

**B.Tech. / M.Tech (Integrated) DEGREE EXAMINATION, JULY 2023**  
Second / Fourth Semester

**21MAB301T – PROBABILITY AND STATISTICS**

*(For the candidates admitted from the academic year 2022-2023)*

(Statistical table, control chart constant table and graph sheets to be provided)

**Note:**

- (i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40<sup>th</sup> minute.
- (ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: 3 Hours

Max. Marks: 75

**PART – A (20 × 1 = 20Marks)**Answer **ALL** Questions

1. A coin is tossed twice, what is the probability of getting atleast one tail?

(A)  $1/4$  (B)  $2/4$   
(C)  $3/4$  (D)  $1$

2. A random variable X has the following probability function

x:	0	1	2	3	4
P(x):	k	2k	5k	7k	9k

(A)  $2/24$  (B)  $21/24$   
(C)  $7/12$  (D)  $1/24$

3. If  $P(A) = P(B) = 1$ , then  $P(A \cap B) =$

(A) 0 (B) 1  
(C)  $1/2$  (D)  $1/4$

4. If the mean of the random variable X is 5, then  $E(2X + 7) =$

(A) 5 (B) 10  
(C) 12 (D) 17

5. The mean of the Poisson distribution is

(A)  $\lambda$  (B)  $\lambda + 1$   
(C)  $\lambda^2$  (D)  $\lambda - 1$

6. The MGF of geometric distribution is

(A)  $\frac{1}{1 - qe^t}$  (B)  $\frac{1}{1 - pe^t}$   
(C)  $\frac{q}{1 - pe^t}$  (D)  $\frac{pe^t}{1 - qe^t}$

7. If the parameter of the exponential distribution is 2, then the variance of the distribution is

(A)  $1/4$  (B)  $1/2$   
(C) 2 (D) 4

Marks	BL	CO	PO
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1	2	1	2
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1	2	1	2
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1	1	1	2
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1	2	1	2
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1	1	2	2
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1	1	2	2
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1	2	2	2
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8. The standard normal distribution is represented by 1    1    2    2  
 (A)  $N(0,1)$  (B)  $N(1,1)$   
 (C)  $N(1,0)$  (D)  $N(0,0)$
9. A \_\_\_\_\_ is a sub set of a \_\_\_\_\_ 1    1    3    2  
 (A) Sample, population (B) Population, sample  
 (C) Statistic, parameter (D) Parameter, statistic
10. A failing student is passed by an examiner it is an example of 1    1    3    2  
 (A) Type I error (B) Type II error  
 (C) Type III error (D) Standard error
11. If the critical region is located equally in both sides of the normal curve of the test statistic, then the test is called 1    1    3    2  
 (A) One-tailed test (B) Two-tailed test  
 (C) Right tailed test (D) Left tailed test
12. The standard deviation of a sampling distribution is called 1    1    3    2  
 (A) Sampling error (B) Sample error  
 (C) Standard error (D) Simple error
13. The two variables deviate in the same direction, then the correlation is 1    1    4    2  
 (A) Negative (B) Zero  
 (C) Positive (D) Partial
14. If  $b_1$  and  $b_2$  are the two regression coefficients, then the correlation is 1    1    4    2  
 (A)  $\frac{b_1}{b_2}$  (B)  $\frac{b_1 + b_2}{2}$   
 (C)  $b_1.b_2$  (D)  $\sqrt{b_1.b_2}$
15. The basic purpose of ANOVA is to test the \_\_\_\_\_ of several means. 1    1    4    2  
 (A) Proportions (B) Heterogeneity  
 (C) Homogeneity (D) Variations
16. In ANOVA table  $SSC=73.2$ ,  $SSR=17.87$ ,  $SSE=62.13$ ,  $C=5$  and  $r=4$ , then  $F_R$  is 1    2    4    2  
 (A) 1.1505 (B) 0.8691  
 (C) 1.9185 (D) 0.6714
17. In c-chart  $\bar{c} = 11$ , then LCL value is 1    2    5    2  
 (A) 1.05 (B) 11  
 (C) 20.95 (D) 7.68
18. Control chart for variable is 1    1    5    2  
 (A) s-chart (B) p-chart  
 (C) np-chart (D) c-chart
19. If  $\bar{X} = 62.69$ ,  $\bar{R} = 19.67$ ,  $D_3 = 0$  and  $D_4 = 2.004$ , then UCL in R-chart is 1    2    5    2  
 (A) 19.67 (B) 39.42  
 (C) 0 (D) 52.19

