SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

S.R.M. Nagar, Kattankulathur - 603203

DEPARTMENT OF MATHEMATICS

QUESTION BANK

I SEMESTER

M.B.A

1918108 – STATISTICS FOR MANAGEMENT

Regulation – 2019

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SUBJECT : 1918108 – STATISTICS FOR MANAGEMENT

SEM / YEAR: I / I Year M.B.A.

UNIT I - INTRODUCTION: Basic definitions and rules for probability, conditional probability independence of events, Bayes' theorem, and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

Q.No.	Question	BT Level	Competence
	PART – A		
1.	Define Statistics.	BTL -1	Remembering
2.	What is the addition and multiplication theorem on probability?	BTL -1	Remembering
3.	Define independent events.	BTL -1	Remembering
4.	Define mutually exclusive events.	BTL -1	Remembering
5.	State the theorem of total probability	BTL -1	Remembering
6	State Baye's theorem	BTL -1	Remembering
7.	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.	BTL -1	Remembering
8	From a pack of cards, one card is drawn. What is the probability that it is either a spade or a king.	BTL -2	Understanding
9.	What is the Probability that a leap year selected at random will have 53 Sundays?	BTL -4	Analyzing
10	If a box contains 75 good items and 25 defective items , and 12 items are selected at random, find the probability that at least one item is defective	BTL -2	Understanding
11.	A and B are events with $P(A) = \frac{3}{8}, P(B) = \frac{1}{2}$ and $P(A \cap B) = \frac{1}{4}$. Find $P(\bar{A} \cap \bar{B})$	BTL -3	Applying
12.	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.	BTL -3	Applying
13.	If $f(x) = kx^2, 0 < x < 3$, is to be a density function, find the value of k.	BTL -2	Understanding
14.	Let X be the lifetime in years of a mechanical part. Assume that X has the cdf $F(x) = 1 - e^{-x}$, $x \geq 0$. Find $P[1 < X \leq 3]$.	BTL -2	Understanding
15.	The mean of Binomial distribution is 20 and standard deviation is 4. Find the parameters of the distribution.	BTL -4	Analyzing

No.of failures	0	1	2	3	4	5	6
Probability	k	2 k	2 k	k	3 k	k	4 k

16.	For a Binomial distribution the mean is 6 and standard deviation is $\sqrt{2}$ Find parameters of the distribution	BTL -4	Analyzing
17.	If 20% of the bolts produced by a machine are defective, Determine the probability that out of 4 bolts chosen at random exactly one defective.	BTL -4	Analyzing
18.	If the mean and variance of a binomial distribution are respectively 6 and 2.4, find P(x=2).	BTL -2	Understanding
19.	Suppose that, on an average, in every three pages of a book there is one typographical error. If the number of typographical errors on a single page of the book is a Poisson random variable. What is the probability if at least one error on a specific page of the book?	BTL -4	Analyzing
20.	If x is a Poisson distribution such that P(x=1)=4P(x=2). Find its mean and variance	BTL -3	Applying
21.	Suppose that X has a Poisson distribution with parameter $\lambda = 2$. Compute $P[X \geq 1]$.	BTL -2	Understanding
22.	Discuss the probability density function of a Uniform distribution	BTL -3	Applying
23.	Let X be a Uniformly distributed R. V. over [-3, 3] Determine $P(X \leq 2)$	BTL -3	Applying
24.	Define Normal distribution	BTL -1	Remembering
25.	State any two properties of normal distribution	BTL -2	Understanding
	PART – B		
1.	Given: The probabilities of three events A, B and C occurring are P(A) = 0.35, P(B) = 0.45 and P(C) = 0.2. Assuming that A, B, or C has occurred, the probabilities of another event X occurring are P(X/A) = 0.8, P(X/B) = 0.65 and P(X/C) = 0.3. Find P(A/X), P(B/X) and P(C/X).	BTL -3	Applying
2.(a)	4 cards are drawn from a well shuffled pack of cards. Find the probability that (i) All the four are queens (ii) There is one card from each suit. (iii) Two cards are diamonds and two are spades All the four cards are hearts and one of them is jack	BTL -5	Evaluating
2.(b)	Given $\lambda = 4.2$, for a poisson distribution. Find (a) $P(X \leq 2)$ (b) $P(X \geq 5)$ (c) $P(X = 8)$.	BTL -5	Evaluating
3.	Three machines all turn out nonferrous castings. Machine A produces 1% defective and Machine B- 2% and machine C – 5%. Each machine produces 1/3 of the output. An inspector examines a single casting, which he determines as non-defective. Estimate the probabilities of its having been produced by each machine	BTL -3	Applying
4.(a)	Two dice are thrown together once. Find the probabilities for getting the sum of the two numbers (i) equal to 5, (ii) multiple of 3, (iii) divisible by 4.	BTL -3	Applying
4.(b)	Messages arrive at a switch board in a Poisson manner at an average rate of 6 per hour. Find the probability that exactly 2 messages arrive within one hour, no messages arrives within one hour and at least 3	BTL -3	Applying

	messages arrive within one hour		
5.	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?	BTL -3	Applying
6.(a)	In 1989, there were three candidates for the position of principal Mr. Chatterji, Mr. Ayangar and Dr. Singh. Whose chances of getting the appointment are in the proportion 4:2:3 respectively. The probability that Mr. Chatterji is selected, would introduce co-education in the college is 0.3. The probabilities of Mr. Ayangar and Dr. Singh doing the same are respectively 0.5 and .08. What is the probability that there was co-education in the college in 1990?	BTL -3	Applying
6.(b)	Find the probability that atmost 5 defective bolts will be found in a box of 200 bolts, if it is known that 2% of such bolts are expected to be defective. (e^{-4}= 0.0183)	BTL -3	Applying
7.	A random variable X has the following probability distribution: X: 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 P(X): 0 | k | 2 k | 2 k | 3 k | k^2 | $2k^2$ | $7k^2$+k Find (i) the value of k (ii) $P(1.5 < X < 4.5 / X > 2)$	BTL -1	Remembering
8.(a)	The probability mass function of a discrete R. V X is given in the following table: X: -2 | -1 | 0 | 1 | 2 | 3 P(X=x): 0.1 | K | 0.2 | $2k$ | 0.3 | k Find (1) Find the value of k, (2) P(X<1)	BTL -4	Analyzing
8.(b)	A box contains 4 bad and 6 good tubes. Two are drawn out from the box at a time. One is tested and found to be good. What is the probability that the other one is also good?	BTL -3	Applying
9.	The probability mass function of a discrete R. V X is given in the following table X: 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 P(X): a | 3a | 5a | 7a | 9a | 11a | 13a | 15a | 17a Find (i) the value of a , (ii) $P(X < 3)$, (iii) Mean of X, (iv) Variance of X.	BTL -5	Evaluating
10.(a)	The atoms of a radioactive element are randomly disintegrating. If every gram of this element, on average, emits 3.9 alpha particles per second, then what is the probability that during the next second the number of alpha particles emitted from 1 gram is (1) at most 6 (2) at least 2 and (3) at least and atmost5	BTL -6	Creating
10.(b)	If the discrete random variable X has the probability function given by the table. x: 1 | 2 | 3 | 4	BTL -3	Applying

