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	Valu-Com Electronics manufactures five different models of telecommunications interface cards for PCs and laptops namely Hyperlink, FastLink, SpeedLink, MicroLink, and EtherLink. Each of these devices require differing amounts of printed circuit board (PC board), resistors, memory chips, and assembly. In its next production period, Valu-Com has 80,000 square inches of PC board, 100,000 resistors, 30,000 memory chips, and 5,000 hours of assembly time available. The company can sell all the product it can manufacture, but the marketing department wants to be sure the company produces at least twice as many FastLink cards as HyperLink cards while maximizing profit. The formulation and the sensitivity report for the same has been given below. **Decision Variables:** X1 = number of HyperLink cards to produce ; X2 = number of FastLink cards to produce ; X3 = number of SpeedLink cards to produce ; X4 = number of MicroLink cards to produce ; X5 = number of EtherLink cards to produce	**10**

MAX $53 X_1 + 48 X_2 + 33 X_3 + 32 X_4 + 38 X_5$

ST

$20 X_1 + 15 X_2 + 10 X_3 + 8 X_4 + 5 X_5 \leq 80{,}000$	PC Board Availability
$28 X_1 + 24 X_2 + 18 X_3 + 12 X_4 + 16 X_5 \leq 100{,}000$	Resistors Available
$8 X_1 + 8 X_2 + 4 X_3 + 4 X_4 + 6 X_5 \leq 30{,}000$	Memory Chips Available
$0.75 X_1 + 0.6 X_2 + 0.5 X_3 + 0.65 X_4 + 1 X_5 \leq 5{,}000$	Assembly Hours Available
$2 X_1 - 1 X_2 \leq 0$	

Sensitivity Report:

Variable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
B4	Quantity Made HyperLink	0	-11.66666667	53	11.66666667	1E+3
C4	Quantity Made FastLink	0	-16	48	16	1E+3
D4	Quantity Made SpeedLink	1666.666667	0	33	15	
E4	Quantity Made MicroLink	5833.333333	0	32	1	5.27272727
F4	Quantity Made EtherLink	0	-9.666666667	38	9.666666667	1E+3

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
G13	PC Board (sq in) Used	63333.33333	0	80000	1E+30	16666.6666
G14	Resistors Used	100000	0.166666667	100000	35000	1000
G15	Memory chips Used	30000	7.5	30000	1578.947368	7777.77777
G16	Assembly Hours Used	4625	0	5000	1E+30	37
G17	Fast/Hyper>2 Used	0	0	0	1E+30	

Use the above output to answer the following questions. **DO NOT SOLVE again**:

a. What is the optimal solution and the maximum profit?

b. Interpret the binding constraints.

c. How much should the marginal profit on FastLink have to increase before it is considered for production?

d. If the company could buy 1,000 additional memory chips, should they do it? If so, how much would profits increase?

e. Suppose the marginal profits used in this analysis were estimated hastily and are known to be somewhat imprecise. If the unit profit on SpeedLink has to be increased by 2 and that of MicroLink decreased by 2, how would this impact the optimal solution?

Q2 (10)

Hilltop Coffee manufactures a coffee product by blending three types of coffee beans. The cost per pound and the available pounds of each bean are as follows:

Bean	Cost per pound	Available Pounds
1	0.50	500
2	0.70	600
3	0.45	400

Consumer tests with coffee products were used to provide ratings on a scale of 0–100, with higher ratings indicating higher quality. Product quality standards for the blended coffee require a consumer rating for aroma to be at least 75 and a consumer rating for taste to be at least 80. The individual ratings of the aroma and taste for coffee made from 100% of each bean are as follows:

Bean	Aroma Rating	Taste Rating
1	75	86
2	85	88

3	60	75

Assume that the aroma and taste attributes of the coffee blend will be a weighted average of the attributes of the beans used in the blend. Hilltop mist meet all quality standards while producing 1000 pounds of the blended coffee product.

Determine the optimal quantity of each bean to be used in the coffee blend which will minimize the overall cost of the product. Formulate and solve the above problem as a linear programing problem.

Q3 **10**

A. M/S Godrej & Boyce and Hindustan Lever Ltd. have been selling competing products Cinthol and Liril respectively. The brand manager ofCinthol raised the following question: What should be the firm's strategy in terms ofadvertising for Cinthol? The market Research group of Godrej & Boyce developed data for varying degrees of advertising by Liril and Cinthol:

- Low advertising and High advertising by both the firms will result in equal marketing share for Liril and Cinthol.
- If Cinthol adopts Low level of advertising it will achieve a market share of 45 percent with Heavy advertising by Liril.
- If Cinthol resorts to Heavy advertising it would achieve a market share of 4.5 per cent with Low advertising by Liril.

i. Display the above information as a 2 person zero sum game.

ii. What is the optimal strategy mix for the brand managers of Cinthol and Liril respectively? As a result how much market share should Cinthol hope to achieve?

B. Allen Young has always been proud of his personal investment strategies and has done very well over the past several years. He invests primarily in the stock market. During the next year, Allen must decide whether to invest $10,000 in the stock market or in a certificate of deposit (CD) at a fixed interest rate of 9%. If the market is good, Allen believes that he could get a higher return on his money than with a fair market. If the market is bad, he will most likely get no return at all. The decision matrix denoting the return for the above is given below:

Alternatives	**Market Conditions**		
	Good	**Fair**	**Bad**
Stock Market	1400	800	0
Certificate of Deposit	900	900	900

i. What should Allen Young's decision be if he adopts the pessimistic approach?

ii. Does the optimal decision change if Allen decides to treat all events equally likely and adopts the LaPlace method?

Q4 **10**

An NGO runs a subsidised community canteen to feed daily workers in a city. Every day, the canteen prepares meals for 900 beneficiaries (daily workers) at a cost of ₹35 per meal. The daily number of beneficiaries who use the canteen for lunch follows a normal distribution with a mean value of 850 and a standard deviation of 150. If the no. of beneficiaries using the canteen for lunch is less, then the unused meals are packed & transported to nearby villages. The packing cost is fixed at ₹10 per meal, but the transportation cost varies daily based on the vehicle used & daily fuel cost. The transportation cost per meal is known to follow a uniform distribution ranging from ₹6 to ₹10. Run a simulation for a 30-day period & determine the

a. Probability of having unused meals in a 30-day period

b. Average daily total cost incurred by the NGO.

Q5 **10**

a. Use exponential smoothing to obtain filtered values for the following time series data (use smoothing constant = 0.65)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Sales ('000s)	465	468	554	744	943	582	581	437	417	617	571

	b. Also compute the forecast for a 4-year and 5 year simple moving average c. Which method results in the most accurate forecasts?	
Q6	The three blood banks in Franklin County are coordinated through a central office that facilitates blood delivery to four hospitals in the region. The cost to ship a standard container of blood from each bank to each hospital is shown in the table on this page. Also given are the biweekly number of containers of blood available at each bank and the biweekly number of containers needed at each hospital.	**10**

TO / FROM	HOSPITAL 1	HOSPITAL 2	HOSPITAL 3	HOSPITAL 4	SUPPLY
BANK 1	$8	$9	$11	$16	50
BANK 2	12	7	5	8	80
BANK 3	14	10	6	7	120
DEMAND	90	70	40	50	

a. How many shipments should be made biweekly from each blood bank to each hospital so that total shipment costs are minimized?

b. Owing to disruptions in the route, Bank 3 cannot deliver to Hospital 3 and Bank 1 cannot deliver to Hospital 1. Does this change the shipment schedule? Re-solve to obtain the optimal schedule in this scenario.