SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM NAGAR, KATTANKULATHUR-603203

DEPARTMENT OF INFORMATION TECHNOLOGY

QUESTION BANK

II SEMESTER

MA3223 -STATISTICAL LEARNING FOR DATA SCIENCE

REGULATION – 2023

ACADEMIC YEAR 2024 – 2025

Prepared by

Mr.L.Mohan, Assistant Professor/ Mathematics

SRM VALLIAMMAI ENGINEERING COLLEGE

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DEPARTMENT OF INFORMATION TECHNOLOGY

SUBJECT: MA3223-STATISTICAL LEARNING FOR DATA SCIENCE

SEM/YEAR: II/I

UNIT – I: PROBABILITY AND RANDOM VARIABLES 12

Random variables (Discrete and continuous)- Moments- Moment generating function-Probability Distributions-Binomial-Poisson- Geometric -Uniform-Exponential-and Normal distribution.

PART – A

Q.No.	Question	BT Level	Competence
1.	Define probability.	BTL -1	Remembering
2.	If the random variable X takes the values 1,2,3 and 4 such that $2P(X=1)=3P(X=2)=P(X=3)=5P(X=4)$, find the probability distribution of X	BTL-1	Remembering
3.	The RV X has the following probability distribution: x: -2, -1, 0, 1 P(x): 0.4, k, 0.2, 0.3 Find k and the mean value of X	BTL-2	Understanding
4.	If three coins are tossed together then what is the Probability that there are exactly 2 heads?	BTL -1	Remembering
5.	A ball is drawn at random from a box containing 6 red balls, 4 white balls and 5 blue balls. Find the probability that the ball drawn is not red.	BTL2	Understanding
6.	From a pack of cards, one card is drawn. What is the probability that it is either a spade or a king.	BTL -1	Remembering
7.	State the theorem of total probability	BTL -1	Remembering
8.	What is the use of Baye's theorem?	BTL2	Understanding
9.	Define continuous random variable with example.	BTL -1	Remembering
10.	Define discrete random variable with example	BTL -2	Understanding
11.	Define Moment Generating function of a random variable.	BTL -1	Remembering
12.	If a random variable X has the MGF $M_X(t)=\frac{2}{2-t}$. Find the mean of X.	BTL -1	Remembering
13.	Suppose that the life of industrial lamp(in thousands of hours) is exponentially distributed with mean life of 3000 hours, find the probability that the lamp will last between 2000 and 3000 hours.	BTL2	Understanding
14.	The mean of Binomial distribution is 20 and standard deviation is 4. Find the parameters of the distribution.	BTL2	Understanding
15.	Find the MGF of Uniform distribution.	BTL2	Understanding
16.	The number of hardware failures of a computer system in a week of operations has the following p.d.f, Find the mean of the number of failures in a week. No.of failures: 0, 1, 2, 3, 4, 5, 6 Probability: .18, .28, .25, .18, .06, .04, .01	BTL2	Understanding

<table>
<tr><td>17.</td><td>The number of hardware failures of a computer system in a week of operations has the following p.d.f, Calculate the value of K.
<table><tr><td>No.of failures</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>Probability</td><td>K</td><td>2 K</td><td>2 K</td><td>K</td><td>3 K</td><td>K</td><td>4 K</td></tr></table></td><td>BTL2</td><td>Understanding</td></tr>
<tr><td>18.</td><td>If x is a Poisson distribution such that P(x=1)=4P(x=2).
Find its mean and variance.</td><td>BTL -1</td><td>Remembering</td></tr>
<tr><td>19.</td><td>If $f(x) = kx^2, 0 < x < 3$, is to be a density function, find the value of k.</td><td>BTL2</td><td>Understanding</td></tr>
<tr><td>20.</td><td>A continuous random variable X has p.d.f $f(x) = 2x , 0 \leq x \leq 1$. Find $P(X > 0.5)$.</td><td>BTL2</td><td>Understanding</td></tr>
<tr><td>21.</td><td>Define Probability.</td><td>BTL -1</td><td>Remembering</td></tr>
<tr><td>22.</td><td>A normal distribution has mean μ = 20 and standard deviation σ = 10. Evaluate $(15 \leq X \leq 40)$.</td><td>BTL2</td><td>Understanding</td></tr>
<tr><td>23.</td><td>Write the axioms of Probability.</td><td>BTL -1</td><td>Remembering</td></tr>
<tr><td>24.</td><td>Find Mean of Binomial Distribution.</td><td></td><td></td></tr>
<tr><td>25.</td><td>If X is a normal random variable with mean 3 and variance 9, find the probability that X lies between 2 and 5.</td><td>BTL2</td><td>Understanding</td></tr>
<tr><td colspan="4">PART – B</td></tr>
<tr><td>1.(a)</td><td>Bag I contains 3 red and 4 blue balls while another Bag II contains 5 red and 6 blue balls. One ball is drawn at random from one of the bags and it is found to be red. Find the probability that it was drawn from second Bag.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>1.(b)</td><td>X speaks truth 4 out of 5 times. A die is thrown. He reports that there is a six. Whatis the chance that actually there was a six?</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>2.</td><td>Out of 2000 families with 4 children each , Find how many family would you expect to have (i) at least 1 boy, (ii) 2 boys, (iii) 1 or 2 girls and iv) no girls</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>3.</td><td>The contents of urns I, II, III are as follows:
1 white, 2 black and 3 red balls;
2 white, 1 black and 1 red balls;
4 white, 5 black and 3 red balls;
One urn is chosen at random and two balls drawn. They happen to be white and red. What is the probability that they come from urns I, II, III?</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>4.</td><td>A factory has 3 machines $A1$, $A2$, $A3$ producing 1000, 2000, 3000 screws per day respectively. $A1$ produces 1% defectives, $A2$ produces 1.5% and $A3$ produces 2% defectives. A screw is chosen at random at the end of a day and found defective. What is the probability that it comes from machines $A1$?</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>5.(a)</td><td>In a bolt factory machines A, B, C manufacture respectively 25, 35 and 40 percent of the total. Of their output 5, 4 and 2 percent are defective bolts respectively. A bolt is drawn at random from the product and is found obe defective. What are the probabilities that it was manufactured by machines A, B or C?</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>5.(b)</td><td>A factory has two machines I and II. Machine I produces 30% of items of the output and Machine II produces 70% of the items. Further 3% of items produced by Machine I are defective and 4% produced by Machine II are defective. If an item is drawn at random, find the probability that it is a defective item.</td><td>BTL -3</td><td>Applying</td></tr>
</table>

