Q.P. Code: 23HS0838 **R23**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR

(AUTONOMOUS)

Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code: PROBABILITY & STATISTICS (23HS0838)

Branches: **Common to CSE, CSIT, CAI, CSM, CIC & CIA branches of B.Tech**

Year &Sem: II-B. Tech & II-Sem **Regulation:** R23

UNIT-I

DESCRIPTIVE STATISTICS

1	a) Define Population and Sample.	**[L1][CO1]**	**[2M]**
	b) What is Primary and Secondary data in statistics?	**[L1][CO1]**	**[2M]**
	c) The weights of 6 competitors in a game are given below 58,62,56,63,55,61 kgs. Find arithmetic mean of weight of competitors.	**[L1][CO1]**	**[2M]**
	a) What is skewness in statistics with example?	**[L1][CO1]**	**[2M]**
	e) Define Kurtosis in statistics.	**[L1][CO1]**	**[2M]**
2	a) Find arithmetic mean to the following data using step deviation method	**[L1][CO1]**	**[5M]**
	b) Find the median to the following data;	**[L1][CO1]**	**[5M]**
3	a) Find arithmetic mean to the following data;	**[L1][CO1]**	**[5M]**
	b) Find mode to the following data;	**[L1][CO1]**	**[5M]**
4	The first four moments of a distribution about the value 5 of the variables are 2, 20, 40 and 50. Calculate mean, Variance, β_1 and β_2 of the distribution.	**[L5][CO1]**	**[10M]**
5	Calculate correlation coefficient to the following data;	**[L5][CO1]**	**[10M]**
6	Calculate the correlation coefficient for the following heights (in inches) of fathers(X) and their sons(Y)	**[L5][CO1]**	**[10M]**
7	Compute rank correlation coefficient for the following data;	**[L5][CO1]**	**[10M]**
8	Ten competitors in a musical test were ranked by the three judges A, B and C in the following order Using rank correlation coefficient method, discuss which pair of judges has the nearest approach to common likings in music.	**[L3][CO1]**	**[10M]**

Marks	10-20	20-30	30-40	40-50	50-60
frequency	5	8	25	22	10

x	5	8	11	14	17	20	23
f	2	8	12	20	10	6	3

X	1	2	3	4	5
F	5	8	10	12	6

X	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
F	5	7	10	18	20	12	8	2

X	10	15	12	17	13	16	24	14	22	20
Y	30	42	45	46	33	34	40	35	39	38

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

X	20	14	36	29	5	11
Y	19	9	25	10	2	6

Ranks by A	1	6	5	10	3	2	4	9	7	8
Ranks by B	3	5	8	4	7	10	2	1	6	9
Ranks by C	6	4	9	8	1	2	3	10	5	7

9	Obtain the rank correlation coefficient for the following data; X: 68, 64, 75, 50, 64, 80, 75, 40, 55, 64 Y: 62, 58, 68, 45, 81, 60, 68, 48, 50, 70	**[L5][CO1]**	**[10M]**
10	Find the regression line $y = a + bx$ by the method of least squares for the following data X: 10, 12, 13, 16, 17, 20, 25 y: 10, 22, 24, 27, 29, 33, 37	**[L3][CO1]**	**[10M]**
11	Find two regression equations from the following data; X: 10, 25, 34, 42, 37, 35, 36, 45 Y: 56, 64, 63, 58, 73, 75, 82, 77	**[L1][CO1]**	**[10M]**

