

Code No: 07A6BS01

**R07****Set No. 2**

**III B.Tech II Semester Examinations, APRIL 2011**  
**PROBABILITY AND STATISTICS**  
**Bio-Technology**

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions  
 All Questions carry equal marks

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1. (a) A sample of size 64 and mean 60 was taken from a population whose standard deviation is 10. Find 95% confidence interval for the mean.
- (b) Experience has shown that 10% of a manufactured product is of top quality. What can you say about the maximum error with 95% confidence for 100 items
- (c) A coin is tossed 512 times. Head turned up 244 times. Can you say that the coin is unbiased. [5+5+6]
  
2. (a) If A and B are two events and  $P(A) = 3/5$ ,  $P(B) = 1/2$  prove that
  - i.  $P(A \cup B) \geq \frac{3}{5}$
  - ii.  $\frac{1}{10} \leq P(A \cap B) \leq \frac{1}{2}$
- (b) An integer is chosen at random from the first 200 positive integers. What is the probability that the integer chosen is divisible by 6 or 8.
- (c) There are 3 boxes. Box-I contains 7 Red, 3 Black, and 4 White balls, box II contains 9 Red, 2 Black, 4 White, box III 10 Red, 5 Black, 5 white balls. One box is chosen and one ball is drawn from it. What is the probability that the ball is
  - i. Red
  - ii. Black
  - iii. White. [5+5+6]
  
3. Sample of size 2 are taken from the population 1,2,3,4,5,6 without replacement. Find
  - (a) The mean of the population.
  - (b) The standard deviation of the population.
  - (c) The mean of sampling distribution of means.
  - (d) The standard deviation of sampling distribution of means. [4×4]
  
4. (a) If  $f(x) = K e^{-|x|}$  is a probability density function in  $-\infty < x < \infty$ , find
  - i. The value of k,
  - ii. the variance
  - iii. The probability between 0 and 4.
- (b) Derive the mean and variance of the Binomial distribution. [8+8]

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5. (a) A Poisson distribution has a double mode at  $x = 2$  and  $x = 3$ , find the maximum probability and also find  $p(x \geq 2)$ .  
 (b) The weekly wages of 1000 workers are normally distributed around a mean of Rs.70 and S.D of Rs.5/-. Estimate the number of workers whose weekly wages will be
- (i) Between Rs.70 and Rs. 72  
 (ii) Between 69 and 72. [8+8]

6. The following data relate to the marks of 10 students in the internal test and the university examination for the maximum of 50 each

Internal marks (x)	25	28	30	32	35	36	38	39	42	45
University marks (y)	20	26	29	30	25	18	26	35	35	46

Find the coefficient of correlation and the two lines of regression. [16]

7. (a) A random sample from a company's very extensive files shows that the orders for a certain kind of machinery were filed, respectively in 10,12,19,14,15,18,11 and 13 days. Use the level of significance  $\alpha=0.01$  to test the claim that on the average such orders are field in 10.5 days. Assume normality.  
 (b) The results of polls conducted 2 weeks and 4 weeks before a gubernatorial election are shown in the following table:

	Two weeks before election	Four weeks before election
For Republican candidate	79	91
For Democratic candidate	84	66
Undecided	37	43

Use the 0.05 level of significance to test whether there has been a change in opinion during the 2 weeks between the polls. [8+8]

8. (a) Fit the curve  $y = ae^{bx}$  to the following data

x:	0	1	2	3	4	5	6	7	8
y:	20	30	52	77	135	211	326	550	1052

- (b) Fit a second degree polynomial to the following data, taking x as independent variable: [8+8]

x:	1	2	3	4	5	6	7	8	9
y:	2	6	7	8	10	11	11	10	15

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1. (a) Five measurements of tar content of a certain kind of cigarettes yielded 14.5, 14.2, 14.4, 14.3 and 14.6 mg per cigarettes. Show that the difference between the mean of this sample  $\bar{x} = 14.4$ , and the average tar claimed by the manufacturer  $\mu = 14.0$ , is significant at  $\alpha = 0.05$ . Assume normality.
- (b) Mechanical Engineers, testing a new arc welding technique, classified welds both with respect to appearance and an X-ray inspection.

