Subject Code: MC914

MCA I Semester [R09] Regular Examinations, January 2010

DISCRETE STRUCTURES AND GRAPH THEORY

Time: 3 Hours **Max Marks: 60**

Answer any FIVE questions All questions carry EQUAL marks

1. a) Find the conjunctive normal form and disjunctive normal forms for
   i) $p \leftrightarrow (p' \vee q')$
   ii) $(p \vee q') \rightarrow q$

   b) Determine the contra positive of the each statement
   i) If john is a poet, then he is poor.
   ii) Only if Marc studies well he pass the test

2. a) Express the following statements using quantifiers. Then construct the negation of the statement
   i) Every bird can fly
   ii) Some birds can talk

   b) Prove that if n is an integer and n^3+5 is odd then n is even.

3. Let R be a binary relation on the set of all positive integers such that
   R = { (a,b)/ a-b is an add positive integer}
   Is R Reflexive? Symmetric? Antisymmtric? Transitive? An equivalence relation? A partial ordering relation?

4. a) let (A, *) be a semi group. Show that, for a, b, c in A, if a*c=c*a and b*c=c*b, then (a*b)*c = c* (a*b)

   b) Let f and g be homomorphism from a group (G, +) to a group (H,*). Show that (C,+) is a subgroup of (G,+), where $C=\{ x\in G \backslash f(x)=g(x)\}$

5. a) Find the sum of all four digit numbers that can be obtained by using (without repetition) the digits 2, 3,5 and 7.

   b) Enumerate the number of ways of placing 20 indistinguishable balls in to 5 boxes where each box is non empty.

6. a) Solve the recurrence relation $t_n = 4(t_{n-1} - t_{n-2})$ subject to initial condition $t_n=1$ for n=0 and n=1

   b) What is an n^{th} order linear homogenous recurrence relation with constant coefficients? Give examples

7. a) What are the necessary and sufficient conditions to specify that two graphs are isomorphic. Explain with an example.

   b) Briefly explain Prim's algorithm for minimum spanning trees.

8. Give example for each of the following
   i)Graph having Euler's circuit
   ii)Graph having Hamiltonian circuit

Subject Code: MC118

MCA I Semester [R06] Supplementary Examinations, January 2010

PROBABILITY AND STATISTICS

Time: 3 Hours **Max Marks: 60**

Answer any FIVE questions All questions carry EQUAL marks

1. (a) If the probability that a communication system will have high fidelity is 0.91 and the probability that it will have high fidelity and selectivity is 0.17. What is the probability that a system with high fidelity will also have high selectivity?
   (b) State and prove Bayes theorem.

2. (a) A continuous random variable has the probability density function
   $f(x)= k \ x \ e^{-\lambda x}$, if $x \geq 0, \lambda > 0$
   $= 0$, otherwise
   Determine (i) k (ii) Mean (iii) Variance

   (b) Find the mean and variance of the uniform probability distribution given by $f(x)=1/n$ for $x=1,2,3,\ldots..n$

3. (a) Find the Poisson approximation to the binomial distribution.
   (b) A random sample of size 100 is taken from an infinite population having mean 76 and variance 256. What is the probability that sample mean lies between 75 and 78.

4. (a) A normal population has a mean of 0.1 and standard deviation of 2.1. Find the probability that mean of a sample of size 800 will be negative?

   (b) A random sample of size 36 from a normal population has the mean 47.5 and standard deviation 8.4. Doe this information support or refuse the claim that mean of the population is 42.1.

5. (a) Describe the method of maximum likelihood for the estimation of unknown parameters. State the important properties of maximum likelihood estimators.
   (b) A coin is tossed 950 times and head turned up 180 times. Is the coin biased?

6. What is meant by (a) a test of null hypothesis? (b) Type I and type II errors (c) Explain the terms one-tail and two-tail tests?

Subject Code: MC118

7. (a) In a random sample of 400 industrial accidents, it was found that 231 were due to least unsafe working conditions. Construct a 99% confidence interval for the corresponding proportion.
(b) Obtain a relation of the form y= a.b ^{x} for the following data by the method of least squares.

x	2	3	4	5	6
y	8.4	15.1	33.1	65.2	127.4

8. (a) The following data pertain to the number of jobs per day and the central processing unit time required.

No. of jobs	1	2	3	4	5
CPU time	2	5	4	9	10

Fit a straight line. Estimate the mean CPU time at x= 3.5

(b) Find the correlation coefficient of the following data

x	10	12	18	24	23	27
y	12	20	12	25	35	10

Subject Code: MC111

MCA I Semester [NR] Supplementary Examinations, January 2010

PROBABILITY AND STATISTICS

Time: 3 Hours **Max Marks: 60**

Answer any FIVE questions All questions carry EQUAL marks

1. a) Two aeroplanes bomb a target in succession. The probability of each correctly scoring a hit is 0.3 and 0.2 respectively. The second will bomb only if the first misses the target. Find the Probability that (i) target is hit (ii) both fails to score hits?

   b) State and prove Baye's theorem?

2. a) Define random variable, discrete probability distribution, continuous probability distribution and Cumulative distribution?

   b) A random variable X has the following probability function:

X	4	5	6	8
P(x)	0.1	0.3	0.4	0.2

   Determine (i) Expectation (ii) Variance (iii) Standard Deviation?

3. a) Fit a Poisson distribution for the following data and calculate the expected frequencies?

x	0	1	2	3	4
f(x)	109	65	22	3	1

   b)If the masses of 300 students are normally distributed with mean 68kgs and standard deviation 3kgs, how many students have masses
   (i) Greater than 72kg
   (ii) Less than or equal to 64kg
   (iii) Between 65 and 71kg inclusive?

4. a) A random sample of size 100 is taken from an infinite population having the mean μ = 76 and the variance σ^2 = 256. What is the probability that $\bar{x}$ will be between 75 and 78?

   b) The mean voltage of battery is 15 and S.D. is 0.2. Find the probability that four such batteries connected in series will have a combined voltage of 60.8 or more volts?

5. a) Experience had shown that 20% of a manufactured product is of the top quality. In one day's production of 400 articles only 50 are of top quality. Test the hypothesis at 0.05 level?

Subject Code: MC111

b) An ambulance service claims that it takes on the average less than 10 minutes to reach its destination in emergency calls. A sample of 36 calls has a mean of 11 minutes and the variance of 16 minutes. Test the significance at 0.05 level?

6. a) In one sample of 8 observations the sum of the squares of deviations of the sample values from the sample mean was 84.4 and in the other sample of 10 observations it was 102.6. Test whether this difference is significant at 5% level?

   b) Find the maximum difference that we can expect with probability 0.95 between the means of samples of sizes 10 and 12 from a normal population if their standard deviations are found to be 2 and 3 respectively?

7. a) Obtain the rank correlation coefficient for the following data

X	68	64	75	50	64	80	75	40	55	64
Y	62	58	68	45	81	60	68	48	50	70

   b) Consider the following data on the number of hours which 10 persons studied for a test and their scores on the test:

Hours Studied (x)	4	9	10	14	4	7	12	22	1	17
Test Score (y)	31	58	65	73	37	44	60	91	21	84

8. What is meant by Statistical Quality Control? The following data provides the values of sample mean $\bar{x}$ and the Range R for ten samples of size 5 each. Calculate the values for central line and control limits for mean-chart and range-chart, and determine whether the process is in control.

Sample No	1	2	3	4	5	6	7	8	9	10
Mean $(\overline{x})$	11.2	11.8	10.8	11.6	11.0	9.6	10.4	9.6	10.6	10.0
Range (R)	7	4	8	5	7	4	8	4	7	9