 = 2$$
$$X_j \geq 0,\ j=1,2,..5$$



C is optimal... What can be inferred about the dual optimum, by Complementary Slackness Theorem?

Primal

$$\text{Max } 3X_1 + 2X_2$$
$$\text{s.t.}$$
$$X_1 + 2X_2 + X_3 = 6$$
$$X_1 - X_2 + X_4 = 4$$
$$-X_1 + 2X_2 + X_5 = 2$$
$$X_j \geq 0,\ j=1,2,..5$$

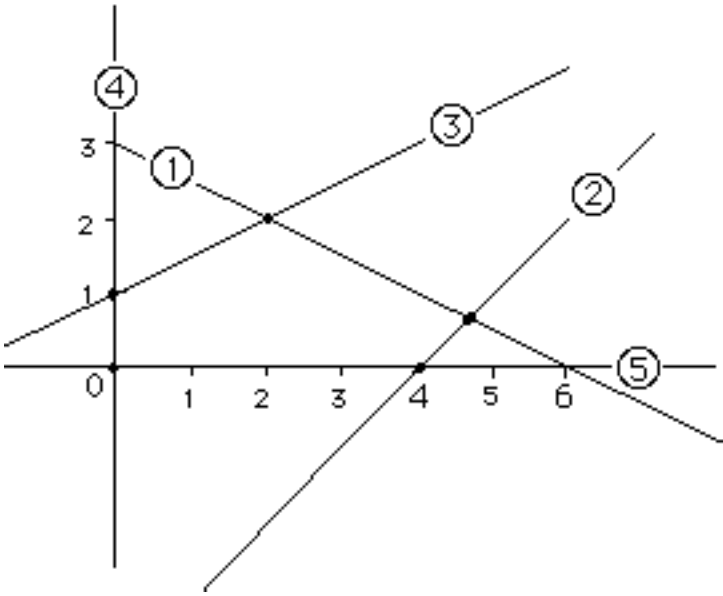


$$\text{Min } 6Y_1 + 4Y_2 + 2Y_3$$
$$\text{s.t. } Y_1 + Y_2 - Y_3 \geq 3$$
$$2Y_1 - Y_2 + 2Y_3 \geq 2$$
$$Y_1 \geq 0,\ Y_2 \geq 0,\ Y_3 \geq 0$$

Dual

Maximize $3X_1 + 2X_2$

subject to
$X_1 + 2X_2 \leq 6$ 1
$X_1 - X_2 \geq 4$ 2
$-X_1 + 2X_2 \leq 2$ 3
$X_1 \geq 0$ 4
X_2 urs 5



Where is the feasible region?

Maximize $3X_1 + 2X_2$

subject to $X_1 + 2X_2 \leq 6$

$X_1 - X_2 \geq 4$

$-X_1 + 2X_2 \leq 2$

$X_1 \geq 0$

X_2 urs

Write the dual LP problem

Minimize $6Y_1 + 4Y_2 + 2Y_3$

s.t. $Y_1 + Y_2 - Y_3 \square 3$

$2Y_1 - Y_2 + 2Y_3 \square 2$

$Y_1 \square 0, Y_2 \square 0, Y_3 \square 0$

Maximize $3X_1 + 2X_2$

subject to $X_1 + 2X_2 = 6$

$X_1 - X_2 \geq 4$

$-X_1 + 2X_2 \leq 2$

$X_1 \leq 0$

$X_2 \geq 0$

Write the dual LP problem

Minimize $6Y_1 + 4Y_2 + 2Y_3$

s.t. $Y_1 + Y_2 - Y_3 \square 3$

$2Y_1 - Y_2 + 2Y_3 \square 2$

$Y_1 \square 0, Y_2 \square 0, Y_3 \square 0$