

Code No: A109210302

**R09****Set No. 2**

II B.Tech I Semester Examinations, MAY 2011

PROBABILITY AND STATISTICS

Common to ME, MECT, MEP, AME, CSE

Time: 3 hours

Max Marks: 75

Answer any FIVE Questions

All Questions carry equal marks

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1. (a) A random sample of 400 items is found to have mean of 82 and S.D of 18. Find 95% confidence limits for the mean of the population from which the sample is drawn.
- (b) A sample of 900 members has a mean 3.4 cms and S.D 2.81 cms Test the difference between the means of sample & population. [7+8]
2. If  $x = 2y+3$  and  $Y = KX+6$  are the regression lines of X on Y and Y on X respectively.
  - (a) Show that  $0 \leq K \leq \frac{1}{2}$
  - (b) If  $K = \frac{1}{8}$  find r and  $(\bar{x}, \bar{y})$  [15]
3. (a) Prove that the Poisson distribution can be approximated by the binomial distribution
- (b) The marks obtained by 100 student is normally distributed with mean 68% and Standard deviation 5%. Determine:
  - i. How many get more than 70%
  - ii. How many students get between 65% and 75% [7+8]
4. (a) If  $P = 1/2$ ,  $q = 1/2$ ,  $z = 1$ , then prove that  $a = 500$ , then find  $d_z$
- (b) If  $P = 1/3$ ,  $q = 1/2$ ,  $z = 1$ ,  $a = 1000$ , then prove that  $a = 500$ , then find  $d_z$ . [15]
5. Bank plans to open a single server drive in banking facility at a certain centre. It is estimated that 20 customers will arrive each hour on average . If on average, it requires 2 minutes to process a customer's transaction, determine.
  - (a) The proportion of time that the system will be idle
  - (b) On the average, how long a customer will have to wait before breaching the server.
  - (c) The fraction of customers who will have to wait. [15]
6. The heights of 10 males of a given locality are found to be 70, 67, 62, 68, 70, 64, 64, 66, inches. Is it reasonable to believe that the average height is greater than 64 inches? Test at 5% significance level assuming that for 9 degrees of freedom ( $t = 1.833$  at  $\alpha = 0.05$ ) [15]

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7. (a) In a random sample of 500 remote controls for home entertainment centres 7 failed during the 90 day warranty period. Construct an upper confidence limit for the true probability of failure during warranty.
- (b) Random samples of 400 men and 600 women in a locality were asked whether they would like to have busstop near their residence. 200 men and 325 women were in favour of the proposal. Test the hypothesis that proportions of men and women in favour of the proposals are same in the male and female. Test at 5% level of significance. [15]
8. (a) A box contains 10 white and 3 black balls, while another box contains 3 white and 5 black balls. Two balls are drawn from the first box and put into the second box and then a ball is drawn from it what is the probability that it is a white ball
- (b) If  $X$  is the continuous random variable whose density function is  
 $f(x) = 2(x-1)$  if  $1 < x < 2$   
 $= 0$ , else where  
Find  $E(X^2 + 3X - 2)$  [7+8]

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1. A carpark contains 5 cars. The arrival of cars in poisson with a mean rate of 10 per hour. The length of time each car spends in the car park has negative exponential distribution with mean of 2 hours. How many cars are in the car park on average and what is the probability of a newly arriving customer finding the carpark full and having to park his car else where? [15]
2. (a) Derive a formula to find the confidence interval between the proportions and the Maximum error.  
(b) In two large populations there are 30% and 25% respectively of fair haired people. Is this difference likely to be hidden in sample of 1200 and 900 respectively for the two proportions. Test at 5% level. [15]
3. (a) What is meant by stochastic processes and what are the types of stochastic processes? Define them.  
(b) Which of the following matrices are stochastic. [15]
  - i.  $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
  - ii.  $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$
  - iii.  $\begin{bmatrix} 0 & 2 \\ 1/3 & 1/4 \end{bmatrix}$
4. (a) A random sample of 10 boys had the following I.Q's 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Do these data support the assumption of a population mean I.Q. of 100.  
(b) Pumpkins were grown under two experimental conditions. Two random samples of 11 and 9 pumpkins. Show the sample standard deviations of their weights as 0.8 and 0.5 respectively. Assuming that the weight distributions are normal, test hypothesis that the true variances are equal. [15]
5. (a) The probability that john hits a target is  $\frac{1}{2}$ . He fires 6 times. Find the probability that he hits the target:
  - i. Exactly 2 times
  - ii. More than 4 times
  - iii. At least once

