To,
The Principal
Shri. Mohatadevi Shikshan Sanstha
Pragati Mahavidyalaya
Sawkheda, Tq. Sillod
Dist. Aurangabad (Chhatrapati Sambhajinagar)

Subject: Proposal for Certificate Course on *"Statistical Methods and Applications"*

Respected Sir,

I am writing to seek your approval for introducing a certificate course entitled ***"Statistical Methods and Applications"*** for the Mathematics department students for the academic year 2023-24.

The proposed course aims to provide students with a comprehensive understanding of statistical techniques and their practical applications. It will cover a range of topics, including descriptive statistics, probability theory, hypothesis testing, and data analysis methods. The total duration of the course will be 32 hours, which will be distributed over several sessions.
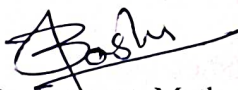
The key objectives of the course are:

1. To equip students with essential statistical tools and techniques.
2. To enhance their ability to apply statistical methods to real-world problems.
3. To prepare students for advanced studies or careers where statistical knowledge is crucial.

The course will be conducted by qualified faculty members and will include both theoretical lectures and hands-on practical sessions. We believe this course will greatly benefit our students by enhancing their analytical skills and increasing their employability.

I kindly request your approval to run this certificate course and allocate the necessary resources for its successful implementation.

Thank you for considering this proposal. I look forward to your positive response.

Yours sincerely,

Head of Department, Mathematics
Shri. Mohatadevi Shikshan Sanstha
Pragati Mahavidyalaya Sawkheda
Tq. Sillod, Dist. Chh. Sambhajinagar
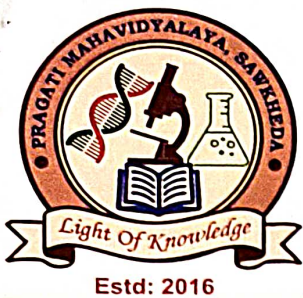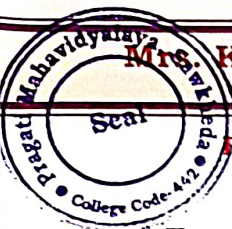
Ref No.: PMS/2023-2024/02   **Date :** 06/09/2023

To,

The Head of Department, Mathematics
Shri. Mohatadevi Shikshan Sanstha
Pragati Mahavidyalaya
Sawkheda, Tq. Sillod
Dist. Aurangabad (Chhatrapati Sambhajinagar)

Subject: Sanction for Certificate Course on "Statistical Methods and Applications"

Dear Sir,

I am pleased to inform you that your proposal for running the certificate course titled ***"Statistical Methods and Applications"*** has been reviewed and approved.

The course, with a total duration of 32 hours, is sanctioned for the academic year 2023-24. The objectives of the course, as outlined in your proposal, align with our institution's goal of enhancing the academic and practical skills of our students.

Please proceed with the necessary arrangements to implement the course, including scheduling, faculty assignments, and resource allocation. Ensure that all course materials and sessions adhere to the guidelines provided and that students are adequately informed about the course details.

We trust that this course will be conducted with the highest standards of academic excellence and will contribute significantly to the development of our students' skills in statistical methods and their applications.

Should you require any additional support or resources, please do not hesitate to contact the administrative office.

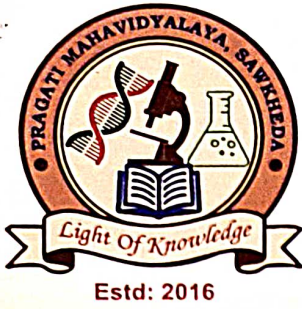Thank you for your initiative and dedication to enhancing our academic programs.

Yours sincerely,

Varsha

PRINCIPAL
Principal **Pragati Mahavidyalaya**
Shri. Mohatadevi Shikshan Sanstha
Pragati Mahavidyalaya
Sawkheda, Tq. Sillod
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Shri Mohatadevi Shikshan Sanstha, Aurangabad.

PRAGATI MAHAVIDYALAYA

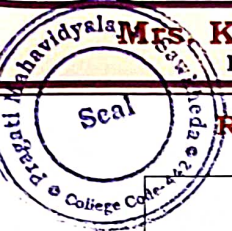**Sawkheda, Tq. Sillod, Dist. Aurangabad.**

Affiliated to: S.N.D.T. Women's University, Mumbai

College Code: 442 Exam. Center Code: 291

Website: www.pragatisawkheda.co.in

Email: pragatiiqac2016@gmail.com, pragatimahavidyalaya442@gmail.com

Contact: 9822021784, 8888611717

Estd: 2016

Mrs. Kaveri Palkar	Mrs. Archana Mukhekar	Dr. Varsha Phalke
President	Secretary	Principal

Seal

Ref No.: PMS/2023-2024/02   **Date : 11 / 09 /2023**

NOTICE

Subject: Introduction of Certificate Course on "Statistical Methods and Applications"

Dear Students,

We are pleased to announce the introduction of a new certificate course titled *"Statistical Methods and Applications"* for the academic year 2023-24. This course is designed to enhance your understanding of statistical techniques and their practical applications.

