SOMAIYA VIDYAVIHAR UNIVERSITY

Semester: Jan – Mar 24 **Maximum Marks: 50** **Examination: ETE Exam** **Date: 05-04-24** **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	Zippy motorcycle manufacturing produces two popular pocket bikes (miniature motorcycles with 49cc engines): the Razor and the Zoomer. In the coming week the manufacturer wants to produce up to 700 bikes and wants to ensure the number of Razors produced does not exceed the number of Zoomer by more than 300. Each Razor produced and sold results in a profit of $70 while each Zoomer results in a profit of $40. The bikes are identical mechanically and only differ in the appearance of the polymer-based trim around the fuel tank and seat. Polymer availability and Production time are limited resources. The above problem has been formulated as a LP as given below. **Decision Variables:** R = number of Razors produced, Z = number of Zoomers produced $\text{MAX} \quad 70R + 40Z$ $\text{ST} \quad R + Z \leq 700$ Total Bike requirement $R - Z \leq 300$ Product Mix of Razors versus Zoomers $2R + 1Z \leq 900$ Pounds of Polymer available $3R + 4Z \leq 2400$ Production time available $R, Z \geq 0$	10

a. Solve the above LP using Solver and obtain the optimal solution. Generate the Sensitivity report to answer the following questions

b. If the profit on Razors decreased to $35 would the optimal solution change?

c. Simultaneous to the above change, if the profit on Zoomers increased to $50, how would the optimal solution be affected?

d. Interpret the shadow price $0 for the constraint limiting the production of pocket bikes to no more than 700 units

e. Suppose the company could obtain 100 additional labor hours in production. What would the new optimal level of profit be?

Q2 **10**

The Win Big Gambling Club promotes gambling junkets from a large midwestern city to casinos in the Bahamas. The club has budgeted up to $8,000 per week for local advertising. The money is to be allocated among four promotional media: TV spots, newspaper ads, and two types of radio advertisements. Win Big's goal is to reach the largest possible high potential audience through the various media. The following table presents the number of potential gamblers reached by making use of an advertisement in each of the four media. It also provides the cost per advertisement placed and the maximum number of ads that can be purchased per week.

MEDIUM	AUDIENCE REACHED PER AD	COST PER AD ($)	MAXIMUM ADS PER WEEK
TV sport (1 minute)	5,000	800	12
Daily newspaper (full-page ad)	8,500	925	5
Radio spot (30 seconds, prime time)	2,400	290	25
Radio spot (1 minute, afternoon)	2,800	380	20

Win Big's contractual arrangements require that at least five radio spots be placed each week. To ensure a broad-scoped promotional campaign, management also insists that no more than $1,800 be spent on radio advertising every week. Formulate the above problem as a Linear Programing Problem and obtain the optimal media allocation that maximizes the reach by using Solver.

Q3 **10**

A. A car manufacturer, Hindustan Motor Company, in a competitive market, has a plant which can produce 5 models of cars in any desired ratio. The company's profit depends upon the models of cars produced by its competitor, Indian Motor Company, and are given in the following table (the figures are in lacs of rupees).

		India Motor Co's Model			
		K1	**K2**	**K3**	**K4**
Hindustan Motor Co's Model	**J1**	6	5	9	8
	J2	5	2	7	4
	J3	2	1	4	5
	J4	6	4	2	3
	J5	2	1	9	4

Although the management of the Hindustan Motor Co. knows the models India Motor Company can produce (along with the resulting pay-oft), it does not know what model(s) would actually be produced and sold by that company. The management of Hindustan wishes to maximise the profits. What is the optimal strategy for both players in this scenario and what is the maximum profit attainable at the optimal strategy for Hindustan Motor Company?

B. A merchant buys a certain item for Rs 20 per case and sells it for Rs 50 per case. The high mark-up reflects the probability of the item and

	the great risk in stocking it. Any unsold items must be scrapped at the end of the day and have no salvage value. The past hundred days' sales show that the daily demand can either be 10, 11, 12 or 13 cases. The merchant has to decide on how many units of the item should be stocked at the beginning of the day. The decision matrix for the same is given below:	

		Number of cases demanded			
		10	**11**	**12**	**13**
Alternatives: Number of cases to be stocked	**10**	300	300	300	300
	11	280	330	330	330
	12	260	310	360	360
	13	240	290	340	390

i. What is the optimal decision using the Hurwicz criterion (use coefficient of optimism (α) as 0.35

ii. How is the optimal decision different if the merchant uses a pessimistic approach (maximin) and optimistic approach (maximax)?

Q4	Daily number of customers at a medical diagnostic facility is normally distributed with a mean value of 80 and a standard deviation of 12. The average time to complete the diagnostic tests for a customer is uniformly distributed from 95 min to 125 min. However, the facility has a limited capacity of handling 90 customers a day and is forced to reschedule all extra customers. Run a simulation model for a 120-day period & determine the a. Average no. of daily customers at the medical diagnostic facility b. Average time to complete the diagnostic tests for a customer. c. Total no. of customers rescheduled in the quarter.	**10**
Q5	a. Plot the following data of annual profit of a company given below.	**10**

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011
Profit in Crores	93	102.8	126.7	103.5	105.7	133.2	156.7	175.7	161.6

b. Fit a straight line trend for the data above and predict the profit for the years 2012 and 2013.

c. Perform a 3 year moving average to forecast profit of the year 2012

d. Comment on which model gives better prediction.

Q6	Prentice Hall, Inc., a publisher headquartered in New Jersey, wants to assign three recently hired college graduates—Jones, Smith, and Wilson—to regional sales districts in Omaha, Dallas, and Miami. The relocation costs are given below.	**10**

OFFICE HIREE	OMAHA	MIAMI	DALLAS
JONES	$800	$1,100	$1,200
SMITH	$500	$1,600	$1,300
WILSON	$500	$1,000	$2,300

a. Obtain the optimal assignment of the recently hired graduates to the various office locations in the least cost possible.

	b. The firm also has an opening in New York and would send one of the three there if it were more economical than a move to Omaha, Dallas, or Miami. It will cost $1,000 to relocate Jones to New York, $800 to relocate Smith there, and $1,500 to move Wilson. What is the optimal assignment of personnel to offices in this scenario?	