

Code No: 07A6BS01

R07**Set No. 2**

III B.Tech II Semester Examinations, December 2010
PROBABILITY AND STATISTICS
Bio-Technology

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
 All Questions carry equal marks

1. (a) Define the terms
 - i. Mean service rate
 - ii. The traffic intensity
 - iii. Idle time
 - iv. Queue length
- (b) A branch of Punjab national bank has only one typist. Since the typing work varies in length the typing rate is randomly distributed approximating a Poisson distribution with mean service rate of 8 letters per hour. The letters arrive at a rate of 5 per hour during the entire 8 hours working day. If the type writer is valued at Rs.1.50 per hour, determine
 - i. Equipment utilisation
 - ii. The percentage time that an arriving letter has to wait. [8+8]
2. A population consists of five numbers. 5, 10, 12, 13, 20. Consider all Samples of size two which can be taken with replacement from this population. Find
 - (a) The population mean
 - (b) The population Standard deviation
 - (c) The mean of the sampling distribution of mean
 - (d) Standard deviation of the sampling distribution of means [16]
3. (a) If A and B are independent events, then prove that A^C and B^C are independent.
- (b) A box I contains 7 red balls, 3 black and 5 white balls. Box II contains 9 red, 2 black and 4 white balls, Box III contains 10 red, 5 black and 5 white balls. A box is chosen at random and a ball is drawn. If it is from box I, what is the probability that it
 - i. Red
 - ii. Black
 - iii. White. [8+8]
4. (a) A continuous Random variable has the p.d.f $f(x) = K(1 - x^2)$, $1 \leq x \leq 4$; = 0 else where Determine
 - i. K
 - ii. the mean

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- iii. variance
- (b) The probability that the life of a bulb is 100- days is .05. Find the probability that out of 6 bulbs
- At least one
 - None
 - more than 4 will have a life of 100 days. [8+8]
5. (a) If X is a poisson variate such that $P(x = 1) = 24P(x = 3)$ Find
- $P(x = 0)$
 - $P(x < 3)$
 - $P(2 < x < 6)$
- (b) 1000 students appear for an examination. It was found that the marks are normally distributed with mean 35 and standard deviation 5. Find the number of students who get
- Marks between 25 and 40
 - Marks below 20
 - more than 50 [8+8]
6. (a) Construct 95% confidence interval for the mean of a normally distributed population from which the following sample was taken 15, 17, 10, 18, 16, 9, 7, 11, 13 and 14.
- (b) A lady stenographer claims that she can take the dictation at the rate of 120 words per minute. Can we reject our claim on the basis of 100 trails in which she demonstrates a mean of 116 words with a S.D of 15 words. [8+8]
7. Determine whether there is really a relationship between the employees performance in the company in training program and his/ her ultimate success in the job taking a sample of 400 cases. [16]
8. (a) Comparing the average protein content of two brands of dog food, a consumer testing service finds that fifty, 5-pound packages of brand A dog food had an average protein content of 11 ounces per package and a standard deviation of 1ounce, while sixty 5-pound packages of brand B food had an average protein content of 9 ounces per package and a standard deviation of 0.5 ounce. A difference of 0.5 ounces is considered to be not sufficiently important to report as a consumer issue. At the 0.01 level of significance should the testing service report this as issue.
- (b) A die is thrown 900 times. 1 or 2 was obtained 200 times. Test whether the die is unbiased. [8+8]

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1. (a) A die is thrown thrice. Getting 1 or 6 is a success. Find the
 - i. Mean
 - ii. Variance of the number of successes.
 (b) The mean and variance of a Binomial distribution are 3 and $9/4$ respectively. Find
 - i. The value of n
 - ii. $P(x \geq 1)$
 - iii. $P(x \leq 7)$ [8+8]
2. A P.C repair man 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 , and if the arrival of sets is approximately Poisson with an average of 10 per 8 hours day. Find
 - (a) The expected idle time per day
 - (b) The probability that there is no unit in the system.
 - (c) Average number of units in the queue.
 - (d) The average waiting time of queue.
 - (e) The probability that a unit will have to wait for more than 10 minutes
 - (f) How many jobs are ahead of the average set just brought in. [16]
3. (a) Derive a formula to find the confidence interval between the proportions and the Maximum error.
 (b) A sample of 50 students in a college got 90% marks in Maths with a standard deviation of 20%. A sample of 60 students in a college got 80% marks in Maths with a standard deviation of 25%. Test the significance between the difference of two means at 5% level. [8+8]
4. (a) If A and B are mutually exclusive events such that $P(A) = 4 P(B)$ and $A \cup B = S$. Find
 - i. $P(A \cap B^c)$
 - ii. $P(A \cap B)$
 - iii. $P(A^c \cup B)$

