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**B.E. (Part Time) End Semester DEGREE EXAMINATION, APR / MAY 2008**

Fourth Semester

Industrial Engineering

7

**PTIE 334 – QUANTITATIVE METHODS**

(Regulation 2002)

Time: 3 Hours

Max. Marks 100

Answer All Questions

**PART 'A' (10 x 2 = 20 Mark)**

1. Define probability tree diagram
2. What is markov chain
3. What do you mean by transition probability
4. What is meant by reneing?
5. What are the cost involved in inventory
6. Define lead time
7. Differentiate between local and global optima
8. Define saddle point
9. What is meant by kuhn-Tucker Conditions?
10. What is a decision tree?

**PART –B( 5 x 16 = 80 Marks)**

11. Annual demand for an item is RS 5400 units. Ordering cost is Rs 600 per-order. Inventory carrying cost is 30% of the purchase price/unit/year. The price breaks are as shown below (16)

Quantity	Price(Rs.)
$0 \leq Q_1 \leq 2400$	12
$2400 \leq Q_2 \leq 3000$	10
$3000 \leq Q_3$	8

Find the optimal order size. If the order cost is changed to Rs.300 per order find the optimal order size

12 a ) Patients arrive at a clinic according to Poisson distribution at rate of 30 patients per hour. The waiting room does not accommodate more than 14 patients. Examination time by single physician is exponential with mean 3 minutes per patient. Find the effective arrival rate at the clinic. What is the expected time a patient has to spend in the clinic until he is discharged

**OR**

12 b) The arrival rate of breakdown machines at a maintenance shop follows poisson distribution with a mean of 4 per hour. The service rate of machines by a maintenance mechanic also follows poisson distribution with a mean of 3 per hour. The down time cost per hour of a breakdown machine is Rs 200. The labour rate per hour is Rs50. Determine the optimal number of maintenance mechanics to be employed to repair the machines such that the total cost is minimized

13 a) Obtain the optimal strategies for both players and the value of the game for two person zero sum game whose pay off matrix as follows (5)

		Player A				
		A1	A2	A3	A4	A5
Player B	B1	1	5	-7	-4	2
	B2	2	6	9	-3	1

OR

13 b) A company management and the labor union are negotiating a new 3 year settlement. Each player has four strategies. The cost to the company are given for every pair of strategy choices

		Company strategies			
		1	2	3	4
Union strategies	1	20	15	12	35
	2	25	14	8	10
	3	40	2	10	5
	4	-5	4	11	0

What strategy will two sides adopt? Also determine the value of the game

14 a) Maximize  $Z = 4X_1 + 6X_2 - 2X_1^2 - 2X_1X_2 - 2X_2^2$

Subjected to

$$X_1 + 2X_2 \leq 2$$

$$X_1, X_2 \geq 0$$

OR

14 b) Maximize  $f(x) = 3x$        $0 \leq x \leq 2$

$$f(x) = -x/3 + 20/3 \quad 2 \leq x \leq 3$$

15 a) Assume the following absorbing matrix

		States			
		1	2	3	4
States	1	1	0	0	0
	2	0	1	0	0
	3	0.3	0.1	0.4	0.2
	4	0.4	0.2	0.2	0.2

Determine the absorbing and nonabsorbing states. Find the steady state matrix and the probabilities of moving from the nonabsorbing to the absorbing states.

OR

15 b) There are three dairies A,B and C in a small town which supply all the milk consumed in the town. Assume that the initial consumer sample is composed of 1000 respondents distributed over three dairies A,B and C. It is known by all the dairies that consumers witch from one dairy to another due to advertising, price and dissatisfaction. All these dairies maintain records of the number of their customers and the dairy from which they obtained each new customer. The following table illustrates the flow of customers over an observation period of one month. Assume that the matrix of transition probabilities remains fairly stable and at the beginning of period one , say April1 , market shares are A= 25%, B =45% and C =30%

Dairy	April1 Number of customers	Changes during period		May1 Number of customers
		Gain	Loss	
A	250	62	50	262
B	450	53	60	443
C	300	50	55	295
Total	1000	165	165	1000

Construct the state transition probability matrix to analysis the problem

Managers of theses dairies wants to know

- i) Market share of their dairies on 1<sup>st</sup> June and 1<sup>st</sup> July
- ii) Their market shares in steady state