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(b) The mean inside diameter of a sample of 200 washers produced by a machine is 500 cms with standard deviation .005 cms. The purpose of which these washers are intended a maximum tolerance in the diameter 0.495 to 0.505 cms, otherwise the washers are considered to be defective. Determine the percentage of defective washers. [7+8]

6. Psychological tests of intelligence and of engineering ability were applied to 10 students. Here is a record of ungrouped data showing intelligence ratio (I.R) and engineering ratio (E.R) calculate the co-efficient of correlation. [15]

| Student | A   | B   | C   | D   | E   | F  | G   | H  | I  | J  |
|---------|-----|-----|-----|-----|-----|----|-----|----|----|----|
| I. R.   | 105 | 104 | 102 | 101 | 100 | 99 | 98  | 96 | 93 | 92 |
| E. R.   | 101 | 103 | 100 | 98  | 95  | 96 | 104 | 92 | 97 | 94 |

7. (a) An event is known to be independent of the events  $B, B \cup C$  and  $B \cap C$ . Show that is also independent of  $C$ .

(b) A coin is tossed 4 times.  $X$  is the random variable number of heads

i. Write the probability distribution of  $X$

ii. The mean

iii. the variance. [7+8]

8. (a) It is desired to estimate the mean number of hours of continuous use until a certain computer will first require repairs. If it can be assumed that is 48 hours. How large the sample will be needed so that one will be able to assert with 90% confidence that the sample mean is off by at most 10 hours

(b) A sample of 155 members has a mean 67 and S.D 5.2. Is this sample has been taken from a large population of mean 70? [7+8]

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1. (a) A sample of 900 members has a mean 3.4 cms and S.D. 2.61 cms. Is this sample has been taken from a large population of mean 3.25 cms and S.D. 2.61 cms. If the population is normal and its mean is unknown. Find the 95% confidence limits of the true mean?
- (b) In a certain factory there are two independent processes for manufacturing the same item. The average weight in a sample of 250 items produced from one process is found to be 120 gms with a S.D of 12 gms. While the corresponding figures in a sample of 400 items from the other process are 124 and 14. Test the significance between the difference of two means 5% level. [7+8]
2. Derive probability of having  $n$  customers  $P_n$  in a queue M/M/1, having poisson arrival. [15]
3. (a) Out of 15 items four are not in good condition. 4 are selected at at random. Find the probability that
  - i. All are not good
  - ii. Two are not good
- (b) A bag contains 10 white and 6 black balls. Four balls are drawn successively. Find the probability that they are alternatively of different colours:
  - i. without replacement
  - ii. With replacement [7+8]
4. (a) If  $x$  is a Poisson variate such that  $3p(x=4) = \frac{1}{2} p(x=2) + p(x=0)$ . Find:
  - i. The mean of  $x$
  - ii.  $p(x \leq 2)$
- (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 Rs.
  - iii. more than 80. [15]
5. (a) A process for making certain ball bearings is under control if the diameters of the bearing have a mean of 60 cm. If a random sample of 100 bearings has mean 64.3cm and S.D of 2.7cm. Is the process under control?

