

**Model Test Paper for Mid-Term Examination
Stat-511 (Statistical Methods for Applied Sciences)**

Time: 1½ Hrs.

M. Marks: 30

Note: Attempt all questions.

Q.1 (a) Define any five:

(i) Random Variable (ii) Ogives (iii) Poisson Distribution (iv) Standard Error
(v) Skewness (vi) Coefficient of Variation (vii) Conditional Probability

(b) A problem is given to two students A and B. The odds in favour of A solving the problem are 6 to 9 and against B solving the problem are 12 to 10. What is the probability that the problem will be solved if they both try independently?

(c) What is Box-Plot technique for description of data? (5+3+2)

Q.2 (a) Define Negative-Binomial Distribution alongwith its properties.

(b) Explain Normal Distribution and Standard Normal Distribution. How it is so important in statistics?

(c) If on an average 20% of the bolts manufactured by a company are defective, then find the probability that in a random sample of 400 bolts, the number of defective bolts are (i) between 76 and 82 (ii) atleast 75. (3+3+4)

Q.3 (a) Find the 95% confidence interval for the normal population mean if a random sample of 16 is drawn whose mean comes to 12.5 and sum of squares of deviations from mean is equal to 93.75.

(b) Find the Binomial Distribution for which mean = 4 and variance = 3.

(c) Given below are the weights of 60 apples in a box:

Weight (gms)	150-180	180-210	210-240	240-270	270-300
No. of Apples	5	10	20	15	10

Find the mean and variance of the distribution by shortcut method. (4+2+4)

**Model Test Paper for Final (Theory) Examination
Stat-511 (Statistical Methods for Applied Sciences)**

Time: 2½ Hrs.

M. Marks: 45

Note: Attempt any five questions.

Q.1 (a) Explain the following:

- (i) Steps for testing of hypothesis
- (ii) Level of significance and Critical Region
- (iii) Properties of Regression Coefficient

(b) Give the procedure of Fisher Z-transformation for testing the null hypothesis $H_0: \rho = \rho_0$ (6+3)

Q.2 (a) How will you test the significance of difference between two population means when population variances are known?

(b) Given below the increases in weights (lbs) of 10 and 12 cattle fed on diets A and B, respectively. Test at 5% level of significance that there is no difference between two diets: (4+5)

	Increase in Weight (lbs)											
Diet A	10	6	16	17	13	12	8	14	15	9		
Diet B	7	13	22	15	12	14	18	8	21	23	10	17

Q.3 (a) How will you test the significance of observed simple, partial and multiple correlation coefficients?

(b) Given the sample correlation coefficients $r_{12} = 0.7$, $r_{23} = 0.5$ and $r_{13} = 0.4$. Find the value of partial correlation coefficient $r_{32.1}$. (5+4)

Q.4 (a) Explain least squares method of curve fitting and use the technique to fit the quadratic curve $y = a + bx + cx^2$

(b) Construct 95% confidence interval for population mean μ given that $n = 20$, $\sum x_i = 400$, $\sum (x_i - \bar{x})^2 = 76$ (5+4)

Q.5 Write short notes on any three of the following:

- (i) Box Plot
- (ii) Kendall Coefficient of Concordance
- (iii) Run Test for Randomness
- (iv) Advantages and Disadvantages of Non-Parametric Tests

Q.6 The quantity of serum albumin (gms) per 100 ml in lepers under four different drugs was recorded as follows:

	Treatments			
Sample No. (Block)	Drug-I	Drug-II	Drug-III	Drug-IV
1	4.30	3.65	3.05	3.90
2	4.00	3.60	4.10	3.10
3	4.10	2.70	4.20	3.20
4	3.80	3.15	3.70	4.20
5	3.30	3.75	3.60	3.00
6	4.50	2.95	4.80	3.40

Apply Friedman's test to confirm whether the contents of serum albumin is same in different treatments. (9)

**Model Test Paper for Final (Practical) Examination
Stat-511 (Statistical Methods for Applied Sciences)**

Time: 1 Hrs.

M. Marks: 20

Note: Attempt any two questions.

Q.1 The grain pod yield (kg) under four different treatments in an experiment is given below:

Pod No.	Treatments			
	T ₁	T ₂	T ₃	T ₄
1	4.18	4.45	4.16	3.49
2	4.41	3.89	3.70	3.38
3	4.51	3.98	4.11	3.59
4	3.88	4.28	3.81	3.85
5	4.89	4.95	4.46	4.01
6	5.01	4.88		3.49
7	4.61	4.26		

Test the hypothesis that there is no significant difference among the (10) treatments affecting the yield by Kruskal-Wallis Test?

