Code :R7322306

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III B.Tech II Semester(R07) Regular & Supplementary Examinations, April/May 2011
PROBABILITY & STATISTICS
(Biotechnology)

Time: 3 hours

Max Marks: 80

Answer any FIVE questions
All questions carry equal marks
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1. (a) Six boys and six girls sit in a row at random. What is the probability that
    i. The girls sit together
    ii. The boys and girls sit alternately.

   (b) If A$_1$, A$_2$,...........A$_n$ are n events then prove that $P(\overset{n}{\underset{i=1}{\cap}} Ai) \geq \overset{n}{\underset{i=1}{\sum}} P(Ai) - (n-1)$.

2. (a) Let X denote the minimum of the two numbers that appear when a pair of dice is thrown once. Determine the
    i. Discrete probability distribution
    ii. Expectation
    iii. Variances

   (b) The probability density f(x) of a continuous random variably is given by $f(x) = ce^{-|x|}, -\infty < x < \infty$. Find
    i. C
    ii. Mean and
    iii. Variance of the distribution.

3. (a) If 3 of 20 tyres are defective and 4 of them are randomly chosen for inspection, what is the probability that only one of the defective tyre will be included ?

   (b) If x is a Passion variate such that $3P(x=4) = \frac{1}{2}P(x=2) = \frac{1}{2}P(x=2) + p(x=0)$, find
    i. Mean of x
    ii. $P(x \leq 2)$

4. (a) When a sample is taken from an infinite population, what happens to the standard error of the mean if the sample size is decreased from 800 to 200.

   (b) The mean voltage of a 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) What is the maximum error one cam expect to make with probability 0.90 when using the mean of a random sample of size n=64 to estimate the mean of population with $\sigma^2 = 2.56$.

   (b) A random sample of size 81 was taken whose variance is 20.25 and mean is 32, construct 98% confidence interval.

6. (a) In a big city 325 men out 600 men were found to be smokers. Does the information support the conclusion that the majority of men in the city are smokers?

   (b) A sample of 64 students have a mean weight of 70kgs. Can this be regarded as a sample from a population with mean weight 56 kgs and S.D 25 kgs.

7. A pair of disc are thrown 360 times and the frequency of each sum is indicated below.

Sum	2	3	4	5	6	7	8	9	10	11	12
Frequency	8	24	35	37	44	65	51	42	26	14	14

Would you say that the dice are fair on the basis of the chi-square test at 0.05 los?

8. (a) Explain briefly the main characteristics of queueing system.

   (b) Explain traffic intensity.

   (c) Explain $(M/M/1) : (\infty/FCFS)$ queuing model.

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1. (a) A and B throw alternately with a pair of ordinary dice. A wins if he throws 6 before B throws 7 and B wins if he throws 7 before A throws 6. If A begins, show that his chance of wining is 30/61.

   (b) State and prove Baye's theorem.

2. (a) A random variable X has the following probability distribution.

X	1	2	3	4	5	6	7	8
F(x)	K	2k	3k	4k	5k	6k	7k	8k

   Find K, $P(x \leq 2)$ and $P(2 \leq x \leq 5)$.

   (b) If probability density function $f(x) = kx^3$ in $0 \leq x \leq 3$ and 0 elsewhere . find the value of K and find the probability between $x = \frac{1}{2}$ and $x = \frac{3}{2}$.

3. Seven coins are tossed and the numbers of heads are noted. The experiment is repeated 128 times and the following distribution is obtained.

No of heads	0	1	2	3	4	5	6	7	Total
Frequency	7	6	19	35	30	23	7	1	128

   Fit a binomial distribution assuming
   (a) Coin is unbased
   (b) The nature of the coin is not known.

4. A population consists of six numbers 4,8,12,16,20,24. Consider all samples of size two which can be drawn without replacement from this population. Find

   (a) The population mean

   (b) The population S.D

   (c) The mean of the sampling distribution of means

   (d) The S.D of the sampling distribution of means. Verify (c) and (d) from (a) and (b).

5. (a) A random sample of 400 items is found to have mean 80 and S.D of 18.7. Find the maximum error of estimation at 95% confidence internal. Find the confidence limits for the mean if x=82.

   (b) What is "Interval estimation"? Give the relations used to find the confidence interval for large and small samples.

6. (a) What is ment by level of significance (LOS) ?

   (b) A sample of the height of 6400 Indians has a mean of 72.85 inches and a S.D of 2.56 inches while a sample of heights of 1600 Asians has a mean of 74.55 inches and S.D of 2.52 inches. Do the data indicate the Asians are on the average taller than the Indians ? (use $\alpha = 0.01$).

7. (a) Write the properties of t-distribution.

   (b) An auditor claims that he takes on an average 10.5 days to file income tax returns. Can this claim be accepted if a random sample shows that he look 13,19,15,10,12,11,14,18 days to file I.T retures (use $\alpha = 0.01$).

8. (a) Explain briefly the main characteristics of queueing system.

