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QUESTION BANK (DESCRIPTIVE)

Subject with Code: PROBABILITY&STATISTICS (16HS613)   **Branches**: CIVIL,EEE,MECH,CSE,CS&IT,AE
Year &Sem: II-B.Tech& II-Sem   **Regulation:** R16

UNIT –I

1. a)Two cards are selected at random from 10 cards numbered 1 to 10. Find the probability that the sum is even if (i) The two cards are drawn together. (ii) The two cards drawn one after other with replacement.   [6 M]

   b) Determine (i) $P\left(B/A\right)$ (ii) $P\left(A/B^C\right)$ if A and B are events with $P(A)=\dfrac{1}{3}$, $P(B)=\dfrac{1}{4}$,

   $P(A\cup B)=\dfrac{1}{2}$.   [6   M]

2. a) State and prove Baye's theorem.   [6 M]

   b) The probability that students A,B,C,D solve the problem are $\dfrac{1}{3}$, $\dfrac{2}{5}$, $\dfrac{1}{5}$ and $\dfrac{1}{4}$ respectively If

   all of them try to solve the problem, what is the probability that the problem is solved.   [6M]

3. Two dice are thrown. Let X assign to each point (a,b) in S the maximum of its numbers i.e, X(a,b)= max (a,b). Find the probability distribution. X is a random variable with X(s)={1,2,3,4,5,6}. Also find the mean and variance of the distribution.   [12 M]
   A random variable X has the following probability function

x	0	1	2	3	4	5	6	7
P(x)	0	K	2K	2K	3K	K^2	$2K^2$	$7K^2+K$

4. Determine (i) K (ii) Evaluate P(X≥6) and P(0<X<5) (iii) if P(X≤K)>1/2, find the minimum value of K (iv) variance.   [12 M]

5. Probability density function of a random variable X is $f(x)=\begin{cases}\dfrac{1}{2}\sin x, for\,0\le x\le\pi\\0, elsewhere\end{cases}$. Find the mean,

   mode and median of the distribution and also find the probability between 0 and $\pi/2$.   [12 M]

6. a)A businessman 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 plumbings. What is the probability that businessman's room having faulty plumbing is assigned to hotel Z?   [6 M]
   b) If A and B are independent events then i) $\overline{A}$ and $\overline{B}$ are also independent events .
   ii) $\overline{A}$ and B are also independent events.   [6 M]

7. a)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.
            If he has brown hair, what is the probability that he has brown eyes also?
   ii)If he has brown eyes, determine the probability that he does not have brown hair?   [6 M]
   b) If X is a continuous random variable and k is a constant, then prove that
   i) $Var(X+k)=Var(X)$ ii) $Var(kX)=k^2\,Var(X)$ [6 M]

8. Two dice are thrown X assign to each point if S is the sum of the variable on the faces. Find mean and variance of the random variable.   [12 M]

9. a) In a certain college 25% of boys and 10% of girls are studying mathematics. The girls constitute 60% of the student body. (a) What is the probability that mathematics is being studied? (b) If a student is selected at random and is found to be studying mathematics, find the probability that the student is a girl? [6 M]

b) Find the mean and variance of the uniform probability distribution given by $f(x) = \dfrac{1}{n}$ for

$x = 1, 2, ..., n.$ [6 M]

10. The probability density $f(x)$ of a continuous random variable is given by $f(x) = ce^{-|x|}, -\infty < x < \infty$.

Show that $c = \dfrac{1}{2}$ and find that the mean and variance of the distribution. Also find the probability that

the variant lies between 0 and 4.

UNIT-II

1. a) Derive mean and variance of Binomial distribution. [6 M]
   b) 20% of items produced from a factory are defective. Find the probability that in a sample of 5 chosen at random (i) one is defective (ii) $p(1 < x < 4)$ [6M]

2. a) Fit a Binomial distribution to the following frequency distribution: [10 M]

x	0	1	2	3	4	5	6
f	13	25	52	58	32	16	4

   b) The mean and variance of a binomial distribution are 4 and $\dfrac{4}{3}$. Find $p(X \geq 1)$. [2M]

3. a) Out of 800 families with 5 children each, how many would you expect to have (a) 3 boys (b) 5 girls (c) either 2 or 3 boys. Assume equal probabilities for boys and girls. [6M]
   b) Two dice are thrown five times. Find the probability of getting 7 as sum i) at least once (ii) $p(1 < x < 5)$ [6M]

4. a) Derive mean and variance of poisson distribution. [6 M]
   b) If 2% of light bulbs are defective. Find the probability that (i) At least one is defective (ii) $p(1 < x < 8)$ in a sample of 100 [6M]

5. a) Fit a Poisson distribution to the following frequency distribution: [10 M]

x	0	1	2	3	4
f	109	65	22	3	1

   b) If the mean of a Poisson distribution is 1.8 then find $p(X > 1)$. [2M]

