

II B.Tech II Semester Supplementary Examinations, Aug/Sep 2007
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

1. (a) If $P(A) = 1/2$, $P(B) = 1/3$, $P(A \cap B) = 1/5$, then find
 - i. $P(A \cup B)$
 - ii. $P(A^c \cap B)$
 - iii. $P(A \cap B^c)$
 - iv. $P(A^c \cap B^c)$
 where (A^c = the compliment of A)
 - (b) Three machines produces 70%, 20% and 10% of the total number of a factory. The percentage of defective output of these machines are 4%, 3% and 2% respectively. An item is selected at random and found defective. Find the probability that it is from
 - i. machine-I
 - ii. machine-II
 - iii. machine-III

[8+8]
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. at least once.

[8+8]
3. (a) A Poisson distribution has a double mode at $x = 2$ and $x = 3$, find the maximum probability and also find $p(x \geq 2)$.
 (b) The weekly wages of 1000 workers are normally distributed around a mean of Rs.70 and S.D of Rs.5/- Estimate the number of workers whose weekly wages will be
 - i. between Rs.70 and Rs.72
 - ii. between 69 and 72.

[8+8]

4. Samples of size 2 are taken from the population 4, 8, 12, 16, 20, 24 without replacement. Find
- mean of the population
 - standard deviation of population
 - the mean of sampling distribution of means
 - standard deviation of sampling distribution of means. [16]

5. (a) A random sample of size 81 was taken whose variance is 20.25 and mean 32 construct 98% confidence interval
- (b) A manufacturer claims that only 4% of his products are defective. A random sample of 500 were taken among which 100 defective Test the hypothesis at .05 level. [8+8]

6. (a) To examine the hypothesis that the husbands are more intelligent than the wives, an investigator took a sample of 10 couples and administered them a test which measures the IQ as follows:

Test the hypothesis with a reasonable test at the level of significance of 0.05?

Husbands:	117	105	97	105	123	109	86	78	103	107
Wives	106	98	87	104	116	95	90	69	108	85

- (b) In an investigation on the machine performance the following results were 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 $\alpha=0.05$ [8+8]

7. (a) The measurements of humidity and the moisture content in a raw material are given in the following table. Fit a St. line of the for $y = ax + b$ Humidity (x)

42	35	50	43	48	62	31	36	44	39	55	48
12	8	14	9	1	16	7	9	12	10	13	11

- (b) Find the most plausible values of x and y
- $$x + 2y - 7 = 0 \quad 2x + 3y - -2 = 0$$
- $$x + 8y - 3 = 0 \quad 3x - y + 5 = 0. \quad [8+8]$$

8. (a) A sample of 12 fathers and their eldest sons gave the following data about their height in inches calculate the coefficient of rank correlation. [8+8]

Fathers	65	63	67	64	68	62	70	66	68	67	69	71
Sons	68	66	68	65	69	66	68	65	71	67	68	70

- (b) Given that $x = 4y + 5$ and $y = kx + 4$ are the regression lines of x on y and y on x, respectively, show that $0 \leq k \leq 25$. If $k = 0.10$ actually, find the means of the variables x and y and also their coefficient of correlation.

Code No: R05220101

Set No. 1

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1. (a) Of the three men, the chances that a politician, a businessman or an academician will be appointed as a vice-chancellor (V.C.) of a university are 0.5, 0.3, 0.2 respectively. Probability that research is promoted by these persons if they are appointed as v.c. are 0.3, 0.7, 0.8 respectively.
 - i. Determine the probability that research is promoted
 - ii. If research is promoted, what is the probability that V.C. is an academician
- (b) There are two boxes in box I, 11 cards are there numbered 1 to 11 and in box II 5 cards numbered 1 to 5. A box is chosen and a card is drawn. If the card shows an even number then another card is drawn from the same box. If card shows an odd number another card is drawn from the other box. Find the probability that
 - i. both are even
 - ii. both are odd
 - iii. if both are even. What is the probability that they are from box 1. [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. At least one
 - ii. greater than 4
 - iii. none, will be having a life of 100days. [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
- how many students score between 12 and 15?
 - how many score above 18
 - how many score below 8. [8+8]
4. If the population is 3,6,9,15,27.
- List all possible samples of size 3 that can be taken without replacement from the finite population.
 - Calculate the mean of each of the sampling distribution of means.
 - 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) The following data pertain to the cosmic ray doses measured at various altitudes:
- | | | | | | | | |
|--------------------|----|-----|-----|------|------|------|------|
| Altitude (Feet x) | 50 | 450 | 780 | 1200 | 4400 | 4800 | 5300 |
| Dose Rate (year y) | 28 | 30 | 32 | 36 | 51 | 58 | 69 |
- Fit a straight lines $y = a + bx$
- (b) Derive normal equations to fit the parabola $y = a + b x + cx^2$. [10+6]
8. Two independent variables x and y have means 5 and 10 and variances 4 and 9 respectively. Find the coefficient of correlation between u and v where
- $u = 3x+4y$, $v = 3x-y$
 - If x and y are not independent and $r=.5$, $u = x+y$, $v = x-y$ [8+8]

