

ISLE323 - Assignment #1

Due Date: Thursday October 29, 2023 11PM

1. Solve the following problem using graphical method.

$$\begin{aligned}
 & \text{Maximize } Z = -10x_1 - 20x_2 \\
 & \text{subject to} \\
 & \qquad 2x_1 - x_2 \geq 4 \\
 & \qquad x_1 + x_2 \geq 4 \\
 & \qquad 5x_1 + 4x_2 \geq 20 \\
 & \qquad x_1 \geq 0 \text{ and } x_2 \geq 0
 \end{aligned}$$

2. We are appointed to help KCC caravan manufacture company for production planning. From past data, the company knows that if the production rate of caravan changes, additional costs are incurred. KCC estimates that the cost of increasing production is \$1500 per caravan increased from one month to the next. Similarly, the cost of decreasing production is \$1000 per unit decreased from one month to the next. Sales forecasts for the next six months are given in Table 1.

Table 1: Caravan Sales Forecasts

Month	Demand
January	400
February	800
March	2200
April	1200
May	500

December production level is at 400 units, and the December 31 inventory level is 200 units. Storage of the first 800 units costs \$200/unit/month. Additional storage (for units in excess of 800) can be rented for \$500/unit/month. (Inventory levels are calculated at the end of a month.) The company must meet demand for a given month. Formulate a linear program to determine the optimal production schedule.

3. The ABC Company manufactures high performance processors for computers at two factories. Three computer companies orders' for this month are 300, 400, 300 units respectively. The cost of shipping each unit from each factory to each of these customers and the number of units that will be produced at each factory are given in Table 2.

Table 2:

From \ To	Unit Shipping Cost			Supply
	Customer 1	Customer 2	Customer 3	
Factory 1	\$300	\$500	\$200	600 units
Factory 2	\$250	\$700	\$400	400 units
Demand	300 units	400 units	300 units	

The ABC Company needs to decide how many units to ship from each factory to each customer. Formulate an LP to solve this problem.

4. MKK Dairy wants to determine the best blend of milks to use in production of ice cream. They can use wholecow milk, goat milk or water buffalo milk. Table 3 summarizes nutrients each milk per liter along with the cost and supply amounts.

Table 3: Nutrition amounts of each milk

	Whole cow's milk	Goat milk	Buffalo milk
Calories	149	205	237
Water	85%	81%	78%
Fat	8 grams	14 grams	18 grams
Protein	8 grams	9 grams	9 grams
Lactose	11 grams	14 grams	13 grams
Cost(per liter)	\$0.8	\$1.1	\$1.6
Supply(liter)	4000	2500	1500

MKK Dairy produces mainly two type ice cream: regular and diet. Each ice cream must have certain specifications to achieve desired quality. These specifications are given in Table 4 along with demand. Formulate an LP to find the best blend of ingredients into final products to meet certain specifications with minimum cost.

Table 4: Ice cream requirements

Ice cream	Specification	Demand
Regular	Not more than 82% of water Not more than 13 grams/liter of lactose At least 14 grams/liter of fat	5000 liter
Diet	Not more than 83% of water Not more than 12 grams/liter of lactose At most 10 grams/liter of fat	2500 liter

5. A governmental agency needs to decide suppliers for fuel to be used in its n depots. The agency takes bids from m different oil companies. The facility capacity of oil company i is a_i liters, and depot j demands b_j liters. Suppose that c_{ij} is the unit delivery cost of oil company i to the depot j . Formulate a linear programming model (in closed form) that minimizes the total purchasing cost.