MA3231 Linear Programming
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LP Assignment 0

DO NOT HAND IN FOR CREDIT

DUE DATE: None. This sheet is for practice purposes.

1.) Gertrude has an online jewelry shop where she sells earrings and necklaces. She sells earrings for $30 and necklaces for $40. It takes 20 minutes to make a pair of earrings and 1 hour to make a necklace, and, since Gertrude is a math PLA, she only has 10 hours a week to make jewelry. In addition, she only has enough materials to make 20 total jewelry items per week.

She makes a profit of $10 on each pair of earrings and $14 on each necklace. How many pairs of earrings and necklaces should Gertrude make each week in order to maximize her profit, assuming she sells all her jewelry?

Formulate this as a linear programming problem. Be sure to define your variables and label your constraints.

2.) Lydia's company is opening a new shoe plant and wants to try minimizing their quarterly cost using linear programming. Each of her workers gets paid $8000 per quarter and works 3 contiguous quarters per year. Additionally, each worker can only make 500 pairs of shoes per quarter. The anticipated demand (in pairs of shoes) is 6000 for Quarter 1, 3000 for Quarter 2, 8000 for Quarter 3, and 1000 for Quarter 4. Pairs of shoes may be put in inventory, but this costs $5 per quarter per pair of shoes, and inventory must be empty at the end of Quarter 4. How can Lydia meet these demands at minimal overall cost?

3.) You are making fruit baskets with oranges, bananas, and apples. The table gives the amount of fruit required for the two arrangements. Each day you have 240 oranges, 270 bananas and 320 apples. Arrangement A earns a profit of $10 per basket and Arrangement B earns $8 per basket. How many of each fruit basket should you make per day to maximize your profit?

Arr.	A	B
oranges	8	8
bananas	12	10
apples	20	15

4.) A farmer has 10 acres to plant in wheat and rye. He has to plant at least 7 acres. However, he has only \$1200 to spend and each acre of wheat costs \$200 to plant and each acre of rye costs \$100 to plant. Moreover, the farmer has to get the planting done in 12 hours and it takes an hour to plant an acre of wheat and 2 hours to plant an acre of rye. If the profit is \$500 per acre of wheat and \$300 per acre of rye how many acres of each should be planted to maximize profits?

5.) Suppose that your client manages 4 sources S_1, S_2, S_3, S_4 of industrial waste and has contracts with three disposal sites D_1, D_2, D_3. The amount of waste generated at source S_i is denoted by a_i and the capacity of disposal site D_j is b_j. It is desired to select appropriate transfer facilities from among three candidate facilities TF_1, TF_2, TF_3. Potential transfer facility TF_k has fixed cost f_k, capacity q_k and unit processing cost α_k per ton of waste. Let c_{ik} and $\bar{c}_{kj}$ be the unit shipping costs from source i to transfer station k and from transfer station k to disposal site j respectively. The problem is to choose the transfer facilities and the shipping pattern that minimize the total capital and operating costs of the transfer stations plus the transportation costs.

Given the following data, formulate this minimization as a linear programming problem.

c_{ik}	TF_1	TF_2	TF_3	a_i
S_1	20	25	20	100
S_2	30	25	50	200
S_3	40	20	40	150
S_4	50	10	10	50

$\bar{c}_{ik}$	D_1	D_2	D_3
TF_1	40	30	60
TF_2	30	50	40
TF_3	40	10	10
b_j	150	250	250