K. J. SOMAIYA INSTITUTE OF MANAGEMENT STUDIES AND RESEARCH,
Vidyavihar, Mumbai- 400077

Program: *PGDM- A, Trim-III*
Subject: Operations Research
(End term exam)

Maximum Marks: 50
Duration: 3hrs.   **Date: 6th April, 2018**

Instructions

1. This exam will be conducted in the computer lab. All answers are to be written in the answer sheet. Use Excel where required.
2. Keep saving the folder on the desktop and d-drive every ten minutes or so.
3. Question No 1 is compulsory.
4. Attempt any four questions from the remaining five questions.

QUESTION 1   (10)

The program manager for channel 10 would like to determine the best way to allocate the time for the 11.00 – 11.30 evening news broadcast. Specifically, she would like to determine the number of minutes of broadcast time to devote to local news, national news, weather and sports. Over the 30-minutes broadcast, 10 minutes are set aside for advertising. The station's broadcast policy states that at least 15% of the time available should be devoted to local news coverage; the time devoted to local news or national news must be at least 50% of the total broadcast time ; the time devoted to the weather segment must be less than or equal to the time devoted to the sports Segment ; the time devoted to the sports segment should be no longer than the total time spent on the local and national news ; and at least 20% of the time should be devoted to the weather segment. The production costs per minute are $300 for local news, $200 for national news, $100 for weather and $100 for sports.

    a. Formulate and solve a linear program model that can determine how the 20 available minutes should be used to minimize the total cost of producing the program.
    b. Interpret the shadow price for the constraint corresponding to the available time. What advice would you give the station manager given this shadow price?
    c. Interpret the shadow price for the constraint corresponding to the requirement that at least 15% of the available time should be devoted to local coverage. What advice would you give the station manager given this shadow price?

QUESTION 2
(10)

The Costello music company has been in business for five years. During that time, the sales of electric organs have grown from 12 units in the first year to 76 units in the most recent year. Fred Costello, the firm's owner, wants to develop a forecast of organ sales for the coming year based on the historical quarterly data.

Year	Quarter1	Quarter2	Quarter3	Quarter4
1	4	2	1	5
2	6	4	4	14
3	10	3	5	16
4	12	9	7	22
5	18	10	13	35

    a. Compute the seasonal indexes for the four quarter.
    b. When does Costello Music experience the largest seasonal effect? Does this result appear to be reasonable? Explain.

QUESTION 3
(10)

The manager of Denton Savings and Loan is attempting to determine how many tellers are needed at the drive-in window during peak times. As a general policy, the manager wishes to offer service such that average customer waiting time does not exceed 2 minutes. The customer inter-arrival times are assumed to be uniformly distributed between 0 and 6 minutes. Customer service time follow the Normal distribution with a mean of 3 minutes and a standard deviation of 0.6 minutes.
    a. Develop simulation model for this waiting line model. Run simulation for 500 trials. Calculate the Average waiting time and interpret.

QUESTION 4   (10)

Ashley's Auto Top Carries currently maintains plants in Atlanta and Tulsa that supply major distribution centers in Los Angeles and New York. Because of an expanding demand, Ashley has decided to open a third plant and has narrowed the choice to one of two cities—New Orleans or Houston. The pertinent production and distribution costs, as well as the plant capacities and distribution demands, are shown in the table below.

From Plants	To distribution centers			
	Los Angeles	New York	Normal Production	Unit Production Cost ($)
Atlanta	$8	5	600	6
Tulsa	4	7	900	5
New Orleans	5	6	500	4

Houston	4	6	500	3
Demand	800	1200		

    a. Draw the network Diagram.
    b. Formulate as Linear Programming Problem.
    c. Determine where to open the new plant. How much difference in the costs for the two
       locations.

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QUESTION 5
(10)

Adirondack Paper Mills, Inc., has paper plants in Augusta, Maine, and Tupper Lake, New York.
Warehouse facilities are located in Albany, New York, and Portsmouth, New Hampshire.
Distributors are located in Boston, New York, and Philadelphia. The plant capacities and
distributor demands for the next months are as follows:

Plant	Capacity (units)		Distributor	Demand (units)
Augusta	300		Boston	150
Tupper Lake	100		New York	100
			Philadelphia	150

The unit transportation costs ($) for shipments from the two plants to the two warehouses and
from the two warehouses to the three distributors are as follows:

Plant	warehouse			Warehouse	Distributor		
	Albany	Portsmouth			Boston	New York	Philadelphia
Augusta	7	5		Albany	8	5	7
Tupper Lake	5	6		Portsmouth	5	6	10

    a. Formulate the Adirondack Paper Mills problem as a Linear Programming problem.
    b. Determine the minimum shipping cost schedule for the problem.

QUESTION 6

(5+5)

(i)   Consider the following LPP

$$Max \quad 3x_1 + 4x_2$$
$$s.t. \quad -x_1 + 2x_2 \leq 8$$
$$x_1 + 2x_2 \leq 12$$
$$2x_1 + x_2 \leq 16$$
$$x_1, x_2 \geq 0$$

a. Show the feasible region.
b. What are the extreme points of the feasible region?
c. Find the optimal solution using the graphical procedure.
d. What are the values of the three slack variables at the optimal solution.

(ii)   Keith shoe stores carries a basic black dress shoe for men that sells at an approximate constant rate of 500 pairs of shoes every three months. Keith's current buying policy is to order 500 pairs each time an order is placed. It costs Keith $30 to place an order. The annual holding cost rate is 20%. With the order quantity of 500, Keith obtains the shoes at the lowest possible unit cost of $28 per pair. Other quantity discounts offered by the manufacturer are as follows. What is the minimum cost order quantity for the shoes? What are the annual savings of your inventory policy over the policy currently being used by Keith?

Order- Quantity	Price per Pair
0-99	$36
100-199	$32
200-299	$30
300 or more	$28