Code No: R22011

$$\boxed{R10}$$

$$\boxed{SET - 1}$$

II B. Tech II Semester Supplementary Examinations Dec – 2012
PROBABILITY AND STATISTICS
(Com. to CE, CHEM, PE)

Time: 3 hours   Max. Marks: 75

Answer any FIVE Questions
All Questions carry Equal Marks
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1. a) A, B, C in order toss a coin. The first one to toss head wins the game. What are the probabilities of winning, assuming that the game may continue indefinitely?
    b) A class had 10 boys and 5 girls. Three students are selected at random one after the other. Find the probability that
    i) first two are boys and third is girl
    ii) first and third of same sex and second is of opposite sex.

2. a) A fair coin is tossed until a head or five tails occurs
    Find i) the discrete probability distribution ii) mean of the distribution
    b) Let $f(x) = 3x^2$, when $0 \le x \le 1$ be the probability density function of a continuous random variable X. Determine a and b such that
    i) $P(X \le a) = P(X > a)$ ii) $P(X > b) = 0.05$.

3. a) When the mean of marks was 50% and standard deviation 5% then 60% of the students failed in an examination. Determine the 'grace' marks to be awarded in order to show that 70% of the students passed. Assume that the marks are normally distributed
    b) If a bank receives on the average of 3 bad cheques per day. What is the probability that it will receive i) 4 cheques per day ii) 8 bad cheques over any three consecutive days

4. a) Take 30 slips of paper and label 5 each -4 and 4, four each -3 and 3, three each -2 and 2, 2 each -1, 0 and 1. If each slip of paper has the same probability of being drawn find the probability of getting -4, -3, -2, -1, 0, 1, 2, 3, 4 and find the mean and variance of this distribution.
    b) Suppose the diameter of motor shafts in a lot have a mean of 0.249 inches and standard deviation if 0.003 inches. The inner dia of bearings in another lot have a mean of 0.255 inches and standard deviation of 0.002 inches. If a shaft and bearing are selected at random, find the probability that the shaft will not fit inside the bearing. Assume that both dimensions are normally distributed.

5. a) Discuss the test of significance procedure.
    b) A machine runs on an average of 125 hours/year. A random sample of 49 machines has an annual average use of 126.9 hours with standard deviation 8.4 hours. Does this suggest believing that machines are used on the average more than 125 hours annually at 0.05 level of significance?

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6. a) In 1950 in india the mean life expectancy was 50 years. If the life expectancies from a random sample of 11 persons are 58.2, 56.6, 54.2, 50.4, 44.2, 61.9, 57.5, 53.4, 49.7, 55.4, 57.0. Does it confirm the expected view?

b) Weights in kg. of 10 students are given as

38, 40, 45, 53, 47, 43, 55, 48, 52, 49. Can we say that variance of the distribution of weights of all students from which the above sample was taken is equal to 20 square kg.

7. a) What are steps involved in construction of *R*-chart?

b) Fit a regression line of Y on X for the following data and hence predict Y if X = 67.5

X	65	66	67	67	68	69	71	73
Y	67	68	64	68	72	70	69	70

8. a) Define the terms

i) Expected queue length   ii) Ideal period

iii) Busy period   iv) Mean service rate

b) Workers come to a tool store room to enquiry about the special tools for a particular job. The average time between the arrivals is 60 seconds and the arrivals are assumed to be in Poisson distribution. The average service time is 40 seconds. Find i) average queue length   ii) Average length of non-empty queue

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1. a) A and B throw alternatively with a pair of ordinary dice. A wins if he throws 6 before 7 and B wins if he throws 7 before A throws 6. If A begins, show that his chance of winning is 30/61.
    b) Three boxes practically indistinguishable in appearance have two drawers each. Box I contains a gold coin and silver coin in the other drawer. Box II contains a gold coin in each drawer and Box III contains a silver coin in each drawer. One box is chosen at random and one of its drawers is opened at random and a gold coin is found. What is the probability that the other drawer contains a coin of silver?

