

INSTRUCTIONS

Work with your group members to answer the following questions.

QUESTIONS

Question 1:

A company manufactures three products: A, B, and C. The company currently has an order for three units of Product A, seven units of Product B, and four units of Product C. There is no inventory for any of these products. All three products require special processing that can be done on one of two machines. The cost of producing each product on each machine is summarized in the following table:

Machine	A	B	C
1	\$13	\$9	\$10
2	\$11	\$12	\$8

The time required to produce each product on each machine is summarized in the following table:

Machine	A	B	C
1	0.4	1.1	0.9
2	0.5	1.2	1.3

Assume Machine 1 can be used for eight hours, and Machine 2 can be used for six hours. Each machine must undergo a special setup operation to prepare it to produce each product. After completing this setup for a product, any number of that product type can be produced. The setup costs for producing each product on each machine are summarized in the following table:

Machine	A	B	C
1	\$55	\$93	\$60
2	\$65	\$58	\$75

- Formulate an ILP model to determine how many units of each product to produce on each machine in order to meet demand at a minimum cost.
- Implement your ILP model using Gurobi and solve it.

C. What is the optimal solution?

Question 2:

Clampett Oil purchases crude oil products from suppliers in Texas (TX), Oklahoma (OK), Pennsylvania (PA), and Alabama (AL), from which it refines four end-products: gasoline, kerosene, heating oil, and asphalt. Because of differences in the quality and chemical characteristics of the oil from the different suppliers, the amount of each end-product that can be refined from a barrel of crude oil varies depending on the source of the crude. Additionally, the amount of crude available from each source varies, as does the cost of a barrel of crude from each supplier. These values are summarized in the following table. For example, the first line of this table indicates that barrel of crude oil from Texas can be refined into two barrels of gasoline, 2.8 barrels of kerosene, 1.7 barrels of heating oil, or 2.4 barrels of asphalt. Each supplier requires a minimum purchase of at least 500 barrels.

Crude Oils	Barrels Available	Gas	Kerosene	Heating Oil	Asphalt	Cost per Barrel	Trucking Cost
TX	1,500	2.00	2.80	1.70	2.40	\$22	\$1,500
OK	2,000	1.80	2.30	1.75	1.90	\$21	\$1,700
PA	1,500	2.30	2.20	1.60	2.60	\$22	\$1,500
AL	1,800	2.10	2.60	1.90	2.40	\$23	\$1,400

The company owns a tanker truck that picks up whatever crude oil it purchases. This truck can hold 2,000 barrels of crude. The cost of sending the truck to pick up oil from the various locations is shown in the column labeled “Trucking Cost.” The company’s plans for its next production cycle specify 750 barrels of gasoline, 800 barrels of kerosene, 1,000 barrels of heating oil, and 300 barrels of asphalt to be produced.

- Formulate an ILP model that can be solved to determine the purchasing plan that will allow the company to implement its production plan at the least cost.
- Implement your ILP model using Gurobi and solve it.
- What is the optimal solution?

Question 3:

The Mega-Bucks Corporation is planning its production schedule for the next four weeks and its forecasting the following demand for compound X – a key raw material used in its production process:

Week	1	2	3	4
Demand	400 lbs.	150 lbs.	200 lbs.	350 lbs.

The company currently has no compound X on hand. The supplier of this product delivers only in batch sizes that are multiples of 100 pounds (0,100, 200, 300, etc.). The price of this material is \$125 per 100 pounds.

Deliveries can be arranged weekly, but there is a delivery charge of \$50. Mega-Bucks estimates that it costs \$15 for each 100 pounds of compound X held in inventory from one week to the next. Assuming Mega-Bucks does not want more than 50 pounds of compound X in inventory at the end of Week 4, how much should it order each week so that the demand for this product will be met in the least costly manner?

- A. Formulate an ILP model for this problem.
- B. Implement your ILP model using Gurobi and solve it.
- C. What is the optimal solution?