<table>
<tr><td>6.(a)</td><td>If the discrete random variable X has the probability function given by the table.
<table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>P(x)</td><td>k/3</td><td>k/6</td><td>k/3</td><td>k/6</td></tr></table>Find the value of k and Cumulative distribution of X.</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>6.(b)</td><td>Find the MGF of Binomial distribution and hence find its mean and variance</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>7.(a)</td><td>A random variable X has the following probability distribution:
<table><tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>P(X)</td><td>0</td><td>k</td><td>2 k</td><td>2 k</td><td>3 k</td><td>k^2</td><td>$2k^2$</td><td>$7k^2$+k</td></tr></table>Find (i) the value of k (ii) $P(1.5 < X < 4.5 / X > 2)$</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>7.(b)</td><td>Find the MGF of Poisson distribution and hence find its mean and variance</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>8.(a)</td><td>Given $\lambda = 4.2$, for a Poisson distribution. Find (a) $P(X \leq 2)$ (b) $P(X \geq 5)$ (c) $P(X = 8)$.</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>8.(b)</td><td>Find the MGF of Exponential distribution and hence find its mean and variance</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>9.</td><td>In an intelligence test administered on 1000 students, the average was 42 and standard deviation 24, find (i) the number of students exceeding a score 50. (ii) the number of students lying between 30 and 54 (iii) the value of score exceeded by top 100 students.</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>10.</td><td>The probability mass function of a discrete R. V X is given in the following table
<table><tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr><tr><td>P(X)</td><td>a</td><td>3a</td><td>5a</td><td>7a</td><td>9a</td><td>11a</td><td>13a</td><td>15a</td><td>17a</td></tr></table>Find (i) the value of a , (ii) $P(X < 3)$, (iii) Mean of X and (iv) Variance of X.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>11.</td><td>The probability distribution of an infinite discrete distribution is given by $P[X = j] = \frac{1}{2^j}$ (j = 1,2,3…) Find (i)Mean of X, (ii)P [X is even], (iii) P(X is odd)</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>12.</td><td>A random variable X has a uniform distribution over (-3, 3). Compute
(i) $P(X< 2)$ (ii) $P(|X| < 2)$ (iii) $P(|X-2| < 2)$
(iv) Find k for which $P(X< k) = 1/3$.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>13.</td><td>X is a normal variable with mean 30 and standard deviation of 5. Find
(i) $P[26 \leq X \leq 40]$ (ii) $P[X \geq 45]$ (iii) $P[|X - 30| > 5]$ use normal distribution tables.</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>14.</td><td>Derive the MGF of Uniform distribution and hence find its mean and variance</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>15.</td><td>Buses arrive at a specified stop at 15 minutes interval starting at 7am that is, 7,7:15,7:30,7:45, and so on, If a passenger arrives at the stop at a random time that is uniformly distributed between 7 and 77:30 am, evaluate the probability that he waits
(a) Less than 5 minutes for a bus and
(b) At least 12 minutes for a bus</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>16.</td><td>State and Prove the memory less property of Exponential distribution</td><td>BTL -3</td><td>Applying</td></tr>
</table>

17.	In a test on 2000 electric bulbs, it was found that the life of a particular make, was normally distributed with an average life of 2040 hours and Standard Deviation of 60 hours. Find the number of bulbs likely to burn for (i) more than 2150 hours (ii) less than 1950 hours and (iii) more than 1920 hours burs less than 2160 hours.	BTL -4	Creating
18.(a)	The time (in hours) required to repair a machine is exponentially distributed with parameter $\lambda = 1/2$. (a) What is the probability that the repair time exceeds 2 hours? (b) What is the conditional probability that a repair time exceeds at least 10 hours that its distribution exceeds 9 hours?	BTL -3	Applying
18.(b)	Let X be a Uniformly distributed R. V. over [-5, 5]. Evaluate (i) $P(X \leq 2)$ (ii) $P(\|X\|>2)$ (iii) Cumulative distribution function of X (iv) Var(X)	BTL -4	Creating

UNIT II - TWO - DIMENSIONAL RANDOM VARIABLES 12

Joint Probability distribution-Marginal and conditional distribution covariance-correlation and regression line - Central limit theorem.

PART – A

Q.No.	Question	BT Level	Competence
1.	The equations of two regression lines are 3x+2y=19 and 3y+9x=46. Obtain the mean of X and Y.	BTL-1	Remembering
2.	The joint probability distribution of X and Y is given by $p(x,y) = \frac{x+y}{21}$, $x = 1,2,3; y = 1, 2$. Find the marginal probability distributions of X	BTL-2	Understanding
3.	Prove that $-1 \leq r_{xy} \leq 1$	BTL-1	Remembering
4.	State any tow properties of correlation coefficient.	BTL-2	Understanding
5.	Define Two dimensional Discrete random variables.	BTL-1	Remembering
6.	The joint probability distribution of X and Y is given by ,P(x,y)=7x+4y $x = 1, 2; y = 1, 2$. Find the marginal probability distributions of X.	BTL-2	Understanding
7.	State the correlation coefficient formula.	BTL-1	Remembering
8.	If $\bar{X} = 970$, $\bar{Y} = 18, \sigma_x = 38$, σ_y= 2 and r = 0.6 , Find the line of regression of X on Y.	BTL-2	Understanding
9.	The regression equations are 3x + 2y = 26 and 6x + y = 31. Find the correlation coefficient.	BTL-1	Remembering
10.	What is the acute angle between the two lines of regression?	BTL-2	Understanding
11.	State Central Limit Theorem.	BTL-1	Remembering
12.	Define Marginal probability density function of X.	BTL-2	Understanding
13.	In a partially destroyed laboratory, record of an analysis of correlation data, The following results only are legible; Variance of X = 9; Regression equations are 8X - 10Y + 66 = 0 and 40X-18Y = 214. Find the mean values of X and Y?	BTL-1	Remembering
14.	Define Two dimensional Continuous random variables.	BTL-2	Understanding
15.	Find the probability distribution of X + Y from the bi-variate distribution of (X,Y) given below:	BTL-1	Remembering