	$P(x)$ | $k/3$ | $k/6$ | $k/3$ | $k/6$ Find the value of k and Cumulative distribution of X.		
11.	A coin is biased so that a head is twice as likely to appear as a tail. If the coin is tossed 6 times, find the probabilities of getting (1) Exactly 2 heads, (2) at least 3 heads, (3) at most 4 heads.	BTL -4	Analyzing
12.(a)	The atoms of a radioactive element are randomly disintegrating. If every gram of this element, on average, emits 3.9 alpha particles per second, then what is the probability that during the next second the number of alpha particles emitted from 1 gram is (1) at most 6 (2) at least 2 and (3) at least and atmost5	BTL -3	Applying
12.(b)	The probability mass function of a RV X is given by $(X = r) = kr^3$, $r = 1,2,3,4$. Find (1) the value of k, (2)$P\left(\frac{1}{2} < X < \frac{5}{2}\right)$ (3) $P(X > 2)$	BTL -3	Applying
13.	In a test of 2000 electric blubs it was found that the life of a particular make was normally distributed with an average life of 2040 hours and S. D. of 60 hours. Estimate the number of blubs likely to burn for (1) More than 2150 hours (2) Less than 1950 hours (3) More than 1920 hours but less than 2160 hours.	BTL -4	Analyzing
14.(a)	4 coins were tossed simultaneously. What is the probability of getting (i) 2 heads, (ii) at least 2 heads, (iii) at most 2 heads?	BTL -3	Applying
14.(b)	A normal distribution has mean $\mu = 20$ and standard deviation $\sigma = 10$. Find$P(15 \leq X \leq 40)$.	BTL -3	Applying
15.	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.	BTL -4	Analyzing
16.(a)	X is a normal variable with mean 30 and standard deviation of 5. Find (i) P[26≤ X ≤ 40] (ii) P [X≥45] use normal distribution tables.	BTL -4	Analyzing
16.(b)	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.	BTL -3	Applying
17.	If X follows a normal distribution with mean 12 and variance 16 cm, find the probabilities for (i)P(X ≤ 20)(ii) P(X ≥ 20), and (iii) P(0 ≤ X ≤ 12)	BTL -4	Analyzing
18.(a)	If the random variable X takes values 1, 2, 3, 4 such that 2P(X = 1) = 3P(X = 2) = P(X=3) = 5P(X = 4), find the probability distribution and cumulative distribution of X	BTL -3	Applying
18.(b)	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.	BTL -3	Applying
	PART – C		
1.	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	BTL -4	Analyzing

	product and is found to be defective. What are the probabilities that it was manufactured by machines A, B or C?		
2.	Out of 800 families with 4 children each, how many families would be expected to have (i) 2 boys and 2 girls (ii) at least 1 boy (iii) at most 2 girls (iv) children of both sexes? Assume equal probabilities for boys and girls.	BTL -4	Analyzing
3.	In a certain factory manufacturing razor blades, there is a small chance of 1/500 for any blade to be defective. The blades are supplied in packets of 10. Use Poisson distribution to calculate the approximate number of packets containing (i) No defective (ii) One defective (iii) Two defective blades Respectively in a consignment of 10,000 packets.	BTL -2	Understanding
4.	Buses arrive at a specified stop at 15 minutes interval starting at 6 AM ie they arrive at 6 AM, 6.15AM, 6.30 AM and so on. If a passenger arrives at the stop at a time that is uniformly distributed between 6 and 6.30 AM. Find the probability that he waits (i) Less than 5 minutes for a bus. (ii) More than 10 minutes for a bus.	BTL -2	Understanding
5.	A bank manager has learnt that the length of time the customers have to wait for being attended by the teller is normally distributed with mean time of 5 minutes and standard deviation of 0.8 minutes. Find the probability that a customer has to wait (i) For less than 6 minutes (ii) For more than 3.5 minutes and (iii) Between 3.4 and 6.2 minutes.	BTL -3	Applying

UNIT II - SAMPLING DISTRIBUTION AND ESTIMATION: Introduction to sampling distributions, sampling distribution of mean and proportion, application of central limit theorem, sampling techniques - Estimation: Point and Interval estimates for population parameters of large sample and small samples, determining the sample size

Q.No.	Question	BT Level	Competence
	PART – A		
1.	Define Sampling distribution of proportion.	BTL -1	Remembering
2.	Define Probable standard error.	BTL -1	Remembering
3.	Define standard error and mention its importance.	BTL -1	Remembering
4.	Define central limit theorem	BTL -1	Remembering
5.	Write the formula of confidence interval for the difference between two population proportions for large samples.	BTL -6	Creating
6	Define stratified sampling technique	BTL -1	Remembering
7.	Briefly describe the significance level.	BTL -1	Remembering
8	Distinguish between parameter and statistic.	BTL -2	Understanding
9.	Define estimator.	BTL -1	Remembering

10	Distinguish between point estimation and interval estimation	BTL -2	Understanding
11.	Mention the properties of a good estimator.	BTL -1	Remembering
12.	Define confidence Interval.	BTL -1	Remembering
13.	What is the level of significance in testing of hypothesis	BTL -6	Creating
14.	Define Point estimate.	BTL -1	Remembering
15.	State the conditions under which a binomial distribution becomes a normal distribution	BTL -4	Analyzing
16.	If the random sample comes from a normal population, what can be said about the sampling distribution of the mean.	BTL -5	Evaluating
17.	Given a population with a standard deviation of 8.6, what sample size is needed to estimate the mean of population within $\pm$ 0.5 with 99% confidence.	BTL -6	Creating
18.	Define Interval estimate.	BTL -6	Creating
19.	Write the formula of confidence interval for the difference between two population means for large samples.	BTL -3	Applying
20.	How large sample is useful in estimation and testing.	BTL -4	Analyzing
21.	Define estimate.	BTL -1	Remembering
22.	Define estimation.	BTL -1	Remembering
23.	What are the different types of Sampling methods?	BTL -1	Remembering
24.	Write the formula of confidence interval for the population mean for large samples.	BTL -6	Creating
25.	Write the formula of confidence interval for the difference between two population means for small samples.	BTL -6	Creating
	PART – B		
1.	Car stereo manufacturer of A have mean lifetime of 1400 hrs with SD of 200 hrs while those of manufacturer B have mean lifetime of 1200hrs with a SD of 100 hrs. If a random sample of 120 stereos of each manufacturer are tested. i. What is the probability that the manufacturer of A's stereos will have a mean lifetime of at least 160hrs more than the manufacturer B's stereos. ii. 250hrs more than the manufacturer B stereos.	BTL -6	Creating
2.(a)	A random sample of size 9 is obtained from a Normal population with mean 25 and if the variance 100 find the probability that the sample mean exceeds 31.2.	BTL -3	Applying
2.(b)	The mean strength of a certain cutting tool is 41.5 hrs with a standard deviation of 2.5 hrs. What is the probability that a random sample of size 50 drawn from the population will have mean between 40.5 hrs and 42 hrs.	BTL -4	Analyzing
3.	A bank has kept records of the checking balances of its customers and determined that the average daily balances of its customers is Rs.300 with a standard deviation of Rs. 48. A random sample of 144 checking accounts is selected.	BTL -6	Creating

	(i)What is the probability that the sample mean will be more than Rs. 306.60? (ii)What is the probability that the sample mean will be less than Rs. 308? (iii)What is probability that the sample mean will between Rs. 302 and Rs. 308? (iv)What is probability that the sample mean will be atleast Rs. 296?		
4.(a)	In a quality department of manufacturing paints at the time of dispatch of decorators 30% of the containers are found to be defective. If a random sample of 500 is drawn with replacement from the population. What is the probability that the sample proportion will be lessthan 25% defective.	BTL -4	Analyzing
4.(b)	A manufacturer of watches has determined from experience that 3% of the watches he produces are defective. If a random sample of 300 watches is examined, what is the probability that the proportion defective is between 0.02 and 0.035.	BTL-2	Understanding
5.	A research troop stated that 16% of the firms of the particular type A increased their market research budget in the five year proceedings the studying for type B firms, the figure was 9% 1. What are the mean and SD of the sampling distribution of the difference between sample proportion based on independent random samples, 100 firms from each type. 2. What proportion of the sample difference would be between 0.05 and 0.10.	BTL -4	Analyzing
6.(a)	A random sample of size 100 is taken from a population whose mean is 60 and variance is 400. Using central limit theorem find what probability that we can assert that the mean of the sample will not differ from μ more than 4?	BTL-5	Evaluating
6.(b)	An economist wishes to estimate the average the family income in a certain population. The population SD is known to be $4.500, and the economist uses a random sample of size n=225. What is the probability that the sample mean will fall within $800 of the population mean.	BTL -6	Creating
7.	In a test given to two group of students the marks obtained were as follows, First group : 18 20 36 50 49 36 34 47 61 Second group: 29 28 26 35 30 44 46 Construct a 95% confidence interval on the mean marks secured by students.	BTL-2	Understanding
8.(a)	A sample of 100 measurements at breaking strength of cotton threads gave a mean of 7.4 and SD of 1.2gms. Find 95% confidence limits for the mean breaking strength.	BTL -3	Applying

