Reg. No.															

B.Tech. / M.Tech. (Integrated) DEGREE EXAMINATION, MAY 2024
Second and Fourth Semester

21MAB301T – PROBABILITY AND STATISTICS

(For the candidates admitted during the academic year 2021-2022 , 2022-2023 & 2023-2024)

(Use of statistical tables permitted graph sheets can 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 40th 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

	Marks	BL	CO	PO
1. Two persons A and B appear in an interview for two vacancies for the same post. The probability of a selection is 1/7 and that of B selection is 1/5. What is the probability that both of them will be selected? (A) 12/35 (B) 0 (C) 5/7 (D) 1/35	1	1	1	1
2. If X and Y two independent random variables, a and b are constants then Var (aX+bY)= (A) aVar(X) – bVar(Y) (B) a^2Var(X) + b^2Var(Y) (C) aVar(X)+bVar(Y) (D) a^2Var(X) – b^2Var(Y)	1	1	1	1
3. If F is the distribution function of the random variable X and if a<b, then $P(a<X\le b)=$ (A) $P(a<X<b)+P(X=a)$ (B) $P(X=a)+F(b)-F(a)$ (C) $F(b)-F(a)-P(X=b)$ (D) $F(b)-F(a)$	1	1	1	2
4. If $E(X^2)=8$ and $E(X)=2$ then Var(X) is _____ (A) 3 (B) 4 (C) 1 (D) 2	1	1	1	1
5. The mean of a geometric distribution whose pdf is $pq^{r-1}, r=1,2,3...$ (A) 1/p (B) p/q (C) q/p (D) 1/q	1	1	2	1
6. A candidate applying for driving license has the probability of 0.8 in passing the road test in a given trial. Find the probability that he will pass the test on 4th trial. (A) 0.0046 (B) 0.0064 (C) 0.0604 (D) 0.0406	1	1	2	1
7. If the random variables X has the P.D.F $Ce^{-x/5}; x>0$ then the value of C is (A) 5 (B) –1/5 (C) 1/5 (D) –5	1	1	2	2

8. The mean of uniform distribution is 1 1 2 1

(A) $\frac{a+b}{2}$ (B) $\frac{a+b}{4}$

(C) $\frac{a-b}{2}$ (D) $\frac{a+b}{8}$

9. If a researcher takes a large enough sample, he/she will almost always obtain 1 2 3 2

(A) Virtually significant results (B) Practically significant results

(C) Consequently significant results (D) Statistically significant results

10. Which of the following values is not typically used for α? 1 2 3 1

(A) 0.01 (B) 0.05

(C) 0.10 (D) 0.25

11. Chi-square test is not very effective if the sample is 1 1 3 1

(A) Small (B) Large

(C) Irregular (D) Heterogeneous

12. Area of the rejection region depends on 1 2 3 1

(A) Test statistic (B) Number of values

(C) Size of α (D) Size of β

13. For the equation $y=3x-2$, if the mean of y is 10, what is the mean of x? 1 1 4 1

(A) 8 (B) 28

(C) 4 (D) 12

14. In one way classification the data are classified according to only _____criterion. 1 1 4 1

(A) Two (B) One

(C) Five (D) Six

15. Regression coefficient is independent of the change of 1 1 4 2

(A) Scale (B) Origin

(C) Both origin and scale (D) Neither origin nor scale

16. Find the correlation coefficient if the regression coefficient of x on y $b_{xy}=1.468$ and regression on coefficient of y on x $b_{yx}=0.6389$. 1 2 4 1

(A) 0.9045 (B) 0.9685

(C) 0.9568 (D) 0.9600

17. Quality control is a powerful _____technique for effective diagnosis of lack of quality in any of the materials. 1 1 5 2

(A) Productivity (B) Quantitative

(C) Non-productivity (D) Cost

18. By quality man power, we mean the qualified and trained personal will give increased efficiency due to the better quality production through the application skill and reduce the _____and waste. 1 1 5 2

