R22(2-1)

COMPUTER ORIENTED STATISTICAL METHODS

JNTUH

(IMP QU'S AND ANS'S)

UNIT 1

1). Suppose colored balls are distributed in three indistinguishable boxes as follows:

	Box I	Box II	Box III
Red	2	4	3

White	3	1	4
Blue	5	3	3

A box is selected at random from which a ball is selected at a random.

What is the probability that the ball is colored a) red, b) blue?

b) Suppose a continuous function X has the probability density function

$$f(x) = \begin{cases} 2ke^{-x^2} & , x > 0 \\ 0 & , x \leq 0 \end{cases}.$$

Compute (i) k, (ii) the distribution function for X, and

(iii) $P(1 < X \leq 2)$.

3.a) State Baye's theorem. Two factories produce identical clocks. The production of the first factory consists of 10,000 clocks of which 100 are defective. The second factory produces 20,000 clocks of which 300 are defective. What is the probability that a particular defective clock was produced in the first factory?

b) Given $f(x) = \begin{cases} ax^2, & \text{for } 0 < x < 1 \\ 0, & \text{elsewhere} \end{cases}$

Find the constant Also find distribution function F(x), mean and variance of X.

4.a) If A and B are any two events (subsets of the sample space S) and are not disjoint, then prove that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.

b) If two dice are thrown, what is the probability that the sum is

(i) greater than 8 , and (ii) neither 7 nor 11 ?

5.a) 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 a random and found to be defective. Find the probability that it is from

i) Machine- I
ii) Machine-II
iii) Machine-III

b) A continuous Random variable has the p.d.f $f(x) = \begin{cases} e^{-x} & \text{If } x \geq 0 \\ 0 & \text{otherwise} \end{cases}$

Determine: i) $P(0 \leq x \leq 2)$

ii) The mean

iii) Variance.

6.a) There are three boxes.

I contains- 10 light bulbs out of which 4 are defective

II contains- 6 light bulbs out of which 1 is defective

III contains- 8 light bulbs out of which 3 are defective

A box is chosen at random and a bulb is selected. If it is defective find

the probability that it is from:

i) Box-I

ii) Box-II

iii) Box-III

b) A continuous Random variable has the p.d.f

$$f(x) = \begin{cases} \frac{1}{2}(x+1) & 1 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$. Determine:

i) $P(2 \leq x \leq 4)$

ii) The mean

iii) Variance.

7). Two dice are thrown the random variable is assigned to the sum. Write the distribution. Find the mean and variance.

8.a) If the probability distribution function of a continuous random variable is $ke^{|x|}, -\alpha \leq x \leq \alpha$. Find

i) k
ii) mean
iii) variance.

b) A sample of 4 items is selected from 12 out of which 5 are defective. Find the expected number of defective items.

9.a) In a certain college 25% of boys and 10% of girls are studying Mathematics. The girls constitute 60% of the students. If a student is selected and is found to be studying Mathematics, find the probability that the student is a:

i) Girl
ii) boy

b) If $f(x) = Ke^{-|x|}$ is p. d. in $-\infty \leq x \leq \infty$, find:

i) K

ii) the mean

iii) Variance.

10.a) There are three boxes.

I contains- 10 light bulbs out of which 4 are defective

II contains- 6 light bulbs our of which 1 is defective

III contains- 8 light bulbs out of which 3 are defective

A box is chosen at random and abulb is selected. If it is defective find the

probability that it is from:

i) Box- I

ii) Box-II

iii) Box-III

b) A continuous Random variable has the p.d.f

$$f(x) = \begin{cases} Kxe^{-\lambda x} & \text{If } x \geq 0, \lambda \geq 0 \\ 0 & \end{cases}$$

. Determine

i) K

ii) The mean

iii) variance.

UNIT 2

1.a) State and prove Chebyshev's Theorem.

b) Show that in a Poisson distribution with unit mean, the mean deviation about the mean is $2/e$ times the standard deviation.

2.a) Derive the mean and variance of Poisson distribution.

b) The incidence of occupational diseases in an industry is such that the workmen have a 10% chance of suffering from it. What is the probability that in a group of 7, five or more will suffer from it?

3). A pair of fair dice is tossed. Let X denote the maximum of the number appearing i.e., $X(a, b) = \max(a, b)$ and Y denotes the sum of the numbers appearing i.e., $Y(a, b) = a + b$. Compute the mean, variance and standard deviation of the distribution of both X and Y.

