

Semester: Jan – Mar 24		
Maximum Marks: 50	Examination: ETE Exam	Date: 05-04-24
Duration: 3 Hrs		
Programme code: 01	Class: FY	Trimester: III
Programme: Master of Business Administration		
College: K. J. Somaiya Institute of Management	Name of the department/Section/Center: Business Analytics	
Course Code: 217P01C312	Name of the Course: Decision Science	
<b>Instructions:</b> <b>1.</b> 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. <b>2.</b> 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. <b>3.</b> Make suitable assumptions if required and state them. <b>4.</b> Write all relevant answers and interpretations in your excel sheet with sufficient details to enable a fast evaluation of your answers. <b>5.</b> Use Excel and Solver as required and keep <u>saving the file every ten minutes</u> or so. <b>6.</b> Make only 1 Excel file with different worksheets pertaining to each question. <b>7.</b> Name the files as instructed by the IT staff invigilator.		

Question No.		Max. Marks
1	<p>Davison Electronics manufactures two LCD television monitors, identified as model A and model B. Davison’s objective is to determine the minimum cost production plan. The decision variables, constraints and the mathematical model for the same is given below.</p> <p>AN: Units of model A produced on the new production line            AO: Units of model A produced on the old production line            BN: Units of model B produced on the new production line            BO: Units of model B produced on the old production line</p> <p>Constraint 1: Minimum production for model A            Constraint 2: Minimum production for model B            Constraint 3: Capacity of the new production line            Constraint 4: Capacity of the old production line</p> <p>Min <math>30AN + 50AO + 25BN + 40BO</math>            s.t.</p> $\begin{array}{rcl} AN & + & AO & & & \geq & 50,000 \\ & & & BN & + & BO & \geq & 70,000 \\ AN & & & + & BN & & \leq & 80,000 \\ & & AO & & + & BO & \leq & 60,000 \end{array}$ <p>Solve the above using Solver and answer the questions that follow:</p> <ol style="list-style-type: none"> <li>What is the optimal solution and the total production cost for Davison Electronics?</li> <li>The production manager noted that the only constraint with a negative shadow price is the constraint on the capacity of the new production line. The manager’s interpretation of this value was that a one-unit increase in the right-hand side of this constraint would actually increase the total production cost by \$15 per unit. Do you agree with this interpretation? Would an increase in capacity for the new production line be desirable? Explain.</li> <li>The production cost for model A on the old production line is \$50 per unit. How much would this cost have to change to make it worthwhile to produce model A on the old production line? Explain.</li> <li>Suppose that the minimum production requirement for model B is reduced from 70,000 units to 60,000 units. What effect would this change have on the total production cost? Explain.</li> </ol>	10
2	<p><b>A.</b> Monica Britt has enjoyed sailing small boats since she was 7 years old, when her mother started sailing with her. Today, Monica is considering the possibility of starting a company to produce small sailboats for the recreational market. Unlike other mass-produced sailboats, however, these boats will be made specifically for children between the ages of 10 and 15. The boats will be of the highest quality and extremely stable, and the sail size will be reduced to prevent problems of capsizing. Her basic decision is whether to build a large manufacturing facility, a small manufacturing facility, or no facility at all. With a favorable market, Monica can expect to make \$90,000 from the large facility or \$60,000 from the smaller facility. If the market is unfavorable, however, Monica estimates that she would lose \$30,000 with a large facility and she would lose only \$20,000 with the small facility.</p>	10

- a. Identify the alternatives available to Monica and the chance events for the problem. Draw out the decision payoff matrix.
- b. What should be her decision if she takes the
- i. Optimistic Approach?
  - ii. Conservative Approach?
  - iii. Minimax Regret Approach?
- B.** A company is currently involved in negotiations with its union on the upcoming wage contract. With the aid of an outside mediator, the table below was constructed by the management group. The values are to be interpreted as proposed wage increases for the union and costs to the company. The mediator informs the management group that he has been in touch with the union and that they have constructed a table that is comparable to the table developed by the management. Both the company and the union must decide on an overall strategy before negotiations begin. Assist the management on this problem. What game value and strategies are available to the opposing groups?

Union Strategies	Company Strategies	
	C1	C2
U1	0.2	0.14
U2	0.08	0.15

3 International City Trust (ICT) invests in short-term trade credits, corporate bonds, gold stocks, and construction loans. To encourage a diversified portfolio, the board of directors has placed limits on the amount that can be committed to any one type of investment as shown in the table below. ICT has a maximum of \$5 million available for immediate investment and wishes to do two things: (1) maximize the return on the investments made over the next 6 months and (2) satisfy the diversification requirements as set by the board of directors. The specifics of the investment possibilities are as follows:

INVESTMENT	INTEREST RETURN	MAXIMUM INVESTMENT \$1,000,000s
Trade credits	7%	1.0
Corporate bonds	11%	2.5
Gold stocks	19%	1.5
Construction loans	15%	1.8

In addition, the board specifies that at least 55% of the funds invested must be in gold stocks and construction loans and that no less than 15% must be invested in trade credits. ICT would like to determine the amount to be invested into the 4 investments such that the return is maximized. Formulate and Solve the above problem as a Linear programming Problem.

4 Daily milk requirement at an ice-cream parlour is normally distributed with a mean value of 350 litres and a standard deviation of 48 litres. The ice-cream parlour currently procures 380 l every day at a fixed rate of ₹45 per litre. Milk procured on any day can be used in the production only on that day. If the milk requirement on any day is more than the procurement, the ice-cream parlour needs to procure extra milk from local distributors at the rate of ₹65 per litre. If the milk requirement is less, the ice-cream parlour incurs a extra cost of ₹4 per litre for overnight refrigerated storage of milk to distribute the extra milk in the local community for free on the next day. Run a simulation model for 30 days in a month & determine the probability of milk shortage and the monthly total cost of milk to the ice-cream parlour.

5 The table below gives monthly sale of apparels in a shop belonging to a famous label:

Month	1	2	3	4	5	6	7	8	9	10	11	12
Sale in Millions	16	20	19	22	19	18	22	30	34	25	26	28

a. Use exponential smoothing to forecast the value for period 13, use the smoothing constant = 0.64.

b. Compute the accuracy measure for the same and compare the results with a 3-period moving average model.

c. Plot the results and interpret.

6 The quantitative methods department head at a major mid-western university will be scheduling faculty to teach courses during the coming autumn term. Four core courses need to be covered. The four courses are at the UG, MBA, MS, and Ph.D. levels. Four professors will be assigned to the courses, with each professor receiving one of the courses. Student evaluations of professors are available from previous terms. Based on a rating scale of 4 (excellent), 3 (very good), 2 (average), 1 (fair), and 0 (poor), the average student evaluations for each professor are shown.

a. Professor D does not have a Ph.D. and cannot be assigned to teach the Ph.D. level course. If the department head makes teaching

assignments based on maximizing the student evaluation ratings over all four courses, what staffing assignments should be made?

	<i>Course</i>			
<i>Professor</i>	<b>UG</b>	<b>MBA</b>	<b>MS</b>	<b>PhD</b>
<b>A</b>	2.8	2.2	3.3	3.0
<b>B</b>	3.2	3.0	3.6	3.6
<b>C</b>	3.3	3.2	3.5	3.5
<b>D</b>	3.2	2.8	2.5	--

- b. PhD course has been outsourced to a visiting faculty and does not need to be covered by the 4 professors. How does the allocation of 4 professors change for the available 3 courses of UG, MBA and MS?