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- (b) In 16 on hour test runs, the garden consumption of an engine averaged 16.4 gallons with a S.D. of 2.1 gallons. Test the claim the average gasoline consumption of this engine is 12.0 gallons per hour.
- (c) A manufacture claims that his list of items cannot have variance more than 1  $\text{cm}^2$ . Test whether the claim of the manufacture is correct. [15]
6. Two independent variable X and Y have means 5 and 10 and variances 4 and 9 respectively. Find the co-efficient of correlation between U and V Where.
- (a)  $U = 3x + 4y$ ;  $V = 3x - y$
- (b) if x and y are not independent and  $r = 5$ ,  $U = x + y$ ,  $V = x - y$ .
- (c) If,  $r = 6$ ,  $U = 2x - y$ ,  $V = 3x + y$  [15]
7. (a) A study shows that 16 of 200 Tractor's produced on one assembly line required extensive adjustments before they could be shipped, while the same was true for 14 of 400 tractors produced on another assembly line. At the .01 level of significance, does this support the claim that the second production line does superior work.
- (b) The owner of a machine shop must decide which of two snack vending machines to install in his shop. If each machine is tested 250 times, the first machine fails to work 13 times and the second machine fails to work 7 times test at the .05 level of significance whether the difference between the corresponding sample proportions is significant. [15]
8. A fair die is tossed repeatedly. If  $X_n$  denotes the maximum of the numbers occurring in the first n tosses, find the transition probability matrix P of the Markov chain  $\{X_n\}$ . Find also  $P^2$  and  $P(X_2 = 6)$ . [15]

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1. Customers arrive at a sales counter manned by a single person according to a poisson process with a mean rate of 20 per hour. The time required to serve a customer has an exponential distribution with a mean of 100 seconds. Find the average waiting time of the customer. [15]
2. (a) Use recurrence formula to find the probability when  $x=0,1,2,3,4$ , and 5 if  $x$  is a poisson variate with mean 2.5  
(b) One thousand students appeared for an examination. It was found that the marks were normally distributed with mean 70 and standard deviation 15. The students who will get greater than or equal to 60 will be placed in first division, between 50 and 60 second division, between 40 and 50 third division, who gets less than 40 will be failed and who get more than 75 in distinction. Find the number of students who get
  - i. Distinction
  - ii. Second Division [7+8]
3. (a) The average breaking strength of the steel rod is specified to be 18.5 thousand pounds. To test this sample of 14 rods were tested. The mean and S.D obtained were 17.85 and 1.955 respectively Is the result of experiment significant?  
(b) A random sample of six steel beams has a mean compressive strength of 59.302 P.S.I. (pound per square inch) with a S.D. of 650 P.S.I. Use this information and the level of significance  $\alpha = 0.05$  to test the true average compressive strength of the steel from which this sample came? [15]
4. (a) If  $P(A/B) = 1$ , then prove that
  - i.  $P(C/A \cap B) = P(C/B)$
  - ii.  $P(A \cap C/B) = P(C/B)$
  - iii.  $P(A \cap B \cap C) = P(B \cap C)$
 (b) A continuous random variable has the probability density function  
 $f(x) = Kxe^{-\lambda x}$ , if  $x \geq 0$ ,  $\lambda > 0$   
 $= 0$  else where. Determine:
  - i. K.
  - ii. Mean.
  - iii. Variance. [7+8]

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5. (a) In a sample of the safety explosive used in certain mining operations explosives containing potassium nitrate were found to be used in 95 of 250 cases. What can we say, with 95% confidence about the maximum error?
- (b) 500 articles from a factory are examined and 5% are found to be defective. 800 similar articles from a second factory are found to be 3% defective. Test the significance between the difference of two proportions at 2% level. [15]
6. (a) What is the maximum error one can expect to make with probability 0.9, when using mean of a random sample of size  $n=64$  to estimate the mean of a population with  $\sigma^2 = 2.56$ ?
- (b) In a certain factory there are 2 independent processes for manufacturing the same item. The average weight in a sample of 250 items produced from one process is found to be 120 gms. With a S.D. of 12 gms while the corresponding figures in a sample of 400 items the other process are 124 and 14. Is there significant difference between the means? [7+8]
7. (a) Define Markov chain, regular and Ergodic and stochastic matrices?
- (b) Explain the process of finding expected duration of the game? [15]
8. Calculate Carl Pearson's correlation co-efficient for the following paired data.

|   |    |    |    |    |    |    |    |    |    |    |
|---|----|----|----|----|----|----|----|----|----|----|
| X | 38 | 45 | 46 | 38 | 35 | 38 | 46 | 32 | 36 | 38 |
| Y | 28 | 34 | 38 | 34 | 36 | 26 | 28 | 29 | 25 | 36 |

What inference would you draw from estimate?

[15]

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