

Code No: X0521

R07**SET - 1**

II B. Tech I Semester Supplementary Examinations May - 2013
PROBABILITY AND STATISTICS

(Com. to CSE, IT)

Time: 3 hours

Max. Marks: 80

Answer any FIVE Questions
 All Questions carry Equal Marks
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1. a) Define i) Conditional Probability ii) Mutually Exclusive events and explain with examples.  
 b) The probabilities of passing in subject A, B, C, D are  $\frac{3}{4}$ ,  $\frac{2}{3}$ ,  $\frac{4}{5}$  and  $\frac{1}{2}$  respectively. To qualify in the examination, a student should pass in A and two subjects among the three. What is the probability of qualifying in that examination?
2. Two dice are thrown X assign to each point if S the sum of the variables on the faces. Find mean and variance of the random variable.
3. Derive Mean and Variance of Normal distribution.
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 mean of each of the sampling distribution of means.
5. a) 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?  
 b) A random sample of 400 items is found to have mean of 82 and standard deviation of 18. Find 95% confidence limits for the mean of the population from which the sample is drawn.
6. A simple sample of height of 6400 Englishmen has a mean of 67.85 inches and S.D of 2.56 inches, while a simple sample of heights of 1600 Australians has a mean of 68.55 inches and a S.D of 2.52 inches. Do the data indicate that Australians are on the average taller than Englishmen?
7. Two independent sample of 8 and 7 items respectively had the following values of the variables

|           |    |    |    |    |    |    |    |    |
|-----------|----|----|----|----|----|----|----|----|
| Sample I  | 9  | 11 | 13 | 11 | 16 | 10 | 12 | 14 |
| Sample II | 11 | 13 | 11 | 14 | 10 | 8  | 10 |    |

Do the estimates of population variance differ significantly?

8. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter arrival time follows an exponential distribution and the service time (the time taken to hump a train) distribution is also exponential with an average 36 minutes. Calculate the following i) Average number of trains in the queue ii) The probability that the queue size exceeds 10.

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- Define i) Sample space ii) Random Experiment and explain with examples.
 - State and prove Baye's Theorem
- If $f(x) = ke^{-|x|}$ is probability density function in $-\infty \leq x \leq \infty$. Then find the value of k and the variance of the random variable. Also find probability between 0 and 4.
- If for a Poisson variate $2P(x=0) = P(x=2)$, find the probability that i) $P(x \leq 3)$ ii) $P(2 < x \leq 5)$ iii) $P(x \geq 3)$
- A population consists of five numbers 2, 3, 6, 8, 11. Consider all possible samples of size two which can be drawn without replacement from the population. Find
 - The mean of the population
 - Standard deviation of the population
 - The mean of the distribution of means.
- A research worker wants to determine the average time it takes a mechanic to rotate the tyres of a car and he wants to be able to assert with 95% confidence that the mean of his sample is off by almost 0.5 minutes. If he can presume from past experience that $\sigma = 1.6$ minutes how large a sample will have to take?
 - The mean and the standard deviation of a population are 11,795 and 14,054 respectively. If $n=50$, find 95% confidence interval for the mean.
- In a study designed to investigate whether certain detonators used with explosives in coal mining meet the requirement that atleast 90% will ignite the explosive when charged, it is found that 174 of 200 detonators function properly. Test the null hypothesis $p=0.9$ against the alternate hypothesis $p<0.9$ at the 0.05 level of significance.
- From the following data find whether is any significant liking in the habit of taking soft drinks among the categories of employees

Soft drinks	Employee			Total
	Clerks	Teachers	Officers	
Pepsi	10	25	65	100
Maaza	15	30	65	110
Thums up	50	60	30	140
Total	75	115	160	350

- Telephone users arrive at a booth following a poisson distribution with an average time of 5 minutes between one arrival and the next. The time taken for a telephone call is on an average 3 minutes and it follows an exponential distribution. What is the probability that the booth is busy? How many more booths should be established to reduce the waiting time to less than or equal to half of the present waiting time?