X \ Y	1	2

<table>
<tr><td></td><td><table><tr><td>1</td><td>0.4</td><td>0.2</td></tr><tr><td>2</td><td>0.3</td><td>0.1</td></tr></table></td><td></td><td></td></tr>
<tr><td>16.</td><td>Let X and Y have the joint p.m.f. Then find P(X+Y > 1)<table><tr><td>Y \ X</td><td>0</td><td>1</td><td>2</td></tr><tr><td>0</td><td>0.1</td><td>0.4</td><td>0.1</td></tr><tr><td>1</td><td>0.2</td><td>0.2</td><td>0</td></tr></table></td><td>BTL-2</td><td>Understanding</td></tr>
<tr><td>17.</td><td>Let X and Y be random variables with joint density function
f(x,y) = $\begin{cases} 4xy\ ,\ 0 < x < 1\ ,\ 0 < y < 1 \\ 0,\ otherwise \end{cases}$ formulate the value of E(XY)</td><td>BTL-1</td><td>Remembering</td></tr>
<tr><td>18.</td><td>What is the condition for two random variables are independent?</td><td>BTL-2</td><td>Understanding</td></tr>
<tr><td>19.</td><td>The joint probability density function of random variables (X, Y) is
$f(x,y) = k\,e^{-(2x+3y)}, x \geq 0,\ y \geq 0$. Find the value of k.</td><td>BTL-1</td><td>Remembering</td></tr>
<tr><td>20.</td><td>The regression equations are x + 6y = 14 and 2x + 3y = 1. Find the correlation coefficient between X & Y.</td><td>BTL-2</td><td>Understanding</td></tr>
<tr><td>21.</td><td>The joint probability function (X,Y) is given by $P(x,y) = k(3x + y)$,
$x = 0,1\ \ y = 1,2$, Find the value of K.</td><td>BTL-1</td><td>Remembering</td></tr>
<tr><td>22.</td><td>If the joint pdf of (X, Y) is $f(x,y) = \begin{cases} \frac{1}{4}\ , 0 < x, y < 2 \\ 0,\ \ otherwise \end{cases}$.
Find $P(X + Y \leq 1)$</td><td>BTL-2</td><td>Understanding</td></tr>
<tr><td>23.</td><td>If the joint probability density function of a random variable X and Y is given by $f(x,y) = \begin{cases} \frac{x^3y^3}{16}\ , 0 < x < 2, 0 < y < 2 \\ 0,\ \ otherwise \end{cases}$. Find the marginal density function of X.</td><td>BTL-1</td><td>Remembering</td></tr>
<tr><td>24.</td><td>The joint probability density of a two dimensional random variable (X, Y) is given by $f(x,y) = \begin{cases} kxe^{-y}; 0 \leq x < 2\ , y > 0 \\ 0,\ \ otherwise \end{cases}$. Evaluate k.</td><td>BTL-2</td><td>Understanding</td></tr>
<tr><td>25.</td><td>The equations of two regression lines are 3x+2y=19 and 3y+9x=46. Derive the correlation coefficient between X and Y.</td><td>BTL-1</td><td>Remembering</td></tr>
<tr><td colspan="4">PART – B</td></tr>
<tr><td>1.</td><td>The two dimensional random variable (X, Y) has the joint probability mass function $f(x,y) = \frac{x+2y}{27}, x = 0,1,2; y = 0,1,2$. Find the conditional distribution of Y given X = 1 also find the conditional distribution of X given Y = 1.</td><td>BTL -3</td><td>Applying</td></tr>
</table>

<table>
<tr><td>2.</td><td>From the following table for bivariate distribution of (X, Y). Find
(i) $P(X \le 1)$ (ii)$P(Y \le 3)$ (iii) $P(X \le 1, Y \le 3)$ (iv)$P(X \le 1/\ Y \le 3)$
(v) $P(Y \le 3/\ X \le 1)$
<table>
<tr><td>X \ Y</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>$\frac{1}{32}$</td><td>$\frac{2}{32}$</td><td>$\frac{2}{32}$</td><td>$\frac{3}{32}$</td></tr>
<tr><td>1</td><td>$\frac{1}{16}$</td><td>$\frac{1}{16}$</td><td>$\frac{1}{8}$</td><td>$\frac{1}{8}$</td><td>$\frac{1}{8}$</td><td>$\frac{1}{8}$</td></tr>
<tr><td>2</td><td>$\frac{1}{32}$</td><td>$\frac{1}{32}$</td><td>$\frac{1}{64}$</td><td>$\frac{1}{64}$</td><td>0</td><td>$\frac{2}{64}$</td></tr>
</table>
</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>3</td><td>If X, Y are RV's having the joint density function
$f(x,y) = k(6 - x - y), 0 < x < 2, 2 < y < 4,$ Find
$(i)\ P(x < 1, y < 3)\ ii)\ P(x < 1 / y < 3)\quad iii) P(y < 3/x < 1)$</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>4(a).</td><td>The joint distribution of X and Y is given by $f(x,y) = \frac{x+y}{21}$,
$x = 1,2,3; y = 1,2.$ Find the marginal distributions of X and Y.</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>4(b).</td><td>The joint pdf a bivariate R.V(X, Y) is given by $f(x,y) = \begin{cases} Kxy & ;\ 0 < x < 1, 0 < y < 1 \\ 0 & ,\ otherwise \end{cases}$
Find (1) K, (2)Are X and Y independent R.V's.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>5.</td><td>If the joint pdf of (X, Y) is given by P(x, y) = K(2x+3y), x=0, 1, 2, y = 1, 2, 3 Find all the marginal probability distribution. Also find the probability distribution of X+Y.</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>6(a).</td><td>Three balls are drawn at random without replacement from a box containing 2 white, 3 red and 4 blue balls. If X denotes the number of white balls drawn and Y denotes the number of red balls drawn, Identify the probability distribution of X and Y.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>6(b).</td><td>The joint pdf of(X,Y) is
$f(x,y) = e^{-(x+y)}, 0 \le x < \infty,\quad 0 \le y < \infty$. Are X and Y independent?</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>7.</td><td>If the joint pdf of a two-dimensional RV(X,Y) is given by
$f(x,y) = \begin{cases} x^2 + \frac{xy}{3}; 0 < x < 1, 0 < y < 2 \\ 0,\ elsewhere \end{cases}$. Find (i) $P\left(X > \frac{1}{2}\right)$
(iii)$P\left(Y < \frac{1}{2} / X < \frac{1}{2}\right)$</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>8</td><td>The joint pdf of a two dimensional random variable (X, Y) is given by
$f(x,y) = xy^2 + \frac{x^2}{8}, 0 \le x \le 2, 0 \le y \le 1.$
Compute $(i)P(Y < 1/2)$ (ii) $P\left(X > 1 / Y < \frac{1}{2}\right)$ (iii)$P\left(Y < \frac{1}{2}/X > 1\right)$</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>9.</td><td>From the following data , Find (i)The two regression equations (ii) The coefficient of correlation between the marks in Mathematics and Statistics (iii) The most likely marks in Statistics when marks in Mathematics are 30
Marks in Maths : 25 28 35 32 31 36 29 38 34 32
Marks in Statistics: 43 46 49 41 36 32 31 30 33 39</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>10(a).</td><td>If f(x,y) = $\frac{6 - x - y}{8}$, $0 \le x \le 2$, , $2 \le y \le 4$ for a bivariate random variable (X,Y), Find the correlation coefficient ρ.</td><td>BTL -4</td><td>Creating</td></tr>
</table>