6. a) An insurance agent policies of 5 men all of identical age and good in health. The probability that a man of this age will be alive 30 years is 2/3. Find the probability that in 30 years.
   (i) At least one man (ii) Almost three will be alive [6M]

   b) If X is a Poisson variate such that $P(X = 1)\dfrac{3}{2} = P(X = 3)$, find (i) $P(X \geq 1)$ (ii) $P(X \leq 3)$ [6M]

7. Derive mean and variance of Normal distribution. [12 M]

8. Find the mean and variance of a Normal distribution in which 7% of items are under 35 and 89% are under 63. [12 M]

9. Find the mean and variance of a Normal distribution in which 31% of items are under 45 and 8% are over 63. [12 M]

10. In a sample of 1000 cases, the mean of 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 students score above 18? (iii) How many students score below 18? [12 M]

UNIT-III

1. a) A Sample of 64 students has a mean weight of 70 k.gms. Can this be regarded as a sample from a population with mean weight 65 k.gms and S.D 25 k.gms with level of significance. [6M]
   b) In two large populations, there are 30%, and 25% respectively of fair haired people. Is this difference likely to be hidden in samples of 1200 and 900 respectively from the two population. [6M]

2. a) The means of two large samples of sizes 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from the same population of S.D 2.5 inches. [6M]
   b) Experience had shown that 20% of a manufactured product is of the top quality. In one day's production of 400 articles only 50 are of top quality. Test the hypothesis at 0.05 level. [6M]

3. a) A sample of 900 members has a mean of 3.4 cms and S.D 2.61 cms. Is the sample from a large population of mean 3.25 cm and S.D 2.61 cms. If the population is normal and its mean is unknown find the 95% fiducial limits of true mean. [6M]
   b)In a big city 325 men out of 600 men were found to be smokers. Does this information support the conclusion that majority of men in this city are smokers? [6M]

4. On the basis of their total scores, 200 candidates of a civil service examination are divided into two groups, the upper 30% and the remaining 70%. Consider the first question of the examination. Among the first group, 40 had the correct answer, whereas among the second group, 80 had the correct answer. On the basis of these results, can one conclude that the first question is not good at discriminating ability of the type being examined here? [12M]

5. The nicotine in milligrams of two samples of tobacco were found to be as follows.

Sample A	24	27	26	23	25	---
Sample B	29	30	30	31	24	36

Can it be said that the two samples have come from the same normal population. [12M]

6. A random sample of 10 boys had the following I.Q's : 70,120,110,101,88,83,95,98,107 and 100
   a)Do these data support the assumption of a population mean I.Q of 100?
   b) Find a reasonable range in which most of the mean I.Q values of samples of 10 boys lie. [12M]

7. a) Blood pressure of 5 women before and after intake of a certain drug are given below

Before	110	120	125	132	125
After	120	118	125	136	121

Test whether the significant change in blood pressure at 1% level of significance.

b) A sample of 26 bulbs gives a mean life of 990 hours with a S.D of 20 hours. The manufacturer claims that the mean life of bulbs is 1000 hours. Is the sample not up to the standard.

8. A die is thrown 264 times with the following results. Show that the die is biased. ($\psi^2 = 11.07$ at 5 d.f & 5% L.S)

Number on the die	1	2	3	4	5	6
Frequency	40	32	28	58	54	52

9. a)The following table gives the classification of 100 workers according to sex and nature of work. Test whether the nature of work is independent of the worker ($\psi^2 = 3.84$ at 1d.f) [12M]

	Stable	Unstable	Total
Males	40	20	60
Females	10	30	40
Total	50	50	100

b) The measurements of the output of two units have given the following results. Assuming that both samples have been obtained from the normal populations at 10% significant level, test whether the two populations have the same variance.

[12M]

Unit A	14.1	10.1	14.7	13.7	14.0
Unit B	14.0	14.5	13.7	12.7	14.1

10. Two random samples reveal the following results: [12M]

Sample	Size	Sample Mean	Sum of squares of deviations from the mean
1	10	15	90
2	12	14	108

Test whether the samples came from the same normal population.

UNIT-IV

1. Define ANOVA.Describe briefly the technique of ANOVA for one-way classification.   [12M]
2. Describe briefly the technique of ANOVA for Two-way classification.   [12M]
3. Set up an analysis of variance table for the following per acre production data for three varieties of wheat, each grown on 4 plots and state if the variety differences are significant.   [12M]

Plot of land	Per acre production data		
	Variety of Wheat		
	A	B	C
1	6	5	5
2	7	5	4
3	3	3	3
4	8	7	4

4. Three samples each of size 5 were drawn from 3 uncorrelated normal populations with equal variances. Test the hypothesis that the population means are equal at 5% level.   [12M]

Sample-1	10	12	9	16	13
Sample-2	9	7	12	11	11
Sample-3	14	11	15	14	16

5. An agriculturist wants to test the effects of four different fertilizers A, B, C, D on the yield of paddy. In order to eliminate sources of error due to variabilities in self-fertility, he used the fertilizers in Latin square arrangements given below where the numbers indicate yields in quintals per unit area. Perform an analysis of variance to decide whether there is a difference between the fertilizers at 5% level of significance.