Course Details:

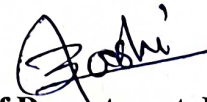- **Title:** *"Statistical Methods and Applications"*
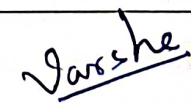- **Duration:** 32 hours

Course Objectives:

1. To provide comprehensive knowledge of essential statistical tools and methods.
2. To develop practical skills for applying statistical techniques to real-world problems.
3. To prepare students for advanced studies or professional opportunities requiring statistical expertise.
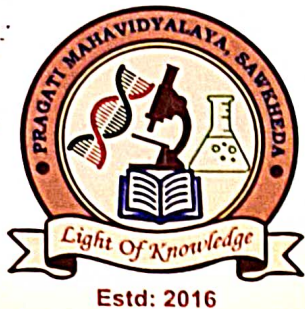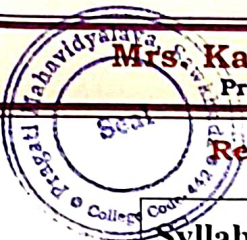
The course will include theoretical lectures as well as hands-on practical sessions. Participation in this course will be beneficial for your academic growth and career prospects.

If you wish to enroll, please register, for any further information or queries, feel free to contact the Mathematics Department office.

We encourage all interested students to take advantage of this valuable opportunity to deepen your statistical knowledge.

Head of Department, Mathematics

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Syllabus for Certificate Course on "Statistical Methods and Applications"

Course Duration: 32 Hours

Course Objective: To provide students with a comprehensive understanding of statistical methods and their applications, including both theoretical concepts and practical skills.

Week 1: Introduction to Statistics (4 Hours)

- **Overview of Statistics:** Definition, importance, and applications
- **Types of Data:** Qualitative vs. quantitative, discrete vs. continuous
- **Data Collection Methods:** Surveys, experiments, observational studies

Week 2: Descriptive Statistics (4 Hours)

- **Measures of Central Tendency:** Mean, median, mode
- **Measures of Dispersion:** Range, variance, standard deviation
- **Data Visualization:** Histograms, bar charts, box plots, pie charts

Week 3: Probability Theory (4 Hours)

- **Basic Probability Concepts:** Probability rules, conditional probability
- **Probability Distributions:** Discrete (Binomial, Poisson) and continuous (Normal, Exponential)
- **The Law of Large Numbers and Central Limit Theorem**

Week 4: Statistical Inference (4 Hours)

- **Sampling Methods:** Random sampling, sampling distributions
- **Estimation:** Point estimation, confidence intervals
- **Hypothesis Testing:** Null and alternative hypotheses, p-values, type I and type II errors

Week 5: Regression Analysis (4 Hours)

- **Simple Linear Regression:** Model, estimation, interpretation
- **Multiple Linear Regression:** Model, variable selection, diagnostics
- **Applications and Case Studies**

Week 6: Analysis of Variance (ANOVA) (4 Hours)

- **One-Way ANOVA:** Concepts, assumptions, interpretation
- **Post-Hoc Tests:** Tukey's HSD, Bonferroni correction
- **Applications in Experimental Design**

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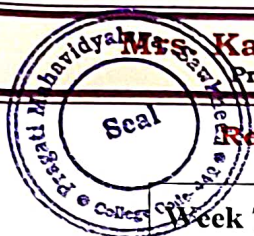# PRAGATI MAHAVIDYALAYA

Sawkheda, Tq. Sillod, Dist. Aurangabad.
Affiliated to: S.N.D.T. Women's University, Mumbai
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Estd: 2016

Mrs. Kaveri Palkar	Mrs. Archana Mukhekar	Dr. Varsha Phalke
President	Secretary	Principal

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Week 7: Non-Parametric Methods (4 Hours)

- **Introduction to Non-Parametric Tests:** When to use non-parametric methods
- **Common Non-Parametric Tests:** Chi-Square test, Wilcoxon rank-sum test, Kruskal-Wallis test
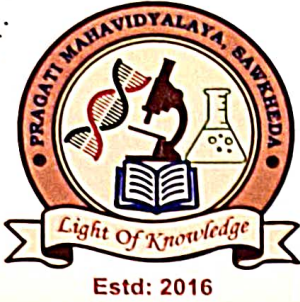- **Applications and Case Studies**

