Clicker #A.1

Consider the functions

$$f(x_1, x_2, x_3) = (x_1 + x_2)(x_1 + x_3)$$

$$g(x_1, x_2, x_3) = (x_1 + x_2) - (x_1 + x_3)$$

$$h(x_1, x_2, x_3) = (x_1 + x_2)\,/\,(x_1 + x_3)$$

Question: Which of these functions are linear?

A. None.

B. Only $f(x_1, x_2, x_3)$

C. Only $g(x_1, x_2, x_3)$

D. Only $h(x_1, x_2, x_3)$

Clicker #A.2

Consider the functions

$$f(x_1, x_2, x_3) = |x_1|$$

$$g(x_1, x_2, x_3) = \log(x_1 + x_2 + x_3)$$

Question: Which of these functions are linear?

A. Neither.
B. Only $f(x_1, x_2, x_3)$
C. Only $g(x_1, x_2, x_3)$
D. Both.

Clicker #A.3

Consider the constraints

$$\begin{aligned} (1) \quad & x_1 + x_2 + x_3 \cdot x_4 \ \leq \ 50 \\ (2) \quad & x_1 + x_2 + x_3 \ \leq \ x_1^2 \\ (3) \quad & x_1 + x_2 + x_3 \ < \ 50 \end{aligned}$$

Question: Which of these constraints are linear?

A. None.
B. Only (1)
C. Only (2)
D. Only (3)

Clicker #A.4

Consider the constraints

$$\begin{array}{rrcl} (1) & x_1 + x_2 + x_3 & \neq & 50 \\ (2) & x_1 + x_2 + x_3 & = & 3x_1 + \log(27) \\ (3) & 1/(x_1 + x_2 + x_3) & \geq & 250 \end{array}$$

Question: Which of these constraints are linear?

A. None.
B. Only (1)
C. Only (2)
D. Only (3)

Clicker #A.5

Consider the variable definitions

$$\begin{array}{ll} (1) & x_1, x_2, x_3 \in \mathbb{Q} \\ (2) & x_1, x_2 \in \mathbb{R} - \{0\} \\ (3) & x_1, x_2 \in \mathbb{R}; \quad x_3 \in \{0, 1, 3\} \end{array}$$

Question: Which of these definitions agree with our standard LP problem?

A. None.
B. Only (1)
C. Only (2)
D. Only (3)

Clicker #A.6

Consider the variable definitions

$$
\begin{aligned}
(1) &\quad x_1, x_2, x_3 \in \mathbb{R} - (-\infty, 0] \\
(2) &\quad x_1, x_2 \in \mathbb{R} - (1, 2) \\
(3) &\quad x_1, x_2, x_3 \in [0, 3]
\end{aligned}
$$

Question: Which of these definitions agree with our standard LP problem?

A. None.
B. Only (1)
C. Only (2)
D. Only (3)

Clicker #B.1

$$\begin{array}{rrcrl}
\max & 4x_1 & + & 8x_2 & \\
s.t. & x_1 & - & x_2 & \leq -1 \\
& 2x_1 & - & x_2 & \leq 5 \\
& -3x_1 & - & x_2 & \leq -3 \\
& 2x_1 & + & x_2 & \leq 7 \\
& 10x_1 & + & x_2 & \leq 20 \\
& x_1, & & x_2 & \geq 0
\end{array}$$

Question: Which of the following vectors is feasible?

A. $x = (0, 0)$

B. $x = (2, 3)$

C. $x = (1, 7)$

D. $x = (1, 4)$

Clicker #B.2

$$\begin{aligned} \max \quad & x_1 + x_2 \\ s.t. \quad & x_1 + x_2 \quad \leq \; 8 \\ & 0 \leq x_1, x_2 \leq 6 \end{aligned}$$

Question: This LP

A. is infeasible

B. is unbounded

C. has infinitely many solutions

D. has a unique solution

Clicker #B.3

$$\begin{array}{rl} \max & x_1 + 2x_2 \\ s.t. & x_1 + x_2 \quad \leq \ 8 \\ & 0 \leq x_1, x_2 \leq 6 \end{array}$$

Question: This LP

A. is infeasible

B. is unbounded

C. has infinitely many solutions

D. has a unique solution

Clicker #B.4

$$\begin{aligned} \max \quad & x_1 + 2x_2 \\ s.t. \quad & x_1 + x_2 \quad \leq \ 8 \\ & 0 \leq x_1, x_2 \leq 1 \end{aligned}$$

Question: This LP

A. is infeasible

B. is unbounded

C. has infinitely many solutions

D. has a unique solution

Clicker #B.5

$$\begin{array}{rll} \max & x_1 + x_2 & \\ s.t. & x_1 - x_2 & \leq \; 8 \\ & x_1 - x_2 & \geq \; 4 \\ & 0 \leq x_1, x_2 & \end{array}$$