		Quality			
		Bad	Normal	Good	Total
X-ray	Bad	20	7	3	30
	Normal	13	51	16	80
	Good	7	12	21	40
	Total	40	70	40	150

Test for independence using  $\alpha = 0.05$  and find the individual cell contribution to the  $\chi^2$  - statistic. [8+8]

2. Observations on price  $x$  and supply  $y$  the following data was obtained.

$$\sum x = 130, \sum y = 220, \sum x^2 = 2288, \sum y^2 = 5506 \text{ and } \sum xy = 3467$$

Find

- (a) coefficient of correlation
  - (b) The line of regression of  $y$  or  $x$
  - (c) The standard error of estimate. [6+5+6]
3. (a) A random sample of size 100 has a standard deviation of 5. What can you say about the maximum error with 95% confidence.
  - (b) Among 900 people in a state 90 are found to be chapatti eaters. Construct 99% confidence interval for the true proportion.
  - (c) A random sample of 1200 apples was taken from a large consignment and found that 10% of them are bad. The supplier claims that only 2% are bad. Test his claim at 95% level. [5+5+6]
4. Fit a parabola of the form  $y = a + bx + cx^2$  for the following data by the method of least squares [16]

x	20	40	60	80	100	120
y	5.5	9.1	14.9	22.8	33.3	46

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5. (a) Out of 15 items 4 are not in good condition. 4 are selected at random. Find the probability that
- All are not good
  - Two are not good
- (b) If A and B are any two events, then prove that  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ .
- (c) In a class 2% of boys and 3% of girls are having blue eyes. There are 30% girls in the class. If a student is selected and having blue eyes, what is the probability that the student is girl. [8+8]
6. (a) For the continuous probability function  $f(x) = kx^2 e^{-x}$  when  $x \geq 0$  find
- k
  - mean
  - variance
- (b) 20% of items produced from a factory are defective. Find the probability that in a sample of 5 chosen at random.
- none is defective
  - one is defective
  - $p(1 < x < 4)$  [8+8]
7. (a) Prove that the mean and variance of poisson distribution are same.
- (b) In a test on 2000 electric bulbs was found that the life of a particular make was normally distributed with an average life of 2040 hrs and S.D of 40hrs. Determine the number of bulbs likely to burn for
- more than 2140 hrs
  - less than 1960 hrs. [8+8]
8. There are 25 cards on four of them written 5, on six of them 10, on five of them 15, on three of them 20, on four of them 25 and three of them 30. One are each of 5,10,15,20,25,30 are selected without replacement. Find
- The mean of the population.
  - Standard deviation of the population.
  - Mean of means of sampling distribution.
  - Standard deviation of means of sampling distribution. [4×4]

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**R07****Set No. 1**

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1. Given below is the number of male births in 1000 families having five children.

Male children	0	1	2	3	4	5
No of families	40	300	250	200	30	180

Test whether the given data is consistent with the hypothesis that the chance of male birth is equal to the chance of female birth. [8+8]

2. (a) In a random sample 200 claims filed against an insurance company writing collision insurance on cars, 84 exceed Rs. 1200. Construct a 95% confidence interval for the true proportion of claims filed?
- (b) A random sample of 10 bags of pesticides are taken whose weights are 50,49,52,44,45,48,46,45,49,45 test whether the average packing can be taken to be 50 kgs. [8+8]
3. (a) The probabilities that students A,B,C,D solve a problem are  $\frac{1}{3}$ ,  $\frac{2}{5}$ ,  $\frac{1}{5}$  and  $\frac{1}{4}$  respectively. If all of them try to solve the problem, what is the probability that the problem is solved.
- (b) In a bolt factory machines A,B,C manufacture 20%, 30% and 50% of the total of their output and 6%, 3% and 2% are defective. A bolt is drawn at random and found to be defective. Find the probabilities that it is manufactured from
- i. Machine A
  - ii. Machine B
  - iii. Machine C
- [8+8]
4. (a) If X is a continuous random variable and  $y = ax + b$  prove that
- i.  $E(y) = aE(x) + b$  and
  - ii. Variance of (Y) =  $a^2$  variance of (X).
- (b) Find the number of families having
- i. Only one boy
  - ii. Atleast one boy
  - iii. All are boys in a village having 1000 families, if each family is having four children. [8+8]
5. (a) A Poisson distribution has a double mode at  $x = 2$  and  $x = 3$ , find the maximum probability and also find  $p(x \geq 2)$ .