A18	C21	D25	B11
D22	B12	A15	C19
B15	A20	C23	D24
C22	D21	B10	A27

6. Analyse the variance in Latin square of yields (in quintels) of wheat where A,B,C,D represent the different manners used   [12M]

D222	A221	C223	B222
B224	C223	A222	D225
A220	B219	D220	C221
C222	D223	B221	A222

Test whether the different manures used have given significantly different yields.

7. A former applies three types of fertilizers on 4 separate plots. The figure on yields per acre are tabulated below   [13M]

Plots	YIELD				Total
Fertilizers	A	B	C	D	T
Nitrogen	6	4	8	6	24
Potash	7	6	6	9	28
Phosphates	8	5	10	9	32
Total	21	15	24	24	84
Grand total					

Find out if the plots are materially different in fertility, as also, if three fertilizers make any material difference in yields.

8. Set up an analysis of variation table for the following two-way design results   [12M]

Per Acre Production Data of Wheat			
	(in metric tonnes)		
Varieties of seeds	A	B	C
Varieties of Fertilizers			
W	6	5	5
X	7	5	4
Y	3	3	3
Z	8	7	4

Also state whether variety differences are significant at 5 per cent level.

9. a) Define R.B.D and L.S.D .   [6M]
   b) Describe briefly the technique of ANOVA for Two-way classification.   [6M]

10. Three different machines are used for a production. On the basis of the outputs, test whether the Machines are equally effective.   [12M]

OUTPUTS		
Machine 1	Machine 2	Machine 3
10	9	20
5	7	16
11	5	10
10	6	4

Probability & Statistics

UNIT-V

1. The following data shows the values of sample mean and range for 10 samples for size 6 each. Calculate the central limits for mean chart and R- chart and draw the control charts and comment on the state of control. [12M]

Sample no.	1	2	3	4	5	6	7	8	9	10
Mean ($\bar{x}$)	43	49	37	44	45	37	51	46	43	47
Range (R)	5	6	5	7	7	4	8	6	4	6

2. The following are the samples means and ranges for 10 samples each of size 5. Construct a mean and range chart and determine whether the process is in control. [12M]

Sample	1	2	3	4	5	6	7	8	9	10
Mean $\overline{X}$	20	34	45	39	26	29	13	34	37	23
Range	23	39	15	05	20	17	21	11	40	10

3. Ten samples each of size 5 drawn at regular intervals from a manufacturing process. The sample means chart and their range are given below. [12M]

Sample no.	1	2	3	4	5	6	7	8	9	10
Mean ($\bar{x}$)	49	45	48	53	39	47	46	39	51	45
Range (R)	7	5	7	9	5	8	8	6	7	6

Calculate the control limits in respect of mean chart and R- chart comment on the state of control.

4. The following are the figures give the number of defectives in 20 samples, containing 2000 items. [12M]
   425, 430, 216, 341, 225, 322, 280, 306, 337, 305, 356,402, 216, 264, 126, 409, 193, 326, 280, 389
   Draw control chart for fraction defective and comment on the state of control of the Process.

5. Samples of 100 tubes are drawn randomly from the output of a process that produces several thousand units daily. Sample items are inspected for quality and defective tubes are rejected. The result of 15 samples are shown below:

Sample No.	No. of Defective tubes	Sample No.	No. of Defective tubes
1	8	9	10
2	10	10	13
3	13	11	18
4	9	12	15
5	8	13	12
6	10	14	14
7	14	15	9
8	6		

On the basis of information given above prepare a control chart for fraction defective. What conclusion do you draw from the control chart?

6. The following are the figures of defectives in 22 lots each containing 2000 rubber belts: [12M]
   425, 430, 216, 341, 225, 322, 280, 306, 337, 305, 356
   402, 216, 264, 126, 409, 193, 326, 280, 389, 451, 420
   Draw control chart for fraction defective and comment on the state of control of the Process.

7. Assume that 20 half liter milk bottles are selected at random from a process. The number of air bubble observed from the bottles is given in the table [12M]

Bottle number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Defects	4	5	7	3	3	5	6	2	4	8	3	5	4	3	4	5	3	7	6	13

Draw the control chart for the above data.

8. The number of weekly customer complaints are monitored at a large hotel using a C-chart. Complaints have been recorded over the past twenty weeks. Develop three sigma contol limits using the following data [12M]

Probability & Statistics

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No.of complaints	3	2	3	1	3	3	2	1	3	1	3	4	2	1	1	1	3	2	2	3

9. A textile company wishes to implement a quality control program on a certain garment with respect to the number of defects found in the final production. A garment was sampled on 33 consecutive hours of production. The number of defects found per garment is given hereunder. [12M]

   Defects: 5,1,7,1,0,2,3,4,0,3,2,4,3,4,4,1,4,2,1,3,4,3,11,3,7,8,5,6,1,2,4,7,3

   Compute the upper and lower 3-sigma control limits for monitoring the number of defects.

10. a) Write the constructions of mean, range, p and c –charts. [6M]

    b) write the causes of variations. [6M]