

BUAD 5022 – Individual Problem Set 1

Due: October 6 by 11:59pm via Blackboard submission

Grade: 10% of your overall class grade

Category A Assignment (i.e., do not discuss with anyone else except the instructor)

Homework should be neat and organized. It is subject to grade penalties if it is not.

1. A company must meet (on time) the following quarterly demands: quarter 1 (30 units), quarter 2 (20 units), quarter 3 (40 units). Each quarter, up to 27 units can be produced with regular-time labor, at a cost of \$40 per unit. During each quarter, an unlimited number of units can be produced with overtime labor, at a cost of \$60 per unit. Of all units produced, 20% are unsuitable and cannot be used to meet demand. Also, at the end of each quarter, 10% of all units on hand spoil and cannot be used to meet any future demands. After each quarter's demand is satisfied and spoilage is accounted for, a cost of \$15 per unit is assessed against the quarter's ending inventory. Formulate an LP that can be used to minimize the total cost of meeting the next three quarters' demands. Assume that 20 usable units are available at the beginning of quarter 1.

- Formulate the model as an LP.
- Solve the model using Python (submit your code).
- Summarize the solution in a succinct and presentable manner.

2. Karen's Electronics produces three products. Each product must be processed on each of three types of machines. When a machine is in use, it must be operated by a worker. The time (in hours) required to process each product on each machine and the profit associated with each product are shown below in the table. At present, five type 1 machines, three type 2 machines, and four type 3 machines are available. The company has 10 workers available and must determine how many workers to assign to each machine. The plant is open 40 hours per week, and each worker works 35 hours per week. Formulate an LP that will enable Karen's Electronics to assign workers to machines in a way that maximizes weekly profits. (Also, workers do not have to spend the entire week operating a single machine.)

Table:	Product 1	Product 2	Product 3
Machine 1	2	3	4
Machine 2	3	5	6
Machine 3	4	7	9
Profit (\$)	6	8	10

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- Solve the model using Python (submit your code).
- Summarize the solution in a succinct and presentable manner.

3. Three different investment options are available at the beginning of each year during the next 6-year period. The durations of the investments are 1 year, 3 years, and 5 years. The 1-year investment yields a total return of 5.1%, the 3-year investment yields a total return of 16.2%, and the 5-year investment yields a total return of 28.5%. If an initial investment of \$10,000 is made and all available funds are invested at the beginning of each year, formulate a linear programming model to determine the investment pattern that results in the maximum available cash at the end of the sixth year.

- Formulate the model as an LP.
(You do not need to solve. Just write or type the formulation.)