8.(b)	A mining company needs to estimate the average amount of copper are per ton mined. A random sample of 50 tons gives a sample mean of 146.75 pounds. The population SD is assumed to be 35.2 pounds. Give a 95% confidence interval for the average amount of copper in the population of tons mined.	BTL -6	Creating
9.	In a certain factory there are two independent process manufacturing the same item. The average weight in a sample of 250 items produced from one process is found to be 120 O_{zs} with a S.D of 12 O_{zs}. While the corresponding figures in a sample of 400 items from the other process are 124 O_{zs} and 14 O_{zs}. Find the 95% and 99% confidence limits for the difference in the average weight of items produced by the processes respectively.	BTL -5	Evaluating
10.(a)	The average travel time taken based on a random sample of 10 people working in a company to reach the office is 40 mins with the SD of 10 mins. Estabilish the 95% confidence interval for the mean travel time of everyone in the company to design the working hours.	BTL -5	Evaluating
10.(b)	A transportation company wants to estimate the average length of time goods are in transit across the country. A random sample of 20 shipments gives $\overline{X}$ = 2.6 days and s = 0.4 day. Give 99% confidence interval for the average transit time.	BTL -3	Applying
11.	A sample poll of 100 voters chosen at random from all voters in a given district indicated that 55% of them were in favour of a particular candidate. Find i. 95% ii. 99% confidence limits for the proportion of all the voters in favour of this candidate.	BTL -4	Analyzing
12.(a)	A survey of 748 randomly selected employees of dot.com companies showed that 35% feel secure about their jobs. Give a 90% confidence interval for the proportion of dot.com company employees who feel secure about their jobs.	BTL -6	Creating
12.(b)	In order to compare the intelligent quotient of students, two schools were selected. A random sample of 90 students was selected from each school. At school A the mean IQ is 109 and SD is 11. At school B, the mean IQ is 98 and SD is 9. Construct 95% confidence interval for the difference between IQ of two schools.	BTL -6	Creating
13.	Two operators perform the same operation of applying plastic coating to a part. A random sample of 100 parts from the first operator shows that 6 are non-conforming. A random sample of 200 parts from the second operator shows that 8 are non-conforming. Find a 90% confidence interval for the difference in the proportion of non-conforming parts produced by the two	BTL -4	Analyzing

	operators.		
14.(a)	A cigarette manufacturer wishes to use a random sample to estimate the average nicotine content. The sampling error should not be more than 1 mg above or below the true mean with a 99% confidence. The population SD is 4mg. What sample size should company use to satisfy these requirements.	BTL -6	Creating
14.(b)	For a test market find the sample size needed to estimate the true proportion of consumers satisfied with a certain new product within ±0.04 at 90% confidence level.	BTL -3	Applying
15.	A market research firm wants to estimate the share that foreign companies have in the U.S market for certain products. A random sample of 100 consumers is obtained, and 34 people in the sample are found to be users of foreign-made products; the rest are users of domestic products. Give 95% and 99% confidence level for the share of foreign products in this product.	BTL -4	Analyzing
16.(a)	For a particular brand of TV picture tube, it is known that the mean operating life of the tubes is 1000 hours with a standard deviation of 250 hours, what is the probability that the mean for a random sample of size 25 will be between 950 and 1050 hours?	BTL -4	Analyzing
16.(b)	Strength of wire were produced by a company A has a mean of 4500kg and a S.D of 200kg, company B A has a mean of 4000kg and a S.D of 300kg. If 50 wires of company A and 100 wires of company B are selected at random and tested for strength. what is the probability that the mean strength of A will be at least 600kg more than that of B.	BTL -3	Applying
17.	Explain the types of Sampling methods.	BTL -5	Evaluating
18.(a)	A manufacturer of pens has determined from experience that 4% of the pens produced are defective. If a random sample of 400 pens is examined, what is the probability of proportion of defects between 0.025 and 0.048	BTL -3	Applying
18.(b)	The life time of a certain brand of an electric bulb may be considered as a random variable with mean 1200 hours and standard deviation 250 hours. Find the probability using central limit theorem that the average life time of 60 bulbs exceed 1250 hours.	BTL -3	Applying
PART – C			
1.	Mary, an auditor for a large credit card company, knows that, on average, the monthly balance of any customer is Rs.112, and the standard deviation is Rs.56. If Mary audits 50 randomly selected accounts, What is the probability that the sample average balance is	BTL -6	Creating

	(i) Below Rs.100 (ii)Between Rs.100 and Rs.130		
2.	From a population of 540, a sample of 60 individual is taken. From this sample, the mean is found to 6.2 and the standard deviation 1.368 (i) Find the estimated standard error of the mean. (ii) Construct a 95% confidence interval for the mean.	BTL-2	Understanding
3.	Explain the properties of good point estimator.	BTL -4	Analyzing
4.	A distribution with unknown mean has variance equal to 1.5. Use central limit theorem to find how large a sample should be taken from the distribution in order that the probability will be at least 0.95 that the sample mean will be within 0.5 of the population mean.	BTL -4	Analyzing
5.	Two independent samples are chosen from two schools A and B and a common test is given in a subject. The scores of the students are as follows. School A : 76 68 70 43 94 68 33 School B : 40 48 92 85 70 76 68 22 Construct a 95% and 99% confidence interval on the mean marks secured by students.	BTL-2	Understanding

UNIT III - TESTS OF HYPOTHESIS- PARAMETRIC TESTS: Hypothesis testing: one sample and two sample tests for means and proportions of large samples (z-test), one sample and two sample tests for means of small samples (t-test), F-test for two sample standard deviations. ANOVA one and two way.

Q.No.	Question	BT Level	Competence
	PART – A		
1.	Define Test of Significance.	BTL-1	Remembering
2.	What are the Type I and Type II errors?	BTL-6	Creating
3.	What do you mean by one tail test?	BTL-6	Creating
4.	State the applications of Z-test.	BTL-4	Analyzing
5.	Define critical region.	BTL-1	Remembering
6	Distinguish between one tail and two tail tests.	BTL-2	Understanding
7.	What is the aim of design of experiments?	BTL-6	Creating
8	Distinguish between one-way and two-way analysis of variance.	BTL-2	Understanding
9.	When does the Z-test apply?	BTL-1	Remembering
10	Explain SSB and SSW in ANOVA.	BTL-4	Analyzing
11.	Describe any two applications of t-distribution.	BTL-1	Remembering
12.	Write the uses of F-test?	BTL-6	Creating
13.	Define the level of significance.	BTL-1	Remembering
14.	Write the properties of t-distribution?	BTL-6	Creating
15.	What is standard error?	BTL-6	Creating
16.	Mention any four applications of t-distribution in tests of hypothesis.	BTL-1	Remembering
17.	Write down the formula of t- statistic to test the significance of difference between the means.	BTL-1	Remembering
18.	Define null hypothesis and Alternative hypothesis?	BTL-6	Creating
19.	Estimate the standard error of difference between two proportion if	BTL-6	Creating

