K. J. SOMAIYA INSTITUTE OF MANAGEMENT STUDIES AND RESEARCH,

Vidyavihar, Mumbai- 400077

Subject: Operations Research

PGDM-B

Maximum Marks: 50

Duration: 3hours   **Date April 2, 2019**

Instructions

- *Question 2 is compulsory. Attempt any 4 questions remaining 5 questions .(10 marks each)*

- *Take assumptions where ever necessary and make a note of it.*

- *Data is in excel file (all questions in separate worksheet)*

- *All data analysis Answers to be given in a single excel sheet with different work sheets.*

Question 1

Command Area Development Authority in the command of River "X" desires to find out the optimal cropping pattern in the area. The total available land is 25 thousand acres. The following crops can be grown:

	Water consumption (in acre feet/acre)	Expected Profit (per acre in Rs)
Wheat	9	2000
Maize	6	1500
Jowar	6.5	1200

It is felt that we cannot use more than 50 percent of the available land for wheat. The available water is 50000 acre-feet. At least 20 per cent of land must be devoted to maize. To ensure balanced development of various crops, the ratio of land devoted to wheat and jowar should not be more than 3:2.

    a. Formulate the problem as a linear programming problem in order to determine the maximum profit which will maximize the profit.

b. What percentage of resource is un utilized
c. Is there a multiple solution? How will you identify?

Question 2

The Marketing Department of Star Company has collected information on the problem of advertising for its products. This relates to the advertising media available, the number of families expected to be reached with each alternative, cost per advertisement, the maximum availability of each medium and the expected exposure of each one (measured as the relative value of one advertisement in each of the media):

The information is as given here:

Advertising Media	No. of Families Expected to Cover	Cost per Ad (Rs)	Maximum Availability (No. of times)	Expected Exposure (Units)
TV (20 sec)	4,000	8,000	8	80
Radio (15 sec)	8,000	3,000	30	20
Sunday edition of a daily (1/2 page)	5,000	4,000	4	50
Magazine (1 page)	2,000	3,000	2	60

Other information and requirements:

(a)   The advertising budget is Rs. 80,000.

(b)   At least 30,000 families should be covered. (The families receiving messages could be common. But a family receiving three messages, for example, would be taken to be equivalent to three.)

(c)   At least 3 insertions be given in Sunday edition of a daily but not more than 4 ads should be given on the TV.

Question 3

MG Auto has three plants in Los Angeles, Detroit, and New Orleans, and two major distribution centres in Denver and Miami. The capacities of the three plants during the next quarter are 1000, 1500, and 1200 cars. The quarterly demands at the two distribution centres are 2300 and 1400 cars. The mileage chart between the plants and the distribution centres is given in **Table 1.**The trucking company in charge of transporting the cars charges 8 cents per mile per car. The transportation costs per car on the different routes, rounded to the closest dollar, are given in **Table 2.**

Table 1   **Mileage Chart**

	Denver	Miami
Los Angeles	1000	2690
Detroit	1250	1350
New Orleans	1275	850

Table 2   **Transportation Cost per Car**

	Denver (1)	Miami (2)
Los Angeles (1)	$80	$ 215
Detroit (2)	$100	$108
New Orleans (3)	$102	$68

Construct a cost table and minimize Transportation Cost.

Question 4

A restaurant is located on an Island, a resort community near Fort Myers, Florida. The restaurant is owned and operated by Singhania, which just completed its fourth year of operation. During this time Singhania sought to establish a reputation for the restaurant as high quality dining establishment that specializes in sea food. Her efforts were successful and her restaurant is known as one of the best in current times. Singhania concluded that to work efficiently she has to get her forecasting system better which enable her to forecast the demand of food and beverages a year in advance.

months	I year	II year	III year
January	200	230	250
February	205	208	205
march	232	247	265
April	178	193	205
may	184	193	210
June	140	149	160
July	145	157	166
Aug	152	161	174
Sept	110	122	126
Oct	130	130	148
Nov	152	167	173

Dec	206	230	235

Managerial report:

Perform an analysis of sales data for Singhania that summarizes four findings, forecast and recommendations. Include the following:

- A graph of time series
- An analysis of seasonality of data. Indicate seasonal index for each month using Ratio to trend method. Do the seasonal indexes make an intuitive sense? Discuss
- Forecast Jan-Dec in fourth year.
- Assume that January sale for the fourth year turned out to be $295. What will be your forecast error? If there is any uncertainty in forecasting how will you resolve it for her?

Question 5

Data is collected on the Electronic payment systems used by banks namely RTGS , NEFT , CTS, IMPS post demonetization by a nationalised bank to know about volume of business affected because of demonetization. Use time series analysis and predict for March 2018. What model of time series will be used and why? Compare the Root mean square (RMSE)of all the Banking Electronic payment systems and suggest which one gives least error on the basis of alpha 0.6 to recent past.

Data for the period	RTGS	NEFT	CTS*	IMPS*
	volume	volume	volume	volume
Jan-17	9.3	164.2	118.5	62.4
Feb-17	9.1	148.2	100.4	59.7
Mar-17	12.5	186.7	119.2	67.4
Apr-17	9.5	143.2	95.3	65.1
May-17	10.4	155.8	97.1	66.7|
Jun-17	9.8	152.3	91.9	65.8
Jul-17	9.4	148.1	92.2	69.1
Aug-17	9.5	151.6	92.1	75.7
Sep-17	9.6	157.7	92.2	82.9
Oct-17	10.0	158.8	94.4	88.1
Nov-17	10.8	162.0	96.3	89.5
Dec-17	10.9	169.0	94.6	98.0
Jan-18	11.2	170.2	96.7	99.6
Feb-18	10.6	165.6	91.8	99.2

Question 6

(i)   In a Business School, there are six classes for a certain course to be taught in the next semester. For this purpose, 4 professors and 2 teaching assistants are available. On the basis of teaching in the past few semesters, the average performance scores on the basis of students' assessment and opinions are given here:

TEACHER	CLASS					
	A	B	C	D	E	F
P1	72	78	73	69	79	70
P2	68	71	72	65	77	68
P3	82	75	74	80	76	74
P4	80	84	72	70	70	80
T1	65	54	62	66	67	63
T2	58	62	64	62	66	62

(a) Find the assignment of teachers to the classes for the next semester on a one-to-one basis so that overall scores total is maximized.

(b) The Academic Dean of the college has just returned from sabbatical. He has decided to take one of the classes and relieve one of the TAs to another assignment. On the basis of past records, the performance score of the dean is expected to average 74. Who of the TAs do you think should be relieved?

(ii)   Reliable Auto purchases a component used in manufacture of automobile generators directly from the supplier. Reliable generator production operation, which is operated at a constant rate, will require 2000 components per month throughout the year (12000 units annually). Assume that the ordering costs are $ 25 per order, the unit cost is $ 2.50 per component, and the annual holding costs are 20% of the value of inventory. It has 250 working days per week and a lead time of 5 days. Answer the following inventory questions.

1. What is the EOQ of this component?
2. What is the reorder point?
3. What is the cycle time?
4. What are the total annual holding and ordering costs associated with your recommended EOQ?