

AIP1 530 – Fall 2023
HOMEWORK 1

Upload a document that includes solutions for these problems.

PROBLEM 1 – 40 points

A farmer in Egypt owns 50 acres of land. He is going to plant each acre with cotton or corn. Each acre planted with cotton yields \$400 profit; each with corn yields \$200 profit. The labor and fertilizer used for each acre are given in the table below.

Resource	Cotton	Corn
Labor (number of workers)	5	3
Fertilizer (tons)	6	2

Resources available include 150 workers and 200 tons of fertilizer. Formulate this problem to decide how much should the farmer plant of each to maximize his profit.

- Write layman's formulation
- Write expanded mathematical formulation
- Write compact mathematical formulation

PROBLEM 2 – 40 points

Sinclair Pharmaceuticals operates two chemical plants which produce antibiotics; the Ohio Valley plant, which produces 5000 boxes per month, and the Lakeview plant, which can produce 7000 boxes per month. Sinclair sells its meds to three different stores: Grand Rapids (demand = 3000 boxes per month), Blue Ridge (demand = 5000 boxes per month), and Sunset (demand = 4000 boxes per month). The costs of shipping between the respective plants and stores is shown in the table below:

Plant/Store	Grand Rapids	Blue Ridge	Sunset
Ohio Valley	50	40	100
Lakeview	75	50	75

Formulate this problem to decide what is the optimal shipping plan.

- Write layman's formulation
- Write expanded mathematical formulation
- Write compact mathematical formulation

PROBLEM 3 – 10 points

Consider the following linear programming problem:

$$\max 2x_1 + 4x_2$$

Subject to:

$$x_1 + x_2 \leq 5$$

$$-x_1 + x_2 \geq 8$$

$$x_1, x_2 \geq 0$$

The above linear programming problem:

- a. has only one optimal solution
- b. has more than one optimal solution
- c. exhibits infeasibility
- d. exhibits unboundedness

PROBLEM 4 – 10 points

Consider the following linear programming problem:

$$\max 2x_1 + 2x_2$$

Subject to:

$$4x_1 + 3x_2 \geq 12$$

$$-2x_1 - 3x_2 \leq 6$$

$$x_2 \geq 2$$

$$x_1, x_2 \geq 0$$

The above linear programming problem:

- a. has only one optimal solution
- b. has more than one optimal solution
- c. exhibits infeasibility
- d. exhibits unboundedness