Total number of printed pages – 8

MCA

PMC 3903

Fourth Semester Examination – 2008

QUANTITATIVE TECHNIQUE – I

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) Why do we require slack, surplus and artificial variables in a LPP ? Explain.

   (b) Explain the terms basic variable, entering and departing variables in Simplex method.

P.T.O.

(c) What do you mean by unbalanced transportation problem ? How can it be balanced ?

(d) Discuss about different queue discipline.

(e) What do you mean by conditional probability ? If $P(A/B) = P(A)$, then what conclusion you can give ?

(f) What are the properties of probability density function ?

(g) How can you get mean and variance of a random variable from the moment generating function ?

(h) What are the conditions so that an experiment will follow binomial distribution ?

(i) How you define standard random variable ? What are the mean and variance of a standard random variable ?

(j) Le X and Y be the life times of two electronic devices. Suppose their joint probability density function is defined as $f(x, y) = e^{-(x+y)}$, $x \geq 0$ and $y \geq 0$.

Do you think that the random variables X and Y are independent? Justify.

2. Three grades of coal A, B and C contain phosphorus and ash as impurities. In a particular industrial process, fuel up to 100 tons (maximum) is required which should contain ash not more than 3% and phosphorus not more than 0.03%. It is desired to maximize the profit while satisfying these conditions. There is an unlimited supply of each grade. The percentage of impurities and the profits of grades are given below.

Coal	Phosphorus(%)	Ash(%)	Profit in Rs. per ton
A	0.02	2.0	12.0
B	0.04	3.0	15.0
C	0.03	5.0	14.0

Formulate this problem into a LPP and solve by using Simplex method to find the maximum profit. 10

3. There are four factories F_1, F_2, F_3, F_4 and five warehouses W_1, W_2, W_3, W_4 and W_5. The transportation costs (in Rs. per unit) of materials from different factories to warehouses are given below. Find the optimum solution to the problem. 10

	W_1	W_2	W_3	W_4	W_5	Available
F_1	7	6	4	5	9	40
F_2	8	5	6	7	8	30
F_3	6	8	9	6	5	20
F_4	5	7	7	8	6	10
Required	30	30	15	20	5	100 (Total)

4. (a) A person repairing TV sets finds that the time spent on repairing the TV sets has exponential distribution with mean 20 minutes. If the TV sets are repaired in the order in which they come in and their

arrival is approximately Poisson with an average rate of 15 for 8-hour day, what is the repairman's idle time each day ? How many jobs are ahead of the set just brought in ? 5

(b) What do you mean by Integer Programming ? Discuss the concept of cutting plane algorithm and branch and bound method to solve an Integer programming problem. 5

5. (a) A lot of transistors contains 0.6 percent defective. Each transistor is subjected to a test that correctly identifies a defective but also misidentifies as defective about two in every 100 good transistors. Given that a randomly chosen transistor is declared defective by the tester, compute the probability that it is actually defective. 5

(b) Three boxes of same appearance have the following proportion of balls :

Box I contains 2 black and 1 white ball; Box II contains 1 black and 2 white balls and Box III contains 2 black and 2 white balls. One of the boxes is selected at random and one ball is drawn, which turns out to be white. Find the probability of drawing white ball again from any box if the first one drawn is not replaced. 5

6. (a) State and prove Chebyshev inequality. 5

(b) The number of aeroplanes arriving at an airport in a 30 minute interval obeys the Poisson law with mean 25. Use Chebyshev inequality to find the least chance that the number of aeroplanes to arrive within a given 30 minute interval will be between 15 and 35. 5

7. (a) What do you mean by lack of memory property ? Show that Geometric distribution possesses lack of memory property. 5

(b) The time (in hours) required to repair a machine is exponentially distributed with parameter $\lambda = \frac{1}{2}$ 5

(i) Find the probability that the repair time exceeds 2 hours

(ii) Find the conditional probability that repairs takes at least 10 hours given that its duration exceeds 9 hours.

8. (a) The joint probability density function of (X , Y) is given by 5

$F_{xy}(x, y) = e^{-x/y} e^{-y}$; *When* $x > 0$ *and* $y > 0$

$= 0$ *otherwise*

Find P(X > 1 , Y = y).

(b) A mischievous student wants to break into a computer file, which is password protected. Assume that there are n equally likely passwords and the student chooses passwords independently at random and tries them. Let N_n be the number of trials required to break into the file. Determine the probability mass function of N_n if

(a) if unsuccessful passwords are not eliminated from further selection

(b) if they are. 5