2. a) A player tosses 3 fair coins. He wins Rs.500 if 3 heads appear, Rs.300 if 2 heads appear, Rs.100 if one head occurs. On the other hand, he loses Rs.1500 if 3 tails occurs. Find the expected gain of the player.
    b) If the probability density function of a random variable X is given by

    $$f(x) = \begin{cases} 2kxe^{-x^2} & for\ x > 0 \\ 0 & for\ x \le 0 \end{cases}$$

    Determine   i) k ii) the cumulative distribution function for X.

3. a) The probability of a man hitting a target is 1/3.
    i) if he fires 5 times what is the probability of his hitting the target atleast twice.
    ii) How many times must he fires so that the probability of his hitting the target atleast once is more than 90%?
    b) The marks obtained in mathematics by 1000 students is normally distributed with mean 78% and standard deviation 11%. Determine
    i) What was the highest mark obtained by the lowest 25% students?
    ii) Within what limit did the middle 90% of the student lie?

4. a) A normal population has a mean 0.1 and a standard deviation of 2.1. Find the probability that the mean of simple sample of 900 members will be negative.
    b) Construct 95% confidence interval for the true proportion of computer literates if 47 out of 150 persons from rural areas are computer literates.

5. a) Discuss critical region and level of significance with example.
    b) It is observed that 174 out of a random sample of 200 truck drivers on highway during night are drunk. Is it valid to state that atleast 90% of the truck drivers are drunk? Use 0.05 LOS.

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6. a) Write the properties of t-distribution.
    b) Under quality improvement programme some teachers are trained by instruction methodology A and some by methodology B. In a random sample of size 10, taken from a large group of teachers exposed to each of these two methods, the following marks are obtained in an appropriate achievement test
    Method A 65 69 73 71 75 66 71 68 68 74
    Method B 78 69 72 77 84 70 73 77 75 65
    Assuming that populations sampled are approximately normally distributed has same variance. Test the claim that method B is more effective at 0.05 LOS.

7. a) What are the advantages of statistical quality control.
    b) In the production of certain rods, a process is said to be in control if the outside diameters have a mean = 2.5 and standard deviation of 0.002. Construct a control chart for the means of random samples of size 4.

8. a) In a colour T.V. manufacturing plant, a loading unit takes exactly 10 minutes to load 2 T.V. sets into a wagon and again comes back to the position to another set of T.V. If the arrival rate is 2 T.V. sets per 20 minutes. Calculate the average time of T.V. sets in a stationary state.
    b) Discuss about classification of queuing models

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1. a) State and prove Boole's inequalities
    b) Two bolts are drawn from a box containing 4 good and 6 bad bolts. Find the probability that the second bolt is good if the first one found to be bad.

2. a) If X is uniformly distributed in $-2 \leq x \leq 2$. Find i) $P(X<1)$ ii) $P(|X-1| \geq 1/2)$
    b) If X is a continuous random variable with probability density function given by

    $$f(x) = \begin{cases} kx^{\alpha-1}(1-x)^{1-\beta} & for 0 < x < 1, \alpha > 0 \beta > 0 \\ 0 & otherwise \end{cases}$$

    Find k and mean value of X.

3. a) A student takes a true false examination consisting of 8 questions. He guesses each answer. Find the smallest value of *n* that the probability of guessing atleast *n* correct answers is less than ½.
    b) At a telephone booth, the customers arrive at an average of 2 per minute. Find the probabilities of customers arriving i) one in 2 minutes ii) at the most 4 in 3 minutes.

4. a) The guaranteed average life of a certain type of electric bulbs is 1500 hrs with a standard deviation of 120 hrs. It is decided to sample the output so as to ensure that 95% of the bulbs do not fall short of the guaranteed average by more than 2.0%. What will be the minimum sample size?
    b) Suppose the diameter of motor shafts in a lot have a mean of 0.249 inches and standard deviation if 0.003 inches. The inner dia of bearings in another lot have a mean of 0.255 inches and standard deviation of 0.002 inches. If a shaft and bearing are selected at random, find the probability that the shaft will not fit inside the bearing. Assume that both dimensions are normally distributed.