Question: This LP

A. is infeasible

B. is unbounded

C. has infinitely many solutions

D. has a unique solution

Clicker #B.6

$$\begin{array}{rll} \min & 2x_1 + 3x_2 & \\ s.t. & x_1 - x_2 & \leq 8 \\ & x_1 - x_2 & \geq 4 \\ & 0 \leq x_1, x_2 & \end{array}$$

Question: This LP

A. is infeasible

B. is unbounded

C. has infinitely many solutions

D. has a unique solution

Clicker #B.7

$$\begin{aligned} \min \quad & 2x_1 + 3x_2 \\ s.t. \quad & 2x_1 - x_2 \geq 8 \\ & x_1 + x_2 \geq 13 \\ & 0 \leq x_1 \leq 6 \qquad 0 \leq x_2 \leq 34 \end{aligned}$$

Question: This LP

A. is infeasible

B. is unbounded

C. has infinitely many solutions

D. has a unique solution

Clicker #B.8

$$
\begin{array}{rll}
\max & x_1 + x_2 + x_3 & \\
s.t. & x_1 + x_2 + x_3 & \geq 25 \\
& x_1 + x_2 - x_3 & \leq 7 \\
& x_1 - x_2 + x_3 & \leq 8 \\
& -x_1 + x_2 + x_3 & \leq 9 \\
& 0 \leq x_1, x_2, x_3 &
\end{array}
$$

Question: This LP

A. is infeasible

B. is unbounded

C. has infinitely many solutions

D. has a unique solution

Clicker #B.9

$$\begin{aligned} \max \quad & x_1 + x_2 + x_3 \\ s.t. \quad & x_1 + x_2 - 2x_3 \leq 6 \\ & x_1 - 2x_2 + x_3 \leq 7 \\ & -2x_1 + x_2 + x_3 \leq 8 \\ & 9 \leq x_1, x_2, x_3 \end{aligned}$$

Question: This LP

A. is infeasible

B. is unbounded

C. has infinitely many solutions

D. has a unique solution

Clicker #B.10

TRUE or FALSE?

There exists an LP that has exactly four optimal solutions that are basic feasible (= corner points of the feasible region).

A. True

B. False

Clicker #C.1

Solve the following LP with the Simplex method:

	Z	x_1	x_2	s_1	s_2	s_3	b
Z	1	-2	-1	-1	0	0	26
s_1	0	4	4	1	0	0	6
s_2	0	5	6	1	1	0	16
s_3	0	7	4	1	0	1	10

Question: Which statement is true?

A. This LP is infeasible

B. The optimal objective value is 32

C. The optimal solution has $x_2 = 8$

D. The optimal solution has $x_2 = 9$

Clicker #C.2

Solve the following LP with the Simplex method:

$$\begin{array}{rrrl} \max & 2x_1 + & x_2 & \\ s.t. & 2x_1 & +3x_2 & \leq 3 \\ & x_1 & +5x_2 & \leq 1 \\ & 2x_1 & + \; x_2 & \leq 4 \\ & 4x_1 & + \; x_2 & \leq 5 \\ & x_1, & x_2 & \geq 0 \end{array}$$

Question: Which statement is true?

A. This LP is infeasible

B. The optimal solution has $x_2 = 0$

C. The optimal solution has $x_2 = 1/10$

D. The optimal solution has $x_2 = 1/5$

Clicker #C.3

Solve the following LP with the Simplex method:

	Z	x_1	x_2	s_1	s_2	s_3	b
Z	1	-1	-1	0	0	0	0
s_1	0	3	5	1	0	0	90
s_2	0	9	5	0	1	0	180
s_3	0	0	1	0	0	1	15

Question: Which statement is true?

A. This LP is infeasible

B. The optimal objective value is 32

C. The optimal solution has $x_2 = 8$

D. The optimal solution has $x_2 = 9$

Clicker #C.4

Solve the following LP with the Simplex method:

$$\begin{array}{rrrrrl} \max & 5x_1 + & 6x_2 + & 9x_3 + & 8x_4 & \\ s.t. & x_1 & +2x_2 & +3x_3 & + \; x_4 & \leq 5 \\ & x_1 & + \; x_2 & +2x_3 & +3x_4 & \leq 3 \\ & x_1, & x_2, & x_3, & x_4 & \geq 0 \end{array}$$

Question: Which statement is true?

A. The optimal objective value is 15

B. The optimal objective value is 17

C. The optimal objective value is 19

D. The optimal objective value is 21