SOMAIYA VIDYAVIHAR UNIVERSITY

Semester: Jan – Mar 24 **Maximum Marks: 50 Examination: ETE Exam Date: 30-03-24 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	Adirondack Savings Bank (ASB) has $1 million in new funds that must be allocated to home loans, personal loans, and automobile loans. The annual rates of return for the three types of loans are 7% for home loans, 12% for personal loans, and 9% for automobile loans. The bank's planning committee has decided that at least 40% of the new funds must be allocated to home loans. In addition, the planning committee has specified that the amount allocated to personal loans cannot exceed 60% of the amount allocated to automobile loans. The formulation for the problem is given below. Let H = amount allocated to home loans P = amount allocated to personal loans A = amount allocated to automobile loans Max $0.07H + 0.12P + 0.09A$ s.t. $H + P + A = 1{,}000{,}000$ Amount of New Funds $0.6H - 0.4P - 0.4A \geq 0$ Minimum Home Loans $P - 0.6A \leq 0$ Personal Loan Requirement a. Solve the above LPP and obtain the Answer and Sensitivity Report to answer the following questions b. How much should be allocated to each type of loan? What is the total annual return? What is the annual percentage return? c. If the interest rate on home loans increased to 9%, would the amount allocated to each type of loan change? Explain. d. Simultaneous to the above, personal loans drop by 2%, how would this impact the optimal solution? e. Suppose the total amount of new funds available was increased by $10,000. What effect would this have on the total annual return? Explain.	**10**
Q2	The Silver Star Bicycle Company will be manufacturing both men's and women's models for its Easy-Pedal 10-speed bicycles during the next two months. Management wants to develop a production schedule indicating how many bicycles of each model should be produced in each month. Current demand forecasts call for 150 men's and 125 women's models to be shipped during the first month and 200 men's and 150 women's models to be shipped during the second month. Additional data are shown:	**10**

Model	Production Costs	Labour Requirements (hours)		Current Inventory
		Manufacturing	Assembly	
Men's	$120	2	1.5	20
Women's	$90	1.6	1	30

Last month the company used a total of 1000 hours of labor. The company's labor relations policy will not allow the combined total hours of labor (manufacturing plus assembly) to increase or decrease by more than 100 hours from month to month. In addition, the company charges monthly inventory at the rate of 2% of the production cost based on the inventory levels at the end of the month. The company would like to have at least 25

units of each model in inventory at the end of the two months.

a. Formulate an LP model that will minimize production and inventory costs and satisfy the labor-smoothing, demand, and inventory requirements.

b. Solve the model using Solver and obtain the optimal solution and production schedule.

Q3 **10**

A. Shruti Ltd. has developed a sales forecasting function for its products and the products of its competitors, Purnima Ltd. There are four strategies S1, S2, S3 and S4 available to Shruti Ltd. and three strategies P1, P2 and P3 to Purnima Ltd. The pay-offs corresponding to all the twelve combinations of the strategies are given below. The table gives the data on the quarterly sales of the companies. Considering this zero-sum game, state what would be the optimal strategy for Shruti Ltd. and Purnima Ltd.? What would be the value of the game?

		Purnima Ltd.'s Strategy		
		P_1	P_2	P_3
Shruti's Strategy	S_1	30,000	−21,000	1,000
	S_2	18,000	14,000	12,000
	S_3	−6,000	28,000	4,000
	S_4	18,000	6,000	2,000

B. Brenda Kelley runs a specialty ski clothing shop outside of Boone, North Carolina. She must place her order for ski parkas well in advance of ski season because the manufacturer produces them in the summer months. Brenda needs to determine whether to place a large, medium, or small order for parkas. The number sold will depend largely on whether the area receives a heavy, normal, or light amount of snow during the ski season. The following table summarizes the payoffs Brenda expects to receive under each scenario

	Amount of Snow		
Size of Order	**Heavy**	**Normal**	**Light**
Large	10	7	3
Medium	8	8	6
Small	4	4	4

Payoffs (in $1000s)

What decision should be made according to the following rules:

i. Maximax decision rule?

ii. Maximin decision rule?

iii. Minimax regret decision rule?

Q4 **10**

The weight of new-born infants in a hospital is normally distributed with a mean weight of 2.8 kg. and a standard deviation of 0.7 kg. If the weight of a new-born infant is less than 1.8 kg., it requires hospitalization in a special pediatric care unit. From past data, it is known that the duration of such hospitalization follows a uniform distribution between 3 days and 21 days, with each day of hospitalization incurring a cost of ₹10000. Simulate the need for such pediatric hospitalization for 30 new-born infants, and determine the number of new-born infants requiring such hospitalization, and the total hospitalization costs incurred.

Q5 **10**

Consider the time series with nine periods of data:

Period	1	2	3	4	5	6	7	8	9
Data	34	38	46	41	43	48	51	50	56

a. Use exponential smoothing to forecast the value for period 10, use the smoothing constant = 0.6.

b. Compare the above results with a 4 year moving average model. Which forecast gives a more accurate value for period 10?

c. Plot the results and interpret.

Q6 **10**

A. Arnoff Enterprises manufactures the central processing unit (CPU) for a line of personal computers. The CPUs are manufactured in Seattle, Columbus, and New York and shipped to warehouses in Pittsburgh, Mobile, Denver, Los Angeles, and Washington, D.C., for further distribution. The following table shows the number of CPUs available at each plant, the number of CPUs required by each warehouse, and the shipping costs (dollars per unit):

	Warehouses					
Plants	**Pittsburgh**	**Mobile**	**Denver**	**Los Angeles**	**Washington**	**CPUs Available**
Seattle	10	20	5	9	10	9000

Columbus	2	10	8	30	6	4000
New York	1	20	7	10	4	8000
CPUs Required	3000	5000	4000	6000	3000	21000

Determine the amount that should be shipped from each plant to each warehouse to minimize the total shipping cost.

B. Scott and Associates, Inc., is an accounting firm that has three new clients. Project leaders will be assigned to the three clients. Based on the different backgrounds and experiences of the leaders, the various leader–client assignments differ in terms of projected completion times. The possible assignments and the estimated completion times in days are given below. Solve to obtain the optimal assignment that minimizes the total completion time.

	Client		
Project Leader	**1**	**2**	**3**
Jackson	10	16	32
Ellis	14	22	40
Smith	22	24	34