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UNIT –II
PROBABILITY

1	a) Define Probability.	**[L1][CO2]**	**[2M]**
	b) Evaluate $P\left(\frac{A}{B}\right)$, if $P(A)=\frac{7}{13}, P(B)=\frac{9}{13}$ and $P(A\cap B)=\frac{4}{13}$.	**[L5][CO2]**	**[2M]**
	c) State Baye's theorem.	**[L1][CO2]**	**[2M]**
	d) Explain types of random variables.	**[L2][CO2]**	**[2M]**
	e) Define expected value of a discrete random variable.	**[L1][CO2]**	**[2M]**
2	a) A class consists of 6 girls and 10 boys. If a committee of 3 is chosen at random from the class, find the Probability that (i) 3 boys are selected (ii) Exactly 2 girls are selected.	**[L1][CO2]**	**[5M]**
	b) If three coins are tossed. Find the probability of getting i) 3 heads ii) 2 heads only iii) no heads.	**[L1][CO2]**	**[5M]**
3	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.	**[L5][CO2]**	**[5M]**
	b) Determine (i) $P(B/A)$ (ii) $P\left(A/B^c\right)$ if A and B are events with $P(A)=\frac{1}{3}$, $P(B)=\frac{1}{4}$, $P(A\cup B)=\frac{1}{2}$.	**[L5][CO2]**	**[5M]**
4	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. i) 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?	**[L1][CO2]**	**[5M]**
	b) The probability that students A,B,C,D solve the problem are $\frac{1}{3}$, $\frac{2}{5}$, $\frac{1}{5}$ and $\frac{1}{4}$ respectively If all of them try to solve the problem, What is the probability that the problem is solved?	**[L3][CO2]**	**[5M]**
5	Two dice are thrown. Let A be the event that the sum of the point on the faces is 9. Let B be the event that at least one number is 6. Find (i) $P(A\cap B)$ (ii) $P(A\cup B)$ (iii) $P(A^c\cup B^c)$ (iv) $P(A^c\cap B^c)$ (v) $P(A\cap B^c)$	**[L1][CO2]**	**[10M]**
6	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? (c) a boy	**[L1][CO2]**	**[10M]**
7	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.	**[L5][CO2]**	**[10M]**
8	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 $2K^2$ $7K^2+K$ Determine (i) K (ii) Evaluate $P(X\geq 6)$ and $P(0<X<5)$ (iii) if $P(X\leq K)>1/2$, find the minimum value of K (iv) variance.	**[L5][CO2]**	**[10M]**

9	a) Find the mean and variance of the uniform probability distribution given by $f(x) = \frac{1}{n}$ for$x = 1,2,\ldots,n$.	**[L1][CO2]**	**[5M]**
	a) If a random variable has a Probability density f(x) as $f(x) = \begin{cases} 2e^{-2x}, for x > 0 \\ 0, for x \leq 0 \end{cases}$ Find the Probabilities that it will take on a value (i) Between 1&3 (ii) Greater than 0.5	**[L1][CO2]**	**[5M]**
10	A continuous random variable has the probability density function. f(x) $= \begin{cases} k(1-x^2) ; & 0 < x < 1 \\ 0 \quad ; & \text{Otherwise} \end{cases}$. Determine i) Constant 'k' ii) Mean and iii) Variance.	**[L5][CO2]**	**[10M]**
11	Probability density function of a random variable X is $f(x) = \begin{cases} \frac{1}{2} sin\, x\, , for 0 \leq x \leq \pi \\ 0, \quad elsewhere \end{cases}$. Find the mean, mode and median of the distribution and also find the probability between 0 and $\pi/2$.	**[L1][CO2]**	**[10M]**

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UNIT-III

PROBABILITY DISTRIBUTIONS

1	a) State the formula for Binomial distribution.	**[L1][CO3]**	**[2M]**
	b) A coin is tossed 9 times. Find the probability of getting 5 heads?	**[L1][CO3]**	**[2M]**
	c) Define Poisson distribution.	**[L1][CO3]**	**[2M]**
	d) If the variance of a Poisson variate is 3. Find $P(1 \leq X < 4)$?	**[L1][CO4]**	**[2M]**
	e) State Normal probability density formula.	**[L1][CO4]**	**[2M]**
2	a) Derive mean of Binomial distribution.	**[L3][CO3]**	**[5M]**
	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) $P(1 < x < 4)$	**[L1][CO3]**	**[5M]**
3	Fit a Binomial distribution to the following frequency distribution: x: 0, 1, 2, 3, 4, 5 f: 2, 14, 20, 34, 22, 8	**[L3][CO3]**	**[10M]**
4	a) Out of 800 families with 5 children each, how many would you expect to have (i) 3 boys (ii) 5 girls (iii) either 2 or 3 boys. Assume equal probabilities for boys and girls.	**[L3][CO3]**	**[5M]**
	b) Two dice are thrown five times. Find the probability of getting 7 as sum i) At least once (ii) $P(1 < x < 5)$	**[L1][CO3]**	**[5M]**
5	a) Derive mean of Poisson distribution.	**[L3][CO3]**	**[5M]**
	b) If 2% of light bulbs are defective. Find the probability that (i) 2 defective items (ii) at least 3 defective items (iii) $P(2 < x < 5)$in a sample of 100.	**[L1][CO3]**	**[5M]**
6	Fit a Poisson distribution to the following data x: 0, 1, 2, 3, 4, 5, Total f: 142, 156, 69, 27, 5, 1, 400	**[L3][CO4]**	**[10M]**
7	a) An insurance agent policy 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) Atmost three will be alive	**[L1][CO4]**	**[5M]**
	b) If X is a Poisson variate such that $2P(X = 0) = P(X = 2)$ find (i) Mean (ii) $P(2 < X \leq 5)$ iii) $P(X \geq 3)$.	**[L1][CO4]**	**[5M]**
8	If X is a normal variate with mean 30 and standard deviation 5. Find $i) P(26 \leq X \leq 40)$ and $ii) P(X \geq 45)$	**[L1][CO4]**	**[10M]**
9	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 8?	**[L3][CO4]**	**[10M]**
10	If the masses of 300 students are normally distributed with mean 68kgs and standard deviation 3kgs.How many students have masses i) Greater than 72kgs ii) Less than or equal to 64kg iii) Between 65 and 71 kgs inclusive.	**[L3][CO4]**	**[10M]**
11	If p is probability of getting head in tossing a coin and a coin is tossed 12 times then Find P(3≤X≤6) using i) Binomial distribution ii) Normal distribution.	**[L3][CO4]**	**[10M]**