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(b) The weekly wages of 1000 workers are normally distributed around a mean of Rs.70 and S.D of Rs.5/- Estimate the number of workers whose weekly wages will be

i. between Rs.70 and Rs.72

ii. between 69 and 72

[8+8]

6. (a) Fit a straight line for the following data.

[10+6]

x	1	2	3	4	6	8
y	2.4	3	3.6	4	5	6

(b) Derive normal equations to fit the curve  $y=a(b)^x$ .

7. (a) If  $\theta$  is the angle between two regression lines, the standard deviation of y is twice the standard deviation of x and  $r= 0.25$ , find  $\tan\theta$

(b) Find the rank correlation for the following indices of supply and price of an article. [6+10]

Supply index	124	100	105	112	102	93	99	115	123	104	99	113	121	103	101
Price index	80	100	102	91	100	111	109	100	89	104	111	102	98	111	123

8. A population consists of 5,10,14,18,13,24 consider all possible samples of size two which can be drawn without replacement from the population. Find

(a) The mean of the population.

(b) The standard deviation of the population.

(c) The mean of the sampling distribution of means

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

[4×4]

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1. (a) The mean diameter is 12 mm and standard deviation 0.02 mm in a sample of 200 washers produced by a machine. Find the percentage of washers produced whose diameters lie
  - i. within 11.97 to 12.03 mm
  - ii. outside 12.03 mm
- (b) Suppose the heights of American men are normally distributed with mean=68 inches and standard deviation 2.5 inches. Find the percentage of people whose heights lie between
  - i. 66 inches and 71 inches
  - ii. at least 6ft. [8+8]
2. (a) State and prove the theorem of total probability
- (b) In a certain college 25% of the students failed in Mathematics, 15% failed in Chemistry and 10% in Mathematics and Chemistry. A student is selected at random.
  - i. If he/she failed in Chemistry, what is the probability that he/she failed in Mathematics.
  - ii. If he/she failed in Mathematics, what is the probability that he/she failed in chemistry. [6+10]
3. A die is thrown 60 times with the following results.

Face	1	2	3	4	5	6
Frequency	8	7	12	8	14	11

Test the goodness of fit at 5% level. [8+8]

4. If the population is 3,6,9,15,27.
  - (a) List all possible samples of size 3 that can be taken without replacement from the finite population.
  - (b) Calculate the mean of each of the sampling distribution of means.
  - (c) Find the standard deviation of sampling distribution of means. [5+5+6]
5. Calculate the coefficient of correlation and the two lines of regression for the following data. [16]

X	1	2	3	4	5	6	7	8	9
Y	9	8	10	12	11	13	14	16	15

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6. (a) Derive normal equations to fit the curve of the form  $y = a + bx^2$   
 (b) Fit a curve of the form  $y = a + bx$  for the following data and find  $y$  when  $x = 12$  [6+10]

x	1	2	3	4	5	6	7	8	9
y	9	8	10	12	11	13	14	16	15

7. (a) Experiences had shown that 20% of a manufactured product is of the top quality. In one days production of 400 articles only 50 are of top quality. Test the hypothesis at .05 level.  
 (b) If the mean breaking strength of copper wire is 505 lbs with a standard deviation of 15 lbs. The sample is 49 construct 95% confidence interval for the mean.  
 (c) If the standard deviation of a sample is 20 and the maximum error with 99% confidence is 1.72. How large the sample might be? [5+5+6]
8. (a) Define random variable, discrete probability distribution, continuous probability distribution and cumulative distribution. Give an example of each.  
 (b) The mean of Binomial distribution is 3 and the variance is  $\frac{9}{4}$ . Find  
 i. The value of  $n$   
 ii.  $p(x \geq 7)$   
 iii.  $p(1 \leq x < 6)$ . [8+8]

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