Q.2 The ages and blood pressures of nine men are given below:

Age (x)	55	41	36	47	49	42	60	72	63
B.P. (y)	142	124	117	127	144	138	154	157	148

Find the regression equation of y on x and estimate the blood pressure of a (10) man of 40 years.

Q.3 (a) Find the Spearman's coefficient of rank correlation between performance in Economics and Statistics:

Student	1	2	3	4	5	6	7	8
Marks in Economics	25	30	38	22	50	70	30	90
Marks in Statistics	50	40	60	40	30	20	40	70

(b) From the following table regarding eye colour of mother and son, test if the colour of son's eye is associated with that of mother:

Mother's eye colour	Son's eye colour	
	Light Blue	Not light blue
Light Blue	45	16
Not Light Blue	4	35

(5+5)

**Revision Exercises for Mid-Term Examination
Stat-511 (Statistical Methods for Applied Sciences)**

Q.1 Define the following:

(i) Coefficient of Variation (ii) Conditional Probability (iii) Skewness (iv) Random Variable (v) Poisson Distribution (vi) Standard Error (vii) Ogives (viii) Pooled Variance (ix) Mean Deviation (x) Harmonic Mean

Q.2 (a) One problem is given to two students A and B. The odds in favour of A solving the problem are 6 to 9 and against B solving the problem are 12 to 10. What is the probability that the problem will be solved if they both try independently?

(b) What is Box-Plot technique for description of data?

Q.3 (a) Given below are the weights of 60 apples in a box:

Weight (gms)	150-180	180-210	210-240	240-270	270-300
No. of Apples	5	10	20	15	10

Find the AM, median, mode and variance of the distribution by shortcut method.

(b) Find the Binomial distribution for which mean = 4 and variance = 3.

Q.4 (a) Explain Normal Distribution and Standard Normal Distribution. How it is important in statistics?

(b) If on an average 20% of the bolts manufactured by a company are defective, then find the probability that in a random sample of 400 bolts, the number of defective bolts are (i) between 76 and 82 (ii) at least 75.

(c) Define Negative-Binomial distribution alongwith its properties.

Q.5 (a) What are raw and central moments? Give the relationship between first four raw and central moments.

(b) What is mathematical expectation? Find the expected number of boys in a family of 3 children.

Q.6 (a) What is Sampling Distribution? Derive the sampling distribution of (i) sample mean (ii) difference between two means (iii) sample proportion (iv) difference between two proportions.

- (b) Calculate the mean deviation about mean of the following frequency distribution:

x	1	2	3	4	5	6	7
f	4	2	1	2	4	8	9

- Q.7 (a) Explain point and interval estimation. Construct the confidence interval for the population mean when (i) population variance (σ^2) is known (ii) when σ^2 is unknown.
- (b) Find the 95% confidence interval for the normal population mean if a random sample of 16 is drawn whose mean comes to 12.5 and the sum of squares of deviations from mean is equal to 93.75.
- Q.8 (a) Give the probability function of Binomial, Poisson and Normal Distributions. When binomial distribution tends to Poisson Distribution and Normal Distribution.
- (b) An aptitude test for selecting the bank officers was conducted on 1000 candidates. The average score was 42 and the standard deviation of scores was 24. Assuming normal distribution for scores, find the expected number of candidates whose score exceed (i) 58 (ii) lies between 40 and 50
- Q.9 Assuming plant heights to be normally distributed with average height 72 cms and variance equal to 81 cm^2 . Find (i) The minimum height of the selected plant if 20% largest plants are to be selected (ii) The maximum height of the selected plant if 15% shortest plants are to be selected.
- Q.10 (a) Find the mean and variance of the following probability distribution:
- | | | | | | |
|------|----------------|---------------|----------------|---------------|---------------|
| x | -3 | -1 | 0 | 2 | 4 |
| p(x) | $\frac{1}{10}$ | $\frac{2}{5}$ | $\frac{1}{10}$ | $\frac{1}{5}$ | $\frac{1}{5}$ |
- (b) If X, Y and Z are independent random variables, then find the mean and variance of the linear combination $(4X + 2Y + 3Z)$ if $E(X) = 3$, $E(Y) = -4$, $E(Z) = 2$, $V(X) = 2$, $V(Y) = 1$, $V(Z) = 4$
- Q.11 (a) A cyclist covers his first five kilometers at an average speed of 10 k/hr and another three km at 8 km/hr and last two km at 5 km/hr. Find the average speed of the cyclist using harmonic mean.

