

Homework #9

This is an individual assignment. All work that you submit for credit must be your own.

1. Twenty-eight graduate students in a case study consulting course must be assigned to work together in a team of four students on one of seven projects. Each student is assigned to a single project, and each project must be assigned four students. The students in the course have been surveyed to indicate their level of preference/interest for each of the projects with 5 indicating a strong preference for a project and 1 indicating a low preference. The student-project preference data is provided in the file `project_data.ipynb`. Construct an optimization model for this problem in a Jupyter Notebook, and use it to find an optimal solution.
2. Tri-County Utilities supplies natural gas to customers in a three county area. The company purchases natural gas from two suppliers: Southern Gas and Northwest Gas. Demand forecasts for the coming winter season are as follows: Hamilton County 400 units, Butler County 200 units, and Clermont County 300 units. Tri-County Utilities has contracted with Southern Gas to provide 500 units and with Northwest Gas to provide 400 units. The distribution cost per unit from each supplier to each county are given in the table below.

Supplier	County		
	Hamilton	Butler	Clermont
Southern Gas	10	20	15
Northwest Gas	12	15	18

- a. Construct an optimization model for this problem in a Jupyter Notebook, and use it to find an optimal solution.
- b. Recent growth in Butler County has the potential to increase demand in that county by 100 units. With which supplier should Tri-County contract to provide the additional gas to meet this increased demand?

Homework #8

This is an individual assignment. All work that you submit for credit must be your own.

1. Better Products, Inc. manufactures three products on two machines. Every product must be processed on both machines. In a typical week, 40 hours are available on each machine. The profit contribution and production time in hours per unit are given in the table below

	Product 1	Product 2	Product 3
Profit/unit	\$30	\$50	\$20
Machine 1 hours/unit	0.50	2.00	0.75
Machine 2 hours/unit	1.00	1.00	0.50

- Two operators are required to run machine 1 which means 2 hours of labor are required for each hour of production time on machine 1. However, only one operator is required to run machine 2. A maximum of 100 labor hours are available each week. Product 1 cannot account for more than 50% of the total units produced, and product 3 must account for at least 20% of the total units produced.
- a. Construct a linear optimization model for this problem and use it to find an optimal solution.
 - b. How many hours of production time are scheduled on each machine?
 - c. What is the value of an additional hour of labor?
 - d. If the labor capacity can be increased by 20 hours would you use them? If so, what would be the new optimal solution using these additional hours?
2. Frandec Company manufactures material handling equipment used in warehouses and distribution centers. One product, called a Liftmaster, is assembled from four components: a frame, a motor, two supports, and a metal strap. Frandec's production schedule calls for 5,000 Liftmasters to be made next month. Frandec purchases the motors from an outside supplier, but the frames, supports, and straps may be either manufactured by Frandec or purchased from an outside supplier. Manufacturing and purchase costs per unit are shown in the table below.

Component	Manufacturing Cost	Purchase Cost
Frame	\$38.00	\$51.00
Support	\$11.50	\$15.00
Strap	\$6.50	\$7.50

Three departments are involved in the production of these components. The time (minutes per unit) required to process each component in each department and the available capacity (in hours) for the three departments are provided in the table below.

Component	Department (mins/unit)		
	Cutting	Milling	Shaping
Frame	3.5	2.2	3.1
Support	1.3	1.7	2.6
Strap	0.8	--	1.7
Capacity (hours)	350	420	680

- Formulate this problem as a linear program and use it to find an optimal solution.
- How much would Frandec be willing to pay for an additional hour of time in each of the three departments?
- Another supplier has offered to sell frames to Frandec for \$45 each. Should Frandec purchase any frames from this supplier? Why or why not?