<table>
<tr><td>10(b).</td><td>If $X_1, X_2, X_3, \cdots X_n$ are Poisson variates with mean 2, use central limit theorem to estimate $P(120 < S_n < 160)$ where $S_n = X_1 + X_2 + X_3 + \cdots + X_n$ and n=75.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>11.</td><td>Find the correlation coefficient for the following heights of fathers X, their sons Y and also find the equations of regression lines. Hence find the height of son when the height of father is 71
<table>
<tr><td>X</td><td>65</td><td>66</td><td>67</td><td>67</td><td>68</td><td>69</td><td>70</td><td>72</td></tr>
<tr><td>Y</td><td>67</td><td>68</td><td>65</td><td>68</td><td>72</td><td>72</td><td>69</td><td>71</td></tr>
</table></td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>12.</td><td>State and Prove Chebyshev's inequality</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>13(a).</td><td>The equation of two regression lines obtained by in a correlation analysis is as follows: 5x-y = 22 , 64x-45y =24. (i) Calculate the correlation coefficient (ii) Mean value of X &Y.</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>13(b).</td><td>The lifetime of a certain brand of an electric bulb may be considered a RV with mean 1200h and standard deviation 250h. Find the probability, using central limit theorem, that the average life time of 60 bulbs exceeds 1250 h.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>14.</td><td>Two random variables X and Y have the joint density
$$f(x,y) = \begin{cases} 2 - x - y, & 0 < x < 1, 0 < y < 1 \\ 0, & otherwise \end{cases}$$
Show that the Correlation coefficient between X and Y is -1 /11.</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>15.</td><td>The following table represents the joint probability distribution of the discrete RV (X,Y). Find all the marginal and conditional distributions.
<table>
<tr><td>Y</td><td colspan="3">X</td></tr>
<tr><td></td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>1</td><td>1/2</td><td>1/6</td><td>0</td></tr>
<tr><td>2</td><td>0</td><td>1/9</td><td>1/5</td></tr>
<tr><td>3</td><td>1/18</td><td>¼</td><td>2/15</td></tr>
</table></td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>16.</td><td>The equation of two regression lines obtained by in a correlation analysis is as follows: 3x + 12y = 19 , 3y + 9x =46.
(i) Calculate the correlation coefficient (ii) Mean value of X &Y.</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>17.</td><td>Find the Coefficient of Correlation between industrial production and export using the following table
<table>
<tr><td>Production (X)</td><td>14</td><td>17</td><td>23</td><td>21</td><td>25</td></tr>
<tr><td>Export (Y)</td><td>10</td><td>12</td><td>15</td><td>20</td><td>23</td></tr>
</table></td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>18.</td><td>Obtain the lines of regression
<table>
<tr><td>X</td><td>50</td><td>55</td><td>50</td><td>60</td><td>65</td><td>65</td><td>65</td><td>60</td><td>60</td></tr>
<tr><td>Y</td><td>11</td><td>14</td><td>13</td><td>16</td><td>16</td><td>15</td><td>15</td><td>14</td><td>13</td></tr>
</table></td><td>BTL -4</td><td>Creating</td></tr>
</table>

UNIT - III: TESTING OF HYPOTHESIS 12

Sampling distributions - Tests for single mean and difference of means (Large and small samples) – Tests for single variance and equality of variances.

PART – A

Q.No.	Question	BT Level	Competence
1.	Define Statistics	BTL -1	Remembering
2.	Define Parameter.	BTL -1	Remembering
3.	In a large city A, 20 percent of a random sample of 900 school boys had a slight physical defect. In another large city B, 18.5 percent of a random sample of 1600 school boys had some defect. Is the difference between the proportions significant?	BTL -2	Understanding

4.	Write down the formula of test statistic ‘t’ to test the significance of difference between the means.	BTL -1	Applying
5.	State any two applications of t-test.	BTL -2	Creating
6	Explain null and alternate hypothesis.	BTL -1	Remembering
7.	Mention the various steps involved in testing of hypothesis.	BTL -1	Remembering
8	Define ‘F’ variate.	BTL -1	Analyzing
9.	What is the assumption of t-test?	BTL -2	Analyzing
10	Give the main use of small sample test	BTL -1	Creating
11.	What are the expected frequencies of 2x2 contingency table? A b C d	BTL -2	Analyzing
12.	Write the formula for the chi- square test of goodness of fit of a random sample to a hypothetical distribution.	BTL -1	Analyzing
13.	What are the properties of “F” test?	BTL -2	Applying
14.	Write the application of ‘F’ test.	BTL -1	Analyzing
15.	Define Type I and Type II error.	BTL -2	Understanding
16.	What is the essential difference between confidence limits and tolerance limits?	BTL -1	Remembering
17.	State level of significance.	BTL -1	Remembering
18.	Twenty people were attacked by a disease and only 18 were survived. The hypothesis is set in such a way that the survival rate is 85% if attacked by this disease. Will you reject the hypothesis that it is more at 5% level.($Z_{0.05} = 1.645$).	BTL -2	Understanding
19.	A standard sample of 200 tins of coconut oil gave an average weight of 4.95 kg with a standard deviation of 0.21 kg. Do we accept that the net weight is 5 kg per tin at 5% level of significance?	BTL -2	Understanding
20.	What are the applications of t-test?	BTL -2	Applying
21.	What are the parameters and statistics in sampling	BTL -1	Remembering
22.	A random sample of 25 cups from a certain coffee dispensing machine yields a mean x = 6.9 occurs per cup. Use 0.05 level of significance to test, on the average, the machine dispense $\mu = 7.0$ ounces against the null hypothesis that, on the average, the machine dispenses $\mu < 7.0$ ounces. Assume that the distribution of ounces per cup is normal, and that the variance is the known quantity $\sigma^2=0.01$ ounces	BTL -2	Understanding
23.	Define Standard Error.	BTL -1	Remembering
24.	A standard sample of 100 tins of coconut oil gave an average weight of 3.92 kg with a standard deviation of 0.11 kg. Do we accept that the net weight is 5 kg per tin at 1% level of significance?	BTL -1	Analyzing
25.	Write the formula for Z-test in Single mean and Difference mean	BTL -1	Remembering

