

# Linear Programming Exam Sample Problems

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1. Solve the linear programming problem

$$\begin{aligned} &\text{Maximize} \\ &Z = 4x_1 + 5x_2 \\ &\text{subject to} \\ &x_1 + 2x_2 \leq 15 \\ &x_1 \text{ and } x_2 \text{ nonnegative} \end{aligned}$$

2. In the following LP,  $B$  is a constant.

$$\begin{aligned} &\text{Maximize} \\ &Z = x_1 + Bx_2 \\ &\text{subject to} \\ &3x_1 + 7x_2 \leq 19 \\ &x_1 \geq 0 \quad x_2 \geq 0 \end{aligned}$$

What is the largest value of  $B$  such that  $x_1$  is a basic variable in the optimal solution?

3. Given the LP

$$\begin{aligned} &\text{minimize} \\ &Z = -2x_1 - x_2 + 3x_3 \\ &\text{subject to} \\ &x_2 - x_3 \leq 10 \\ &-x_1 + 4x_2 \leq 20 \\ &x_1 \geq 0 \quad x_2 \geq 0 \quad x_3 \geq 0 \end{aligned}$$

Write down the dual LP.

4. In solving a linear programming problem by the simplex method, suppose you arrive at the following table.

$Z$	$x_1$	$x_2$	$x_3$	$w_1$	$w_2$	$w_3$	$RHS$
1	0	3.5	-.5	2.5	0	0	15
0	1	1.5	.5	.5	0	0	2.5
0	0	-5	0	-2	1	0	1
0	0	-5	.5	-1.5	0	1	.5

Which variables are currently the basic variables? What is the entering basic variable? What is the leaving basic variable?

5. Given the LP

$$\begin{aligned} & \text{Maximize} \\ & Z = 3x_1 + 4x_2 + 5x_3 + x_4 \\ & \text{subject to} \\ & \quad x_1 + x_2 \geq 7 \\ & \quad x_1 + x_3 + 2x_4 \leq 50 \\ & \quad x_2 + 3x_4 \leq 80 \\ & \quad x_1 \geq 0 \quad x_2 \geq 0 \quad x_3 \geq 0 \quad x_4 \geq 0 \end{aligned}$$

Write down the table for the auxiliary problem used to find an initial feasible solution. Perform one pivot operation and turn the infeasible table into a feasible table.