4.a) Given that $P(X = 2) = 45 \cdot P(X = 6) - 3 \cdot P(X = 4)$ for a Poisson variate X, find the probability that $3 < X < 5$.

b) A car firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as Poisson variable with mean 1.5. Calculate the probability that on a day some demand is refused.

5.a) Six cards are drawn from a pack of 52 cards. Getting a red card is a success. Find the probability of getting the success:

i) At least once
ii) 3 times

b) The probabilities of a Poisson variate taking the values 1 and 2 are equal. Find:

i) μ
ii) $P(x \geq 1)$

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6.a) Assume that 60% of the students passed an examination. Find the probability that among 12.

i) Exactly 8 ii) At least 4 pass the examination

b) If the variance of a Poisson variate is 3. Find the probability that:

i) $P(x=0)$ ii) $P(1 \le x < 4)$

7.a) Eight coins are tossed. Find the probability of getting heads:

i) $p(x = 3)$ ii) $p(x \le 4)$.

b) The probabilities of a Poisson variate taking the values 1 and 2 are equal. Calculate:

i) $p(x = 0)$

ii) $p(x = 3)$

8.a) Mean heights of students is 158cms with a standard deviation of 20. Find how many students heights lie between 150cms and 170cms in a class of 100 students.

b).

9.a) The probability of man hitting a target is 1/3.If he fires 6 times, find the probability of hitting:

i) At the most 5 times

ii) At least 5 times

b). The probabilities of a Poisson, variate taking the values 1 and 2 are equal, Find:

i) μ

ii) $P(x \geq 1)$.

10.a) Assume that 50% of the Engineers are good in Mathematics. Find the probability that among 9:

i) Exactly 5

ii) At least 6

UNIT 3

1.a) A variable X is normally distributed with unknown mean and standard deviation. If $P(X>8.5)=0.005$ and $P(X<-7.5)=0.025$ find the mean and the standard deviation?

b) Ten individuals are chosen at random from a normal population and their heights are found to be 63,63,66,67,68,69,70,70,71,71 inches. Test if the sample belongs to the population whose mean height is 66 inches.

2.a) Explain exponential distribution and show that exponential distribution tends to normal distribution for large values of the parameter λ.

b). A random sample of 16 values from a normal population showed a mean of 41.5 inches and the sum of the squares of deviations from this mean equal to 135 square inches. Test whether mean of 43.5 inches for the population.

3.a) In a distribution exactly normal 7% of items are under 35 and 89% of items are under 63. Find the probability that an item selected at random lies between 45 and 56.

b). A random sample of size 100 is taken from an infinite population having a mean of 76 and a variance of 256 . What is the probability of getting?

i. $\bar{x}$ greater than 75 ?

ii. $\bar{x}$ between 75 and 78 ?

iii. Determine the specifications that are symmetric about the mean that include approximately 95% of all data.

4). A population consists of the five numbers 2, 3, 6, 8, 11. Consider all possible samples of size two which can be drawn with replacement from this 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 the sampling distribution of means, i.e., the standard error of means.

5.a) 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

b) Two horses A, B were tested according to the time (in seconds) to run a particular track with the following results.

Horse A	28	30	32	33	33	29	34
Horse B	29	30	30	24	27	29	

Test whether the two horses have the same running capacity at 95% level.

6.a) If the weights of 300 students are normally distributed with mean 68kgs and standard deviation 3kgs. How many students have weights

i). Greater than 72 kg

ii) Less than or equal to 64 kg

iii). Between 65 and 71 kg inclusive.

b) The following table gives the number of aircraft accidents that occur during various days of the week. Find whether the accidents are uniformly distributed over the week.

Days of week	Mon	Tue	Wed	Thu	Fri	Sat
No. of accidents	15	19	13	12	16	15

7). From the following data find whether there is any significant liking in the habit of taking soft drinks among the categories of employees.

Soft drinks	Employees		
	Clerks	Teachers	Officers
Pepsi	10	25	65

Thumsup	15	30	65
Maaza	50	60	30

9.a) The weekly wages of workers are normally distributed with mean Rs. 3,000 and S.D. Rs. 500 . Find the probability of workers whose weekly wages will be.

(i) More than Rs. 3,400

(ii) Between Rs. 2,500 and Rs. 3,500.

b) A random sample from a company's very extensive files shows that orders for a certain piece of machinery were filled, respectively in

10,12,19,14,15,18,11 and 13 days. Test the claim that on the average such orders are filled in 10.5 days. Test at 0.01 level.

10.a) Write the properties of normal distribution.

b) Find the mean and variance of gamma distribution.

