

Code No: 07A51801

**R07****Set No. 2**

**III B.Tech I Semester Examinations, May 2011**  
**PROBABILITY AND STATISTICS**  
**Metallurgy And Material Technology**

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions  
 All Questions carry equal marks

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1. Bricks made in 2 kilns have graded as I, II and III. The production of Bricks in a particular period was as follows. Determine whether the manager of kiln A justified in claiming that he produces Bricks of a higher quality than that of the other one.

kiln	Grade I	Grade II	Grade III
Kiln A	24	43	13
Kiln B	31	57	32

[16]

2. (a) A sample of size 81 was taken whose variance is 20.25 and mean 32. Construct 95% Confidence interval for the mean.
- (b) What is the maximum error with 99% confidence, if the standard deviation of the sample of size 72 is 5?
- (c) In 64 randomly selected hours of production, the mean and the standard deviation of the number of acceptance pieces produced by an automatic stamping machine are 1.038 and .146. At the .05 level of significance test whether the mean is greater than 1.000. [5+5+6]
3. (a) A class contains 10 men and 20 women of which half the men and half the women have brown eyes. Find the probability that the person is a man or has brown eyes.
- (b) There are three bags. Bag I contains - 1 White, 2 red and 3 green balls  
 Bag II- contains- 2 White, 3 red and 1 green balls  
 Bag III- contains- 3 White, 1 red and 2 green balls  
 One bag is selected and one ball is drawn. Find the probability that it is from
- i. Bag- I
  - ii. Bag-II
  - iii. Bag-III.
- [8+8]
4. (a) A fair coin is tossed until a head or five tails occur. Find the expected number of tosses of the coin.
- (b) Derive a formula to find the mode of binomial distribution. [8+8]
5. (a) At a telephone booth, the customers arrive on average 2 per minute. Find
- (i)  $P(x > 1)$
  - (ii)  $P(x = 3)$
  - (iii)  $P(1 < x < 5)$

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- (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
- (i) Above 90
  - (ii) Between 55 and 80
  - (iii) Below 50
- [8+8]
6. The Customer arrive at a fast food centre at an arrival of 11 minutes and they are served at the rate of 1 / 9 per minute. Find
- (a) Average number of customers in the system.
  - (b) Average number of customers in the queue.
  - (c) The average waiting time of queue.
  - (d) The probability that queue length is greater than or equal to five.
  - (e) The probability that an arrival will have to wait for more than 10 minutes [16]
7. (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 1 ounce, 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]
8. A population consists if five numbers 8, 24, 36, 45, 52. Consider all Samples of size two which can be taken without 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]

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1. (a) What is the maximum error one can expect to make with probability .95, when using the mean of a random sample of size  $n=90$  to estimate the mean of a population with  $\sigma^2 = 6.25$
- (b) A sample of 155 members has a mean 67 and S.D 5.2. Is this sample has been taken from a large population of mean 70?
- (c) A random sample of 400 flower stems has an average length of 15 cms. Can this be regarded as a sample from a large population with mean 16 cms and standard deviation 5 cms.? [5+5+6]
2. (a) If A and B are any two events, then prove that  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- (b) In a certain town 40% have brown hair, 25% have brown eyes and 15% have both brown hair and brown eyes  
 A person is selected at random from the town.
  - i. If he has brown hair, what is the probability that he has brown eyes
  - ii. If he has brown eyes, what is the probability that he does not have brown hair. [8+8]
3. A population consists of five numbers. 21, 32, 45, 52 and 60
  - (a) write all Samples of size three without replacement.
  - (b) The population Standard deviation
  - (c) The mean of the sampling distribution of mean
  - (d) Standard deviation of the sampling distribution of means [16]
4. A survey of 400 families with 5 children each revealed the following distribution. Is this result with the hypothesis that male births are equally probable?
 

No. of boys	0	1	2	3	4	5
No. of families	25	60	110	113	62	30

 [16]
5. (a) Given that  $P(x=2)=45p(x=6)-3p(x=4)$  for a Poisson variate X. Find
  - i.  $P(x > 1)$
  - ii.  $P(x < 3)$
  - iii.  $P(x \geq 1)$
- (b) In a distribution exactly normal 7% of the items are under 35 and 89% are under 63. Find the mean and the Standard deviation of mark. [8+8]

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6. The customers arrive at a one window drive according to a Poisson distribution with a mean of 10 minutes and service time per customer is exponential with mean of 6 minutes. The space in front of the window can accommodate only three vehicles including the serviced one. Other vehicles have to wait outside this space. Calculate
- The probability that an arriving customer can drive directly to the space in front of the window.
  - The probability that an arriving customer will have to wait outside the directed space.
  - How long an arriving customer will have to wait outside the directed space? [16]
7. (a) A sample of 100 electric bulbs produced by a manufacturer A showed a mean life time of 1190hrs and a standard deviation of 90 hrs. Another sample of 75 bulbs produced by a manufacturer B showed a mean life of 1230hrs with a S.D of 120hrs. Test the significance of the difference between the means at 99% level.
- (b) In a random sample of 400 industrial accidents, it was found that 231 were due to unsafe working conditions Find
- The maximum error
  - Construct 95% confidence interval for the proportion. [8+8]
8. (a) A continuous Random variable has the p.d.f  $f(x) = \frac{(3+x)^2}{16}$  if  $-3 \leq x \leq -1$   
 $= \frac{(6-2x^2)}{16}$  if  $-1 \leq x \leq 1$   
 $= \frac{(3-x)^2}{16}$  if  $1 \leq x \leq 3$   
 $= 0$  else where  
 Find
- Mean
  - Variance
- (b) A coin is so weighted that the probability of getting head is  $2/3$ . 8 such coins are tossed Find the probability of getting head
- At least once
  - Exactly 4 times
  - $> 3$  times [8+8]

