Santa Clara University

M6: Application Assignment

INSTRUCTIONS

Work with your group members to answer the following questions.

QUESTIONS

Question 1:

Bowden Transport provides dispatching services for independent truckers who specialize in transporting cars purchased online from the seller to the buyer. At present, there are four cars needing to be picked up and delivered and five trucks in the vicinity of these cars. The following table summarizes the marginal cost of each truck picking up and delivering each of the cars along with the current number of available cars carrying spots available on each truck.

Marginal Cost to Pick Up and Deliver					
	Car 1	**Car 2**	**Car 3**	**Car 4**	**Capacity**
Truck 1	$276	$497	$251	$364	2 cars
Truck 2	$179	$375	$298	$190	1 car
Truck 3	$150	$475	$344	$492	1 car
Truck 4	$97	$163	$285	$185	1 car
Truck 5	$305	$150	$225	$165	2 cars

Bowden charges the car buyer a flat fee of $600 to pick up and deliver each car and keeps 50% of the profit earned.

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

Question 2:

The teenage daughter of a recently deceased movie star inherited a number of items from her famous father's estate. Rather than convert these assets to cash immediately, her financial advisor has recommended that she let some of these assets appreciate in value before disposing of them. An appraiser has given the following estimates of the assets' worth (in $1,000s) for each of the next five years.

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**

Car	$35	$37	$39	$42	$45
Piano	$16	$17	$18	$19	$20
Necklace	$125	$130	$136	$139	$144
Desk	$25	$27	$29	$30	$33
Golf Clubs	$40	$43	$46	$50	$52
Humidor	$5	$7	$8	$10	$11

Knowing this teenager's propensity to spend money, her financial advisor would like to develop a plan to dispose of these assets that will maximize the amount of money received and ensure that at least $30,000 of new funds become available each year to pay her college tuition.

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

Question 3:

The emergency services coordinator for Dade County, Tallys DeCampinas, is interested in locating the county's two ambulances to maximize the number of residents that can be reached within four minutes in emergency situations. The county is divided into six regions, and the average times required to travel from one region to the next are summarized in the following table:

	To Region					
From Region	**1**	**2**	**3**	**4**	**5**	**6**
1	0	4	3	6	6	5
2	4	0	7	5	5	6
3	3	7	0	4	3	5
4	6	5	4	0	7	5
5	6	5	3	7	0	2

6	5	6	5	5	2	0

The population (in 1,000s) in regions 1 through 6 are estimated, relatively, as 21, 35, 15, 60, 20, and 37. In which two regions should the ambulances be placed?

A. Formulate an ILP model for this problem.
B. Implement your ILP model using Gurobi and solve it.
C. What is the optimal solution?
D. How many ambulances would be required to provide coverage within four minutes to all residents?
E. Suppose the county wants to locate three ambulances in such a way to provide coverage to all residents within four minutes and maximize the redundancy in the system. (Assume redundancy means being able to provide service by one or more ambulances within four minutes.) Where should the ambulances be located?