PART – B

1.(a)	A group of 10 rats fed on diet A and another group of 8 rats fed on diet B, Recorded the following increase the following increase in weight.(gm) Diet A: 5, 6, 8, 1, 12, 4, 3, 9, 6, 10 Diet B: 2, 3, 6, 8, 10, 1, 2, 8, -, - Find the variances are significantly different. (Use F-test)	BTL -3	Applying
1.(b)	The marks obtained by a group of 9 regular course students and another group of 11 part time course students in a test are given below : Sample I: 56, 62, 63, 54, 60, 51, 67, 69, 58 Sample II: 62, 70, 71, 62, 60, 56, 75, 64, 72, 68, 66	BTL -4	Creating

Diet A	5	6	8	1	12	4	3	9	6	10
Diet B	2	3	6	8	10	1	2	8	-	-

Sample I	56	62	63	54	60	51	67	69	58		
Sample II	62	70	71	62	60	56	75	64	72	68	66

<table>
<tr><td></td><td>Examine whether the marks obtained by regular students and part-time students differ significantly at 5% levels of significance.</td><td></td><td></td></tr>
<tr><td>2.</td><td>Records taken of the number of male and female births in 800 families having four Children are as follows :
Number of male births : 0 1 2 3 4
Number of female births : 4 3 2 1 0
Number of Families : 32 178 290 236 64
Infer whether the data are consistent with the hypothesis that the binomial law holds the chance of a male birth is equal to female birth, namely p = ½ = q.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>3.</td><td>The nicotine content in milligram of two samples of toboco where found to be as follows
Sample 1 24 27 26 21 25
Sample 2 27 30 28 31 22 36
Can it be said that this samples where from normal population with the same mean.</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>4.</td><td>Mechanical engineers testing a new arc welding technique, classified welds both with respect to appearance and an X-ray inspection<table><tr><td>X-ray/Appearance</td><td>Bad</td><td>Normal</td><td>Good</td></tr><tr><td>Bad</td><td>20</td><td>7</td><td>3</td></tr><tr><td>Normal</td><td>13</td><td>51</td><td>16</td></tr><tr><td>Good</td><td>7</td><td>12</td><td>21</td></tr></table>Test for independence using 0.05 level of significance.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>5.</td><td>Two random samples gave the following results:<table><tr><td>Sample</td><td>Size</td><td>Sample mean</td><td>Sum of squares of deviation from the mean</td></tr><tr><td>1</td><td>10</td><td>15</td><td>90</td></tr><tr><td>2</td><td>12</td><td>14</td><td>108</td></tr></table>Analyze whether the samples have come from the same normal population.</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>6.</td><td>Random samples drawn from two places gave the following data relating to the heights of male adults:<table><tr><td></td><td>Place A</td><td>Place B</td></tr><tr><td>Mean height (in inches)</td><td>68.50</td><td>65.50</td></tr><tr><td>S.D (in inches)</td><td>2.5</td><td>3.0</td></tr><tr><td>No. of adut males in sample</td><td>1200</td><td>1500</td></tr></table>Test at 5 % level, that the mean height is the same for adults in the two places.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>7.</td><td>The following data gives the number of aircraft accidents that occurred during the various days of a week. Find whether the accidents are uniformly distributed over the week<table><tr><td>Days</td><td>Sun</td><td>Mon</td><td>Tues</td><td>Wed</td><td>Thu</td><td>Fri</td><td>Sat</td></tr><tr><td>No. of accidents</td><td>14</td><td>16</td><td>08</td><td>12</td><td>11</td><td>9</td><td>14</td></tr></table></td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>8.</td><td>The nicotine content in milligram of two samples of tobacco where found to be as follows, test the significant difference between means of the two samples.<table><tr><td>Sample I</td><td>21</td><td>24</td><td>25</td><td>26</td><td>27</td><td>-</td></tr><tr><td>Sample II</td><td>22</td><td>27</td><td>28</td><td>30</td><td>31</td><td>36</td></tr></table></td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>9.</td><td>Test of fidelity and selectivity of 190 radio receivers produced the results shown in the following table</td><td>BTL -4</td><td>Creating</td></tr>
</table>

<table>
<tr><td></td><td>
Fidelity
<table>
<tr><td>Selectivity</td><td>Low</td><td>Average</td><td>High</td></tr>
<tr><td>Low</td><td>6</td><td>12</td><td>32</td></tr>
<tr><td>Average</td><td>33</td><td>61</td><td>18</td></tr>
<tr><td>High</td><td>13</td><td>15</td><td>0</td></tr>
</table>
Use 0.01 level of significance to test whether there is a relationship between fidelity and selectivity.
</td><td></td><td></td></tr>
<tr><td>10.</td><td>
Two independent samples of sizes 8 and 7 contained the following values.
<table>
<tr><td>Sample I</td><td>19</td><td>17</td><td>15</td><td>21</td><td>16</td><td>18</td><td>16</td><td>14</td></tr>
<tr><td>Sample II</td><td>15</td><td>14</td><td>15</td><td>19</td><td>15</td><td>18</td><td>16</td><td></td></tr>
</table>
Test if the two populations have the same mean.
</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>11.</td><td>
Samples of two types of electric bulbs 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 Size</td><td>8</td><td>7</td></tr>
<tr><td>Sample Mean</td><td>1234hrs</td><td>1036hrs</td></tr>
<tr><td>Sample S.D</td><td>36hrs</td><td>40hrs</td></tr>
</table>
Analyze that, is the difference in the means sufficient to warrant that type I is superior to type II regarding the length of life?
</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>12.</td><td>
Two independent samples of 8 and 7 items respectively had the following Values of the variable (weight in kgs.) Use 0.05 LOS to
<table>
<tr><td>Sample I</td><td>9</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>10</td><td>12</td><td>10</td><td>14</td><td>9</td><td>8</td><td>10</td><td></td></tr>
</table>
test
whether the variances of the two population’s sample are equal.
</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>13.</td><td>
A survey of 320 families with 5 children each revealed the following distribution
<table>
<tr><td>Boys</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Girls</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Families</td><td>14</td><td>56</td><td>110</td><td>88</td><td>40</td><td>12</td></tr>
</table>
Is this result consistent with the hypothesis that male and female births are equally probable?
</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>14.</td><td>In a certain factory there are two independent processes manufacturing the same item. The average weight in a sample of 250 items produced from one process is found to be 120 Ozs, with a standard deviation of 12 Ozs, while the corresponding figures in a sample of 400 items from the other process are 124 and 14. Is the difference between the two sample means significant?</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>15. (a)</td><td>A simple sample of heights of 6400 Englishmen has a mean of 170cms and a standard deviation of 6.4cms, while a simple sample of heights of 1600 Americans has a mean of 172 cm and a standard deviation of 6.3cms. Do the data indicate that Americans are, on the average, taller than Englishmen?</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>15.(b)</td><td>A sample of 100 students is taken from a large population. The mean height of the students in this sample is 160cms. Can it be reasonably regarded that this sample is from a population of mean 165 cm and standard deviation 10 cm?</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>16.</td><td>The heights of 10 males of a given locality are found to be 70, 67, 62, 68, 61, 68, 70, 64, 64, 66 inches. Is it reasonable to believe that the average height is grater than 64 inches?</td><td>BTL -4</td><td>Creating</td></tr>
</table>