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1. (a) Define a random experiment, sample space, event and mutually exclusive events. Give examples of each.
(b) Box A contains 5 red and 3 white marbles and box B contains 2 red and 6 white marbles.
 - i. If a marble is drawn from each box, what is the probability that they are both of the same colour? [8+8]
2. (a) If X and Y are discrete random variables and K is a constant then prove that.
 - i. $E(X + K) = E(X) + K$
 - ii. $E(X+Y) = E(X) + E(Y)$(b) Out of 800 families with 5 childrens each, how many would you expect to have
 - i. 3 boys
 - ii. At least one boy. [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. There are 25 cards on four of them written 5, on six of them 10, on five of them 15, on three of them 20, on four of them 25 and three of them 30. One are each of 5,10,15,20,25,30 are selected without replacement. Find
 - (a) The mean of the population.
 - (b) Standard deviation of the population.
 - (c) Mean of means of sampling distribution.
 - (d) Standard deviation of means of sampling distribution. [4×4]

5. (a) In a random sample of 125 cola drinkers, 68 said they prefer thums up to pepsi. Test the null hypothesis $p = .5$ against the alternate hypothesis $p > .5$
- (b) 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 478.6 to 495.4. [8+8]

6. (a) To examine the hypothesis that the husbands are more intelligent than the wives, an investigator took a sample of 10 couples and administered them a test which measures the IQ as follows:

Test the hypothesis with a reasonable test at the level of significance of 0.05?

Husbands:	117	105	97	105	123	109	86	78	103	107
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- (b) In an investigation on the machine performance the following results were 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 $\alpha=0.05$ [8+8]

7. (a) The following are the measurements of the air velocity and evaporation coefficient of burning fuel droplets in air impulse engine

Air velocity x	20	60	100	140	180	220	260	300	340	380
Evaporation Coefficient y	.18	.37	.35	.78	.56	.75	1.18	1.36	1.17	1.65

Fit a straight line to the above data.

- (b) Fit a curve of the form $y = a.(b)^x$ by the method of least squares for the following data. [8+8]

x	0	1	2	3	4	5	6	7
y	10	21	35	59	92	200	400	610

8. (a) If there are no ties in the ranks then show that the rank correlation is given by $\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$ where $d_i = \text{rank of } x_i - \text{rank of } y_i$
- (b) For 20 army personnel, the regression of weight of kidneys (y) on weight of heart (x), both measured in oz, is $y = 0.399x + 6.394$ and the regression of weight of heart on weight of kidneys is $x = 1.212y - 2.461$. Find the correlation coefficient between the two variables and also their means. [8+8]

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1. (a) A Band C in order toss a coin. The first one to toss a head wins the game. What are their probabilities of winning, assuming that the game may continue indefinitely?

(b) State and prove Baye's theorem. [8+8]

2. (a) If $F(x)$ is the distribution function of X given by

$$\begin{aligned} F(x) &= 0 && \text{if } x \leq 1 \\ &= k(x-1)^4 && \text{if } 1 < x \leq 3 \\ &= 1 && \text{if } x > 3 \end{aligned}$$

determine

- i. $f(x)$
 ii. k
 iii. Mean.
- (b) Find the maximum n such that the probability of getting no head in tossing a coin n times is greater than .1 [8+8]

3. (a) If the variance of a poisson variate is 3. Find the probability that

- i. $x=0$
 ii. $1 \leq x < 4$
 iii. $0 < x \leq 3$

- (b) Given that the mean heights of students in a class is 158cms with standard deviation of 20cms. Find how many students heights lie between 150cms and 170cms, if there are 100 students in the class. [8+8]

4. (a) A random sample of size 144 is taken from an infinite population having the mean 75 and variance 225. What is the probability that x will be between 72 and 77.

- (b) A normal population has a mean of .1 and standard deviation of 2:1. Find the probability that the mean of simple sample of 900 members will be negative. [8+8]

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. 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? [16]

7. (a) The following data pertain to the cosmic ray doses measured at various altitudes:

Altitude (Feet x)	50	450	780	1200	4400	4800	5300
Dose Rate (year y)	28	30	32	36	51	58	69

Fit a straight lines $y = a + bx$

- (b) Derive normal equations to fit the parabola $y = a + b x + cx^2$. [10+6]

8. The following are the data on the number of twists required to break a certain kind of forged alloy bar and the percentage of two alloying elements present in the metal.

Fit at least sequence regression line of on x_1 and x_2 . [16]

No. of tourists	(y)	41	49	69	65	40	50	58	57	31	36	44	57	19	31	33	43
% of elements of A	(x_1)	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
% of elements of B	(x_2)	5	5	5	5	10	10	10	10	15	15	15	15	20	20	20	20
