K. J. SOMAIYA INSTITUTE OF MANAGEMENT STUDIES AND RESEARCH

Program PGDM A Tri (III)

Subject: Operations Research
(End-Term Examination)

Date of Exam:06/04/2017 **Time: 3 hours** **Marks:50**

Notes:

1. **You have to attempt 5 questions in all.**
2. **Make suitable assumptions if required and state them.**
3. **Write all relevant answers in your answer sheet, with sufficient detail to enable a fast evaluation of your answers.**
4. **Use Excel as required and keep saving the file on the desktop every ten minutes or so.**
5. **Make only 1 Excel file with different worksheets pertaining to each question.**
6. **Name the file with your division and roll number only (no names). Finally, before handling over the answer sheet, transfer the file to an exam folder, as per on-the-spot instructions given to you.**
7. **You can use Andersen Sweeney Textbook for Reference since this is an open book exam.**

Question 1 **10 mks**

A. Does the following linear programming problem exhibit infeasibility, unboundedness, or alternate optimal solutions? Explain.

Min $1X + 1Y$

s.t. $5X + 3Y \leq 30$
$3X + 4Y \geq 36$
$Y \leq 7$
$X,Y >= 0$

B. The Tiernan Gallery and Art Museum distributes to its visitors a printed guide to its collections. There are about 18000 visitors per year. Holding costs for the brochures are 20% and it costs $30 to place an order with the printer. The printer has offered the following discount schedule:

Category	Order Size	Unit Cost
1	0 - 1499	$2.50
2	1500 - 2999	$2.20
3	3000 and over	$1.80

How many brochures should be printed at a time?

Question 2 **10 mks**

The LP problem determines how many necklaces, bracelets, rings, and earrings a jewelry store should stock. The objective function measures profit; it is assumed that every piece stocked will be sold. Constraint 1 measures display space in units, constraint 2 measures time to set up the display in minutes. Constraints 3 and 4 are marketing restrictions.

SOLVE THE LINEAR PROGRAMMING PROBLEM USING SOLVER

MAX 100X1+120X2+150X3+125X4

S.T.

1) X1+2X2+2X3+2X4<108
2) 3X1+5X2+X4<120
3) X1+X3<25
4) X2+X3+X4>50

Answer the questions.

a. How many necklaces, bracelets, rings and earrings should be stocked?
b. How much space will be left unused?
c. How much time will be used?
d. By how much will the second marketing restriction be exceeded?
e. What is the profit?
f. To what value can the profit on necklaces drop before the solution would change?
g. By how much can the profit on rings increase before the solution would change?
h. By how much can the amount of space decrease before there is a change in the profit?
i. You are offered the chance to obtain more space. The offer is for 15 units and the total price is 1500. What should you do?

Question 3 **10 mks**

A. Tots Toys makes a plastic tricycle that is composed of three major components: a handlebar-front wheel-pedal assembly, a seat and frame unit, and rear wheels. The company has orders for 12,000 of these tricycles. Current schedules yield the following information.

Component	Requirements Plastic	Time	Space	Cost to Manufacture	Cost to Purchase
Front	3	10	2	8	12
Seat/Frame	4	6	2	6	9
Rear wheel (each)	.5	2	.1	1	3
Available	50000	160000	30000		

The company obviously does not have the resources available to manufacture everything needed for the completion of 12000 tricycles so has gathered purchase information for each component. Develop a linear programming model to tell the company how many of each component should be manufactured and how many should be purchased in order to provide 12000 fully completed tricycles at the minimum cost. **DO NOT SOLVE, ONLY FORMULATE**

B. A professor has been contacted by four not-for-profit agencies that are willing to work with student consulting teams. The agencies need help with such things as budgeting, information systems, coordinating volunteers, and forecasting. Although each of the four student teams could work with any of the agencies, the professor feels that there is a difference in the amount of time it would take each group to solve each problem. The professor's estimate of the time, in days, is given in the table below. Use SOLVER to see which team works with which project.

	Projects			
Team	Budgeting	Information	Volunteers	Forecasting
A	32	35	15	27
B	38	40	18	35
C	41	42	25	38
D	45	45	30	42

Question 4 **10 mks**

a. The Future Furniture Company recently began construction of a new warehouse. During the construction period, several changes have occurred that require development of a new distribution plan.

The current figures for supply are:

Plant	Supply (Pieces per week)
East LA	600
West LA	800
El Toro	400

The current figures for demand are:

Warehouse	Demand (Pieces per week)
Orange County #1	300
Orange County #2	400
Long Beach	200
Los Angeles	900

Shipping costs per unit (in $) are:

To From	Orange County #1	Orange County #2	Long Beach	Los Angeles
East LA	8	9	6	4
West LA	10	7	2	3
El Toro	5	7	9	12

Solve the transportation problem to determine the optimal shipping schedule that minimizes the total cost.

b. The president of a small manufacturing firm is concerned about the continual increase in manufacturing costs over the past several years. The following figures provide a time series of the cost per unit (in $) for the firm's leading product over the past eight years:

Year :	1	2	3	4	5	6	7	8
Cost /Unit :	20		24.5	28.2	27.5		26.6	
30	31		36					

i. Graph the time series. Does a linear trend appear?

ii. Develop the equation for the linear trend component for this time series.

iii. Use the trend equation to estimate the cost/unit for 9th year.

iv. What is the average cost increase per year?

Question 5 **10 mks**

South Central Airlines operates a commuter flight between Atlanta and Charlotte. The plane holds 30 passengers and the airline makes a $100 profit on each passenger on the flight. When South Central takes 30 reservations for the flight experience has shown that on an average 2 passengers do not show up. As a result, with 30 reservations, South Central is averaging 28 passengers with a profit of 28(100) =$2800 per flight. The Airline operations office has asked for an evaluation of an overbooking strategy where they would accept 32 reservations even though the airplane holds only 30 passengers. The probability distribution for the number of passengers showing up when 32 reservations are accepted is as follows:

Passengers showing up	Probability
28	0.05
29	0.25
30	0.5
31	0.1
32	0.1

The airline will receive a profit of $100 for each passenger on the flight upto the capacity of 30 passengers. The airline will incur a cost for any passenger denied seating on the flight. This cost covers added expenses of rescheduling the passenger as well as loss of goodwill estimated to be $150 per passenger. Develop a worksheet model that will simulate the performance of the overbooking system. Simulate the number of passengers showing up for each of 100 flights. Use the results to compute the profit for each flight.

a. Does your simulation recommend the overbooking strategy? What is the mean profit per flight if overbooking is implemented?

Question 6 **10 mks**

The number of properties newly listed with a real estate agency in each quarter over the last four years is given. Forecast the number of properties that will be listed for year 5. Make suitable assumptions, draw the graph and state which Forecasting model you are using and why.

	Year			
Quarter	1	2	3	4
1	73	81	76	77
2	89	87	85	92
3	123	115	108	131
4	92	93	87	101

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