Roll No. _____

(Do not write anything on question paper except Roll No.)

[This paper consists of FOUR Pages]

Jagan Institute of Management Studies

End-Term Examination, April, 2017

Trimester III – PGDM 2016-18

Operations Research

ET_PG_OR_1704

Time: 3 Hrs. *M. Marks: 70*

INSTRUCTIONS: Attempt any SEVEN questions. All questions carry equal marks.

Q 1 A diet is to contain at least 20 ounces of protein and 15 ounces of carbohydrate. There are three foods A, B and C available in the market, costing Rs.2, Re.1 and Rs.3 per unit respectively. Each unit of A contains 2 ounces of protein and 4 ounces of carbohydrate; each unit of B contains 3 ounces of protein and 2 ounces of carbohydrate; and each unit of C contains 4 ounces of protein and 2 ounces of carbohydrate. Find by using simplex method, how many units of each food the diet should contain so that the cost per diet is minimum. **10**

Q 2 a) Explain the relationship between primal and it's dual in a linear programming problem. Also explain the economic interpretation of slack variables in the problem. What is degeneracy in LPP? **5**

b) Solve the following Problem graphically

Z =	$18X_1+15X_2$ (Maximise)
Subject to Constraints	
	$2X_1+5X_2 \leq 30$
	$X_1+2X_2 \leq 24$
	$4X_1+2X_2 \leq 20$
	$X_1, X_2, \geq 0$

Find the optimum feasible mix and the maximum value of the objective function. **5**

Q 3 Following is the profit matrix based on 4 factories and 3 sales depots of the company:

		SALES DEPOT			
		S_1	S_2	S_3	Availability
Factories	F_1	6	6	1	10
	F_2	-2	-2	-4	150
	F_3	3	2	2	50
	F_4	8	5	3	100
Requirement		80	130	150	

Determine the most profitable distribution schedule and the corresponding profit assuming no profit in case of surplus production. Use Vogel's Approximation Method. **10**

Q 4 A car hiring co. has one car at each of the five depots A, B, C, D, and E. A customer in each of the five towns V, W, X, Y, and Z requires a car. The distance in kms. between depots (origin) and the towns (destinations) are given in the following table:

		DEPOTS				
		A	B	C	D	E
TOWNS	V	3	5	10	15	8
	W	4	7	15	18	8
	X	8	12	20	20	12
	Y	5	5	8	10	6
	Z	10	10	15	25	10

Find out as to which car should be assigned to which customer so that the total distance traveled is a minimum. How much is the total traveled distance? **10**

Q 5 a) Customers arrive at a bakery at an average rate of 18 per hour on weekday mornings. The arrival distribution can be described by a Poisson distribution with a mean of 16. Each clerk can serve a customer in an average of three minutes; this time can be described by an exponential distribution with a mean of 3.0 minutes.

i) What are the arrival and service rates?

ii) Compute the average number of customers being served at any time.

iii) Suppose it has been determined that the average number of customers waiting in line is 3.2. Compute the average number of customers in the system, the average time customers wait in line, and average time in the system. **5**

b) A tyre dealer sells all kinds of tyres but the demand for radial tyres account for a large portion of sales. The firm wishes to manage the inventory of radial tyres. To see what the demand would look like the firm wishes to simulate the demand for ten days.

Following data are given:

Demand for radial tyres:	0	1	2	3	4	5
Frequency (days):	10	20	40	60	40	30=200 days

Consider the following sequence of random numbers: 52, 37, 82, 69, 98, 96, 33, 50, 88 90. Using the sequence, simulate the demand for next 10 days. **5**

Q 6 An Engineering project has the following activities, whose time

estimates are listed below:

Activity (i-j)	Estimated duration (in months) Optimistic	Most likely	Pessimistic
1-2	2	2	14
1-3	2	8	14
1-4	4	4	16
2-5	2	2	2
3-5	4	10	28
4-6	4	10	16
5-6	6	12	30

i) Draw the project network and find the critical path.

ii) Find the expected duration and variance for each activity. What is the expected project length?

iii) Calculate the variance and standard deviation of the project length.

iv) What is the probability that the project will be completed at least 8 months earlier than the expected time?

v) If the project due date is 38 months, what is the probability of not meeting the due date?

Given:

Z :	0.50	0.67	1.00	1.33	2.00
Prob. :	0.3085	0.2514	0.1587	0.0918	0.0228

10

Q 7 The time cost estimates for the various activities of a project are given below:

Activity	Preceding Activity	Normal Time (weeks)	Crash Time (weeks)	Normal Cost (in Rs.)	Crash Cost (in Rs.)
A	-	8	6	8,000	10,000
B	-	7	5	6,000	8,400
C	A	5	4	7,000	8,500
D	B	4	3	3,000	3,800
E	A	3	2	2,000	2,600
F	D,E	5	3	5,000	6,600
G	C	4	3	6,000	7,000

The project manager wishes to complete the project in the minimum possible time. However, he is not authorized to spend more than Rs. 5,000/- on crashing.

Suggest the least cost schedule for achieving the objective of the project manager. Assume there is no indirect or utility cost. **10**

Q 8 Explain the following statistical decision criteria:

a) Maximax Criterion

b) Maximin Criterion

c) Minimax Regret Criterion
d) Laplace Criterion; and
e) Hurwicz Criterion. **10**

Q 9 What is game theory? What is its contribution to management science? Briefly explain the major limitations of the game theory. Two firms are competing for business under the conditions so that one firm's gain is another firm's loss. Firm A's payoff matrix is given below:

Firms B

Firm A		*NoAdv*	*MediumAdc*	*HeavyAdv*
	NoAdv	10	5	– 2
	MediumAdv	13	12	15
	HeavyAdv	16	14	10

Suggest optimal strategies for the two firms and the net outcome thereof. **10**

Q 10 The inter-arrival time of customers at the bank counter having only one teller is as follows. The service time of the teller is also given. Use the random numbers to simulate the various parameters of the queue such as Lq, Ls,Ws,Wq for five days.

Inter-Arrival Time	Probability	Cumulative Prob.
0	0.06	0.06
3	0.09	0.15
6	0.25	0.4
9	0.37	0.77
12	0.16	0.93

Service Time	Probability	Cumulative Prob.
4	0.04	0.04
6	0.1	0.14
8	0.18	0.32
10	0.44	0.76
12	0.24	1

Use the following Random Numbers for simulation.
Set 1 Random numbers to simulate Inter-Arrival time –68, 13, 09, 20, 73
Set 2 Random Numbers to Simulate Service Time – 47, 03, 74, 25, 21 **10**

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