Visva-Bharati
Palli Siksha Bhavana (Institute of Agriculture)
Department of Agricultural Statistics
M. Sc. (Ag.) Semester: II Examination, 2025
Course: STAT 502
(Statistical Methods for Applied Sciences)

Time: **90 Minutes**   Full marks: **30**

Questions are of values as indicated in the margin

Answer any three questions

Q.1 (a) What do you mean by nonparametric test?

(b) In an agricultural experiment, a researcher wants to compare the yield of a paddy variety under two different fertilizer treatments (Treatment A and Treatment B) on the same plots of land while controlling for soil variability. A total of 10 plots were selected, and each plot received both treatments in two successive seasons. The yields (in kg per plot) under both treatments were recorded. Suggest a suitable statistical test to analyse this situation. Explain the test procedure.   **(3+7 = 10)**

Q.2 (a) Define a standard normal variable Z. Write down its mean, variance and density function. State the approximate value of the probability $P(-3 \leq Z \leq 3)$.

(b) The systolic blood pressure X (in mmHg) of an individual selected at random from a certain population is normally distributed with a mean of 120 mmHg and an *s.d.* of 10 mmHg. Find the probability that the blood pressure (mmHg) of a randomly selected person from the said population will be (i) below 90 and (ii) between 110 and 140.   **(5+5 = 10)**

Q.3 (a) If the fitted multiple regression equation is

$Y = 4.44 + 0.0287\, X_1 + 0.0159\, X_2 + 0.0321\, X_3 - 0.0942\, X_4$

(i) Considering the standard notation state what are the values of b_0, b_1, b_2 b_3 and b_4?

(ii) If $R^2 = 0.5041$, then what R^2 Value tells you about the fit.

Here Y=Seed yield(gm.); X_1 = Plant height (cms), X_2 =Length of primaries (cms), X_3 =Length of Secondaries (cms), X_4 =Days to first flowering

(b) Write the normal equations for fitting $y = \alpha + \beta x + \gamma x^2 + \varepsilon$ with n pairs of observations (x_i, y_i) ; $i = 1, 2, \ldots, n$.   **(3+4+3 = 10)**

Q.4 (a) Give two examples of variables measured under Nominal, Ordinal and Scale measurement.

(b) If $r_{12} = r_{23} = r_{31} = k$, then find $R_{1.23}$ **(6+4 = 10)**

Q.5 Write short notes on **any two** of the following: **(5×2 = 10)**

(a) Properties of Correlation

(b) Sample survey vs complete enumeration

(c) Errors in the context of test of hypothesis

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Department of Agricultural Statistics

M. Sc. (Ag.) Semester: II Examination, 2025

Statistical Methods for Applied Sciences (Practical)

Course: STAT 502

Time: **2 hours**   Full marks: **20**

Attempt All the questions

1. In an agricultural experiment, a researcher wants to compare the mean yield of a new paddy variety under two different fertilizer treatments, Treatment A and Treatment B, to determine if there is a significant difference in yield. The yields (in quintals per hectare) from 10 randomly selected plots under Treatment A and 8 randomly selected plots under Treatment B are as follows:

   Treatment A: 48, 50, 52, 47, 49, 53, 51, 50, 49, 51

   Treatment B: 46, 48, 43, 47, 45, 46, 48, 45

   Test at the 5% level of significance whether there is a significant difference between the mean yields under the two fertilizer treatments (assuming equal variances).   **[8]**

2. Following table gives the value of soil temperature (X) at 4 inches below the ground in degree Fahrenheit (^oF) and germination interval in days (Y) for wheat at 12 places. Find the coefficient of correlation between the two characters and test its significance.   **[7]**

Place	1	2	3	4	5	6	7	8	9	10	11	12
Soil temperature (^oF)	57	42	40	38	42	45	42	44	40	46	44	43
Germination interval (days)	10	26	30	41	29	27	27	19	18	19	31	29

3. Practical Note Book and Viva-Voce   **[3+2=5]**

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Department of Agricultural Statistics

M. Sc. (Ag.) Semester: II Examination, 2025

Course: **STAT 521**

(Applied Regression Analysis)

Time: 90 minutes   **Full marks: 30**

Questions are of values as indicated in the margin
Answer any three questions

1.   (a) If the fitted multiple regression equation is

$S = 1.833 + 1.076\ Y - 0.947\ N$

(i) What are the values of b_0, b_1, b_2?