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- (b) Three machines I, II and III produce 40%, 30% and 30% of the total number of items of a factory. The percentages of defective items of these machines are 4%, 2% and 3%. An item is selected at random and found to be defective. Find the probability that it is from
- Machine - I
 - Machine - II
 - Machine - III.

[8+8]

5. Given below is the No of male births.in1000 families with 5 children each. Is this result with the hypothesis that male births are equally probable?

No. of boys	0	1	2	3	4	5
No. of families	40	300	250	200	30	180

[16]

6. Apopulation consists if five numbers 5, 8, 15, 24, 32. Consider all Samples of size two which can be taken without replacement from this population. Find

- The population mean
- The population Standard deviation
- The mean of the sampling distribution of mean
- Standard deviation of the sampling distribution of mean

[16]

7. (a) the maximum error, with 90% confidence is 2.8 and the sample size is 750 then find the standard deviation of the sample .

- (b) A random sample of size n is taken. The maximum error with .95 is 1.2 the standard deviation is 10, then find the sample size.

- (c) A sample of 100 students is found to have a mean height of 160 cms. Can this be regarded as a sample from a population with mean weight 165 cms. and standard deviation25 cms.

[5+5+6]

8. (a) A new car on average has three defective parts. If you buy a new car, what is the probability that the car will have

- No defective part
- At the most one defective part
- At least two defective parts

- (b) If the masses of 1000 students are normally distributed with mean 75 kgs and standard deviation 10kgs. How many students have masses

- Greater than 90 kgs
- Between 65 and 88 kgs

[8+8]

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R07**Set No. 1**

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1. (a) If $f(x) = Ke^{-|x|}$ is p. d.f in $-\infty \leq x \leq \infty$, find
 - i. K
 - ii. the mean
 - iii. Variance.
- (b) A die is thrown 6 times. Getting an even number is a success. Find the probability that there are
 - i. At least one success.
 - ii. ≤ 3 successes
 - iii. 4 successes
2. (a) Two random sample are drawn from two normal populations are as follows.

Sample I	17	27	18	25	27	29	13	17
Sample II	16	16	20	27	26	25	21	

Test whether two populations have been drawn from the same normal population.
- (b) Five measurements of the tar content of a certain kind of cigarette yielded 14.5, 14.2, 14.4, 14.3 and 14.6 mg per cigarette. If the average tar claimed by the manufacturer is 14.4, test the claim at .05 level. [8+8]
3. (a) The mean height of 50 male students who participated in sports is 68.2 inches with a S.D of 2.5. The mean height of 50 male students who have not participated in sports is 67.2 inches with a S.D of 2.8. Test the hypothesis that the height of students who participated in sports is more than the students who have not participated in sports.
- (b) A coin is tossed 10000 times and it turns up head 5195 times. Discuss whether the coin may be regarded as unbiased one. [8+8]
4. (a) Five measurements of the tar content of a certain kind of cigarette yielded 15.5, 15.6, 16, 14.9 and 16.2 Construct 99% confidence interval for the mean.
- (b) It was found that the average income of 36 workers is 12000 per annum. .Is this sample has been taken from a large population whose mean of annual income is 11,800 and S.D 800. [8+8]
5. (a) At a telephone booth, the customers arrive on average 2 per minute. Find
 - i. $P(x > 1)$
 - ii. $P(x = 3)$

