BVA 507E Business Analytics
Mini Exam 1
Due Date 17/11/2023 23:59

1) You have a small financial management company that manages personal financial portfolios. The company manages six mutual funds and has a client that has acquired $500,000 from an inheritance. Characteristics of the funds are given in Table.

Fund	Expected Annual Return	Risk Measure
Low-priced Stock Fund	8.13%	10.57
Multinational Fund	9.02%	13.22
Mid-cap Stock Fund	7.56%	14.02
Mortgage Fund	3.62%	2.39
Income Equity Fund	7.79%	9.30
Balanced Fund	4.40%	7.61

The company uses a proprietary algorithm to establish a measure of risk for its funds based on the historical volatility of the investments. The higher the volatility, the greater the risk. The company recommends that no more than $200,000 be invested in any individual fund, that at least $50,000 be invested in each of the multinational and balanced funds, and that the total amount invested in income equity and balanced funds be at least 40% of the total investment, or $200,000. The client would like to have an average return of at least 5% but would like to minimize the weighted risk.

a) What portfolio would achieve this? Clearly define decision variables, objective function and constraints. Solve it using PULP.
b) If you had a chance to increase the $200,000 cap for one individual fund, which one would you prefer? Explain why.
c) If the client asks for more return than 5%, will it increase the overall risk of the portfolio? Explain your reasoning.
d) Recall that, the company has a rule to invest at least $50,000 to the multinational fund, reducing this threshold, will increase the risk of the portfolio. True or false, why?

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. Clearly define decision variables, objective function and constraints.

a) Solve the problem **using PULP** and report your code and output.
b) 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.