5. a) Discuss types of error of statistical hypothesis and give example.
    b) A random sample of 40 geysers produced by company A have a mean life time of 647 hours of continuous use with a standard deviation of 27 hours, while a sample 40 produced by another company B have mean life time of 638 hours with standard deviation 31 hours. Does this substantiate the claim of company A that their geysers are superior to those produced by company B at 0.01 LOS.

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6. a) Explain steps involved in computation of one-way Analysis of Variance?
    b) The average weekly losses of man hours due to strikes in an institute before and after a disciplinary program was implemented are as follows

Before	45	73	46	124	33	57	83	34	26	17
After	36	60	44	119	35	51	77	29	24	11

    Is there reason to believe that the disciplinary program is effective at 0.05 LOS.

7. a) What are the major parts of a Control Chart.
    b) Find the rank correlation for the following marks obtained by 12 students in Mathematics and Statistics

Mathematics	78	56	36	66	25	75	82	62
Statistics	84	44	57	58	60	68	62	58

8. a) Discuss basic queuing process
    b) Explain about exponential distribution.

Code No: R22011 $\boxed{\textbf{R10}}$ $\boxed{\text{SET - 4}}$

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1. a) A ten digit number is formed using the digits 0 through 9, every digit being used only once. Find the probability that the number is divisible by 4?

   b) A, B, C hit a target with probabilities $\frac{1}{3}, \frac{2}{3}, \frac{3}{4}$ if all of them fire at the target. Find the probability that   i) none of them hits the target   ii) one of them hits the target
   iii) All of them hits the target   iv) atmost two of them hit the target.

2. Probability density function of a random variable X is

   $$f(x) = \begin{cases} \dfrac{1}{2} \, sinx, 0 \le x \le \pi \\ 0, \quad elsewhere \end{cases}$$ Find the mean, mode and median of the distribution.

3. a) A manufacturer of pins knows that 2% of his product is defective. If he sells pins in boxes of 100 and guarantees that not more than 4 pins will be defective. What is the probability that a box will fail to meet the guaranteed quality.
   b) Find the probability of getting 1 or 4 or 5 or 6 in throwing a die 5 to 7 times among 9 trials using normal distribution.

4. a) The mean of certain normal population is equal to the standard error of the mean of the samples of 64 from that distribution. Find the probability that the mean of the sample size 36 will be negative?
   b) If the mean of breaking strength of copper wire is 575 lbs with a standard deviation of 8.3 lbs. How large a sample must be used in order that there will be one chance in 100 that the mean breaking strength of the sample is less than 572 lbs.

5. a) Discuss various types of alternative hypothesis with suitable example.
   b) A manufacturer's claim that the mean tensile strength of a thread A exceeds the mean tensile strength of thread B by at least 12 kgs. If 50 pieces of each type of thread are tested under similar conditions yielding the mean of type A thread is 86.7 with standard deviation 6.28 and mean of type B thread is 77.8 with standard deviation 5.61. Test the manufactures claim at 0.05 level of significance.

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6. a) Write the conditions of validity of χ^2-test.
    b) Two random samples gave the following results

Sample	Size	Sample Mean	Sum of square of deviation from the mean
1	10	15	90
2	12	14	108

   Test whether the samples came from the same normal population.

7. a) What are the various techniques used for statistical quality control.
    b) Calculate coefficient of correlation from the following data

X	12	9	8	10	11	13	7
Y	14	8	6	9	11	12	3

8. a) Discuss different states of the queuing system
    b)Show that for a single service station, Poisson arrivals and exponential service time, the probability that exactly n calling units are in the queuing system is $P_n = (1-\rho)\rho^n$, n≥0, where ρ is the traffic intensity.