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	Tucker Inc. produces high-quality suits and sport coats for men. Each suit requires 1.2 hours of cutting time and 0.7 hours of sewing time, uses 6 yards of material, and pro vides a profit contribution of $190. Each sport coat requires 0.8 hours of cutting time and 0.6 hours of sewing time, uses 4 yards of material, and provides a profit contribution of $150. For the coming week, 200 hours of cutting time, 180 hours of sewing time, and 1200 yards of fabric are available. Additional cutting and sewing time can be obtained by scheduling overtime for these operations. Each hour of overtime for the cutting operation increases the hourly cost by $15, and each hour of overtime for the sewing operation increases the hourly cost by $10. A maximum of 100 hours of overtime can be scheduled. Marketing requirements specify a minimum production of 100 suits and 75 sport coats. Let S = number of suits produced SC = number of sport coats produced D1 = hours of overtime for the cutting operation D2 = hours of overtime for the sewing operation	10

Variable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
B2	S	100	0	190	35	1E+30
C2	SC	150	0	150	1E+30	23.33333333
D2	D1	40	0	-15	15	172.5
E2	D2	0	-10	-10	10	1E+30

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
B12	Cutting Hours LHS	200	15	200	40	60
B13	Sewing Hours LHS	160	0	180	1E+30	20
B14	Yards of Material LHS	1200	34.5	1200	133.3333333	200
B15	Overtime Hours LHS	40	0	100	1E+30	60
B16	Production of Suits LHS	100	-35	100	50	100
B17	Production os Sports Coats LHS	150	0	75	75	1E+30

Refer to the sensitivity solution and answer the following:

a. What is the optimal solution, and what is the total profit? What is the plan for the use of overtime?

b. A price increase for suits is being considered that would result in a profit contribution of $210 per suit. If this price increase is undertaken, how will the optimal solution change?

c. Discuss the need for additional material during the coming week. If a rush order for material can be placed at the usual price plus an extra $8 per yard for handling, would you recommend the company consider placing a rush order for material? What is the maximum price Tucker would be willing to pay for an additional yard of material? How many additional yards of material should Tucker consider ordering?

d. Suppose the minimum production requirement for suits is lowered to 75. Would this change help or hurt profit? Explain.

e. Interpret the Reduced Cost value associated with overtime hours for the sewing procedure.

Q2 **10**

The accounting firm of Coopers & Andersen is conducting a benchmarking survey to assess the satisfaction level of its clients versus clients served by competing accounting firms. The clients are divided into four groups:

Group 1: Large clients of Coopers & Andersen;

Group 2: Small clients of Coopers & Andersen;

Group 3: Large clients of other accounting firms;

Group 4: Small clients of other accounting firms.

A total of 4,000 companies are being surveyed either by telephone or via a two-way web-cam interview. The costs associated with surveying the different types of companies are summarized below

	Survey Costs	
Group	Telephone	Webcam
1	$18	$40
2	$14	$35
3	$25	$60
4	$20	$45

Coopers & Andersen wants to carry out the survey in the least costly way that meets the following conditions:

i. At least 50% of the companies surveyed should be clients of Coopers & Andersen.

ii. At least 25% of the surveys should be done via web cam.

iii. At least 50% of the large clients of Coopers & Anderson who are surveyed should be done via web cam.

iv. A maximum of 40% of those surveyed may be small companies.

v. A maximum of 25% of the small companies surveyed should be done via web cam.

a. Formulate a Linear Programing model for this problem.

b. Solve the formulated problem using Solver. What is the optimal solution?

Q3 **10**

A. Cal Bender and Becky Addison have known each other since high school. Two years ago they entered the same university and today they are taking undergraduate courses in the business school. Both hope to graduate with degrees in finance. In an attempt to make extra money and to use some of the knowledge gained from their business courses, Cal and Becky have decided to look into the possibility of starting a small company that would provide word processing services to students who needed term papers or other reports prepared in a professional manner. Using a systems approach, Cal and Becky have identified three strategies. Strategy 1 is to invest in a fairly expensive microcomputer system with a high-quality laser printer. In a favorable market, they should be able to obtain a net profit of $10,000 over the next 2 years. If the market is unfavorable, they can lose $8,000. Strategy 2 is to purchase a less expensive system. With a favorable market, they could get a return during the next 2 years of $8,000. With an unfavorable market, they would incur a loss of $4,000. Their final strategy, strategy 3, is to do nothing. Cal is basically a risk taker, whereas Becky tries to avoid risk.

a. Draw out the Decision (Payoff) Matrix

b. What would Cal's decision be being an optimistic decision maker?

c. Since Becky is risk averse, what would be the optimal decision Becky should make as a conservative person?

d. If both are indifferent to the occurrence of the events and treat the events as equally likely, what is the optimal decision in this case?

B. Firm X is fighting for its life against the determination of firm Y to drive it out of the industry. Firm X has the choice of increasing price or leaving it unchanged. On the other hand, Firm Y has the option to do nothing or reduce their price. Firm X's gross sales in the event of each of the pairs of choices are shown below:

		Firm Y's Pricing Strategy	
		Do not Change	Reduce Price
Firm X's Pricing Strategy	Increase Price	80	110
	Do not Change	100	90

Obtain the value of the game and the optimal strategies of both the players.

Q4 **10**

An electronics company is planning to introduce a new affordable foldable smartphone in the market. The fixed cost involved in launching this phone is ₹25000000, and the variable cost is likely to range between ₹40000 and ₹45000 with a uniform probability distribution. With the phone pricing set at ₹65000, the monthly demand is estimated to be normally distributed with a mean value of 5000 and a standard deviation of 1000. Simulate the profit for 100 random trials & determine the following:

a. Maximum Profit
b. Average monthly profit.
c. Probability of Loss

Q5 **10**

Reported below are the amounts spent on advertising ($ millions) by a large firm from 2000 to 2010.

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Amount	88.1	94.7	102.1	109.8	118.1	125.6	132.6	141.9	150.9	157.9	162.6

a. Plot the given data and interpret the pattern observed.
b. Calculate a three-year and a four-year moving average of the following data.
c. Compare the performance metrics of the above three-year and four-year data and comment on which method is more accurate.

Q6 **10**

Klein Chemicals, Inc., produces a special oil-based material that is currently in short supply. Four of Klein's customers have already placed orders that together exceed the combined capacity of Klein's two plants. Klein's management faces the problem of deciding how many units it should supply to each customer. Because the four customers are in different industries, different prices can be charged because of the various industry pricing structures. However, slightly different production costs at the two plants and varying transportation costs between the plants and customers make a "sell to the highest bidder" strategy unacceptable. After considering price, production costs, and transportation costs, Klein established the following profit per unit for each plant-customer alternative:

	Customers			
Plants	**D1**	**D2**	**D3**	**D4**
Clifton Springs	$ 32	$ 34	$ 32	$ 40
Danville	$34	$ 30	$ 28	$ 38

The plant capacities and customer orders are as follows:

Plants	**Capacity (Units)**	**Distributor Orders (units)**
Clifton Springs	5000	**D1 :** 2000
Danville	3000	**D2 :** 5000
		D3 : 3000
		D4 : 2000

a. How many units should each plant produce for each customer to maximize profits? Additionally, there is a penalty of ₹2, ₹5, ₹3, and ₹2 for any unsatisfied demand occurring at D1, D2, D3 anD4 respectively.
b. Will there be any customer whose demand is not met?
c. What is the total penalty for any unsatisfied demand?