17.	In a sample of 8 observations, the sum of squares of devaitation of the sample values from the sample mean was 84.4 and in the other sample of 10 observations it was 102.6. Test whether this difference is significant at 5% level, given that the 5% point of F for v1=7 and v2=9 defres of freedom is 3,27	BTL -3	Applying
18.	The mean braking strength of the cables supplied by manufacture is 1800 with S.D 100. By a new technique in the manufacturing process it is claimed that the breaking strength of the cable has increased. To test this claim a sample of 50 cables is tested and is found that the mean braking strength is 1850. Can we support the claim at 1% level of significance.	BTL -4	Creating

UNIT-IV: PARAMETRIC TESTS 12

Chi-square tests for independence of attributes and goodness of fit – Design of experiments one way and two way classification.

PART – A

Q.No	Question	BT Level	Competence
1.	What is ANOVA?	BTL -1	Remembering
2.	What are the uses of ANOVA?	BTL -1	Remembering
3.	What are the components of design of experiment?	BTL -1	Remembering
4.	Write the basic assumptions in analysis of variance.	BTL -1	Remembering
5.	What are the basic principles of Experimental Design?	BTL-1	Applying
6.	Define experimental error.	BTL-2	Understanding
7.	Write any two advantages of RBD over CRD.	BTL -1	Remembering
8.	What is the aim of design of experiments?	BTL -2	Understanding
9.	What is the degrees of freedom for Error in one way classficiation?	BTL -2	Understanding
10.	What is the degrees of freedom for Error in Two way classficiation?	BTL -2	Understanding
11.	What is the degrees of freedom for Sum of Squares due to Treatments inOne–way Classification?	BTL -1	Applying
12.	What is the TSS degrees of freedom for Two–way Classification with r – rows and c – columns?	BTL-1	Remembering
13.	What is meant by tolerance limits?	BTL -2	Applying
14.	What are the basic elements of an Completely Randomized Experimental Design?	BTL -1	Analyzing
15.	When do you apply analysis of variance technique?	BTL -1	Analyzing
16.	Define Replication	BTL -2	Analyzing
17.	What is a completely randomized design.	BTL -2	Analyzing
18.	Explain the advantages of a Latin square design?	BTL -2	Analyzing
19.	Demonstrate the purpose of blocking in a randomized block design?	BTL -1	Creating
20.	State the Basic principles of the design of experiment?	BTL -2	Creating
21.	Why a 2x2 Latin square is not possible? Explain.	BTL-1	Remembering
22.	Demonstrate main advantage of Latin square Design over Randomized Block Design?	BTL-1	Remembering
23.	Analyze the advantages of the Latin square design over the other design.	BTL-2	Understanding
24.	Write any two differences between RBD and LSD.	BTL-2	Understanding
25.	Define Randomization		

Part B

<table>
<tr><td>1.</td><td>The accompanying data resulted from an experiment comparing the degree of soiling for fabric copolymerized with the 3 different mixtures of met acrylic acid. Analyze the classification.
Mixture 1 : 0.56 1.12 0.90 1.07 0.94
Mixture 2 : 0.72 0.69 0.87 0.78 0.91
Mixture 3 : 0.62 1.08 1.07 0.99 0.93</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>2.</td><td>The following table shows the lives in hours of four brands of electric lamps brand
A: 1610, 1610, 1650, 1680, 1700, 1720, 1800
B: 1580, 1640, 1640, 1700, 1750
C: 1460, 1550, 1600, 1620, 1640, 1660, 1740, 1820
D: 1510, 1520, 1530, 1570, 1600, 1680
Identify an analysis of variance and test the homogeneity of the mean lives of the four brands of lamps.</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>3.</td><td>A sample of 200 persons with a particular disease was selected. Out of these, 100 were given a drug and the others were not given any drug. The result are as follows:
<table>
<tr><td>Number of persons</td><td>Drug</td><td>No drug</td><td>Total</td></tr>
<tr><td>Cured</td><td>65</td><td>55</td><td>120</td></tr>
<tr><td>Not cured</td><td>35</td><td>45</td><td>80</td></tr>
<tr><td>Total</td><td>100</td><td>100</td><td>200</td></tr>
</table>
Test whether the drug is effective or not?</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>4.</td><td>A random sample is selected from each of 3 makes of ropes and their braking strength are measured with the following results.
I : 70 72 75 80 83
II : 100 110 108 112 113 120 107
III : 60 65 57 84 87 73
Test whether the braking strehgth of the ropes differs significantly?</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>5.</td><td>Given the following table for hair color and eye color, identify the value of Chi-square. Is there good association between hair color and eye color?
<table>
<tr><td colspan="6">Hair color</td></tr>
<tr><td rowspan="5">Eye color</td><td></td><td>Fair</td><td>Brown</td><td>Black</td><td>Total</td></tr>
<tr><td>Blue</td><td>15</td><td>5</td><td>20</td><td>40</td></tr>
<tr><td>Grey</td><td>20</td><td>10</td><td>20</td><td>50</td></tr>
<tr><td>Brown</td><td>25</td><td>15</td><td>20</td><td>60</td></tr>
<tr><td>Total</td><td>60</td><td>30</td><td>60</td><td>150</td></tr>
</table></td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>6.</td><td>A random sample is selected from each of three makes of ropes and their breaking strength (in pounds) are measured with the following results
Sample I : 70 72 75 80 83
Sample II : 100 110 108 112 113 120 107
Sample III: 60 65 57 84 87 73
Test whether the breaking strength of the ropes differs significantly?</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>7.</td><td>Ten persons were appointed in the officer cadre in an office. Their performance was noted by giving a test and marks were recorded out of 100.
Employee : A B C D E F G H I J
Before Training : 80 76 92 60 70 56 74 56 70 56
After Training : 84 70 96 80 70 52 84 72 72 50
By applying t-test can it be concluded that the employees have been benefited by the training?</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>8.</td><td>Five doctors each test five treatments for a certain disease and observe the number of days each patient takes to recover. The results are as follows</td><td>BTL -4</td><td>Creating</td></tr>
</table>

(recovery time in days)

	Treatment				
Doctor	1	2	3	4	5
A	10	14	23	18	20
B	11	15	24	17	21
C	9	12	20	16	19
D	8	13	17	17	20
E	12	15	19	15	22

Estimate the difference between (a) doctors and(b)treatments for the above data at 5% level.

