MSIS 638

Jia Liang Ma

Case 3.1a

1. Defining the objective function might not be straight forward in many real-world applications of optimization. For example, consider the following problem: The university has some extra budget to spend on improving the quality of education. How can you define an objective function for this example (Hint: what should be maximized or minimized)? Give at least three different ways the objective function can be defined.

Defining the objective function:

1. Minimized the total human resources cost and waste

2. Maximized the equipment and tools’ cost to enhance the quality of learning

3. Increase the scalability and flexibility of international and domestic students’ admission services

(by product-mix and plus, we can figure out the objective function)

1. What are some alternatives for investing the extra budget?

1. Investing in the stock portfolio

2. Building the new academic building or chamber (ex, library)

3. Buying new academic equipment for the students

4. Extending and refurbishing the surrounding area

5. Hiring the outperformance staffs and professors to improve the academic environment

6. Enhancing the school security

1. Do you think the whole budget should be spent on one of the alternatives, or divided between different alternatives? Why?

In my option, I do not think all the budget should be spent in one alternative. Consider that the chosen alternative may not be the optimal solution for benefiting the school by spending all the extra budget. Based on real-world situation, we also need to consider the opportunity cost and actual benefit ratio. By cross comparison to find out the optimal solution and it may be only one. On the other hands, if we want to put all the eggs in one basket, then we should examine first. Make sure the performance and return of that alternative is better than the portfolio one. Also, risk assessment is required as process for the examination.

1. Considering your answer to parts (b) and (c), and assuming the whole budget is $1,000,000, give three examples of feasible solutions (Hint: three ways to spend the budget).
2. Hiring five experienced and passion professors (cost: $450,000/ per year), Purchasing the new academic and scientific equipment (ex, microscope, desks and chairs, textbook, teaching martials) (cost: $500,000), Repairing the surrounding (cost: $30,000), Bursary ($20,000)

450,000x+500,000y+30,000z+20,000w <= 1,000,000

1. Enhancing the school security by hiring two more guards (cost: $90,000/per year), Improving the studying environment (upgrade the size and quality of classrooms) (cost: $ 600,000), Investing the stock portfolio ($300,000) <expected with good ROI>, Bursary (cost: $10,000)

90,000x+600,000y+300,000z+10,000w <= 1,000,000

1. Building a new library with a study room (cost: $850,000~ $950,000), Bursary (cost: $50,000)

950,000x+50,000y <= 1,000,000

References:

<https://www.jamesgmartin.center/2019/12/did-you-know-average-salaries-for-professors-by-rank/?gclid=Cj0KCQjwo-aCBhC-ARIsAAkNQivmCyhTbhMISZlswIbQNRwGRISP7rlF3XiFk6YEYPMZdLahrn30dW8aAmZwEALw_wcB>

<https://www.ziprecruiter.com/Salaries/High-School-Security-Salary--in-Massachusetts>

1. Give an example of an infeasible solution.
2. Without a careful risk assessment, making lost in investing mutual fund.
3. Building the new building without setting a budget on the material and quality. (caused over cost)