Darshan Institute of Engineering & Technology

B.Tech. | Sem-4 | Summer-2023

Course Code	: 2101HS402	**Date**	: 03-04-2023
Course Name	: Probability & Statistics	**Duration**	: 150 Minutes
		Total Marks	: 70

Instructions:
1. Attempt all the questions.
2. Figures to the right indicates maximum marks.
3. Make suitable assumptions wherever necessary.

Q.1 **(A)** A random variable X has the following probability function.   **4**

X	-2	-1	0	1	2	3
$P(X = x)$	0.1	p	0.2	2p	0.3	p

Find the value of p and variance.

(B) Let A & B are independent events with $P(A) = 0.26, P(B) = 0.45$.   **3**
Find $P(A' \cap B')$.

OR

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

(C) In a bolt factory, machine A, B and C manufacture 25%, 35% and 40% of the total   **7**
output and out of the total manufacturing, 5%, 4% and 2% are defective bolts. A
bolt is drawn at random from the product and is found to be defective. Find the
probabilities that it is manufactured from machine A, machine B and machine C.

OR

The pdf of a continuous random variable X is given by, $f(x) = \dfrac{e^{-|x|}}{2}$. Find cdf $F(x)$.

Q.2 **(A)** If X is random variable which follows an exponential distribution with parameter   **4**
λ with $P(X \le 1) = P(X > 1)$, find $Var(X)$.

(B) If the probability of a defective bolt is $\dfrac{1}{8}$, find the mean and variance for the   **3**
distribution of 640 defective bolts.

OR

In eight throws of a die, 5 or 6 is considered as a success. Find the mean number
of success and the standard deviation.

(C) In a certain factory turning out blades, there is a small chance of $\frac{1}{500}$ for any blade to be defective. The blades are supplied in a packets of 10. Use the poisson distribution to calculate the approximate number of pockets containing no defective, one defective and two defective blades in a consignment of 10000 packets.   **7**

OR

If the weights of 300 students are normally distributed with a mean of 68 kg and a standard deviation of 3 kg, how many students have weights
(i) greater than 72 kg?
(ii) less than or equal to 64 kg?
(iii) between 65 kg and 71 kg inclusive?
$P(0 \leq Z \leq 1.33) = 0.4082 \, , P(0 \leq Z \leq 1) = 0.3413.$

Q.3 **(A)** State all formulae to find various measures of mean deviation.   **4**

(B) Find standard deviation of data: $6.48, 6.51, 6.47, 6.48, 6.52, 6.50, 6.46.$ **3**

OR

Find median of below data:

x	0	1	2	3	4	5	6	7	8
y	1	8	28	56	70	56	28	8	1

(C) Obtain the mean, mode and median for the following information: **7**

x	< 10	< 20	< 30	< 40	< 50	< 60
f	12	30	57	77	94	100

OR

Can we consider the data tabulated below follows normal distribution?

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
f	13	20	30	25	12

Q.4 **(A)** 100 articles from a factory are examined and 10 are found to be defective. Out of 500 similar articles from a second factory 15 are found to be defective. Test the significance between the difference of two proportions at 5% level. Take, $Z_{0.05} = 1.96.$ **4**

(B) Find r_{xy} from given data: **3**

$$n = 10, \quad \sum (x - \bar{x})(y - \bar{y}) = 1650, \quad \sigma_x^2 = 196, \quad \sigma_y^2 = 225.$$

OR

Find b_{xy} from given data:
$$n = 10, \sum x = 30, \sum y = 40, \sum x^2 = 222, \sum y^2 = 985, \quad \sum xy = 384.$$

(C) Fit a second-degree parabola $y = ax^2 + bx + c$ to the following data: **7**

x	−1	0	1	2	3
y	5	6	21	50	93

(i) In a random sample of 160 worker exposed to a certain amount of radiation, 24 experienced some ill effects. Construct a 99% confidence interval for the corresponding true percentage. Take, $Z_{0.01} = 2.58$.

(ii) A random sample of 300 shoppers at a supermarket includes 204 who regularly uses cents off coupons. In another sample of 500 shoppers at a supermarket includes 75 who regularly uses cents off coupons. Obtain 95% confidence limits for the difference in the populations. Take, $Z_{0.05} = 1.96$.

Q.5 **(A)** Two random samples gave the following data: **4**

	No. of samples	Variance
Sample I	8	1.2
Sample II	11	2.5

Test the alternative hypothesis $\sigma_1^2 > \sigma_2^2$ by using F – Test.
Take, $F_{0.05}(10,7) = 3.64$.

(B) A coefficient of correlation of 0.2 is derived from a random sample of 625 pairs **3** of observations. Is this value of r significant? Take, $t_{0.05,623} = 1.96$.

OR

For $n = 26$, $\bar{x} = 147$, $\mu = 140$ and $s = 16$. Show that $\mu > 140$.
Take, $t_{0.05,25} = 1.708$

(C) A die is thrown 276 times and the results of these throws are given below: **7**

Number appeared on the die	1	2	3	4	5	6
Frequency	40	32	29	59	57	59

Test whether the die is biased or not.
[χ^2 at 5% level of significance for 5 df is 11.07.]

OR

From the following data, find whether there is any significant linking in the habit of taking soft drinks among the categories of employees.

Soft drinks	Employees		
	Clerks	Teachers	Officers
Pepsi	15	5	20
Thumsup	20	10	20
Fanta	25	15	20

[χ^2 at 5% level of significance for 4 df is 9.49]

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