	p_1=0.10, p_2=0.133 and n_1=50, n_2=75.		
20.	Mention any two assumptions made in analysis of variance techniques.	BTL-1	Remembering
21.	What is ANOVA?	BTL -1	Remembering
22.	What is the aim of design of experiments?	BTL -1	Remembering
23.	Define Replication.	BTL -1	Remembering
24.	Define Randomization.	BTL -1	Remembering
25.	Define Local control.	BTL -1	Remembering
PART – B			
1.	A machine puts out 16 imperfect articles in a sample of 500. After the machine is overhauled it puts out 3 imperfect articles in a batch of 100. Has the machine Improved?	BTL-5	Evaluating
2.(a)	In a sample of 1000 people in Mumbai 540 are rice eaters and the rest are wheat eaters. Can we assume that both rice and wheat are equally popular in this state at 1% level of significance?	BTL -5	Evaluating
2.(b)	The mean lifetime of a sample of 100 lite tubes produced by a Company is found to be 1580 hours with standard deviation of 90 hours. Test hypothesis that the mean lifetime of tubes produced by the company is 1600 hours.	BTL-5	Evaluating
3.	A sample of heights of 6400 Englishmen has a mean of 170cm and a SD of 6.4cm, While a sample of heights of 1600 Americans has a mean of 172cm and SD of 6.3cm. Do the data indicate that Americans are on the average taller than Englishmen?	BTL-2	Understanding
4.(a)	40 people were attacked by a diseases and only 36 survived. Will you reject the hypothesis that the survival rate if attacked by this diseases, is 85% in favor of the hypothesis that it is more at 5% level of significance?	BTL-2	Understanding
4.(b)	A sample of 100 students is taken from a large population. The mean height of the students in this sample is 160 cm. Can it be reasonably regarded that this sample is from a population of mean 165 cm and SD 10 cm?	BTL-2	Understanding
5.	Two independent samples of 8 and 7 items respectively had the following values. Sample I : 9 11 13 11 15 9 12 14 Sample II: 10 12 10 14 9 8 10 Is the difference between the means of samples significant?	BTL-5	Evaluating
6.(a)	Ten oil tins are taken at random from an automatic filling machine. The mean weight of the tins is 15.8kg and SD is 0.5kg. Does the sample mean differ significantly from the intended weight of 16kg?	BTL-6	Creating
6.(b)	In one sample of 8 observations the sum of the squares of deviations 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 v_1=7 and v_2= 9 degrees of freedom is 3.29?	BTL-2	Understanding
7.	Two random samples drawn from two normal populations are	BTL-4	Analyzing

<table>
<tr><td></td><td>Sample I : 20 16 26 27 23 22 18 24 25 19
Sample II: 27 33 42 35 32 34 38 28 41 43 30 37
Obtain the estimates of variances of the population and test whether the populations have the same variances</td><td></td><td></td></tr>
<tr><td>8.(a)</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 greater than 64 inches?</td><td>BTL-5</td><td>Evaluating</td></tr>
<tr><td>8.(b)</td><td>A certain stimulus administered to each of 12 patients resulted in the following increase of blood pressure 5,2,8,-1,3,0,
-2, 1,5,0,4 and 6. Can it be concluded that the stimulus will, in general, be accompanied by an increase in blood pressure?</td><td>BTL-4</td><td>Analyzing</td></tr>
<tr><td>9.</td><td>Two independent samples of sizes 8 and 7 contained the following
<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>values. Test if the two populations have the same mean.</td><td>BTL -2</td><td>Understanding</td></tr>
<tr><td>10.</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 -1</td><td>Remembering</td></tr>
<tr><td>11.</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>Analyzing</td></tr>
<tr><td>12.</td><td>Analyze the RBD at 5% level of significance.
<table><tr><td></td><td colspan="3">Variety</td></tr><tr><td>Treatment</td><td>1</td><td>2</td><td>3</td></tr><tr><td>1</td><td>8</td><td>10</td><td>12</td></tr><tr><td>2</td><td>2</td><td>6</td><td>7</td></tr><tr><td>3</td><td>4</td><td>10</td><td>9</td></tr><tr><td>4</td><td>3</td><td>5</td><td>9</td></tr></table></td><td>BTL-2</td><td>Understanding</td></tr>
<tr><td>13.</td><td>Apply ANOVA technique and write your comment regarding the performance of the 4 machines? Test at 1% level of significance.
<table><tr><td rowspan="2">Machines</td><td>A</td><td>8</td><td>9</td><td>11</td><td>12</td></tr><tr><td>B</td><td>6</td><td>8</td><td>10</td><td>4</td></tr></table></td><td>BTL -3</td><td>Applying</td></tr>
</table>

<table>
<tr><td></td><td></td><td><table>
<tr><td></td><td>C</td><td>14</td><td>12</td><td>18</td><td>9</td></tr>
<tr><td></td><td>D</td><td>20</td><td>22</td><td>25</td><td>23</td></tr>
</table></td><td></td><td></td></tr>
<tr><td>14.</td><td>A Company appoints 4 salesmen A, B, C, D and observes their sales in 3 seasons, summer, winter and monsoon. The figures (in lakhs) are given in the following table:
<table>
<tr><td></td><td colspan="4">Salesmen</td></tr>
<tr><td>Season</td><td>A</td><td>B</td><td>C</td><td>D</td></tr>
<tr><td>Summer</td><td>45</td><td>40</td><td>38</td><td>37</td></tr>
<tr><td>Winter</td><td>43</td><td>41</td><td>45</td><td>38</td></tr>
<tr><td>Monsoon</td><td>39</td><td>39</td><td>41</td><td>41</td></tr>
</table>
Carry out the analysis of variance.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>15.</td><td>The following are the number of mistakes made in 5 successive days by four technicians working for a photographic laboratory. Test whether the difference among the four sample means can be attributed to chance. Test at a level of significance $\alpha = 0.01$.
<table>
<tr><td colspan="4">Technician</td></tr>
<tr><td>I</td><td>II</td><td>III</td><td>IV</td></tr>
<tr><td>6</td><td>14</td><td>10</td><td>9</td></tr>
<tr><td>14</td><td>9</td><td>12</td><td>12</td></tr>
<tr><td>10</td><td>12</td><td>7</td><td>8</td></tr>
<tr><td>8</td><td>10</td><td>15</td><td>10</td></tr>
<tr><td>11</td><td>14</td><td>11</td><td>11</td></tr>
</table></td><td>BTL -4</td><td>Analyzing</td></tr>
<tr><td>16.</td><td>The following data represent the number of units of production per day turned out by different workers using four different types of machines.

Test whether the five men differ with respect to mean productivity
Test whether the mean productivity is the same for the four different machine types.

<table>
<tr><td rowspan="6">Workers</td><td></td><td colspan="4">Machine Type</td></tr>
<tr><td></td><td>A</td><td>B</td><td>C</td><td>D</td></tr>
<tr><td>1</td><td>44</td><td>38</td><td>47</td><td>36</td></tr>
<tr><td>2</td><td>46</td><td>40</td><td>52</td><td>43</td></tr>
<tr><td>3</td><td>34</td><td>36</td><td>44</td><td>32</td></tr>
<tr><td>4</td><td>43</td><td>38</td><td>46</td><td>33</td></tr>
<tr><td>5</td><td>38</td><td>42</td><td>49</td><td>39</td></tr>
</table></td><td>BTL -4</td><td>Analyzing</td></tr>
<tr><td>17.</td><td>A completely randomized design experiment with 10 plots and 3 treatments gave the results given below. Analyze the results for the effects of treatments.</td><td>BTL-5</td><td>Evaluating</td></tr>
</table>

<table>
<tr><td></td><td><table>
<tr><td>Treatement</td><td colspan="4">Replications</td></tr>
<tr><td>A</td><td>5</td><td>7</td><td>1</td><td>3</td></tr>
<tr><td>B</td><td>4</td><td>4</td><td>7</td><td></td></tr>
<tr><td>C</td><td>3</td><td>1</td><td>5</td><td></td></tr>
</table></td><td></td><td></td></tr>
<tr><td>18.</td><td>In order to determine whether the significant difference in the durability of 3makes of computers, samples of size 5 are selected from each make and the frequency of repair during the first year of purchase is observed. The results are as follows: In view of the above data, what conclusion can you draw?
Makes<table>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>5</td><td>8</td><td>7</td></tr>
<tr><td>6</td><td>10</td><td>3</td></tr>
<tr><td>8</td><td>11</td><td>5</td></tr>
<tr><td>9</td><td>12</td><td>4</td></tr>
<tr><td>7</td><td>4</td><td>1</td></tr>
</table></td><td>BTL -1</td><td>Remembering</td></tr>
<tr><td colspan="4">PART – C</td></tr>
<tr><td>1.</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-2</td><td>Understanding</td></tr>
<tr><td>2.</td><td>In a test given to two groups of students the marks obtained were as follows,
First group : 18 20 36 50 49 36 34 49 41
Second group: 29 28 26 35 30 41 46
Examine the significance difference between the means of marks secured by students of the above two groups.</td><td>BTL -5</td><td>Evaluating</td></tr>
<tr><td>3.</td><td>For the following three samples,
Sample I : 90 82 79 98 83 91
Sample II : 105 89 93 104 89 95 86
Sample III: 83 89 80 94
Perform an analysis of variance to test at 5% level of significance.</td><td>BTL-2</td><td>Understanding</td></tr>
<tr><td>4.</td><td>A laboratory technician measures the breaking strength of each of five kinds of linen threads by using four different measuring instruments, and obtain the following results.</td><td>BTL-1</td><td>Understanding</td></tr>
</table>