9. Perform a 2-way ANOVA on the data given below: — BTL -3 — Applying

		Treatment 1		
		1	2	3
Treatment 2	1	30	26	38
	2	24	29	28
	3	33	24	35
	4	36	31	30
	5	27	35	33

Use the coding method subtracting 30 from the given no.

10. A chemist wishes to test the effect of four chemical agents on the strength of a particular type of cloth. Because there might be variability from one bolt to another , the chemist decides to use a randomized block design ,with the bolts of cloth consider as blocks ,she selects five bolts and applies all four chemical in random order to each bolt, The resulting tensile strength follows — BTL -4 — Creating

		BOLT				
		1	2	3	4	5
CHEMICAL	1	73	68	74	71	67
	2	73	67	75	72	70
	3	75	68	78	73	68
	4	73	71	75	75	69

Does the tensile strength depend on chemical? Test at 10% level of significance.

11. The following data gives the number of aircraft accidents that occurred during the various days of a week. Find whether the accidents are uniformly distributed over the week — BTL -3 — Applying

Days	Sun	Mon	Tues	Wed	Thu	Fri	Sat
No. of accidents	14	16	08	12	11	9	14

12. Four different though supposedly equivalent forms of a standardized reading achievement test were given to each of 5 students and the following are the scores, which they obtained — BTL -4 — Creating

		Student				
		1	2	3	4	5
Form	A	75	73	59	69	84
	B	83	72	56	70	92
	C	86	61	53	72	88
	D	73	67	62	79	95

Perform a two way analysis of variance to test at the level of significance 1%.

13. A company appoints 4 salesmen A, B, C and D and observes their sales in 3 seasons, summer winter and monsoon. The figures are given in the following table:

	Salesmen			
Season	1	2	3	4
Summer	45	40	28	37
Winter	43	41	45	38
Monsoon	39	39	43	41

Carry out an Analysis of variances

BTL -3 | Applying

14. The following data resulted from an experiment to compare three burners A, B, C. A Latin square design was used as the tests were made on 3 engines and were spread over 3 days.

A 16	B 17	C 20
B 16	C 21	A 15
C 15	A 12	B 13

Test the hypothesis and infer that there is no difference between the burners.

BTL -4 | Creating

15. A farmer wishes to test the effects of four different fertilizers A,B,C, Don the yield of Wheat. In order to eliminate sources of error due to variability in soil fertility, he uses the fertilizers, in a Latin square arrangement a syndicated in the following table, where the numbers indicate yields per unit area.

A18	C21	D25	B11
D22	B12	A15	C19
B15	A20	C23	D24
C22	D21	B10	A17

Design an analysis of variance to determine if there is a significant difference between the fertilizers at $\alpha=0.05$ and $\alpha=0.01$ levels of significance.

BTL - 3 | Applying

16. Set up the analysis of variance for the following results of a Latin Square Design(use $\alpha = 0.01$) level of significance

A12	C19	B10	D8
C18	B12	D6	A7
B22	D10	A5	C21
D12	A7	C27	B17

BTL -4 | Creating

17. In a 5x5 Latin square experiment, the data collected is given in the matrix below Yield per plot is given in quintals for the five different cultivation treatments A, B, C,D and E. Perform the analysis of variance.

A48 E66 D56 C52 B61
D64 B62 A50 E64 C63
B69 A53 C60 D61 E67
C57 D58 E67 B65 A55
E67 C57 B66 A60 D57

BTL - 3 | Applying

18. A variable trial was conducted on wheat with 4 varieties in a Latin square design. The plan of the experiment and the per plot yield are given below.

C25 B23 A20 D20
A19 D19 C21 B18
B19 A14 D17 C20
D17 C20 B21 A15

BTL -4 | Creating

UNIT-V: TIME SERIES ANALYSIS **12**

Time series as a discrete stochastic process. Stationarity- Main characteristics of stochastic process (mean, auto co variation and auto correlation function)-Autoregressive models AR (p) -Yull-Worker equation Auto regressive moving average models ARMA.

PART – A			
Q.No.	**Question**	**BTL Level**	**Competence**
1.	Define Discrete Random Process with example.	BTL -1	Remembering
2.	Define wide sense stationary process.	BTL -1	Remembering
3.	What are the four types of a stochastic process?	BTL -1	Remembering
4.	Derive the auto correlation for a Poisson process with rate λ.	BTL -1	Remembering
5.	A random process X (t) = A sin *t* + B cos *t* where A and B are independent random variables with zero means and equal standard deviations. Find the mean of the process.	BTL -1	Remembering
6.	Find the mean of a stationary random process whose auto correlation function is given by $R_{(Z)} = \frac{25Z^2+36}{6.25Z^2+4}$	BTL -1	Remembering
7.	Define Time Series Analysis	BTL -2	Understanding
8.	Why should we learn Time Series?	BTL -2	Understanding
9.	How many Components of Time Series?	BTL -2	Understanding
10.	Explain Cyclic Variations	BTL -2	Understanding
11.	How can be Seasonality assessed using graphical procedures?	BTL -1	Applying
12.	Write the Formula for Multiplicative Model in Time Series?	BTL -1	Applying
13.	List the methods for Measurements of Trends?	BTL -1	Applying
14.	Fit a trend line by the method of freehand method for the given data. Year: 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007 Sales: 30, 46, 25, 59, 40, 60, 38, 65	BTL -2	Analyzing
15.	What are the Process Model for a Time Series?	BTL -1	Analyzing
16.	Define White Noise Process?	BTL -2	Analyzing
17.	What is First order Markov Process?	BTL -1	Analyzing
18.	Define AR process	BTL -2	Analyzing
19.	Explain Auto regressive process of order 2	BTL -2	Creating
20.	Which treatment(s) for seasonality ?	BTL -1	Analyzing
21.	Define Discrete Random sequence with example.	BTL -1	Applying
22.	Define Discrete Random Process with example.	BTL -1	Applying
23.	Compute the mean value of the random process whose auto correlation function is given by $R_{XX}(\tau) = 25 + \frac{4}{1+6\tau^2}$.	BTL -1	Applying
24.	Find the mean of a stationary random process whose auto correlation function is given by $R_{XX}(\tau) = 18 + \frac{2}{6+\tau^2}$.	BTL -1	Analyzing
25.	Define Box –Jenkins model	BTL -2	Analyzing