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- iii. $P(1 < x < 5)$
- (b) The mean and standard deviation of an I.Q test of 400 students is 65 with a standard deviation of 12. Find the number of students whose marks are
- Above 90
 - Between 55 and 80
 - below 50
- [8+8]
6. A population consists of six numbers 4, 8, 12, 16, 20, 24. Consider all samples of size two which can be taken without replacement from this population. Find
- The population mean
 - The population Standard deviation
 - The mean of the sampling distribution of mean
 - Standard deviation of the sampling distribution of mean
- [16]
7. A road transport company has one reservation clerk on duty at a time. She handles information of bus schedules and makes reservation. Customers arrive at a rate of 8 per hour and the clerk can service 12 customers on an average per hour. Find
- Average number of customers waiting for the service.
 - Average time a customer has to wait before getting service.
 - The management is contemplating to install a computer system to handle the information and reservations. This is expected to reduce the service time from 5 to 3 minutes. The additional cost of having the new system works out to be 12 paise per minute spent waiting before being served. Assume 8 hour working day. Should the company install the computer system?
- [16]
8. (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 tails and 1 head.
- (b) 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.
- [8+8]

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1. A population consists of six numbers. 5, 7, 10, 12, 15, 17.
 - (a) Write samples of size 2 drawn with replacement.
 - (b) Find the mean of the sampling distribution of mean
 - (c) Standard deviation of the sampling distribution of means [16]
2. (a) In a random sample of 100 packages shipped by air freight 13 had some damage. Construct 5% confidence interval for the proportion.
- (b) In a sample of 500 people in Maharashtra, 300 are wheat eaters. What can you say about the maximum error with 99% confidence.
- (c) In a study designed to investigate whether certain detonators used with explosives in coal mining meet the requirement that at least 90% will ignite the explosive when charged. It is found that 174 of 200 detonators function properly. Test the null hypothesis $P = .9$ against the alternative hypothesis $P < .9$ at the .05 level of significance. [5+5+6]
3. (a) Three students are in a swimming race. A and B have the same probability of winning and each is twice as likely to win as C. Find the probability that
 - i. B wins
 - ii. C wins
 - iii. B or C wins
- (b) There are two boxes. I contains 9 cards with digits 1 to 9 II contains 5 with digits 1 to 5
 A box is chosen at random and a card is selected. If the digit is even find the probability that it is from
 - i. Box - I
 - ii. Box - II. [8+8]
4. Two independent samples from two normal populations respectively had the following values of the variables.

Sample I	16	26	27	23	24	22
Sample II	33	42	35	32	28	31

Do the estimates of variances differ significantly? [16]
5. (a) A random sample with replacement of size 2 taken from $S = (1, 2, 3)$ Let the random variable X denote the sum of the two numbers

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- i. Write the probability distribution of X
 - ii. The mean
 - iii. The Variance
- (b) Assume that 50% of the Engineers are good in Mathematics. Find the probability that among 9
 - i. Exactly 5
 - ii. At least 6
 - iii. At the most 5 are good in Mathematics. [8+8]
6. On an average 96 patients per 24 hour day require the service of an emergency clinic. Also on average, a patient requires 10 minutes of active attention. Assume that the facility can handle only one emergency at a time. Suppose it costs the clinic Rs. 100 per patient treated, to obtain an average servicing time of 10 minutes and that each minute of decrease in this average time would cost Rs. 10 per patient treated. How much would have to be budgeted by the clinic to decrease the average size of queue from 1 patient to $1/2$ patient. [16]
7. (a) A random sample of 10 items was taken from a population. Construct 95% confidence interval for the mean. 19, 16, 15, 23, 21, 19, 20, 15, 14, 16.
(b) An aircraft strobe light is designed so that the times between flashes have a mean of 10.15 s and a standard deviation of 0.4 s. Officials at the airport want to check if the strobe light needs adjustment. A sample of 50 times is randomly selected and the mean time between flashes is 9.87 Use the 5% level of significance. [8+8]
8. (a) Average number of accidents on any day on a national highway is 1.6. Determine the probability that the number of accidents is
 - i. At least one
 - ii. At the most one
(b) Prove that for a normal variate Mean = Median = Mode. [8+8]