20. If 'd' is the number of defectives in a sample of size 'n' then the sample proportion of defective is \_\_\_\_\_
- (A) n (B) d  
(C) dn (D) d/n

**PART – B (5 × 8 = 40 Marks)**

Answer ALL Questions

Marks	BL	CO	PO
8	3	1	2

21. a. The contents of Urns I, II and III are as follows:  
 1 white, 2 red and 3 black balls  
 2 white, 3 red and 1 black balls and  
 3 white, 1 red and 2 black balls  
 One Urn is chosen of random and 2 balls are drawn. They happen to be white and red. What is the probability that they came from Urn I, Urn II?

**(OR)**

- b. The density function of a random variable 'X' is given by  
 $f(x) = kx(2-x); 0 \leq x \leq 2$   
 Find k, mean and variance.

22. a. Fit a Poisson distribution for the following data and also calculate the theoretical frequency:

x:	0	1	2	3	4	5
f:	142	156	69	27	5	1

**(OR)**

- b. In a normal distribution, 7% of the items are under 35 and 89% are under 63. What are the mean and standard deviation of the distribution?

23. a. The fatality rate of typhoid patients is believed to be 17.26 percent. In a certain year 640 patients suffering from typhoid were treated in a metropolitan hospital and only 63 patients died. Can you consider the hospital efficient?

**(OR)**

- b. Theory predicts that the proportion of beans in four groups A, B, C, D should be 9:3:3:1. In an experiment among 1600 beans, the numbers in the four groups were 882, 313, 287 and 118. Does the experiment support the theory?

24. a. The two line of regression are:  
 $8x - 10y + 66 = 0$  and  $40x - 18y - 214 = 0$   
 The variance of X is 9.  
 Find, (i) the mean values of X and Y (ii) correlation coefficient between X and Y (iii) standard deviation of Y.

**(OR)**

- b. Three different machines were used for a production, on the basis of outputs, set up one-way ANOVA table and test whether the machines are equally effective.

8 4 4 2

Outputs		
Machine I	Machine II	Machine III
10	9	20
15	7	16
11	5	10
20	6	14

Given that the value of F at 5% LOS for (2,9) degree of freedom is 4.26.

25. a. 15 samples of 200 items each were drawn from the output of a process. The number of defective items in the samples are given below. Prepare a control chart for the fraction defective and comment on the state of control.

8 3 5 2

Sample No:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No. of defects (np):	12	15	10	8	19	15	17	11	13	20	10	8	9	5	8

(OR)

- b. Given below are the values of sample mean  $\bar{X}$  and sample range R for 10 samples, each of size 5. Draw the appropriate mean chart and comment on the state of control of the process.

8 3 5 2

Sample No:	1	2	3	4	5	6	7	8	9	10
Mean:	43	49	37	44	45	37	51	46	43	47
Range:	5	6	5	7	7	4	8	6	4	6

### PART – C (1 × 15 = 15 Marks)

Marks BL CO PO

Answer ANY ONE Questions

26. Obtain the equations of the regression lines from the following data. Hence find the coefficient of correlation between X and Y. Also estimate the value of (i) Y, when X=38 and (ii) X, when Y=18.

15 3 4 2

X:	22	26	29	30	31	31	34	35
Y:	20	20	21	29	27	24	27	31

27. The values of sample mean  $\bar{X}$  and sample standard deviations for 15 samples, each of size 4, drawn from a production process are given below. Draw the appropriate control charts for the process average and process variability. Comment on the state of control.

15 3 5 2

Sample No:	1	2	3	4	5	6	7	8
Mean:	15.0	10.0	12.5	13.0	12.5	13.0	13.5	11.5
S.D:	3.1	2.4	3.6	2.3	5.2	5.4	6.2	4.3

Sample No:	9	10	11	12	13	14	15
Mean:	13.5	13.0	14.5	9.5	12.0	10.5	11.5
S.D:	3.4	4.1	3.9	5.1	4.7	3.3	3.3

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