		Thread		Instruments					
				I_1	I_2	I_3	I_4		
			1	20.9	20.4	19.9	21.9		
			2	25	26.2	27.0	24.8		
			3	25.5	23.1	21.5	24.4		
			4	24.8	21.2	23.5	25.7		
			5	19.6	21.2	22.1	22.1		
	Perform a 2-way ANOVA using the 0.05 level of significance.								
5.	The followi ng 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.							BTL -1	Remembering

UNIT IV - NON-PARAMETRIC TESTS: Chi-square test for single sample standard deviation. Chi-square tests for independence of attributes and goodness of fit. Sign test for paired data. Rank sum test. Kolmogorov-Smirnov – test for goodness of fit, comparing two populations. Mann – Whitney U test and Kruskal Wallis test. One sample run test.

Q.No.	Question	BT Level	Competence
	PART – A		
1.	Write the formula for the chi- square test of goodness of fit of a random sample to a hypothetical distribution.	BTL -5	Evaluating
2.	Give the main use of ψ^2-test.	BTL -6	Creating
3.	Write the contingency 2*2 table for $\aleph^2$ test.	BTL-5	Evaluating
4.	Define Rank Correlation test.	BTL-1	Remembering
5.	Define Rank-Sum test.	BTL-1	Remembering
6.	Mention the advantages of Nonparametric Tests.	BTL-1	Remembering
7.	What is the other name or non-parametric test? Why?	BTL-6	Creating
8	When are non-parametric tests used?	BTL-1	Remembering
9.	What is the null hypothesis framed in Mann-Whitney test?	BTL-6	Creating
10	Write down the working rule for Mann-Whitney U-test and Kruskal-Wallis test.	BTL-1	Remembering
11.	Explain sign test.	BTL-4	Analyzing
12.	Define one sample run test?	BTL-1	Remembering
13.	When is Krushkal-Wallis test used?	BTL-1	Remembering
14.	Distinguish between Mann-Whitney U-test and Krushkal-Wallis test.	BTL-2	Understanding
15.	Define 'H' test.	BTL-1	Remembering
16.	Write down the formula to calculate rank correlation Coefficient (including tie values).	BTL-1	Remembering
17.	Two HR managers (A and B) ranked five candidates for a new position.	BTL-6	Creating

<table>
<tr><td></td><td>Their rankings of the candidates are show below:
Candidate Rank by A Rank by B
Nancy 2 1
Mary 1 3
John 3 4
Lynda 5 5
Steve 4 2
Compute the Spearman’s rank correlation.</td><td></td><td></td></tr>
<tr><td>18.</td><td>Define rank correlation co-efficient.</td><td>BTL-1</td><td>Remembering</td></tr>
<tr><td>19.</td><td>The following are the ranks obtained by 10 students in Statistics and Mathematics. Find out the rank correlation coefficient.
<table>
<tr><td>Statistics</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>Mathematics</td><td>2</td><td>5</td><td>1</td><td>6</td><td>7</td><td>4</td><td>3</td></tr>
</table></td><td>BTL-4</td><td>Analyzing</td></tr>
<tr><td>20.</td><td>Explain Kolmogorov-Smirnov Test for one sample problem.</td><td>BTL-4</td><td>Analyzing</td></tr>
<tr><td>21.</td><td>What adjustment is to be done for tie values to find rank Correlation?</td><td>BTL-6</td><td>Creating</td></tr>
<tr><td>22.</td><td>Mention the properties of linear coefficient of correlation.</td><td>BTL-1</td><td>Remembering</td></tr>
<tr><td>23.</td><td>Name any three non-parametric tests.</td><td>BTL-1</td><td>Remembering</td></tr>
<tr><td>24.</td><td>Mention the disadvantages of Nonparametric Tests.</td><td>BTL -2</td><td>Understanding</td></tr>
<tr><td>25.</td><td>Write down the formula for Spearman’s coefficient of rank correlation for repeated ranks?</td><td>BTL-1</td><td>Remembering</td></tr>
<tr><td colspan="4">PART – B</td></tr>
<tr><td>1.</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="2" rowspan="2"></td><td colspan="4">Hair color</td></tr>
<tr><td></td><td>Fair</td><td>Brown</td><td>Black</td><td>Total</td></tr>
<tr><td rowspan="4">Eye color</td><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 -1</td><td>Remembering</td></tr>
<tr><td>2.(a)</td><td>Test of fidelity and selectivity of 190 radio receivers produced the results shown in the following table
<table>
<tr><td></td><td colspan="3">Fidelity</td></tr>
<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>BTL -1</td><td>Remembering</td></tr>
<tr><td>2.(b)</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 -1</td><td>Remembering</td></tr>
<tr><td></td><td>
<table>
<tr><td>Sand I</td><td>63</td><td>17</td><td>35</td><td>49</td><td>18</td><td>43</td><td>12</td><td>20</td><td>47</td></tr>
</table></td><td></td><td></td></tr>
</table>

3.	“ 136 51 45 84 32 40 44 25 Sand II 113 54 96 26 39 88 92 53 101 “ 48 89 107 111 58 62 In a study of sedimentary rocks, the following data were obtained from samples of 32 grains from two kinds of sand. Apply Mann-Whitney U test with suitable null and alternative hypotheses.	BTL -3	Applying
4.	In 30 tosses of a coin, the following sequence of head and tails is obtained HTTHTHHHTHHTTHTHTHHHTHTTHTHHTHT (i) Determine the number of runs (ii) Test at 0.10 level of significance, whether the sequence is random	BTL -2	Understanding
5.	The following are the prices in Rs. per kg of a commodity from 2 random samples of shops from 2 cities *A&B*. City A 2.7 3.8 4.3 3.2 4.7 3.6 3.8 4.1 2.7 2.8 3.2 3.4 3.8 4.4 4.9 3.9 4.7 City B 3.7 5.3 4.7 3.6 4.7 4.8 6.0 4.8 4.9 3.8 3.9 4.8 5.2 6.1 3.6 3.8 Apply the run test to examine whether the distribution of prices of commodity in the two cities is the same.	BTL -3	Applying
6.	An experiment designed to compare three preventative methods against corrosion yielded the following maximum depths of pits (in thousands of an inch) in pieces of wire subjected to the respective treatments: Method A: 77 54 67 74 71 66 Method B: 60 41 59 65 62 64 52 Method C: 49 52 69 47 56 Use the Kruskal-Wallis test at the 5% level of significance to test the null hypothesis that the three samples come from identical populations.	BTL -3	Applying
7.	Two researchers adopted different sampling techniques while investigating the same group of students to find the no of students falling in different intelligence level. The results are as follows: No. of students in each level Researchers | Below Average | Average | Above Average | Genius X 86 60 44 10 200 Y 40 33 25 2 100 Total 126 93 69 12 300 Would you say that the sampling techniques adopted by the two researchers are independents (Use Chi-Square test at $\alpha = 0.05$).	BTL -3	Applying
8.(a)	The number of defects in printed circuit boards in hypothesized to follow a Poisson distribution. A random sample of 60 printed boards have been collected and the number of defects observed. The following table gives the results. Table:	BTL -4	Analyzing

