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	The Electrotech Corporation manufactures two industrial-sized electrical devices: generators and alternators. Both of these products require wiring and testing during the assembly process. Each generator requires 2 hours of wiring and 1 hour of testing and can be sold for a $250 profit. Each alternator requires 3 hours of wiring and 2 hours of testing and can be sold for a $150 profit. There are 260 hours of wiring time and 140 hours of testing time available in the next production period and Electrotech wants to maximize profit. The LPP for the same is given below: Let X1 = number of generators, X2 = number of alternators MAX 250 X1 + 150 X2 ST 2 X1 + 3 X2 <= 260 Wiring Time 1 X1 + 2 X2 <= 140 Testing Time Use Solver to generate the answer and sensitivity report for the above formulation and answer the following: a. What is the company's total profit if it has 10 additional hours of wiring capacity? b. By how much does the profit on alternators need to increase before their production is justified? c. Does the optimal solution change if the marginal profit on generators decreases by $50 and the marginal profit on alternators increases by $75?	**10**
Q2	Romans Food Market, located in Saratoga, New York, carries a variety of specialty foods from around the world. Two of the store's leading products use the Romans Food Market name: Romans Regular Coffee and Romans DeCaf Coffee. These coffees are blends of Brazilian Natural and Colombian Mild coffee beans, which are purchased from a distributor located in New York City. Because Romans purchases large quantities, the coffee beans may be purchased on an as-needed basis for a price 10% higher than the market price the distributor pays for the beans. The current market price is $0.47 per pound for Brazilian Natural and $0.62 per pound for Colombian Mild. The compositions of each coffee blend are as follows: **Blend** **Bean** | Regular | DeCaf Brazilian Natural | 75% | 40% Colombian Mild | 25% | 60% Romans sells the Regular blend for $3.60 per pound and the DeCaf blend for $4.40 per pound. Romans would like to place an order for the Brazilian and Colombian coffee beans that will enable the production of 1000 pounds of Romans Regular coffee and 500 pounds of Romans	**10**

DeCaf coffee. The production cost is $0.80 per pound for the Regular blend. Because of the extra steps required to produce DeCaf, the production cost for the DeCaf blend is $1.05 per pound. Packaging costs for both products are $0.25 per pound.

a. Formulate a linear programming model that can be used to determine the pounds of Brazilian Natural and Colombian Mild that will maximize the total contribution to profit of Regular and DeCaf Coffee.

b. Solve the model in Excel Solver. What is the optimal solution and what is the contribution to profit?

Q3

A. Hudson Corporation is considering three options for managing its data processing opera tion: continuing with its own staff, hiring an outside vendor to do the managing (referred to as outsourcing), or using a combination of its own staff and an outside vendor. The cost of the operation depends on future demand. The annual cost of each option (in thousands of dollars) depends on demand as follows:

	Demand		
Staffing Options	**High**	**Medium**	**Low**
Own staff	650	650	600
Outside vendor	900	600	300
Combination	800	650	500

Identify the decision alternative that will minimize the cost using the Optimistic approach (maximax approach), LaPlace Principle and Minmax Regret approach

B. Suppose that there are only two vehicle dealerships (A and B) in a small city. Each dealership is considering three strategies that are designed to take sales of new vehicles from the other dealership over a period of four months. The strategies, assumed to be the same for both dealerships, are:

Strategy 1: Offer a cash rebate on a new vehicle.

Strategy 2: Offer free optional equipment on a new vehicle.

Strategy 3: Offer a 0% loan on a new vehicle.

The payoff table (in number of new vehicle sales gained per week by Dealership A (or lost by Dealership B) is shown below. Solve to identify the optimal strategy for both the players and the gain in vehicle sales for Dealership A.

		Dealership B		
		Cash Rebate	Free Options	0% Loan
Dealership A		*b*1	*b*2	*b*3
Cash Rebate	*a*1	2	2	1
Free Options	*a*2	−3	3	−1
0% Loan	*a*3	3	−2	0

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Q4

ChemCrop imports a chemical X and processes it to produce its main product Y-pro. Chemical X prices vary on a daily basis following a uniform distribution between $800 and $1000 per ton. ChemCorp is also exposed to USD-INR exchange rate variations since payments for procuring chemical X are to be done in USD. On a monthly basis, the USD-INR exchange rate can be assumed to be uniformly distributed between 80 and 82. The cost for processing chemical X is ₹2000 per ton. If the selling price of Y-pro is fixed at ₹75000 per ton, determine the probability of loss by simulating the profit per ton for 100 trials. (Assume 1 ton of Y-pro is produced for every ton of chemical X processed).

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Q5

The amount of movie tickets sold at the Library Cinema-Complex between 1998 and 2010 are listed here, in thousands.

Year	**Number of tickets sold**
1988	8.61
1999	8.14
2000	7.67
2001	6.59
2002	7.37
2003	6.88
2004	6.71
2005	6.61
2006	5.58
2007	5.87
2008	5.94

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	2009 | 5.49 2010 | 5.43 a. Plot the data on a time series graph and interpret the pattern b. Create a five-year weighted moving average using the following weights: 0.18, 0.16, 0.22, 0.25, and 0.19. c. Also compute a five-year moving average and compare the accuracy of the two methods. d. Forecast the sales for year 2011 using the better forecasting method of the two obtained above.	
Q6	Tropicsun is a leading grower and distributor of fresh citrus products with three large citrus groves scattered around central Florida in the cities of Mt. Dora, Eustis, and Clermont. Tropicsun currently has 275,000 bushels of citrus at the grove in Mt. Dora, 400,000 bushels at the grove in Eustis, and 300,000 bushels at the grove in Clermont. Tropicsun has citrus processing plants in Ocala, Orlando, and Leesburg with processing capacities to handle 200,000, 600,000, and 225,000 bushels, respectively. Tropicsun contracts with a local trucking company to transport its fruit from the groves to the processing plants. The trucking company charges a flat rate for every mile that each bushel of fruit must be transported. Each mile a bushel of fruit travels is known as a bushel-mile. The following table summarizes the distances (in miles) between the groves and processing plants: **Distances (in miles) Between Groves and Plants** **Grove** | **Ocala** | **Orlando** | **Leesburg** Mt. Dora | 21 | 50 | 40 Eustis | 35 | — | 22 Clermont | 55 | 20 | 25 Further, the route from Eustis to Orlando is blocked because of construction. a. Considering the transporting constraints, solve to determine how many bushels to ship from each grove to each processing plant to minimize the total number of bushel-miles the fruit must be shipped. b. Identify the plant that does not receive its full capacity and by how much is it deficit.	**10**