VIA 508 Business Analytics
Mini Exam 1
Due Date 07/11/2021 23:59

1- Sunco processes oil into aviation fuel and heating oil. It costs $40 to purchase each 1,000 barrels of oil, which is then distilled and yields 500 barrels of aviation fuel and 500 barrels of heating oil. Output from the distillation may be sold directly or processed in the catalytic cracker. If sold after distillation without further processing, aviation fuel sells for $60 per 1,000 barrels, and heating oil sells for $40 per 1,000 barrels. It takes 1 hour to process 1,000 barrels of aviation fuel in the catalytic cracker, and these 1,000 barrels can be sold for $130. It takes 45 minutes to process 1,000 barrels of heating oil in the cracker, and these 1,000 barrels can be sold for $90. Each day, at most 20,000 barrels of oil can be purchased, and 8 hours of cracker time are available. Formulate an LP to maximize Sunco's profits.
   a) Clearly define decision variables, objective function and constraints.
   b) Solve the problem using PULP and report the code and output.
   c) Is it profitable to buy an **extra** barrel of oil?
   d) How would Sunco's profit change if they were able to purchase an extra barrel of oil?
   e) How would Sunco's profit change if they were able to have an extra hour of cracker time?

2- PM Computers assembles its own brand of personal computers from component parts it purchases overseas and domestically. PM sells most of its computers locally to different departments at State University as well as to individuals and businesses in the immediate geographic region. PM has enough regular production capacity to produce 160 computers per week. It can produce an additional 50 computers with overtime. The cost of assembling, inspecting, and packaging a computer during regular time is $190. Overtime production of a computer costs $260. Furthermore, it costs $10 per computer per week to hold a computer in inventory for future delivery. PM wants to meet all customer orders, with no shortages, to provide quality service. PM's order schedule for the next 6 weeks is as follows:

Week	*Computer Orders*
1	105
2	170
3	230
4	180
5	150
6	250

PM Computers wants to determine a schedule that will indicate how much regular and overtime production it will need each week to meet its orders at the minimum cost. The company wants no inventory left over at the end of the 6-week period.
   a. Clearly define decision variables, objective function and constraints.
   b. Solve the problem **using PULP** and report your code and output.
   c. If you had a chance to expand the regular production capacity, which week would you choose to decrease the cost most?

3- A jewelry store makes necklaces and bracelets from gold and platinum. The store has 18 ounces of gold and 20 ounces of platinum. Each necklace requires 3 ounces of gold and 2 ounces of platinum, whereas each bracelet requires 2 ounces of gold and 4 ounces of platinum. The demand for bracelets is no more than four. A necklace earns $300 in profit and a bracelet, $400. The store wants to determine the number of necklaces and bracelets to make in order to maximize profit.
   a. Formulate a linear programming model for this problem.
   b. Solve this model by using **graphical analysis**. Determine the range of profit per necklace that leaves the current solution optimal using graphical analysis.