- (b) A test was given to 400 school children of whom 150 were boys and 250 girls. The results were as follows:

$n_1=150$
$\bar{X}_1=72$
$s_1=7.0$

$n_2=250$
$\bar{X}_2=73$
$s_2=6.4$

Find the mean and standard deviation of the combined group.

- Q.12 (a) The probability that a man will alive next 25 years is $\frac{2}{3}$ and the probability that his wife will alive is $\frac{3}{5}$. Find the probability that (i) at least one will alive (ii) exactly one will alive (iii) Both will alive.
- (b) In a single throw of a pair of die, find the probability of getting a doublet or the sum of points as 8.
- (c) A bag contains 10 red, 5 white and 9 blue balls. If 4 balls are drawn at random, then find the probability that (i) all 4 are red balls (ii) 1 red and 2 white balls.

**Revision Exercises for Final Examination
Stat-511 (Statistical Methods for Applied Sciences)**

- Q.1 Define null hypothesis, critical region, level of significance, one tailed and two tailed test used in testing of hypothesis. Explain the various steps involved in testing of hypothesis.
- Q.2 What are the underlying assumptions of (i) Two sample Z-test and (ii) Two sample t-test for testing the equality of two population means? Explain the complete procedure of any one of them.
- Q.3 What is difference between two-sample t-test and paired t-test? Explain the procedure of paired t-test.
- Q.4 The length of tillers in a wheat variety V_1 for a random sample of 10 from a field gave the following data:

Tiller Length in Inches: 4.2, 4.6, 3.9, 4.1, 5.2, 3.8, 3.9, 4.3, 4.4, 5.6

Can we accept the hypothesis that the average tiller length of the variety is equal to 4.0 inches?

- Q.5 Given below the increases in weights (lbs) of 10 and 12 cattle fed on diets A and B, respectively. Test at 5% level of significance that there is no difference between two diets:

	Increase in Weight (lbs)											
Diet A	10	6	16	17	13	12	8	14	15	9		
Diet B	7	13	22	15	12	14	18	8	21	23	10	17

- Q.6 The heights of six randomly chosen sailors are 64, 66, 69, 70, 72, 73 inches and those of 10 randomly selected soldiers are: 61, 62, 65, 66, 69, 69, 70, 71, 72, 73. Discuss the suggestion that the sailors on an average are as tall as soldiers.
- Q.7 Given below are the increase in weight (lbs) of 8 pigs when given two foods A and B on two different occasions. Test at 5% level whether (i) there is any difference between two foods; (ii) food B is superior to food A.

Food A	49	53	51	52	47	50	52	53
Food B	52	55	52	53	50	54	54	53

Q.8 An I.Q. test was administered to 8 persons before and after they were trained. The results are given below:

Persons	1	2	3	4	5	6	7	8
I.Q. before Training	110	120	123	132	120	115	118	122
I.Q. after Training	120	118	125	140	124	121	119	128

Test whether there is any change in I.Q. after training programme.

Q.9 Write short notes on the following:

(i) Box Plot (ii) Bartlett Test (iii) Fisher Z-transformation (iv) Kendall Coefficient of Concordance (v) Runs Test for randomness

Q.10 Give assumptions, situations and method of testing the differences between two population means when:

(i) Population variances are known (ii) Population variances are unknown

Q.11 What are the uses of chi-square test? How the independence of two attributes is tested in $m \times n$ contingency table. When and how Yates's Correction is used?

Q.12 In a genetic crosses on 400 seeds ($RrYy \times RrYy$) the following data on observed frequencies were obtained:

Phenotype	Ry	Ry	ry	ry
Observed Frequency	215	78	81	26

Test whether the data agrees with the ratio 9:3 3:1

Q.13 The following figure shows the distribution of digits in numbers chose at random from a telephone directory:

Digit	0	1	2	3	4	5	6	7	8	9
Frequency	180	200	190	230	210	160	250	220	210	150

Test whether digit may be taken to occur equally frequently in the directory.

Q.14 Explain the following:

(i) Steps for testing of statistical hypothesis (ii) Type-I and type-II errors (iii) Sampling distribution (iv) Mean Deviation about Mode (v) Standard Error (vi) Coefficient of determination (vii) Scatter Diagram (viii) Critical Region

Q.15 Show that the conditions at home has a bearing on the condition of the child on the basis of the following table:

	Condition at Home	
Condition of Child	Clean	Not Clean
Clean	75	40
Fairy Clean	35	15
Dirty	25	45

Q.16 From the following table regarding eye colour of mother and son, test if the colour of son's eye is associated with that of mother:

Mother's eye colour	Son's eye colour	
	Light Blue	Not light blue
Light Blue	45	16
Not Light Blue	4	35

Q.17 Discuss the F-test for testing the equality of two population variances. How the equality of more than two populations be tested?

