Set No. 1

II B.Tech II Semester Regular Examinations, Apr/May 2008
PROBABILITY AND STATISTICS
(Common to Civil Engineering, Mechanical Engineering, Chemical Engineering, Mechatronics, Production Engineering, Bio-Technology and Automobile Engineering)

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) If A and B are two events and P(A) = 3/5, P(B)=1/2 prove that
   i. $P(AUB) \geq \frac{3}{5}$
   ii. $\frac{1}{10} \leq P(A \cap B) \leq \frac{1}{2}$

   (b) An integer is chosen at random from the first 200 positive integers. What is the probability that the integer chosen is divisible by 6 or 8.

   (c) There are 3 boxes. Box–I contains 7 Red, 3 Black, and 4 White balls, box -II contains
   9 Red, 2 Black, 4 White, box- III 10 Red, 5 Black, 5 white balls. One box is chosen and one ball is drawn from it. What is the probability that the ball is
   i. Red
   ii. Black
   iii. White.   [5+5+6]

2. (a) For the continuous probability function $f(x) = kx^2 \, e^{-x}$ when $x \geq 0$ find
   i. k
   ii. mean
   iii. variance

   (b) 20% of items produced from a factory are defective. Find the probability that in a sample of 5 chosen at random.
   i. none is defective
   ii. one is defective
   iii. $p(1 < x < 4)$ [8+8]

3. (a) The probabilities of a poisson variate taking the values 1 and 2 are equal. Find
   i. μ
   ii. $p(x \geq 1)$
   iii. $p(1 < x < 4)$

   (b) In a sample of 1000 cases, the mean of a certain test is 14 and standard deviation is 2.5. Assuming the distribution to be normal, find
   i. how many students score between 12 and 15
   ii. how many score above 18

    iii. how many score below 8   [8+8]

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 the mean of each of the sampling distribution of means.

    (c) Find the standard deviation of sampling distribution of means.   [5+5+6]

5. (a) A sample of size 64 and mean 60 was taken from a population whose standard deviation is 10. Find 95% confidence interval for the mean.

    (b) Experience has shown that 10% of a manufactured product is of top quality. What can you say about the maximum error with 95% confidence for 100 items

    (c) A coin is tossed 512 times. Head turned up 244 times. Can you say that the coin is unbiased.   [5+5+6]

6. A large electronic firm that hires many workers with disabilities wants to determine whether their disabilities affect such workers performance. Use the level of significance of $\alpha = 0.05$ to decide on the basis of the following data, whether it is reasonable to maintain that the disabilities have no effect on the worker's performance.   [16]

	Above avaerage	Average	Below average
Blind	21	64	17
Deaf	16	49	14
No disability	29	93	28

7. (a) Derive normal equations to fit $y = ax^b$

    (b) Fit a parabola of the form $y = a + bx + cx^2$ for the following data   [6+10]

x	2	4	6	8	10
y	3.07	12.85	31.47	57.38	91.29

8. (a) The regression equations of two variables x and y are
x = 0.7 y + 5.2, y = 0.3x + 2.8. Find the mean of the variables and the coefficient of correlation between them

    (b) Consider the following data:

x	-4	-3	-2	-1	0	1	2	3	4
y	0.1	2.5	3.4	3.9	4.1	3.8	3.5	2.8	0.3

Find the correlation coefficient 'r'.   [6+10]

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$$\boxed{\textbf{Set No. 2}}$$

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1. (a) Out of 10 girls in a class , 3 have blue eyes. If 2 of the girls are chosen at random, what is the probability that
    i. both have blue eyes
    ii. at least one has blue eyes

    (b) Define conditional probability. Give an example. State the general multiplicative rule and special multiplication rule (when the events are independent)
    [8+8]

2. (a) A pair of dice are thrown. Let the random variable X assign to each point (a,b) in S the sum of its numbers.
    i. Find the distribution of X
    ii. the mean of the random variable.

    (b) Assuming that half the population are consumers of rice. If 8 individuals are taken to test find the probability that
    i. Two are consumers of rice
    ii. At least two are consumer's of rice
    iii. $1 \leq x \leq 4$ are consumers of rice.   [8+8]

3. (a) The average number of phone calls/minute coming into a switch board between 2 p.m. and 4. p.m. is 2.5. Determine the probability that during one particular minute there will be
    i. 4 or fewer
    ii. more than 6 calls

    (b) The marks obtained in mathematics by 1000 students is normally distributed with mean 78% and standard deviation 11%. Determine
    i. how many students got marks above 90%
    ii. what was the highest mark obtained by the lowest 10% of the student
    iii. within what limits did the middle of 90% of the students lie   [8+8]

4. 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. [4×4]

5. (a) A die is thrown 256 times an even digit turns up 150 times. Can we say that the die is unbiased.

(b) If we can assert with 95% that the maximum error is 0.05 and p=0.2, find the sample size.

(c) Write about null hypothesis and testing of null hypothesis . [5+5+6]

6. A large electronic firm that hires many workers with disabilities wants to determine whether their disabilities affect such workers performance. Use the level of significance of $\alpha = 0.05$ to decide on the basis of the following data, whether it is reasonable to maintain that the disabilities have no effect on the worker's performance. [16]

	Above avaerage	Average	Below average
Blind	21	64	17
Deaf	16	49	14
No disability	29	93	28

7. Fit a parabola of the form y = a + bx + cx^2 for the following data by the method of least squares [16]

x	20	40	60	80	100	120
y	5.5	9.1	14.9	22.8	33.3	46

8. (a) The following table gives experimental values of the three variates X,Y and Z. Fit a multiple regression of the type Z = α X + βY.

