

Code No: A109210302

R09**Set No. 2****II B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010****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

1. (a) In a random sample of 100 packages shipped by air freight 13 had some damage. Construct 95% confidence interval for the true proportion of damage package.

- (b) 100 articles from a factory are examined and 10 are found to be defective. 500 similar articles from a second factory are found to be 15 defective. Test the significance between the difference of two proportions at 5% level. [15]

2. (a) Memory capacity of 10 students were tested before and after training. State whether the training was effective or not from the following scores.

Before training	12	14	11	8	7	10	3	0	5	6
After training	15	16	10	7	5	12	10	2	3	8

- (b) In one sample of 10 observations, the sum of the squares of the deviations of the sample values from sample mean was 120 and in the other sample of 12 observations, it was 314, test whether the difference is significant at 5% level. [15]

3. Find the most likely production corresponding to a rainfall 40 from the following data : [15]

	Rain fall	Production
Average	30	500 Kgs
Standard deviation	5	100 Kgs
Coefficient of correlation	0.8	

4. (a) The probability that a man hitting a target is $1/3$. If he fires 6 times, find the probability that he fires

- At the most 5 times
- Exactly once
- At least two times

- (b) In a test on electrical bulbs, it was found that the life of a particular make was normally distributed with an average life of 2040 hours and S.D of 40 hrs. Estimate the number of bulbs likely to burn for more than 2140. [7+8]

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

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- (b) On the average, how long a customer will have to wait before reaching the server.
- (c) The fraction of customers who will have to wait. [15]
6. (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 $d_z = 900$. [15]
7. (a) A coin is biased in a way that a head is twice as likely to occur as a tail. If the coin is tossed 3 times, find the probability of getting 2 tail and 1 head
- (b) If X is the continuous random variable whose density function is
 $f(x) = x$ if $0 < x < 1$
 $= (2-x)$ if $1 \leq x < 2$
 $= 0$, else where
 Find $E(25X^2 + 30X - 5)$ [7+8]
8. (a) Prove that for a random sample of size n , X_1, X_2, \dots, X_n taken from a finite population $s^2 = \frac{1}{n} \sum_{i=1}^n (X_i - \bar{X})^2$ is not unbiased estimator of the parameter σ^2 but $\frac{1}{n} \sum_{i=1}^n (X_i - \bar{X})^2$ is unbiased.
- (b) A sample of 100 iron bars is said to be drawn from a large number of bars. Whose lengths are normally distributed with mean 4 feet and S.D..6 ft. If the sample mean is 4.2 feet can the sample be regarded as a truly random sample? [8+7]

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Time: 3 hours

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Answer any FIVE Questions
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1. (a) From a sample of 200 pairs of observation the following quantities were calculated.
 $\sum x = 11.34$, $\sum y = 20.78$, $\sum X^2 = 12.16$
 $\sum y^2 = 84.96$, $\sum xy = 22.13$ from the above data show how to complete the coefficients of the equation $y = a + bk$.

(b) Show that the maximum value of the rank correlation coefficient is 1. [7+8]

2. Patients arrive at a clinic in a poisson manner at an average rate of 6 per hour. The doctor on average can attend to 8 patients. Per hour. Assuming that the service time distribution is exponential, find

(a) Average number of patients waiting in the queue.

(b) Average time spent by a patient in the clinic. [15]

3. Three boys A, B, C are throwing a ball to each other. A always throws the ball to B; B always throws the ball to C; but C is just as likely to throw the ball to B as to A. Show that the process is Markovian. Find the transition matrix and classify the states. Do all the states are ergodic? [15]

4. (a) In an investigation on the machine performance the following results are obtained.

	No. of units inspected	No. of defectives
Machine 1	375	17
Machine 2	450	22

Test whether there is any significant performance of two machines at $\alpha = 0.05$

- (b) A firm manufacturing rivets wants to limit variations in their length as much as possible. The length (in cms) of 10 rivets manufactured by a new process are

2.15 1.99 2.05 2.12 2.17
 2.01 1.98 2.03 2.25 1.93

Examine whether the new process can be considered superior to the old if the old population has standard deviation 0.145 cm? [15]

5. (a) Traffic control engineer reports that 75% of the vehicles passing through a checkpoint are from within state. What is the probability that fewer than 4 of the 9 are from out of the state?
- (b) A normal population has a mean of 0.1 and S.D of 2.1. Find the probability that the mean of sample of 900 members will be negative. [7+8]

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6. (a) In 64 randomly selected hours of production, the mean and the standard deviation of the number of acceptance pieces produced by an automatic stamping machine are $\bar{x} = 1.038$ and $\sigma = .146$
At the .05 level of significance does this enable us to reject the null hypothesis $\mu = 1.000$ against the alternative hypothesis $\mu > 1.000$?
- (b) A company claims that its light bulbs are superior to those of its main competitor. If a study showed that a sample of 40 of its bulbs have a mean life time of 647 hrs of continuous use with a S.D of 27 hrs. While a sample of 40 bulbs made by its main competitor had a mean life time of 638 hrs of continuous use with a S.D of 31 hrs. Test the significance between the difference of two means at 5% level.. [7+8]
7. (a) A manufacturer of electric bulbs claims that the percentage defectives in his product does not exceed 6. A sample of 40 bulbs is found to contain 5 defectives. Would you consider the claim justify.
- (b) Before an increase on excise duty on tea 500 people out of a sample of 900 found to have the habit of having tea. After an increase on excise duty 250 are have the habit of having tea among 1100. Is there any decrease in the consumption of tea. Test at 5% level. [15]
8. (a) There are six boxes, of which two are round and four are square. Each round box contains two green marbles and three blue marbles. Each square box contains one green marble and three blue marbles. A box is chosen at random and a marble is chosen at random from it. If the marble is blue, what is the probability that it is from
- Round box
 - Square box.
- (b) Find the mean and the variance of uniform probability distribution given by $f(x) = \frac{1}{n}$ for $x=1,2,3,4,\dots,n$ [7+8]