   (b) A bank plans to open a single server drive in banking facilities at a particular center. It is estimated that 20 customers will arrive each hour on an average. If on an average, it required 2 minutes to process a customers transaction, determine

   i. The proportion of time that the system will be idle.
   ii. On the average how long a customer will have to wait before reaching the server.
   iii. Traffic intensity of Bank.

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1. (a) If a number x is selected from the natural numbers 1,2,..........,100. Find the probability of x to follow $x + \frac{100}{x} > 29$.

   (b) State and prove Baye's theorem.

2. (a) A random variable X has the following probability function.

X	0	1	3	4	5	6	7
P(x)	0	K	2k	2k	3k	K^2	$7k^2+k$

      i. Find the value of K.
      ii. Evaluate $P(x < 6), P(x \geq 6)$,
      iii. Evaluate $P(0 < x < 5)$.

   (b) Suppose a continuous random variable X has the probability density $f(x) = K(1 - x^2)$ for $0 < x < 1$, and f(x)=0 otherwise. Find

      i. K
      ii. Mean
      iii. Variance.

3. (a) 2% of the items of a factory defective. The items are packed in boxes. What is the probability that these will be

      i. 2 defective items.
      ii. at least three defective items in a box of 100 items.

   (b) Suppose the weights of 800 male students are normally distributed with mean $\mu = 140$ pounds and S.D 10 pounds. Find the number of students whose weights are

      i. Between 138 and 148 pounds
      ii. More than 152 pounds.

4. A population consists of five numbers 2,3,6,8 and 11. Consider all possible samples of size 2 that can be drawn with replacement from this population. Find

   (a) The mean of the population

   (b) The S.D of the population

   (c) The mean of the sampling distribution of means and

   (d) The standard deviation of the sampling distribution of means.

5. (a) Define (i) Estimate and (ii) Estimator.

   (b) Give a short note on types of estimation.

   (c) Explain Bayesian estimation.

6. (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 of 0.05 level of significance.

   (b) The means of two large samples of size 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from the same population of S.D 2.5 inches.

7. (a) A sample of 26 bulbs gives a mean life of 990 hours with a S.D of 20 hours. The manufactures claims that the mean life of bulbs is 1000 hours. Is the sample not upto the standard.

   (b) The following figures show the distribution of digits in numbers choosen at random from a telephone directory.

Digits	0	1	2	3	4	5	6	7	8	9
Frequency	1026	1107	997	966	1075	933	1107	972	964	853

   Test whether the digits may be taken to occur equally frequently in the directory.

8. A self service canteen employs one cashier at its counter. Customers arrive per every 10 minutes on an average. The cashier can serve on average one per minute. Assuming that the arrivals are poisson and the service time distribution is exponential, determine

   (a) The average number of customers in the system.

   (b) The average queue length.

   (c) Average time a customer spends in the system

   (d) Average waiting time of each customer.

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1. (a) A and B throw alternately with a pair of dice. One who first throws a total of nine wins. What are their respective chances of winning if A starts the game.

   (b) State and prove Baye's theorem.

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 1 head occurs. On the other hand, he loses Rs 1500 if 3 tails occur. Find the expected gain of the player.

   (b) Suppose a continuous random variable X has the probability density $f(x) = K(1-x^2)$ for 0<x<1, and f(x)=0 otherwise, find
      i. K
      ii. Mean
      iii. Variance.

3. (a) In 256 sets of 12 tosses of coin, in hour many cases one can expect 8 heads and 4 tails.

   (b) The marks obtained in statistics in a certain examination found to be normally distributed. If 15% of the students $\geq$ 60 marks, 40% <30 marks, find the mean and S.D.

4. A population consists of six numbers 1,2,3,4,5,6. Consider all possible samples of size 2 that can be drawn with replacement from this population. Find

   (a) The mean of the population

   (b) The S.D of the population

   (c) The mean of the sampling distribution of means and

   (d) The S.D of the sampling distribution of means.

5. (a) In a study of an automobile insurance a random sample of 80 body repair costs had a mean of Rs 472.36 and the S.D of Rs 62.35. If $\bar{x}$ is used as a point estimate to the true average repair costs, with what confidence we can assert that the maximum error doesn't exceed Rs 10 ?

   (b) What is the size of the smallest sample required to estimate an unknown proportion to within a maximum error of 0.06 with at least 95% confidence.

6. (a) A random sample of 500 pineapples was taken from a large consignment and 65 were found to be bad. Find the percentage of bad pineapples in the consignment.

   (b) In two large populations, there are 30% and 25% respectively of fair haired people. Is this difference likely to be hidden in samples of 1200 and 900 respectively.

7. The number of automobile accidents per week in a certain community are as follows: 12,8,20,2,14,10,15,6,9,4. Are these frequencies in agreement with the belief that accident conditions were the same during this 10 week period.

8. Assume that both arrival rate and service rate follows paisson distribution. The arrival rate and service rate are 25 and 35 customers/hour respectively at a single window in RTC reservation counter. Find

   (a) Traffic intensity

   (b) Average number of customers in the system.

   (c) Average number of customers in the queue.

   (d) Average time that the customer spends in the system

   (e) Average waiting time of a customer in the queue.

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