(A) Production cost (B) Quantity

(C) Material (D) Business

19. If d is the number of defectives in a sample of size n then the sample proportion defective is _____ 1 1 5 1

(A) $p = d / n$ (B) $p = d$

(C) $p = d / s$ (D) $p = d / \sqrt{n}$

20. c-chart is used when $\bar{c} \geq$_____ 1 1 5 1

(A) 1 (B) 2

(C) 3 (D) 4

PART – B (5 × 8 = 40 Marks)

Answer **ALL** Questions

		Marks	BL	CO	PO
21. a.	A company has two plants to manufacture IC chips. Plant I manufactures 80% of the chips and the plant II the rest. At plant I, 85 out of 100 chips are rated higher quality and in plant II, only 65 out of the 100 chips are rated. Find the probability that the IC chip chosen at random came from plant II.	8	2	1	2
	(OR)				
b.	The pdf of a continuous random variable X as follows $f(x) = \begin{cases} 6x(1-x) & ;0 < x < 1 \\ 0 & ;\text{otherwise} \end{cases}$ Find the CDF for X.	8	3	1	2
22. a.	The savings bank account of a customer showed an average balance of ₹ 150 and S.D of ₹ 50. Assuming that the account balances are normally distributed. (i) What percentage of account is over ₹ 200? (ii) What percentage of account is between ₹ 120 and ₹ 170? (iii) What percentage of account is less than ₹ 75?	8	3	2	2
	(OR)				
b.	Starting at 5.00 am every half an hour there is a flight from san-Francisco airport to Los Angels international airport. Suppose that none of these plane tickets is completely sold out and that they always have room for passengers. A person wants to fly to Los Angels arrives at the airport at a random time between 8.45 am and 9.45 am. Find the probability that she waits (i) atmost 10 minutes (ii) atleast 15 minutes.	8	4	2	2
23. a.	In a random sample of size 500, the mean is found to be 20. In another independent sample size 400, the mean is 15. Could the samples have been drawn from the sample population with S.D 4?	8	3	3	2
	(OR)				
b.	1000 students at college level were graded according to their I.Q and their economic conditions. What conclusion can you draw from the following data.	8	4	3	2

Economic conditions	I.Q level	
	High	Low
Rich	460	140
Poor	240	160

24. a. Two lines of regression are $8x-10y+66=0$; $40x-18y-214=0$ the variance of X is 9. Find (i) mean values of x and y (ii) correlation coefficient between X and Y. | 8 | 3 | 4 | 2

(OR)

b. Calculate the correlation coefficient for the following data. | 8 | 3 | 4 | 2

X	10	14	18	22	26	30
Y	18	12	24	6	30	36

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 of defective and comment on the state of control. | 8 | 4 | 5 | 2

Sample No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No. of defectives	12	15	10	8	19	15	17	11	13	20	10	8	9	5	8

(OR)

b. Given below are the sample mean $\overline{X}$ 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 | 4 | 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)

Answer **ANY ONE** Questions

Marks	BL	CO	PO

26. The sales of a convenience store on a randomly selected day are X thousand dollars, where X is a random variable with a cdf | 15 | 4 | 1 | 2

$$F(x)=\begin{cases}0 & ; \quad x<0\\ \dfrac{x^2}{2} & ; \quad 0<x<1\\ K\left(4x-x^2\right); & 1<x<2\\ 1 & ; \quad x\geq 2\end{cases}$$

Suppose that this convenience store's total sales on any given day are less than \$2000.

(a) Find the value of K

(b) Let A and B be the events such that the stores total sales are between 500 and 1500 dollars, and over 1000 dollars respectively.

(c) Find P(A) and P(B).

27. The following data represent the number of units of a product produced by 3 different workers using 3 different types of machines. | 15 | 4 | 4 | 2

Workers	Machines		
	M_1	M_2	M_3
W_1	8	32	20
W_2	28	36	38
W_3	6	28	14

Test (i) whether the mean productivity is the same for the different machine types and (ii) whether the three workers differ with respect to mean productivity.

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