**MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE**
**SEMESTER END EXAMINATION**
**B. Sc. (Hons) Agriculture**

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|---|---|---|---|---|---|
| **Semester** | : | III (New) | **Academic Year** | : | 2019-20 |
| **Course No.** | : | STAT- 231 | **Title** | : | Statistical Methods |
| **Credits** | : | 2 (1+1) | **Time** | : | 2 hrs |
| **Day & Date** | : | | **Total Marks** | : | 40 |

**MODEL ANSWERS**
**SECTION "A"**

| | | Marks |
|---|---|---|
| Q.1 | What is Statistics? Give its importance and limitations. | |
| **Ans:** | **Statistics** is science of counting. Statistics is science of estimates and probabilities. Statistics is defined as the science of collection, presentation, analysis and interpretation of numerical data.(Any other relevant definition) | 01 |
| | **Importance :**<br>In the early part of the growth period, statistics use was restricted to the states only. But today its scope has spread to the study of problems which may be social, religious, economic, political, administrative, Industries, agricultural, financial, medical, relating to business management planning research education,. Psychology, forecasting and to so many other spheres.<br>This widely use of statistics is on account of the fact that the statistical principles have a very wide scope of application and their knowledge is very essential for any research work in any branch of study. | 03 |
| | **Limitation of statistics :**<br>1) It does not study qualitative phenomena<br>2) Statistical studies are true only on an average<br>3) It does not study individuals<br>4) It does not reveal the entire story<br>5) It is liable to be misused | |
| Q.2 | State the characteristics of an ideal Measure and explain any one. | |
| **Ans:** | 1. It should be rigidly defined<br>2. It should be rigidly understood and easy to calculate<br>3. It should be based upon all the observations<br>4. It should suitable for further mathematical calculations<br>5. It should not be affected by the fluctuations of sampling. | 2 |
| | Explanation of any one measure like Mean, Mode, Median, Variance, Decile, etc | 2 |
| Q.3 | Define correlation. State different types of correlation and explain any two. | |
| **Ans:** | **Correlation:** Correlation is association between two variables.<br>Correlation is relation between two variables. | 01 |
| | **Types of correlation.**<br>1) Positive correlation 2) Negative correlation 3) Strong correlation<br>4) Weak correlation 5) Moderate correlation 6) No correlation. | 03 |
| Q.4 | Explain in detail Range and Variance. | |
| **Ans:** | a) Range: Range is difference between maximum value and minimum value in a dataset<br>Range = Max. value – Min. value | 02 |

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| | Range only considers extreme values of dataset. Range is affected by outliers.<br>b) Variance : It is aggregation of differences of each observation from mean value. It is square Root of standard deviation. It is best measure of dispersion. Give the Notation and Formulae. Application of variance. | 02 |
| Q.5 | Define Coefficient of regression and state its properties. | |
| **Ans:** | **Definition**: Regression coefficient is a statistical measure of the average functional relationship between two or more variables. The constant 'b' in the regression equation (Y = a + bX) is called as the **Regression Coefficient**. It determines the slope of the line, i.e. the change in the value of Y corresponding to the unit change in X and therefore, it is also called as a **"Slope Coefficient."** | 01 |
| | **Properties :**<br>1) The correlation coefficient is the **geometric mean** of two regression coefficients. Symbolically, it can be expressed as: $r = \sqrt{b_{xy} \cdot b_{yx}}$<br>2) If one of the regression coefficients is greater than unity, the other must be less than unity.<br>3) The sign of both the regression coefficients will be same, i.e. they will be either positive or negative. Thus, it is not possible that one regression coefficient is negative while the other is positive.<br>4) The coefficient of correlation will have the same sign as that of the regression coefficients, such as if the regression coefficients have a positive sign, then "r" will be positive and vice-versa.<br>5) The average value of the two regression coefficients will be greater than the value of the correlation.<br>6) The regression coefficients are **independent of the change of origin, but not of the scale**. | 03 |
| Q.6 | Write the steps involved in hypothesis testing. | |
| **Ans:** | Steps given as follows:<br>1) Setting null hypothesis<br>2) Setting alternative hypothesis<br>3) Fixing level of significance<br>4) Deciding test criterion<br>5) Decision making | 04 |
| Q.7 | Define the term sample. Explain the concept of Random sampling and Standard error. | |
| **Ans:** | **Sample** : A sample is the number of individuals each of which is a member of the population to be studied. It is expected to be the representative of the whole population. | 01 |

**Random sampling** : A simple random sampling is a method of selecting a sample of n units such that every one of all possible samples of size n, which are ${}^{N}C_{n}$ in number has an equal chance of being selected or it in that the chance of selecting every unit is the same. 02

Standard Error : The term standard error of any estimate is used for a measure of the average magnitude of the difference between the sample estimate and the population parameter taken overall possible samples of the same size from the population.

The standard deviation of the sampling distribution of a statistic (estimate) is known as the standard error of that statistic (estimate)

It we take all possible samples from the population of the same side and get a sampling distribution of means, it can be proved that the mean of this sampling distribution of means is the population mean and its standard deviation the **standard error** of mean.

It is not possible to draw all possible samples, we get the estimate of the **standard error** from a single sample. 01

Q.8 State assumptions of Simple linear regression and write down its equation.

**Ans:** Simple linear Equation is $Y = a + bX$

Assumptions :

1) The relationship between Independent and Dependent variable is linear. 01

2) The observations in data are independent from each other.

3) The errors are normally distributed

4) The residuals must be independent.

5) Homoscedasticity (constant variance) of residuals must be required. 03

Q.9 Define probability and find the probability of getting two heads, if coin is tossed 2 times.

**Ans:** **Probability** : Probability is ratio of favourable outcomes and total possible Outcomes. It is the term related to uncertainty. 01

**Solution :** Total number of outcomes = {HH,HT,TH,TT} = 4

Number of favourable outcomes = {HH} = 1

Probability = 1/4 = 0.25. 03

Q.10 Write short notes on. (Any two).

**Ans:** (1) Chi-square test: 02

(1) Any one definition

(2) Application chi-square test

(3) Limitation of chi-square test

(2) Student 't' test 02

(1) Any one definition and formulae

(2) Application

(3) Limitation

(3) Analysis of Variance :

Analysis of Variance (ANOVA) is splitting of overall variation due to Factors. There is two way classification of ANOVA on the basis of Variability in dependent variable due to several independent variables as **One way** and **Two way ANOVA**.

| | SECTION "B" | |
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| Q.11 | Define the following terms. | |
| | 1) Type one Error (2) Independent Events<br>3) Parameter (4) Mode | 04 |
| **Ans:** | (1) **Type one error** : The error arises due to Null hypothesis is rejected when it is actually true.<br>(2) **Independent Events** : Events are said to be dependent or independent accordingly as the occurrence of one does or does not affect the occurrence of the others.<br>(3) **Parameter** : It is numerical quantity consider for study of population.<br>(4) **Mode** : Mode is frequently repeated observation in a dataset.<br>**Or any other relevant definition.** | |
| Q.12 | Fill in the blanks. | |
| **Ans:** | 1) The father of statistics is **R.A. Fisher .**<br>2) If **A'** is complement of event **A** then P (A') = **1 – P(A) .**<br>3) Conclusion drawn from sample is called as **Statistics.**<br>4) The average relationship between dependent and independent variable is known as **Regression.** | 04 |

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