UNIT –IV

ESTIMATION AND TESTING OF HYPOTHESIS, LARGE SAMPLE TESTS

1	a) What is Point Estimation in Statistics?	**[L1][CO5]**	**[2M]**
	b) Find the value of correction factor if n=10 and N=1000.	**[L1][CO5]**	**[2M]**
	c) The variance of a population is 2. The size of the sample collected from the population is 169. What is the standard error of mean?	**[L1][CO5]**	**[2M]**
	d) Define Critical region.	**[L1][CO5]**	**[2M]**
	e) Define i) Null hypothesis ii) Alternative hypothesis.	**[L1][CO5]**	**[2M]**
2	A population consists of six numbers 4,8,12,16,20,24 consider all samples of size two which can be drawn without replacement form the population. Find a) The population mean b) The population standard deviation c) The mean of the sampling distribution of means d) The standard deviation of the sampling distribution of means.	**[L1][CO5]**	**[10M]**
3	A random sample of size 100 is taken from an infinite population having the mean $\mu = 76$ and variance $\sigma^2 = 256$. What is the probability that $\bar{x}$ will be between 75 and 78?	**[L1][CO5]**	**[10M]**
4	a) What is the maximum error one can expect to make with probability 0.9 when using the mean of a random sample of size n=64 to estimate the mean of population with $\sigma^2 = 2.56$	**[L1][CO5]**	**[5M]**
	b) A random sample of size 100 is taken from a population with $\sigma = 5.1$. Given that the sample mean is $\bar{x} = 21.6$ .Construct a 95% confidence interval for a population mean μ.	**[L6][CO5]**	**[5M]**
5	a) 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.	**[L4][CO5]**	**[5M]**
	b) In a random sample of 125 cool drinkers 68 said they prefer Thumsup to Pepsi. Test thus null hypothesis $P = 0.5$ against the alternative hypothesis is $P > 0.5$	**[L4][CO5]**	**[5M]**
6	a) A sample of 64 students have mean weight of 70 kgs. Can this be regarded as a sample from a population with mean weight 56 kgs and standard deviation 25 kgs.	**[L2][CO5]**	**[5M]**
	b) In a big city 325 men out of 600 men were found to be smokers. Does this information support the conclusion that the majority of men in this city are smokers?	**[L2][CO5]**	**[5M]**
7	The means of two large samples of sizes 1000 and 2000 members are 67.5inches and 68.0 inches respectively. Can the samples be regarded as drawn from the same population of standard deviation 2.5 inches .	**[L2][CO5]**	**[10M]**
8	Samples of students were drawn from two universities and from their weights in kilograms, mean and standard deviations are calculated and shown below. Make a large sample test to significance of the difference between the mean	**[L4][CO5]**	**[10M]**
9	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 populations?	**[L4][CO5]**	**[10M]**

	Mean	S.D	Size of the sample
University A	55	10	400
University B	57	15	100

10	a) 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 of 16 minutes. Test the significance at 0.05 level.	**[L4][CO5]**	**[5M]**
	b) Experience had shown that 20% of a manufactured product is of top quality. In one day's production of 400 articles only 50 are of top quality. Test the hypothesis at 0.05 level.	**[L4][CO5]**	**[5M]**
11	A sample of the height of 6400 Englishmen has a mean of 67.85 inches and a standard deviation of 2.5 inches while a simple sample of height of 1600 Australians has a mean of 68.55 inches and a standard deviation of 2.52 inches. Do the data indicate the Australians are on the average taller than the Englishmen?	**[L4][CO5]**	**[10M]**