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1. (a) Out of 15 items four are not in good condition. 4 are selected 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]
2. (a) If we can assert with 95% that the maximum error is .05 and p is given as 0.2. Find the size of the sample.
- (b) In a sample of 600 students of a certain college 400 are found to use ball pens. In another college from a sample of 900 students 450 were found to use ball pens. Test whether 2 colleges are significantly different with respect to the habit of using ball pens.

[15]
3. (a) 30% of items from a factory are defective. Find the probability that in a sample of 8
 - i. one
 - ii. At least two
 - iii. $p(1 < x < 6)$ are defective.
- (b) Six cards are drawn from a pack of 52 cards. Find the probability that
 - i. At least 3 are diamonds
 - ii. only 4 are diamonds
 - iii. none is a diamond

[7+8]
4. Prove the following result. If the stakes are doubled while the initial capitals remain unchanged the probability of rein decreases for the player whose probability of success $P < 1/2$.

[15]
5. A TV repair man finds that the time spent on his jobs has an exponential distribution with mean 30 minutes. He repairs sets in the order in which they arrive. The arrival of the sets is approximately Poisson with an average of 10 per an eight hour day. Find the repairman's idle time each day. How many jobs are ahead of the average set just brought in?

[15]

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R09**Set No. 1**

6. Calculate coefficient of correlation between age of cars and annual maintenance and comment. [15]

Age of cars (years)	2	4	6	7	8	10	12
Annual maintenance cost (rupees)	1600	1500	1800	1900	1700	2100	2000

7. (a) At a certain large university a sociologist speculates that male students spend considerably more money on junk food than do female students. To test her hypothesis, the sociologist randomly selects from the registrar's records the names of 200 students. Of these, 125 are men and 75 are women. The sample mean of the average amount spent on junk food per week by the men is Rs. 400 and standard deviation is 100.

For the women the sample mean is Rs 450 and the sample standard deviation is Rs.150.

Test the difference between the mean at .05 level.

- (b) A sample of size 300 was taken whose variance is 225 and mean 54. Construct 95% confidence interval for the mean. [8+7]

8. (a) A random sample of six steel beams has a mean compressive strength of 58392 with a standard deviation of 648. Use this information at the level of significance $\alpha = 0.5$ to test whether the true average compressive strength of the steel from which this sample came is 58,000.

- (b) For an F- distribution find

- $F_{0.05}$ with $\nu_1 = 7$ and $\nu_2 = 15$
- $F_{0.01}$ with $\nu_1 = 24$ and $\nu_2 = 19$
- $F_{0.95}$ with $\nu_1 = 19$ and $\nu_2 = 24$
- $F_{0.99}$ with $\nu_1 = 28$ and $\nu_2 = 12$

[15]

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Time: 3 hours

Max Marks: 75

Answer any FIVE Questions
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1. 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. [15]

2. A gambler has Rs.2. He bets Rs.1 at a time and wins Rs.1 with probability 0.5. He stops Playing if he loses Rs.2 or wins Rs.4.

- (a) What is the Transition probability matrix of the related markov chain?
- (b) What is the probability that he has lost his money at the end of 5 plays? [15]

3. (a) To compare two kinds of bumper guards, 6 of each kind were mounted on a car and then the car was run into a concrete well. The following are the costs of repair.

Guard 1	107	148	123	165	102	119
Guard 2	134	115	112	151	133	129

Use 0.01 level of significance to test whether the difference between two sample means is significant.

- (b) The blood pressure of 5 women before and after intake of a certain drug are given below.

Before	110	120	125	132	125
After	120	118	125	136	121

Test whether there is significant change in blood pressure at 1% level of significance. [15]

- 4. (a) A manufacturer claimed that at least 95% of the equipment which he supplied to a factory conformed to specifications. An examination of a sample of 200 pieces of equipments received 80 were faulty. Test the claim at .05 level.
- (b) A machine puts out 9 imperfect articles in a sample of 200 articles. After the Machine is overhauled it puts out 5 imperfect articles in a sample of 700 articles. Test at 5% level whether the Machine is improved? [15]

5. If θ is the angle between two regression lines, the standard deviation of Y is twice

- (a) The standard deviation of X and $r = 0.25$ Find $\tan \theta$.

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- (b) If $\sigma_x = \sigma_y = \sigma$ and the angle between the regression lines is $\tan^{-1} \frac{4}{3}$. Find the coefficient of correlation. [15]
6. (a) If A and B are two events, prove that $P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$
- (b) If X is a continuous random variable and $Y = aX + b$, then prove that
- (i) $E(Y) = aE(X) + b$
- (ii) $V(Y) = a^2V(X)$. [7+8]
7. (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]
8. A P.C repairman finds that the time spent on jobs has an exponential distribution with mean 30 minutes. If the sets are repaired in the order, in which they come in, if the arrival of sets is approximately poisson with an average of 10 per 8 hour day, what is the repair mans expected idle time each day? How many jobs are a head of the average set just brought in. [15]