UNIT 4

1.a) A manufacturer claimed that at least 98% of the steel pipes which he supplied to a factory conformed to specifications. An examination of a sample of 500 pieces of pipes revealed that 30 were defective. Test this claim at a significance level of 0.05.

b) A machine puts out 16 imperfect articles in a sample 500 . After machine is overhauled, it puts out 3 imperfect articles in a batch of 100. Has the machine improved? Test at 5% level of significance

2). The efficiency expert of a computer company tested 40 engineers to estimate the average time it takes to assemble a certain computer component, getting a mean of 12.73 minutes and s.d. of 2.06 minutes.

(a) If $x = 12.73$ is used as a point estimate of the actual average time required to perform the task, determine the maximum error with 99% confidence,

(b) construct 98% confidence intervals for the true average time it takes to do the job

(c) with what confidence can we assert that the sample mean does not differ from the true mean by more than 30 seconds.

3). The following are the average weekly losses of worker hours due to accidents in 10 industrial plants before and after a certain safety programme was put into operation:

Before: 45 73 46 124 33 57 83 34 26 17

After: 36 60 44 119 35 51 77 29 24 11

Test whether the safety programme is effective in reducing the number of accidents at the level of significance of 0.05 ?

4.a) A sample of 900 members has a mean 3.4cms and S.D 2.61cms. Is this sample has been taken from a large population of mean 3.25 and S.D 2.61.(ii) If the population is normal and its mean is unknown, find the 95% and 98% confidence limits of true mean.

b) In a city A 20% of a random sample of 900 school boys had a certain slight physical defect. In another city B 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportions is significant at 0.05 level of significance.

5.a) A random sample of 100 electric bulbs, produced by a manufacturer A showed a mean life of 1190hrs with a standard deviation of 90 . Another sample of 75 electric bulbs produced by a manufacturer B showed a mean life of 1230 with a standard deviation of 120hrs. Find whether there is significant difference between the mean.

b) 50 people were attacked by a disease and 30 were survived. If the survival rate is 70%, test the chain at 5% level.

6.a) The Gallup Poll reported that 45% of individuals felt they were worse off than 1 year ago. A politician feels that this is too high for her district, so she commissions her own survey and finds that, out of 150 randomly selected citizens, 58 feel they are worse off today than 1 year ago. At significance level 0.05, is the politician correct about her district?

b). A random sample of 90 observations produced a mean $\bar{x} = 25.9$ and a standard deviation $s = 2.7$. How do you find a 95% confidence interval for the population mean μ?

UNIT 5

1.) Define Markov chain and classify its states. Let each of these two brands have exactly 50% the total market in same period and let the market be of a fixed size. The transition matrix is given as follows:
If the initial market share breakdown is 50% for each brand, then determine their market shares in the steady

2). An urn A contains 5 red, 3 white and 8 green marbles while urn B contains 3 red and 5 white marbles. A fair die is tossed; if 3 or 6 appears a marble is chosen from B otherwise from A. Determine the probability that

a) a red marble is chosen,

b) a white marble is chosen,

c) a green marble is chosen.

3). Suppose an urn A contains 2 white marbles and urn B contains 4 red marbles. At each step of process, a marble is selected at random from each urn and the two marbles selected are interchanged. Let X_n denotes the number of red marbles in urn A after n interchanges.

(i) Find the transition matrix P.

(ii) What is the probability that there are 2 red marbles in urn A after 3 steps?

(iii) In the long run, what is the probability that there are 2 red marbles in urn A?

(iv) What is the stationary distribution of the system.

4). Find the relative minimum, maximum or saddle point (if any) of the function:

$$f(x_1, x_2) = x_1 + 2x_2 + x_1x_2 - x_1^2 - x_2^2$$

5). Consider the Markov chain with three states, S={1,2,3}, that has the following transition matrix

$$P = \begin{bmatrix} \frac{1}{2} & \frac{1}{4} & \frac{1}{4} \\ \frac{1}{3} & 0 & \frac{2}{3} \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$$

a. Draw the state transition diagram for this chain.

b. If we know $P(X_1 = 1) = P(X_1 = 2) = \frac{1}{4}$, find

$$P(X_1 = 3, X_2 = 2, X_3 = 1).$$

6). A professor has three pet questions, one of which occurs on every test he gives. He never uses the same question twice in successive examinations. If he used the question no. 1 , he tosses a coin and uses the question no. 2 . If he uses the question no. 2, he tosses two coins and use the question no. 3 , if both are heads. If he uses the question no. 3 , he tosses three coins and use the question no 1 , if all are heads. In long run which question does he use most often and with how much frequency is it used.