(ii) Comment on the goodness of fit of the multiple regression equation when multiple correlation value $(R^2) = 0.896$

Here, S=Yearly Savings in '000' Rs.;

Y=Monthly Income in '000' Rs.;

N=Number of children

(b) How to decide that the data set is linear or non-linear?   **(3+7 = 10)**

2.   (a) Write normal equations for Power equation and Compound equation

(b) Explain simple, multiple and partial correlation.   **(4+6 = 10)**

3.   What is multicollinearity? Why is it important to detect multicollinearity in multiple regression analysis? What are the various methods used to detect multicollinearity in a dataset, and what remedies can be applied to address it?   **(2+3+5 =10)**

4.   (a) Given two regression lines $X + 3Y - 5 = 0$ and $4X + 3Y - 8 = 0$, state what is the correlation coefficient between the variables X and Y?

(b) Discuss about autocorrelation and heteroscedasticity in the context of multiple linear regression. Mention one statistical test used to detect each of these problems.

(6+4 = 10)

5.   Write short notes on **any two** of the following: **(5×2 = 10)**

(a) Properties of regression coefficients

(b) Spearman rank correlation

(c) Step-wise selection of variables

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Department of Agricultural Statistics

M. Sc. (Ag.) Semester: II Examination, 2025

Applied Regression Analysis (Practical)

Course: STAT 521

Time: **2 hours**   Full marks: **20**

Attempt All the questions

1. Identify the data and predict the value of y at $x = 7$?   **[10]**

x	y
1	3
2	6
3	12
4	24
5	48

2. You are provided with a dataset from a field experiment that records the yield (Y) of wheat (in kg/ha) as the output variable, along with three input variables: Nitrogen application (X_1), Irrigation level (X_2) and Pesticide usage (X_3). Which prediction model would you suggest for estimating wheat yield based on these input variables and what preliminary steps should be taken to fit a model using this dataset?   **[5]**

3. Practical Note Book and Viva-Voce   **[3+2=5]**

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Palli Siksha Bhavana (Institute of Agriculture)
Department of Agricultural Statistics
M. Sc. (Ag.) Semester: II Examination, 2025
Course: STAT 522
(Data Analysis using Statistical Packages)

Time: **90 minutes**   Full marks: **30**

Questions are of equal value or as indicated in the margin

Answer any three questions

1. State two descriptive measures and their uses in describing the data, write the *R* code for those measure you have proposed. Describe any two graphical methods used to check whether a given data set follows a normal distribution, and explain how these graphical methods help in assessing the normality of the data.   **(5+5 = 10)**

2. Write the factorial CRD model with two factors. State why missing plot technique not applicable in CRD. Explain the randomization procedure for Split plot design with 3 main plots 4 sub plots and 2 replications.   **(2+3+5 = 10)**

3. In brief discuss about SPSS. Write the steps of SPSS when it is required to analyze Factorial Experiment data: where Factor A = 2 levels, Factor B = 3 levels, Replication = 3.   **(4+6 = 10)**

4. (a) Define the null hypothesis and the alternative hypothesis.

    (b) A fertilizer company claims that its new organic fertilizer increases the average rice yield to 60 quintals per hectare. However, an agricultural scientist, using a small sample, suspects that the actual yield is more than the claimed amount. Which statistical test should be used to verify this claim? Describe the test procedure in details.   **(3+7 = 10)**

5. Write short notes on **any two** of the following: **(5×2 = 10)**

    a) Chi-square test for goodness of fit

    b) Properties of regression coefficients

    c) Paid software vs free software vs open-source software

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Department of Agricultural Statistics
M. Sc. (Ag.) Semester: II Examination, 2025

Data Analysis using Statistical Packages **(Practical)**

Course: STAT 522

Time: **2 hours**   Full marks: **20**

Attempt All the questions

1. The yield of wheat in Kg per plot, the various treatment combination in the split-plot design carried out at a research station are given below, the main plot treatment was sowing dates S1, S2, S3 and sub plot treatment were two level of the factor N or doses of Nitrogen N0 and N1. The study was replicated three times and data recorded for the experiment are shown in the table.   **[8]**

Treatment	R1	R2	R3
S1N0	32	52	54
S1N1	54	38	44
S2N0	49	64	63
S2N1	58	50	54
S3N0	56	72	68
S3N1	67	62	51

Analyze the data using SPSS and draw your conclusion.

2. A sample dataset of statistics examination results for 100 M.Sc. (Ag) students was analyzed, revealing the following distribution: 4 students failed, 12 secured a third division, 36 secured a second division, and the rest of the students were placed in the first division. Test at 5% level of significance using SPSS or R whether these figures commensurate with the general examination result which is in the ratio of 1: 2: 3: 4 for the various categories respectively.   **[7]**

3. Practical Note Book and Viva-Voce   **[3+2=5]**