	<table><tr><td>No. of defects</td><td>Observed Frequency</td></tr><tr><td>0</td><td>32</td></tr><tr><td>1</td><td>15</td></tr><tr><td>2</td><td>9</td></tr><tr><td>3</td><td>4</td></tr></table> Does the assumption of a poisson distribution seem appropriate as a probability model for this process?		
8.(b)	The following are the measurements of breaking strength of a certain kind of 2 inch cotton ribbon in pounds. Use the sign test to test the hypothesis of 0.05 LOS that the mean breaking strength is 160 pounds. <table><tr><td>163</td><td>165</td><td>160</td><td>189</td><td>161</td><td>171</td><td>158</td><td>151</td><td>169</td><td>162</td></tr><tr><td>163</td><td>139</td><td>172</td><td>165</td><td>148</td><td>166</td><td>172</td><td>163</td><td>187</td><td>173</td></tr></table>	BTL -3	Applying
9.	Apply the K-S test to check that the observed frequencies match with the expected frequencies which are obtained from Normal distribution. (Given at n=5, D_n = 0.510 at 10% LOS). <table><tr><td>Test Score</td><td>51-60</td><td>61-70</td><td>71-80</td><td>81-90</td><td>91-100</td></tr><tr><td>Observed Frequency</td><td>30</td><td>100</td><td>440</td><td>500</td><td>130</td></tr><tr><td>Expected Frequency</td><td>40</td><td>170</td><td>500</td><td>390</td><td>100</td></tr></table>	BTL -5	Evaluating
10.(a)	The following data represents the number of hours that a rechargeable hedge trimmer operates before a recharge is required. 1.5,2.2,0.9,1.3,2.0,1.6,1.8,1.5,2.0,1.2 and 1.7. Use the Sign test to test the hypothesis of the 0.05 LOS that this particular trimmer operates with a mean of 1.8 hours before requiring a recharge.	BTL -6	Creating
10.(b)	From a Maths class of 12 equally capable students using a programmed material, 5 are selected at random and given additional instructions by the teacher. The results on the final exam is as follows. Additional Instruction: 87 69 78 91 80 No Additional Instruction: 75 88 64 82 93 79 67 Use the Rank Sum test at 5% LOS to determine if the additional instruction affects the average grade.	BTL -3	Applying
11.	The following are the year of experience (X) and the average customer satisfaction (Y) for 10 service providers. Is there a significant rank correlation between two measures? Use the 0.05 level of significance. X: 6.3 5.8 6.1 6.9 3.4 1.8 9.4 4.7 7.2 2.4 Y: 5.3 8.6 4.7 4.2 4.9 6.1 5.1 6.3 6.8 5.2	BTL -1	Remembering
12.	The scores of a written examination of 24 students, who were trained by using three different methods, are given below. <table><tr><td>Video cassetteA</td><td>74</td><td>88</td><td>82</td><td>93</td><td>55</td><td>70</td><td>65</td><td></td><td></td></tr><tr><td>Audio cassetteB</td><td>78</td><td>80</td><td>65</td><td>57</td><td>89</td><td>85</td><td>78</td><td>70</td><td></td></tr><tr><td>Class Room C</td><td>68</td><td>83</td><td>50</td><td>91</td><td>84</td><td>77</td><td>94</td><td>81</td><td>92</td></tr></table> Use Krushkal-Wallis test at α = 5% level of significance, whether the three methods of training yield the same results.	BTL-3	Applying
13.	Apply the K-S test to check that the observed frequencies match with the expected frequencies which are obtained from Normal distribution. (Given at n=7, D_n = 0.486 at 5% LOS).	BTL -1	Remembering

	<table><tr><td></td><td>25-30</td><td>31-36</td><td>37-42</td><td>43-48</td><td>49-54</td><td>55-60</td><td>61-66</td></tr><tr><td>Observed Frequency</td><td>9</td><td>22</td><td>25</td><td>30</td><td>21</td><td>12</td><td>6</td></tr><tr><td>Expected Frequency</td><td>6</td><td>17</td><td>32</td><td>35</td><td>18</td><td>13</td><td>4</td></tr></table>		
14.(a)	The theory predicts that the population of beans in the four groups A, B, C and D should be 9:3:3:1. In an experiment among 1600 beans, the number in the four groups was 882,313,287 and 118. Do the experimental results support the survey?	BTL -4	Analyzing
14.(b)	The nicotine content of two brands of cigarettes, measured in milligrams was found as follows. Brand A: 2.1 4.0 6.3 5.4 4.8 3.7 6.1 3.3 Brand B: 4.1 0.6 3.1 2.5 4.0 6.2 1.6 2.2 1.9 5.4 Use the Rank Sum test at 5% LOS.	BTL -3	Applying
15.	The production volume of units assembled by three different operators during 9 shifts is summarized below. Check whether there is significant difference between the production volumes of units assembled by the three operators using Krushkal-Wallis test at a significant level of 0.05. <table><tr><td>Operator I</td><td>29</td><td>34</td><td>34</td><td>20</td><td>32</td><td>45</td><td>42</td><td>24</td><td>35</td></tr><tr><td>Operator II</td><td>30</td><td>21</td><td>23</td><td>25</td><td>44</td><td>37</td><td>34</td><td>19</td><td>38</td></tr><tr><td>Operator III</td><td>26</td><td>36</td><td>41</td><td>48</td><td>27</td><td>39</td><td>28</td><td>46</td><td>15</td></tr></table>	BTL-3	Applying
16.	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.	BTL-3	Applying
17.	Melisa's Boutique has three mall locations. Melisa keeps a dairy record for each location of number of customers who actually make a purchase. A sample of those data follows. Using the kruskal-wallis test, can you say at the 0.05 level of significance that her stores have the same number of customers who busy? <table><tr><td>DSF Mall</td><td>99</td><td>64</td><td>101</td><td>85</td><td>79</td><td>88</td><td>97</td><td>95</td><td>90</td><td>100</td></tr><tr><td>Forest Mall</td><td>83</td><td>102</td><td>125</td><td>61</td><td>91</td><td>96</td><td>94</td><td>89</td><td>98</td><td>75</td></tr><tr><td>Big-Ben Mall</td><td>89</td><td>98</td><td>56</td><td>105</td><td>87</td><td>90</td><td>87</td><td>101</td><td>76</td><td>89</td></tr></table>	BTL -3	Applying
18.	A brand manager is concerned that her brand's share may he unevenly distributes through the country. In a survey in which the country was divided into four geographic regions, a random sampling of 100 consumers in each region was surveyed, with the following results: <table><tr><td></td><td>NE</td><td>NW</td><td>SE</td><td>SW</td><td>TOTAL</td></tr><tr><td>Purchase the brand</td><td>40</td><td>55</td><td>45</td><td>50</td><td>190</td></tr><tr><td>Do not purchase</td><td>60</td><td>45</td><td>55</td><td>50</td><td>210</td></tr><tr><td>Total</td><td>100</td><td>100</td><td>100</td><td>100</td><td>400</td></tr></table> (i) Develop a table of observed and expected frequencies for this problem.	BTL -6	Creating

