SOMAIYA VIDYAVIHAR UNIVERSITY

Semester: Jan – Mar 24 **Maximum Marks: 50 Examination: ETE Exam Date: 04-04-24 Duration: 3 Hrs**		
Programme code: 01 **Programme: Master of Business Administration**	**Class:** FY	**Trimester: III**
College: K. J. Somaiya Institute of Management	**Name of the department/Section/Center:** Business Analytics	
Course Code: 217P01C312	**Name of the Course: Decision Science**	

Instructions:

1. **You have to attempt 5 questions in all. Question 1 is compulsory. Do any 4 questions Question 2 to Question 6. All questions carry equal marks.**
2. **You will be assessed for your abilities to formulate the O.R. problem, model it in excel, solve it with Solver, and interpret the results.**
3. **Make suitable assumptions if required and state them.**
4. **Write all relevant answers and interpretations in your excel sheet with sufficient details to enable a fast evaluation of your answers.**
5. **Use Excel and Solver as required and keep saving the file every ten minutes or so.**
6. **Make only 1 Excel file with different worksheets pertaining to each question.**
7. **Name the files as instructed by the IT staff invigilator.**

Question No.		Max. Marks
Q1	Bhavika Investments, a group of financial advisors and retirement planners, has been requested to provide advice on how to invest $200,000 for one of its clients. The client has stipulated that the money must be put into either a stock fund (S) or a money market fund (M) and the annual return should be at least $14,000. Other conditions related to risk have also been specified, and the following linear program was developed to help with this investment decision. $\text{Minimize risk} = 12S + 5M$ subject to $S + M = 200{,}000$ total investment is $200,000 $0.10S + 0.05M \geq 14{,}000$ return must be at least $14,000 $M \geq 40{,}000$ at least 40,000 must be in money market fund $S, M \geq 0$ where S = dollars invested in stock fund M = dollars invested in money market fund a. Solve the model in Excel Solver and provide the solution. Use relevant output to answer the following questions: b. What is the optimal allocation of funds and what is the total return? c. Would the solution change if the risk measure for each dollar in the stock fund were 14 instead of 12? d. For each additional dollar that is available, how much does the risk change? e. Interpret the binding and non-binding constraints.	**10**
Q2	The Whole Food Nutrition Center uses three bulk grains to blend a natural cereal that it sells by the pound. The cost of each bulk grain and the protein, riboflavin, phosphorus, and magnesium units per pound (lbs) of each are shown in the table below.	**10**

GRAIN	COST PER POUND (CENTS)	PROTEIN (UNITS/LB)	RIBOFLAVIN (UNITS/LB)	PHOSPHORUS (UNITS/LB)	MAGNESIUM (UNITS/LB)
A	33	22	16	8	5
B	47	28	14	7	0
C	38	21	25	9	6

On the packaging for each of its products, Whole Food indicates the nutritional content in each bowl of cereal when eaten with 0.5 cup of milk. The

USRDA (U.S. Recommended Dietary Allowance) and the more recent DRI (Dietary Reference Intake) were consulted to establish recommended amounts of certain vitamins and minerals for an average adult. Based on these figures and the desired amounts for labeling on the package, Whole Food has determined that each 2-ounce serving of the cereal should contain atleast 3 units of protein, 2 units of riboflavin, 1 unit of phosphorus, and 0.425 unit of magnesium.

The Nutrition center wishes to identify the pounds of each grain type required in a 2-ounce serving of a cereal such that the total cost is minimized. (1 ounce = 0.0625 lbs)

Formulate the above problem as a linear programing problem and obtain the optimal solution using Solver.

Q3 **10**

A. Farm Grown, Inc., produces cases of perishable food products. Each case contains an assortment of vegetables and other farm products. Each case costs $5 and sells for $15. If there are any cases not sold by the end of the day, they are sold to a large food processing company for $3 a case. The daily demand is uncertain but and can be either 100 cases, 200 cases or 300 cases. Farm Grown has a policy of always satisfying customer demands. If its own supply of cases is less than the demand, it buys the necessary vegetables from a competitor. The estimated cost of doing this is $16 per case. The payoff for this decision problem is given below:

Alternatives : Farm grown's Supply (Cases)	**Demand(Cases)**		
	100	**200**	**300**
100	1000	900	800
200	800	2000	1900
300	600	1800	3000

Identify the optimal decision that Farm Grown should take using

i. An optimistic approach (Maximax)

ii. A Pessimistic (Maximin) approach.

iii. The LaPlace rule

B. Two banks (Franklin and Lincoln) compete for customers in the growing city of Logantown. Both banks are considering opening a branch office in one of three new neighborhoods: Hillsboro, Fremont, or Oakdale. The strategies, assumed to be the same for both banks, are:

Strategy 1: Open a branch office in the Hillsboro neighborhood.

Strategy 2: Open a branch office in the Fremont neighborhood.

Strategy 3: Open a branch office in the Oakdale neighborhood.

Values in the payoff table below indicate the gain (or loss) of customers (in thousands) for Franklin Bank based on the strategies selected by the two banks.

		Lincoln Bank		
		Hillsboro	Fremont	Oakdale
Franklin Bank		b_1	b_2	b_3
Hillsboro	a_1	4	2	3
Fremont	a_2	6	–2	–3
Oakdale	a_3	–1	0	5

Identify the neighborhood in which each bank should locate a new branch office. What is the value of the game?

Q4 **10**

At a B-school, historical data suggest that between 5 to 25 students, out of a total of 600, opt out of placements at the start of the placement season. This number of students opting out of placements is uniformly distributed. The number of students offered pre-placement offers (PPO) follows a normal distribution with a mean value of 47 and a standard deviation of 3.9. The remaining students need placement support from the placement department. Run a simulation with 50 trials to determine the average number of students

a. Receiving a pre-placement offer

b. Dropping out of placement process right at the beginning

c. Who require placement support from the placement department.

Q5 **10**

Appliance Centre sells a variety of electronic equipment and home appliances. For the last four years, the following quarterly sales (in $ millions) were reported.

	Quarter			
Year	**I**	**II**	**III**	**IV**
2007	5.3	4.1	6.8	6.7
2008	4.8	3.8	5.6	6.8

2009	4.3	3.8	5.7	6
2010	5.6	4.6	6.4	5.9

a. Determine a typical seasonal index for each of the four quarters.

b. When does the company experience the largest seasonal effect? Does this result appear to be reasonable? Explain.

Q6 **10**

Premier Consulting's two consultants, Avery and Baker, can be scheduled to work for clients up to a maximum of 160 hours each over the next four weeks. A third consultant, Campbell, has some administrative assignments already planned and is available for clients up to a maximum of 140 hours over the next four weeks. The company has four clients with projects in process. The estimated hourly requirements for each of the clients over the four-week period are:

Client	**Hours**
A	180
B	75
C	100
D	85

Hourly rates vary for the consultant–client combination and are based on several factors, including project type and the consultant's experience. The rates (dollars per hour) for each consultant–client combination are as follows:

	Client			
Consultant	**A**	**B**	**C**	**D**
Avery	100	125	115	100
Baker	120	135	115	120
Campbell	155	150	140	130

Solve the above problem as a transportation problem where the supply availability is the number of hours a consultant is available and the demand requirements are the hourly requirements each of the clients.

a. What is the number of hours that the consultants should be scheduled to the clients so as to maximize the consulting firm's billings.

b. Is there any client whose hourly requirements are not satisfied?