Q.18 Test the assumption for equality of two population variances in Q5.

Q.19 Two independent samples of sizes 13 and 16 gave the sum of squares of deviations about their means as 240 and 600, respectively. Test at 5% level of significance the equality of population variances.

Q.20 Explain the principle of least squares method of curve fitting and use this technique to fit (i) the parabola $y = a + bx + cx^2$ (ii) $y = ax^b$ (iii) $y = ab^x$

Q.21 What is simple correlation? What are different methods of measuring it? How will you test the null hypothesis regarding population correlation coefficient in the following cases:

(i) Null hypothesis $\rho = 0$

(ii) Null hypothesis $\rho = \rho_0$ ($\rho_0 \neq 0$)

Q.22 What is the difference between correlation and regression? What is the utility of two regression lines? Derive the relationship between coefficient of correlation and regression coefficients.

- Q.23 From the following data on partially destroyed laboratory records, regression equations are: $8x + 10y + 66 = 0$ and $40x + 18y + 214 = 0$ Variance (x) = 9. Find (i) the mean values of x and y; (ii) Coefficient of correlation between x and y.
- Q.24 How the regression coefficient of y on x is tested? Also give the properties of correlation coefficient and regression coefficient.
- Q.25 Explain simple, partial and multiple correlation coefficients. Give the test statistic and its distribution for testing each of them.
- Q.26 Find the Spearman's coefficient of rank correlation and Kendall's between performance in Economics and Statistics:

Student	1	2	3	4	5	6	7	8
Marks in Economics(x)	25	30	38	22	50	70	30	90
Marks in Statistics (y)	50	40	60	40	30	20	40	70

- Q.27 Calculate the multiple correlation coefficients $R_{1.23}$ and $R_{3.12}$ from the following data: $r_{12} = 0.60$; $r_{13} = 0.70$ and $r_{23} = 0.65$, $n = 25$ and test their significance.
- Q.28 Calculate the partial correlation coefficients $r_{32.1}$, $r_{12.3}$ and $r_{13.2}$ from the following data $r_{12} = 0.7$, $r_{23} = 0.5$ and $r_{13} = 0.4$ and test for its significance.
- Q.29 What are non-parametric tests? Discuss their advantages and disadvantages as compared to parametric tests.
- Q.30 How Wilcoxon signed rank test is an improvement over sign test. Explain the complete procedure of both.
- Q.31 To compare the effectiveness of three types of weight reducing diets, a homogeneous group of 22 women was divided into 3 sub-groups and each subgroup followed one of these diet plans for a period of two months. The weight reductions (kg) were recorded and are given below:

Diet Plan-I	4.3	3.2	2.7	6.2	5.0	3.9			
Diet Plan-II	5.3	7.4	8.3	5.5	6.7	7.2	8.5		
Diet Plan-III	1.4	2.1	2.7	3.1	1.5	0.7	4.3	3.5	0.3

Use Kruskal-Wallis test to test the hypothesis that the three weight reducing diet plans are equally effective at 5% level of significance.

Q.32 The grain pod yield (kg) under four different treatments in an experiment is given below:

Pod No.	Treatments			
	T ₁	T ₂	T ₃	T ₄
1	4.18	4.45	4.16	3.49
2	4.41	3.89	3.70	3.38
3	4.51	3.98	4.11	3.59
4	3.88	4.28	3.81	3.85
5	4.89	4.95	4.46	4.01
6	5.01	4.88		3.49
7	4.61	4.26		

Test at $\alpha = 0.05$ that there is no significant difference among the treatments affecting the yield by Kruskal-Wallis Test?

Q.33 The quantity of serum albumin (gms) per 100 ml in lepers under four different drugs were recorded as follows:

Sample No. (Block)	Treatments			
	Drug-I	Drug-II	Drug-III	Drug-IV
1	4.30	3.65	3.05	3.90
2	4.00	3.60	4.10	3.10
3	4.10	2.70	4.20	3.20
4	3.80	3.15	3.70	4.20
5	3.30	3.75	3.60	3.00
6	4.50	2.95	4.80	3.40

Apply Friedman's test to confirm that the contents of serum albumin are same in different drugs.

Q.34 Two models of machine are under consideration for purchase. An organization demonstrates the output capacity in the trial period with a team of 15 operators separately. The output is given below:

Operator No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Model-I	78	75	53	68	82	64	95	86	64	71	51	80	51	70	75
Model-II	60	58	46	71	80	59	73	78	37	75	60	79	38	51	69

Use Wilcoxon signed rank test to infer if there is any significant difference between the output capacities of the two machine models at 5% level of significance.