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- Two cards are selected at random from 10 cards numbered 1 to 10. Find the probability that the sum is even if the two cards are drawn one after the other with replacement.
  - 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 girl.
- If the probability density of a random variable is given by  

$$f(x) = \begin{cases} k(1-x^2), & \text{for } 0 < x < 1 \\ 0 & , \text{ otherwise} \end{cases}$$
 Find the value of k and the probabilities that a random variable having the value i) between 0.1 and 0.2      ii) greater than 0.5
- 2% of the items of a factory are defective. The items are packed in boxes. What is the probability that there will be    i) 2 defective items    ii) atleast three defective items  
 iii)  $2 < \text{defective} < 5$  in a box of 100 items.
- What is the value of correction factor if  $n=5$  and  $N=200$
  - A sample of size 400 is taken from a population whose standard deviation is 16. Find the standard error and probable error.
- It is desired to estimate the mean time of continuous use until an answering machine will first require service. If it can be assumed that  $\sigma = 60$  days how large a sample is needed that one will be able to assert with 90% confidence that the sample mean is off by at most 10 days.
  - A random sample of size 81 was taken whose variance is 20.25 and mean is 32, construct 98% confidence interval.
- A sample of 400 items is taken from a population whose standard deviation is 10. The mean of the sample is 40. Test whether the sample has come from a population with mean 38. Also calculate 95% confidence interval.
- The daily wages in rupees of skilled workers in two cities are as follows
 

| City   | Size of sample | S.D of wages of the sample |
|--------|----------------|----------------------------|
| City A | 16             | 25                         |
| City B | 13             | 32                         |

 Test at 5% level the equality of variances of the wage distribution in the two cities.
- A personal computer repairer 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 hour day, what is the repairer's expected idle time each day? How many jobs are ahead of the average set just brought in?

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1. a) What is the probability that a card drawn at random from the pack of playing cards may be either a queen or a king?
 b) A business man goes to hotels X, Y, Z, 20%, 50%, 30% of the time respectively. It is known that 5%, 4%, 8% of the rooms in X, Y, Z hotels have faulty plumbing. What is the probability that business man's room having faulty plumbing is assigned to hotel 'z'.
2. a) From a lot of 10 items containing 3 defectives, a sample of 4 items is drawn at random. Let the random variable X denote the number of defective items in the sample. Find the probability distribution of X when the sample is drawn without replacement.
 b) If X is a continuous random variable and k is a constant then prove that $\text{Var}(kx) = k^2 \text{Var}(x)$.
3. An insurance agent accepts policies of 5 men all of identical age and in good health. The probability that a man of this age will be alive 30 years is $\frac{2}{3}$. Find the probability that in 30 years i) all five men ii) atleast one man iii) at most three will be alive.
4. Define Sample and types of sampling and explain with examples.
5. A random sample of 100 teachers in a large metropolitan area revealed a mean weekly salary of Rs. 487 with a standard deviation Rs.48. With what degree of confidence can we assert that the average weekly salary of all teachers in the metropolitan area is between 472 to 502?
6. A lady stenographer claims that she can take dictation at the rate of 120 words per minute. Can we reject her claim on the basis of 100 trails in which she demonstrates a mean of 116 words with a S.D of 15 words?
7. Two horses A and B were tested according to the time (in seconds) to run a particular track with the following results

Horse A : x_i	28	30	32	33	33	29	34
Horse B : y_i	29	30	30	24	27	29	--

Test whether the two horses have the same running capacity.

8. Consider a box office ticket window being manned by a single server. Customer arrives to purchase tickets according poisson input process with a mean rate of 30 per hour. The time required to serve a customer has an exponential distribution with a mean of 910 seconds. Determine the following i) Fraction of the time the server is busy ii) the average number of customers queuing for service.