<table>
<tr><td></td><td>(ii) Calculate the sample $\aleph^2$ value.
(iii) State the null and alternative hypothesis.
(iv) At 0.05 LOS, test whether brand share is the same across the four regions</td><td></td><td></td></tr>
<tr><td colspan="4">PART – C</td></tr>
<tr><td>1.</td><td>Explain the Mann-Whitney test procedure with appropriate examples</td><td>BTL-1</td><td>Remembering</td></tr>
<tr><td>2.</td><td>Write the application of Non parametric test and Sign test in statictics.</td><td>BTL-1</td><td>Remembering</td></tr>
<tr><td>3.</td><td>The sales records of two branches of a department store over the last 12 months are shown below.(sales figures are in thousands of dollars). We want to use the Mann-Whitney-Wilcoxon test to determine if there is a significant difference in the sales of the two branches.
<table>
<tr><th>Month</th><th>Branch A</th><th>Branch B</th></tr>
<tr><td>1</td><td>257</td><td>210</td></tr>
<tr><td>2</td><td>280</td><td>230</td></tr>
<tr><td>3</td><td>200</td><td>250</td></tr>
<tr><td>4</td><td>250</td><td>260</td></tr>
<tr><td>5</td><td>284</td><td>275</td></tr>
<tr><td>6</td><td>295</td><td>300</td></tr>
<tr><td>7</td><td>297</td><td>320</td></tr>
<tr><td>8</td><td>265</td><td>290</td></tr>
<tr><td>9</td><td>330</td><td>310</td></tr>
<tr><td>10</td><td>350</td><td>325</td></tr>
<tr><td>11</td><td>340</td><td>329</td></tr>
<tr><td>12</td><td>372</td><td>335</td></tr>
</table>
(i) Compute the sum of the ranks for branch A
(ii) Compute the mean μT.
(iii) Compute σT.
(iv) Use $\alpha = 0.05$ and test to determine if there is a significant difference in the population of the sales of the two branches</td><td>BTL-4</td><td>Analyzing</td></tr>
<tr><td>4.</td><td>Independent random samples of ten day students and ten evening students at a university showed the following age distributions. We want to use the Mann-Whitney-Wilcoxon test to determine if there is a significant different in the age distribution of the two groups.
<table>
<tr><th>Day</th><th>Evening</th></tr>
<tr><td>26</td><td>32</td></tr>
<tr><td>18</td><td>24</td></tr>
<tr><td>25</td><td>23</td></tr>
<tr><td>27</td><td>30</td></tr>
<tr><td>19</td><td>40</td></tr>
<tr><td>30</td><td>41</td></tr>
<tr><td>34</td><td>42</td></tr>
<tr><td>21</td><td>39</td></tr>
<tr><td>33</td><td>45</td></tr>
<tr><td>31</td><td>35</td></tr>
</table>
(i) Compute the sum of the ranks for the day students.
(ii) Compute the mean μT.
(v) Compute σT.</td><td>BTL-2</td><td>Understanding</td></tr>
</table>

	(iii) Use $\alpha = 0.05$ and test to determine if there is a significant difference in the population of the sales of the two groups		
5.	A company's trainees are randomly assigned to groups which are taught a certain industrial inspection procedure by 3 different methods. At the end of the inspection period they are tested for inspection performance quality. The following are their scores. Method A: 80 83 79 85 90 68 Method B: 82 84 60 72 86 67 91 Method C: 93 65 77 78 88 Use H test to determine at 0.05 LOS whether the three methods are equally effective.	BTL -3	Applying

UNIT V - CORRELATION AND REGRESSION: Correlation – Coefficient of Determination – Rank Correlation – Regression – Estimation of Regression line – Method of Least Squares – Standard Error of estimate.

Q.No.	Question	BT Level	Competence
	PART – A		
1.	Define regression coefficient?	BTL -1	Remembering
2.	Write the formula for finding standard error of the regression coefficient.	BTL -6	Creating
3.	Write the Properties of Correlation Coefficient?	BTL -1	Remembering
4.	What is the angle between the regression lines?	BTL -1	Remembering
5.	When is linear regression used?	BTL -1	Remembering
6	Distinguish between correlation and regression	BTL -2	Understanding
7.	What is regression analysis?	BTL -6	Creating
8	What do you interpret if the r =0, r = + 1 and r = -1?	BTL -1	Remembering
9.	Specify the range of correlation.	BTL -6	Creating
10	Define standard error of estimate?	BTL -4	Analyzing
11.	Define correlation coefficient between two variables.	BTL -1	Remembering
12.	Write the formula for finding the standard error of estimate?	BTL -6	Creating
13.	If the equations of the regression lines are x+2y=5 and 2x+3y=8, find the correlation coefficient between x and y.	BTL -3	Applying
14.	Find the mean values of regression lines are 2y-x =50 and 3y-2x =10.	BTL -1	Remembering
15.	Write the correlation coefficient in terms of regression Coefficients.	BTL -6	Creating
16.	Write the Equations of Regression lines.	BTL -1	Remembering
17.	Explain the difference between the coefficient of determination and the coefficient of correlation.	BTL -1	Remembering

18.	What are the various methods in correlation?	BTL -1	Remembering
19.	If the equations of the regression lines are x+2y=5 and 2x+3y=8, find the mean of X and Y.	BTL -1	Remembering
20.	What is positive and negative correlation?	BTL -1	Remembering
21.	State any two uses of regression Analysis.	BTL -3	Applying
22.	The regression equations are x + 6y = 14 and 2x + 3y = 1. Find the correlation coefficient between X & Y**.**	BTL4	Analyzing
23.	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.	BTL4	Analyzing
24.	The regression equations are x + 6y = 14 and 2x + 3y = 1. Find the mean of X & Y**.**	BTL4	Analyzing
25.	The regression equations are 3x + 2y = 26 and 6x + y = 31. Find the correlation coefficient**.**	BTL5	Evaluating
	PART – B		
1.	The following data relate to marketing expenditure in lakhs of rupees and the corresponding sales of a product in crores of rupees. Estimate the marketing expenditure to attain a sales target of rupees 40 crores Marketing Expenditure : 10 12 15 20 23 Product Sales : 14 17 23 21 25. Also find the coefficient of correlation between Marketing Expenditure and sales.	BTL -3	Applying
2.(a)	The following data pertains of X = Revenue (in '000 of rupees) generated at a Corporate Hospital and Y = Number of Patients (in '00) arrived for the last ten years. X 86 95 75 85 90 98 112 74 100 110 Y 21 24 18 24 22 30 27 18 25 28 Find the Karl Pearson's coefficient of correlation and give your comment.	BTL -4	Analyzing
2.(b)	Obtain the two regression lines: X: 45 48 50 55 65 70 75 72 80 85 y: 25 30 35 30 40 50 45 55 60 65	BTL-5	Evaluating
3.	Out of the two lines of regression given by x+2y-5=0 and 2x+3y-8=0, which one is the regression line of X and Y? Use the equations to find the means of X and Y. If the variance of X is 12, find the variance of Y?	BTL -2	Understanding
4.(a)	Calculate the correlation coefficient for the following heights (in inches) of fathers(x) and their sons (y) X: 65 66 67 67 68 69 70 72 Y: 67 68 65 68 72 72 69 71	BTL -1	Remembering
4.(b)	Cost accountants often estimate overhead based on the level of production. At the standard Knitting Co., they have collected information on overhead expenses and units produced at different plants and want to estimate regression equation to predict future overhead. Overhead 191 170 272 155 280 173 234 116 153 178	BTL -6	Creating

<table>
<tr><td></td><td>Units 40 42 53 35 56 39 48 30 37 40
a) Develop the regression equation for the Cost accountants by using the method of least squares
(b) Predict overhead when 50 units are produced.
(c) Calculate the standard error of estimate.</td><td></td><td></td></tr>
<tr><td>5.</td><td>Ten competitors in a beauty contest are ranked by 3 judges in the following order.
A : 1 6 5 10 3 2 4 9 7 8
B : 3 5 8 4 7 10 2 1 6 9
C : 6 4 9 8 1 2 3 10 5 7
Find out which pair of Judges has awarded the ranks to the nearest common taste of beauty.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>6.</td><td>Find the two regression equations for the following data:
X: 57 58 59 59 60 61 62 64
Y: 77 78 75 78 82 82 79 81
Also estimate the value of Y when X = 65.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>7.</td><td>For the following set of data
<table>
<tr><td>X</td><td>13</td><td>16</td><td>14</td><td>11</td><td>17</td><td>9</td><td>13</td><td>17</td><td>18</td><td>12</td></tr>
<tr><td>Y</td><td>6.2</td><td>8.6</td><td>7.2</td><td>4.5</td><td>9.0</td><td>3.5</td><td>6.5</td><td>9.3</td><td>9.5</td><td>5.7</td></tr>
</table>
Plot the scatter diagram.
Using the method of least squares find the regression equation.
Predict Y for X= 10, 15, 20.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>8.(a)</td><td>From the following data, obtain two regression equations.
X: 6 2 10 4 8
Y: 9 11 5 8 7</td><td>BTL -4</td><td>Analyzing</td></tr>
<tr><td>8.(b)</td><td>Two faculty members ranked 12 candidates for scholarships. Calculate the spearman rank-correlation coefficient and test it for significance. Use 0.05 level of significance.
<table>
<tr><th>Candidate</th><th>Rank by Professor A</th><th>Rank by Professor B</th></tr>
<tr><td>1</td><td>6</td><td>5</td></tr>
<tr><td>2</td><td>10</td><td>11</td></tr>
<tr><td>3</td><td>2</td><td>6</td></tr>
<tr><td>4</td><td>1</td><td>3</td></tr>
<tr><td>5</td><td>5</td><td>4</td></tr>
<tr><td>6</td><td>11</td><td>12</td></tr>
<tr><td>7</td><td>4</td><td>2</td></tr>
<tr><td>8</td><td>3</td><td>1</td></tr>
<tr><td>9</td><td>7</td><td>7</td></tr>
<tr><td>10</td><td>12</td><td>10</td></tr>
<tr><td>11</td><td>9</td><td>8</td></tr>
<tr><td>12</td><td>8</td><td>9</td></tr>
</table></td><td>BTL-3</td><td>Applying</td></tr>
<tr><td>9.</td><td>From the following data find the equations of regression lines.
<table>
<tr><th></th><th>Marks in Mathematics</th><th>Marks in English</th></tr>
<tr><td>Mean</td><td>62.5</td><td>39</td></tr>
<tr><td>S.D</td><td>9.5</td><td>10</td></tr>
</table>
Coefficient of correlation between marks in mathematics and English =0.60</td><td>BTL -4</td><td>Analyzing</td></tr>
</table>

