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	A furniture manufacturer produces two types of tables (country and contemporary) using three types of machines (a router, a sander, and a polisher). The minutes required to produce the tables on each machine is a limited resource. Country tables sell for $350 and contemporary tables sell for $450. The company wants to determine the number of each type of table to be produced such that the revenue is maximized. The above problem is formulated as the following linear programing problem with additional constraints that at least 20% of the tables made should be country and at least 30% should be contemporary: **Decision Variables:** X1 = Number of country tables to produce ; X2 = Number of contemporary tables to produce $\text{MAX} \quad 350\,X_1 + 450\,X_2$ $\text{ST} \quad 1.5\,X_1 + 2\,X_2 \le 1{,}000$ Router Time Available $3\,X_1 + 4.5\,X_2 \le 2{,}000$ Sander Time Available $2.5\,X_1 + 1.5\,X_2 \le 1{,}500$ Polisher Time Available $0.8\,X_1 - 0.2\,X_2 \ge 0$ Units of Country Produced $-0.3\,X_1 + 0.7\,X_2 \ge 0$ Units of Contemporary Produced $X_i \ge 0$ a. Solve the above problem using Solver. What is the maximum revenue? b. Which resources have been utilized to the fullest? c. If the company could get 50 more units of sanding capacity, should they do it? If so, how much should they be willing to pay for it? d. Contemporary tables sell for $450. By how much would the selling price have to decrease before we would no longer be willing to produce contemporary tables? Does this make sense? Explain. e. "The optimal revenue generated is more sensitive to the selling price of Contemporary tables than the selling price of Country tables." Do you agree with the above statement? Explain	**10**
Q2	Tuckered Outfitters plans to market a custom brand of packaged trail mix. The ingredients for the trail mix will include Raisins, Grain, Chocolate Chips, Peanuts, and Almonds costing, respectively, $2.50, $1.50, $2.00, $3.50, and $3.00 per pound. The vitamin, mineral, and protein content of each of the ingredients (in grams per pound) is summarized in the following table along with the calories per pound of ingredient:	**10**

	Raisins	Grain	Chocolate	Peanuts	Almonds
Vitamins	20	10	10	30	20
Minerals	7	4	5	9	3
Protein	4	2	1	10	1
Calories	450	160	500	300	500

The company would like to identify the least costly mix of these ingredients that provides at least 40 grams of vitamins, 15 grams of minerals, 10 grams of protein, and 600 calories per 2 pound package. Additionally, they want each ingredient to account for at least 5% and no more than 50% of the weight of the package.

a. Formulate an LP model for this problem.
b. Solve the model using Solver
c. What is the optimal mix and how much is the total ingredient cost per package?

Q3 **10**

A. Morley Properties is planning to build a condominium development on St. Simons Island, Georgia. The company is trying to decide between building a small, medium, or large development. The payoffs received for each size of development will depend on the market demand for condominiums in the area, which could be low, medium, or high. The payoff matrix for this decision problem is:

	Market Demand		
Size of Development	**Low**	**Medium**	**High**
Small	400	400	400
Medium	200	500	500
Large	−400	300	800

(Payoffs in $1,000s)

a. What decision should be made according to the Maximax and Maximin Rule?
b. If the coefficient of optimism (α) is 0.45, what decision should be made according to the Hurwicz criterion?

B. Two packaged food manufacturers 'McFood' and 'BigBite' are competing for increasing their market shares. The pay-off matrix shown in the following table, describes the increase in market share for 'McFood' and decrease in market share for 'BigBite'. Determine the optimal strategy mix for both the firms and the value of the game.

McFood	**BigBite**	
	Give Coupons	**Decrease Price**
Decrease Price	6	1
Maintain Present Strategy	-3	2

Q4 **10**

An FMCG company is planning a digital marketing campaign during IPL for its latest personal care product. The campaign will run ads only on the OTT platform streaming the IPL matches. The average cost of advertising during an IPL match is normally distributed with a mean value of ₹15 lakh and a standard deviation of ₹1 lakh. The average sales from advertising during an IPL match is estimated to range from 7500 to 9000 units following uniform distribution with revenue from each sale amounting to ₹350. Simulate the avg. advertising cost & avg. revenue for 70 IPL league matches and determine the

a. Probability of spending more than ₹17 lakh on advertising of the product
b. Probability of earning more than ₹30 lakh from the sales generated of the product
c. Return on advertising spend (ROAS). (ROAS = total revenue / total advertising spend).

Q5 **10**

Listed below is the number of rooms rented at Plantation Resorts of Georgia for the years from 1999 to 2009.

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Rental	6,714	7,991	9,075	9,775	9,762	10,180	8,334	8,272	6,162	6,897	8,285

a. Plot the above data on a timeline and interpret the pattern observed.
b. Develop the trend equation for the given data and forecast the sales for 2010 and 2011 using the trendline equation.
c. Compare the forecasts with the forecasts of a 3 year weighted moving average model. Which method is more accurate?

Q6 **10**

Five employees are available to perform four jobs. Each employee can do only one job. However, since each job requires specific skills, some employees may not be able to perform specific jobs (as indicated by --). The time it takes each person to perform each job is given in the table below.

Employee	***Time (Hours)***			
	Job 1	**Job 2**	**Job 3**	**Job 4**
1	22	18	30	18
2	18	--	27	22

3	26	20	28	28
4	16	22	--	14
5	21	--	25	28

a. Determine the assignment of employees to jobs that minimizes the total time required to perform the four jobs.

b. If Employee 2 is unavailable to perform any job, how does your optimal allocation change?