X	1	2	3	5
Y	1	3	4	2
Z	7	18	25	23

(b) The following are the marks obtained by 12 students in Economics and Statistics:

Economics(x)	78	56	36	66	25	75	82	62
Statistics(y)	84	44	51	58	60	68	62	58

Compute the Spearman rank correlation coefficient between x and y. [8+8]

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1. (a) If P(A) = a, P(B) =b, $P(A \cap B)$ = c, express the following interms of a, b, and c

   i. $P(A^c \cap B^c)$
   ii. $P(A^c \cap B)$
   iii. $P(A^c \cap (A \cup B))$
   iv. $P[(AU(A^c \cap B))]$

   (b) Box A contains nine cards numbered 1 to 9 and box B contains five cards numbered 1 to 5. A box is chosen at random and a card is drawn, if the card shows an even number another card is drawn from the same box, if the card shows an odd number a card is drawn from the other box.

   i. What is the probability that both cards show even numbers?
   ii. If both cards show even numbers, what is the probability that they come from box A.
   iii. What is the probability that both cards show an odd number?   [8+8]

2. (a) Let x be a discrete random variable having the following probability distribution, then

X	-2	-1	0	1	2	3
P(X)	0.1	k	0.2	2k	0.3	3k

   Find

   i. K
   ii. mean
   iii. variance

   (b) The probability that the life of a bulb is 100 days is .05. Find the probability that one of 6 bulbs.

   i. Atleast one
   ii. greater than 4
   iii. none, will be having a life of 100 days.   [8+8]

3. (a) Define Poisson distribution and find its variance and the mean.

(b) Find the mean and standard deviation of a normal distribution in which 7% of items are under 35 and 89% are under 63. [8+8]

4. (a) A random sample of size 100 is taken from an infinite population having the mean $\mu=76$ and the variance $\sigma^2 = 256$. Find the probability that $\bar{x}$ will be between 75 and 78.

(b) Write about
   i. Null hypothesis
   ii. Alternate Hypothesis [8+8]

5. (a) A lady stenographer claims that she can take dictation at the rate of 118 words per minute can we reject her claim on the basis of 100 trials in which she demonstrates a mean of 116 words and a S.D of 15 words.

(b) In a large consignment of oranges a random sample of 64 oranges revealed that 14 oranges were bad. If it reasonable to ensure that 20% of the oranges are bad? [8+8]

6. Given below is the number of male births in 1000 families having five children.

Male children	0	1	2	3	4	5
No of families	40	300	250	200	30	180

Test whether the given data is consistent with the hypothesis that the chance of male birth is equal to the chance of female birth. [8+8]

7. (a) Fit a straight line for the following data

x	1	2	3	4	5	6	7	8	9	10
y	52.5	58.7	65	70.2	75.4	81.1	87.2	95.5	102.2	108.4

(b) Fit a curve of the form $y = ae^{bx}$ by the method of least squares for the following data and estimate the value of y when x = 300. [8+8]

x	77	100	185	239	285
y	2.4	3.4	7.0	11.1	19.6

8. (a) If θ is the angle between two regression lines, the standard deviation of y is twice the standard deviation of x and r= 0.25, find $\tan\theta$

(b) Find the rank correlation for the following indices of supply and price of an article. [6+10]

Supply index	124	100	105	112	102	93	99	115	123	104	99	113	121	103	101
Price index	80	100	102	91	100	111	109	100	89	104	111	102	98	111	123

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1. (a) State and prove the theorem of total probability

   (b) In a certain college 25% of the students failed in Mathematics, 15% failed in Chemistry and 10% in Mathematics and chemistry. A student is selected at random.

      i. If he/she failed in Chemistry, what is the probability that he/she failed in Mathematics.

      ii. If he/she failed in Mathematics, what is the probability that he/she failed in Chemistry. [6+10]

2. (a) Suppose a continuous random variable X has the probability density f(x)=k$(1 - x^2)$ for $0 < x < 1$ and f(x) = 0 otherwise. Find

      i. k

      ii. mean

      iii. variance.

   (b) 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. atleast once. [8+8]

3. (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≤2)

   (b) Prove that the mean = mode = median for a normal distribution. [8+8]

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 the mean of each of the sampling distribution of means.

   (c) Find the standard deviation of sampling distribution of means. [5+5+6]

5. (a) A lady stenographer claims that she can take dictation at the rate of 118 words per minute can we reject her claim on the basis of 100 trials in which she demonstrates a mean of 116 words and a S.D of 15 words.

   (b) In a large consignment of oranges a random sample of 64 oranges revealed that 14 oranges were bad. If it reasonable to ensure that 20% of the oranges are bad? [8+8]

6. The following is the distribution of hourly number of trucks arriving at a company's warehouse;

No.of Trucks	0	1	2	3	4	5	6	7	8
Frequency	52	151	130	102	45	12	5	1	2

Find the mean of this distribution, and using it as parameter λ, fit a Poisson distribution. Test for goodness of fit at the 0.05 level of significance? [16]

7. (a) Derive normal equations to fit the curve $y = ax + bx^2$

   (b) Obtain a relation of the form $y = a.\ (b)^x$ for the following data by the method of least squares. [6+10]

x	2	3	4	5	6
y	8.3	15.4	33.1	65.2	17.4

8. Use the formula $\rho = \frac{\sigma_{x+y}^2 - \sigma_x^2 - \sigma_y^2}{2\sigma_x \sigma_y}$ to compute the correlation coefficient to the following data [16]

x:	62	56	36	66	25	75	82	78
y:	58	44	51	58	60	68	62	84

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