<table>
<tr><td></td><td>(i) Estimate the marks in English when marks in Mathematics is 70?
(ii) Estimate the marks in Mathematics when marks in English is 54?</td><td></td><td></td></tr>
<tr><td>10.(a)</td><td>Find the correlation coefficient for the following data:
X: 10 14 18 22 26 30
Y: 18 12 24 6 30 36</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>10.(b)</td><td>Find the regression lines, from the following data:
X: 6 8 10 18 20 23
Y: 40 36 20 14 10 2</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>11.</td><td>Given that
$n = 10, \sum X = 130, \ \sum X^2 = 2288, \ \sum Y = 220, \ \sum Y^2 = 5506, \ \text{and} \ \sum XY = 3467.$
Compute correlation coefficient and regression equation of X on Y.</td><td>BTL -6</td><td>Creating</td></tr>
<tr><td>12.</td><td>The following are the annual profits, in thousands of rupees, in a business.
<table><tr><td>Year</td><td>1971</td><td>1972</td><td>1973</td><td>1974</td><td>1975</td><td>1976</td></tr><tr><td>Profits</td><td>83</td><td>92</td><td>71</td><td>90</td><td>169</td><td>191</td></tr></table>Calculate the trend values by the method of least squares. Also estimate the profit for the year 1979.</td><td>BTL -4</td><td>Analyzing</td></tr>
<tr><td>13.</td><td>Promotional expenses and sales data for an equipment manufacturer are as follows. Calculate the correlation coefficient and comment
<table><tr><td>Promotional expenses in Lakhs</td><td>7</td><td>10</td><td>9</td><td>4</td><td>11</td><td>5</td><td>3</td></tr><tr><td>Sales in Units</td><td>12</td><td>14</td><td>13</td><td>5</td><td>15</td><td>7</td><td>4</td></tr></table></td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>14.</td><td>Calculate the trend values by the method of least squares. Also Calculate the sales for the years 1999 and 2000
<table><tr><td>Year</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>Values</td><td>125</td><td>128</td><td>133</td><td>135</td><td>140</td><td>141</td><td>143</td></tr></table></td><td>BTL -3</td><td>Remembering</td></tr>
<tr><td>15.</td><td>The equations of two variables X and Y as follows 3X+2Y-26 =0, 6X+Y-31=0 Find the means, regression coefficient & coefficient of correlation.</td><td>BTL -4</td><td>Analyzing</td></tr>
<tr><td>16.</td><td><table><tr><td>X independent variable</td><td>80</td><td>120</td><td>90</td><td>240</td><td>130</td><td>370</td><td>100</td><td>160</td></tr><tr><td>Y independent variable</td><td>36</td><td>25</td><td>33</td><td>15</td><td>28</td><td>19</td><td>20</td><td>22</td></tr></table>(i) Develop a regression equation that best describes this data.
(ii) Calculate karl-pearson correlation coefficient.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>17.</td><td>Campus stores has been selling the believe it or not. Wonders of statistics study guide for 12 semesters and would like to estimate the relationship between sales and no. of sections of elementary statistics taught in each semester. The following data have been</td><td>BTL -6</td><td>Creating</td></tr>
</table>

<table>
<tr><td></td><td>collection:
<table><tr><td>Sales (units)</td><td>33</td><td>38</td><td>24</td><td>61</td><td>52</td><td>45</td><td>65</td><td>82</td><td>29</td><td>63</td><td>50</td></tr><tr><td>No. of sections</td><td>3</td><td>7</td><td>6</td><td>6</td><td>19</td><td>12</td><td>12</td><td>13</td><td>12</td><td>13</td><td>14</td></tr></table>Develop the estimating equation that best fits the data.
Calculate the sample coefficient of determination and the sample coefficient of correlation</td><td></td><td></td></tr>
<tr><td>18.(a)</td><td>Find the correlation coefficient of X and Y
<table><tr><td>X</td><td>30</td><td>32</td><td>35</td><td>40</td><td>48</td><td>50</td><td>52</td><td>55</td><td>57</td><td>61</td></tr><tr><td>Y</td><td>1</td><td>0</td><td>2</td><td>5</td><td>2</td><td>4</td><td>6</td><td>5</td><td>7</td><td>8</td></tr></table></td><td>BTL -2</td><td>Understanding</td></tr>
<tr><td>18.(b)</td><td>Find the most likely production corresponding to a rainfall 40’’ from the following data.
<table><tr><td></td><td>Rainfall</td><td>Production</td></tr><tr><td>Average</td><td>30’’</td><td>500kg</td></tr><tr><td>Standard Deviation</td><td>5’’</td><td>100kg</td></tr></table>Coefficient of Correlation = 0.8</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td colspan="4">PART – C</td></tr>
<tr><td>1.</td><td>A Computer while calculating the correlation coefficient between x and y from 25 pairs of observations, obtained the following $n = 25, \sum X = 125, \ \sum X^2 = 650, \ \sum Y = 100, \ \sum Y^2 = 460, \ \text{and} \ \sum XY = 508.$
It was however, later discovered at the time of checking that they had coppied down two pairs has (6,14), (8, 6) while the correct values were (8, 12) and (6, 8). Obtain the correct value of the correlation coefficient.</td><td>BTL -1</td><td>Remembering</td></tr>
<tr><td>2.</td><td>What is assumption made by the regression model in estimating the parameters and in significance testing?</td><td>BTL -1</td><td>Remembering</td></tr>
<tr><td>3.</td><td>In what ways can regression analysis to be used?</td><td>BTL-2</td><td>Understanding</td></tr>
<tr><td>4.</td><td>The following table gives according to age, the frequency of marks obtained by 100 students in an intelligence test. Calculate the correlation Coefficient.
<table><tr><td>Age in Year/Marks</td><td>18</td><td>19</td><td>20</td><td>21</td><td>Total</td></tr><tr><td>10-20</td><td>4</td><td>2</td><td>2</td><td>-</td><td>8</td></tr><tr><td>20-30</td><td>5</td><td>4</td><td>6</td><td>4</td><td>19</td></tr><tr><td>30-40</td><td>6</td><td>8</td><td>10</td><td>11</td><td>35</td></tr><tr><td>40-50</td><td>4</td><td>4</td><td>6</td><td>8</td><td>22</td></tr><tr><td>50-60</td><td>-</td><td>2</td><td>4</td><td>4</td><td>10</td></tr><tr><td>60-70</td><td>-</td><td>2</td><td>3</td><td>1</td><td>6</td></tr><tr><td>Total</td><td>19</td><td>22</td><td>31</td><td>28</td><td>100</td></tr></table></td><td>BTL -4</td><td>Analyzing</td></tr>
<tr><td>5.</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>
</table>


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