PART – B			
1.	The process {X(t)} whose probability distribution under certain conditions is given by $P\{X(t)=n\} = \begin{cases} \frac{(at)^{n-1}}{(1+at)^{n+1}}, & n=1,2 \\ \frac{at}{(1+at)}, & n=0 \end{cases}$ Show that it is not stationary.	BTL -3	Applying
2.	The probability of a dry day following a rainy day is 1/3 and the at the probability of a rainy day following a dry day is ½. Given that May 1^{st} is a dry day. Find the probability that May 3^{rd} is a dry day also May 5^{th} is a dry day.	BTL -4	Creating

<table>
<tr><td>3.</td><td>Describe Co-variance stationary of Auto Regressive Process of order 2 (Yule Process)</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>4.</td><td>Calculate three-yearly moving averages of number of students studying in a higher secondary school in a particular village from the following data.
<table>
<tr><td>Year</td><td>1995</td><td>1996</td><td>1997</td><td>1998</td><td>1999</td></tr>
<tr><td>Sales</td><td>332</td><td>317</td><td>357</td><td>392</td><td>402</td></tr>
<tr><td>Year</td><td>2000</td><td>2001</td><td>2002</td><td>2003</td><td>2004</td></tr>
<tr><td>Sales</td><td>405</td><td>410</td><td>427</td><td>435</td><td>438</td></tr>
</table></td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>5.</td><td>If the customers arrive in accordance with the Poisson process, with rate of 2 per minute, Find the probability that the interval between 2 consecutive arrivals is (i) more than 1 minute, (ii) between 1 and 2 minutes, (iii) less than 4 minutes.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>6.</td><td>The sales of a commodity in tones varied from January 2010 to December 2010 as follows:
<table>
<tr><td>Month</td><td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>June</td></tr>
<tr><td>Sales</td><td>280</td><td>240</td><td>270</td><td>300</td><td>280</td><td>290</td></tr>
<tr><td>Month</td><td>July</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td></tr>
<tr><td>Sales</td><td>210</td><td>200</td><td>230</td><td>200</td><td>230</td><td>210</td></tr>
</table>
Fit a Trend the line by the method of Semi-Average</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>7.</td><td>Prove that the difference of two independent Poisson process is not a Poisson process.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>8.</td><td>The following figures relates to the profits of a commercial concern for 8 years
<table>
<tr><td>Year</td><td>1986</td><td>1987</td><td>1988</td><td>1989</td><td>1990</td><td>1991</td><td>1992</td><td>1993</td></tr>
<tr><td>Profit</td><td>15420</td><td>15470</td><td>15520</td><td>21020</td><td>26500</td><td>31950</td><td>35600</td><td>34900</td></tr>
</table>
Find the trend of profits by the method of three yearly moving Average</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>9.</td><td>A salesman's territory consists of three regions A, B, C. He never sells in the same region on successive days. If he sells in region A, then the next day he sells in B. However, if he sells either B or C, then the next day he is twice as likely to sell in A as in the other region. Explain How often does he sell in each of the regions in the steady state?</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>10.</td><td>Check whether the Poisson process $X(t)$ given by the probability law
$P\{X(t)=n\}=\frac{e^{-\lambda t}(\lambda t)^n}{n!}, n=0,1,2,\cdots$ is stationary or not.</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>11.</td><td>Write the short notes of models of time series</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>12.</td><td>Explain ARMA process with suitable example.</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>13.</td><td>Fit a trend line by the method of semi- averages for the given data.
<table>
<tr><td>Year</td><td>1990</td><td>1991</td><td>1992</td><td>1993</td><td>1994</td><td>1995</td><td>1996</td><td>1997</td></tr>
<tr><td>Sales</td><td>15</td><td>11</td><td>20</td><td>10</td><td>15</td><td>25</td><td>35</td><td>30</td></tr>
</table></td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>14.</td><td>Find the trend of annual sales of a trading organization by Moving Average Method:
<table>
<tr><td>Year</td><td>Annual Sales (Rs. In '000)</td><td>Year</td><td>Annual Sales (Rs. In '000)</td></tr>
<tr><td>1964</td><td>80</td><td>1974</td><td>84</td></tr>
<tr><td>1965</td><td>84</td><td>1975</td><td>96</td></tr>
<tr><td>1966</td><td>80</td><td>1976</td><td>92</td></tr>
<tr><td>1967</td><td>88</td><td>1977</td><td>104</td></tr>
</table></td><td>BTL -4</td><td>Creating</td></tr>
</table>

<table>
<tr><td></td><td><table><tr><td>1968</td><td>98</td><td>1978</td><td>116</td></tr><tr><td>1969</td><td>92</td><td>1979</td><td>112</td></tr><tr><td>1970</td><td>84</td><td>1980</td><td>102</td></tr><tr><td>1971</td><td>88</td><td>1981</td><td>114</td></tr><tr><td>1972</td><td>80</td><td>1982</td><td>108</td></tr><tr><td>1973</td><td>100</td><td>1983</td><td>126</td></tr></table>(Use the most appropriate period of moving average)</td><td></td><td></td></tr>
<tr><td>15.</td><td>Show that the random process $X(t) = Acos\omega t + Bsin\omega t$ is wide sense stationary process if A and B are random variables such that $E(A) = E(B) = 0, E(A^2) = E(B^2)$ and $E(AB) = 0$</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>16.</td><td>The sales of a commodity in tones varied from January 2020 to December 2020 as follows:<table><tr><td>Month</td><td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>June</td></tr><tr><td>Sales</td><td>210</td><td>200</td><td>230</td><td>200</td><td>230</td><td>210</td></tr><tr><td>Month</td><td>July</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td></tr><tr><td>Sales</td><td>280</td><td>240</td><td>270</td><td>300</td><td>280</td><td>290</td></tr></table>Fit a Trend the line by the method of Semi-Average</td><td>BTL -4</td><td>Creating</td></tr>
<tr><td>17.</td><td>Three boys A, B and C are throwing a ball to each other. A always throws the ball to B and B always throws the ball to C but C is just as likely to throw the ball to B as to A. Show that the process is Markovian. Find the transition probability matrix and classify the states</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>18.</td><td>Write the short notes of Yull-Worker equation Auto regressive moving average models</td><td>BTL -4</td><td>Creating</td></tr>
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