UNIT-V
SMALL SAMPLE TESTS

<table>
<tr><td>1</td><td>a) Define t-test for single mean.</td><td>[L1][CO6]</td><td>[2M]</td></tr>
<tr><td></td><td>b) Write the formula for F-test.</td><td>[L1][CO6]</td><td>[2M]</td></tr>
<tr><td></td><td>c) What is the Null hypothesis and Alternative hypothesis for F-test ?</td><td>[L1][CO6]</td><td>[2M]</td></tr>
<tr><td></td><td>d) What is the difference between F-test and t-tests?</td><td>[L1][CO6]</td><td>[2M]</td></tr>
<tr><td></td><td>e) Write the formula for Chi-square test for goodness of fit.</td><td>[L1][CO6]</td><td>[2M]</td></tr>
<tr><td>2</td><td>a) 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.</td><td>[L4][CO6]</td><td>[5M]</td></tr>
<tr><td></td><td>b) Find the maximum difference that we can expect with probability 0.95 between the mean of samples of sizes 10 and 12 from a normal population if their standard deviations are found to be 2 and 3 respectively.</td><td>[L1][CO6]</td><td>[5M]</td></tr>
<tr><td>3</td><td>Two independent samples of 8 and 7 items had the following values
<table>
<tr><td>Sample-I</td><td>11</td><td>11</td><td>13</td><td>11</td><td>15</td><td>9</td><td>12</td><td>14</td></tr>
<tr><td>Sample-II</td><td>9</td><td>11</td><td>10</td><td>13</td><td>9</td><td>8</td><td>10</td><td>-</td></tr>
</table>
Is the difference between the means of samples significant?</td><td>[L2][CO6]</td><td>[10M]</td></tr>
<tr><td>4</td><td>Samples of two types of electrical light blubs were tested for length of life and following data were obtained
<table>
<tr><td></td><td>Type I</td><td>Type II</td></tr>
<tr><td>Sample numbers</td><td>8</td><td>7</td></tr>
<tr><td>Sample mean</td><td>1234 hrs</td><td>1036 hrs</td></tr>
<tr><td>Sample S.D</td><td>36 hrs</td><td>40 hrs</td></tr>
</table>
Is the difference in the means sufficient to warrant that type I is superior to type II regarding length of life</td><td>[L2][CO6]</td><td>[10M]</td></tr>
<tr><td>5</td><td>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 I.Q. The results are as follows:
<table>
<tr><td>Husbands</td><td>117</td><td>105</td><td>97</td><td>105</td><td>123</td><td>109</td><td>86</td><td>78</td><td>103</td><td>107</td></tr>
<tr><td>Wives</td><td>106</td><td>98</td><td>87</td><td>104</td><td>116</td><td>95</td><td>90</td><td>69</td><td>108</td><td>85</td></tr>
</table>
Test the hypothesis with a reasonable test at the level of significant of 0.05 and also calculate F-test.</td><td>[L4][CO6]</td><td>[10M]</td></tr>
<tr><td>6</td><td>Scores obtained in a shooting competition by 10 soldiers before and after intensive training are given below:
<table>
<tr><td>Before</td><td>67</td><td>24</td><td>57</td><td>55</td><td>63</td><td>54</td><td>56</td><td>68</td><td>33</td><td>43</td></tr>
<tr><td>After</td><td>70</td><td>38</td><td>58</td><td>58</td><td>56</td><td>67</td><td>68</td><td>75</td><td>42</td><td>38</td></tr>
</table>
Test whether the intensive training is useful at 0.05 level of significance.</td><td>[L4][CO6]</td><td>[10M]</td></tr>
<tr><td>7</td><td>Blood pressure of 5 women before and after intake of a certain drug are given below
<table>
<tr><td>Before</td><td>110</td><td>120</td><td>125</td><td>132</td><td>125</td></tr>
<tr><td>After</td><td>120</td><td>118</td><td>125</td><td>136</td><td>121</td></tr>
</table>
Test whether the significant change in blood pressure at 1% level of significance.</td><td>[L4][CO6]</td><td>[10M]</td></tr>
</table>

8 The nicotine in milligrams of two samples of tobacco were found to be as follows. **[L2][CO6]** **[10M]**

Sample A	24	27	26	21	25	---
Sample B	27	30	28	31	22	36

Can it be said that the two samples have come from the same normal population.

9 A pair of dice are thrown 360 times and the frequency of each sum is indicated below: **[L4][CO6]** **[10M]**

Sum	2	3	4	5	6	7	8	9	10	11	12
Frequency	8	24	35	37	44	65	51	42	26	14	14

Would you say that the dice are fair on the basis of the chi-square test at 0.05 level of significant?

10 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) **[L2][CO6]** **[10M]**

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

11 The following table gives the classification of 100 workers according to gender and nature of work. Test whether the nature of work is independent of the gender of the worker ($\psi^2 = 3.84$ at 1d.f) **[L4][CO6]** **[10M]**

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

Prepared by: Dept. of Mathematics