VIA507E Business Analytics
Mini Exam 2
Due Date 23/11/2021 23:59

1- To graduate from Basketweavers University with a major in operations research, a student must complete at least two math courses, at least two OR courses, and at least two computer courses. Some courses can be used to fulfill more than one requirement: Calculus can fulfill the math requirement; operations research, math and OR requirements; data structures, computer and math requirements; business statistics, math and OR requirements; computer simulation, OR and computer requirements; introduction to computer programming, computer requirement; and forecasting, OR and math requirements. Some courses are prerequisites for others: Calculus is a prerequisite for business statistics; introduction to computer programming is a prerequisite for computer simulation and for data structures; and business statistics is a prerequisite for forecasting. Formulate an IP that minimizes the number of courses needed to satisfy the major requirements demands.Clearly define decision variables, objective function and constraints. Solve the problem using PULP and report the code and output.

2- Glueco produces three types of glue on two different production lines. Each line can be utilized by up to seven workers at a time. Workers are paid $500 per week on production line 1, and $900 per week on production line 2. A week of production costs $1,000 to set up production line 1 and $2,000 to set up production line 2. During a week on a production line, each worker produces the number of units of glue shown in the following Table.

	Glue		
Production Line	1	2	3
1	20	30	40
2	50	35	45

Each week, at least 120 units of glue 1, at least 150 units of glue 2, and at least 200 units of glue 3 must be produced. Formulate an IP to minimize the total cost of meeting weekly demands. Clearly define decision variables, objective function and constraints. Solve the problem using PULP and report your code and output.

3- A monopolist can purchase up to 17.25 oz of a chemical for $10/oz. At a cost of $3/oz, the chemical can be processed into an ounce of product 1; or, at a cost of $5/oz, the chemical can be processed into an ounce of product 2. If x1 oz of product 1 are produced, it sells for a price of $30-x1 per ounce. If x2 oz of product 2 are produced, it sells for a price of $50-2x2 per ounce. Determine how the monopolist can maximize profits. (Hint: Be aware that you need to transform the problem into a minimization problem and flip the direction of $\leq$ constraints by multiplying with -1 to solve the problem in scipy)

4- During the summer, Olympic swimmer Adam Johnson swims every day. On sunny summer days, he goes to an outdoor pool, where he may swim for no charge. On rainy days, he must go to a domed pool. At the beginning of the summer, he has the option of purchasing a $15 season pass to the domed pool, which allows him use for the entire summer. If he doesn't buy the season pass, he must pay $1 each time he goes there. Past meteorological records indicate that there is a 60% chance that the summer will

be sunny (in which case there is an average of 6 rainy days during the summer) and a 40% chance the summer will be rainy (an average of 30 rainy days during the summer). Before the summer begins, Adam has the option of purchasing a long-range weather forecast for $1. The forecast predicts a sunny summer 80% of the time and a rainy summer 20% of the time. If the forecast predicts a sunny summer, there is a 70% chance that the summer will actually be sunny. If the forecast predicts a rainy summer, there is an 80% chance that the summer will actually be rainy. Assuming that Adam's goal is to minimize his total expected cost for the summer, what should he do? Also find EVSI and EVPI.