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1. (a) There are 25 cards numbered 1 to 25. Two cards are drawn. Find the probability that
  - i. The sum is even
  - ii. The sum is a multiple of 3
- (b) Define conditional probability. A box I contains 5 red balls, 3 white balls. Box II contains 3 red balls 6 white balls. A box is chosen at random and a ball is drawn and put it into another box. A ball is drawn from second box. Find the probability that both are of same colour. [8+8]
2. A typist at an office receives on average 30 letters per day for typing. The typist works 8 hours per day and he takes 15 minutes for typing
  - (a) What is the average number of letters waiting to be typed?
  - (b) The probability that more than or equal to 4 letters are being waiting to be typed.
  - (c) What is the average waiting time needed to have a letter to be typed?
  - (d) The time that the typist is idle per day [16]
3. (a) A sample of size 10 was taken from a population with S.D .03. Find the maximum error with 99% confidence interval.
- (b) A random sample of size 144 was taken and the maximum error with probability .99 is .86, then find the variance of the population.
- (c) An ambulance service claims that it takes on the average less than 10 minutes to reach its destination in emergency calls. A sample of 36 calls has a mean of 11 minutes and variance 16 minutes. Test the claim at .05 levels. [5+5+6]
4. (a) Probability density function of a random variable  $= \frac{1}{2} \sin x$  in  $0 \leq x \leq \pi$ ;  $=0$  else where. Find
  - i. The mean
  - ii. Mode
  - iii. Median
  - iv.  $P(0 < x < \frac{\pi}{2})$ .
- (b) The probability that a man hitting a target is  $\frac{1}{3}$ . If he fires 6 times, find the probability that he fires
  - i. At the most 5 times

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ii. Exactly once

iii. At least two times.

[8+8]

5. (a) Given that  $P(x=2) = 9P(x=4) + 90P(x=6)$  for a Poisson variate  $X$ . Findi.  $P(x < 2)$ ii.  $P(x > 4)$ iii.  $P(x \geq 1)$ 

(b) In a distribution exactly normal 31% of the items are under 45 and 8% are over 64. Find the mean and the Standard deviation of mark. [8+8]

6. The table below shows results of a survey in which 250 respondents were categorized according to the level of education towards students.

City	Against	Neutral	For
Elementary school	40	25	5
High school	40	20	5
College	30	15	30
Professional College	15	15	10

Test at the 0.01 level whether the classifications are independent.

[16]

7. Take 30 slips of paper and label 5 each -4 and 4, four each -3 and 3, three each -2 and 2 two each -1, 1 and if each slip of paper has the same probability of being drawn. Find the mean and variance of the distribution. [16]

8. (a) In a certain factory there are two independent processes for manufacturing the same item. The average weight in a sample of 400 items produced from one process is found to be 150 gms with a standard deviation of 20 gms while the corresponding figures in a sample of 500 items from the other process are 190 and 24. Is there significant difference between the mean (test at 95% level).

(b) Among 100 fish caught in a large take, 18 were inedible due to the pollution of the environment. With what confidence can we assert that the error of this estimate is at most .065? [8+8]

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1. (a) There are two coins such that the probability of getting head is  $\frac{2}{3}$ . If these two coins are tossed, find the probability of getting
  - i. At least one head
  - ii. Two heads
- (b) 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. [8+8]
2. (a) Patients arrive at a clinic according to Poisson distribution at the rate of 15 patients per hour. Estimation time per patients is exponential with mean 25 per hour. Find
  - i. The probability that the person arriving at the clinic will have to wait.
  - ii. Average length of the queue that forms from time to time
- (b) Patients arrive at a clinic according to Poisson distribution at the rate of 30 patients per hour. Estimation time per patients is exponential with mean 20 per hour. Find
  - i. Expected waiting time until a patient is discharged from the clinic.
  - ii. Average number of Patients in the queue [8+8]
3. (a) A college conducts both day and night classes. A sample of 50 students in day college got an average of 98% marks in Maths with a standard deviation of 20%. Sample of 60 students in night college got 88% marks in Maths with a standard deviation of 30%. Test the significance between the difference of two means at 1% level.
- (b) Before an increase on excise duty on tea 500 people out of a sample of 900 found to have the habit of having tea. After an increase on excise duty 250 are have the habit of having tea among 1100. Is there any decrease in the consumption of tea. Test at 5% level. [8+8]
4. Two independent samples from two normal populations respectively had the following values of the variables.

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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 of 100 items is taken from a population whose standard deviation is 5.1. The mean of the sample is 21.6. Construct 95% confidence interval for the mean.
- (b) Maximum error = 0.7. The standard deviation = 5 with 95% confidence what is the sample size?
- (c) A lady stenographer claims that she can take the dictation at the rate of 118 words per minute. Can we reject our claim on the basis of 100 trials in which she demonstrates a mean of 112 words with a S.D of 10 words. [5+5+6]
6. (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]
7. A population consists of five numbers 12, 32, 40, 51, 60. 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 means [16]
8. (a) Two dice are thrown. Let  $X$  assign to each point (a, b) the maximum of its number. Find
- The probability distribution
  - The mean
- (b) A student takes a true false examination consisting of 8 questions. He guesses each answer. The guesses are made at random. Find the smallest value of  $n$  that the probability of guessing at least  $n$  correct answers is less than  $1/2$ . [8+8]

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