Week 8: Practical Applications and Review (4 Hours)

- **Hands-On Practice:** Using statistical software (e.g., R, SPSS, Excel) for data analysis
- **Case Studies and Projects:** Application of learned methods to real-world data
- **Review and Q&A Session:** Addressing student questions and clarifications

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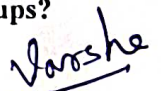
Final examination for the certificate course on *"Statistical Methods and Applications"*

Final Examination: Multiple Choice Questions

1. What is the measure of central tendency that divides a dataset into two equal halves?

a) Mean
b) Median
c) Mode
d) Range

2. Which of the following is NOT a measure of dispersion?

a) Variance
b) Standard Deviation
c) Median
d) Range

3. What is the probability of rolling a sum of 7 with two dice?

a) 1/12
b) 1/6
c) 1/8
d) 1/4

4. The Central Limit Theorem states that the distribution of the sample mean approaches a normal distribution as the sample size:

a) Decreases
b) Remains constant
c) Increases
d) Becomes zero

5. In a hypothesis test, the value at which you decide to reject the null hypothesis is called:

a) Alpha level
b) Beta level
c) p-value
d) Confidence interval

6. Which of the following tests is used for comparing the means of three or more groups?

a) t-Test
b) Chi-Square Test
c) ANOVA
d) Wilcoxon Test

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PRAGATI MAHAVIDYALAYA

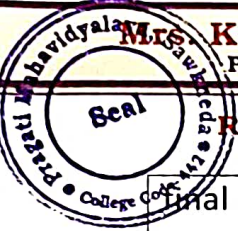Sawkheda, Tq. Sillod, Dist. Aurangabad.

Affiliated to: S.N.D.T. Women's University, Mumbai
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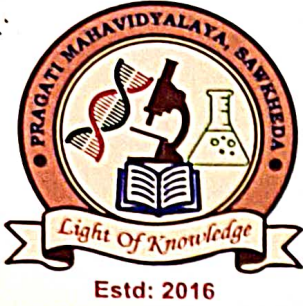| Mrs. Kaveri Palkar	Mrs. Archana Mukhekar	Dr. Varsha Phalke
President	Secretary	Principal

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7. A researcher wants to determine the effect of a new drug on blood pressure. What statistical method is most appropriate?

a) Descriptive Statistics
b) Correlation Analysis
c) Regression Analysis
d) ANOVA

8. The chi-square test is typically used for:

a) Comparing means
b) Testing relationships between categorical variables
c) Regression analysis
d) Time series analysis

9. What is the value of the median in the dataset {3, 7, 5, 9, 11}?

a) 5
b) 7
c) 9
d) 6

10. Which of the following distributions is known for its bell-shaped curve?

a) Binomial Distribution

b) Normal Distribution

c) Poisson Distribution

d) Exponential Distribution

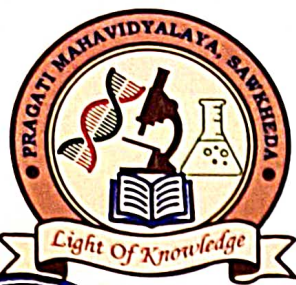11. In regression analysis, what is the term for the variable that is predicted?

a) Independent Variable

b) Dependent Variable

c) Control Variable

d) Moderator Variable

12. Which non-parametric test can be used instead of a t-test when data do not meet the assumptions of normality?

a) Chi-Square Test

b) Kruskal-Wallis Test

c) Mann-Whitney U Test

d) Wilcoxon Signed-Rank Test

13. What is the purpose of a confidence interval?

a) To estimate the precision of a sample mean

b) To test hypotheses

c) To describe the distribution of data

d) To calculate probabilities

14. The interquartile range (IQR) is the difference between:

a) Mean and Median

b) 25th percentile and 75th percentile

c) Maximum and Minimum

d) Mode and Mean

15. In a dataset with a negative skew, the mean is typically:

a) Greater than the median

b) Less than the median

c) Equal to the median

d) Unrelated to the median

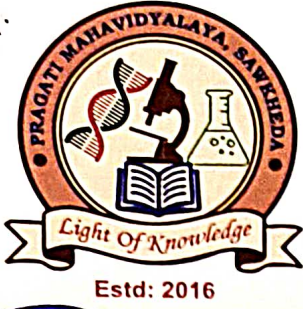**16. Which of the following is an example of a discrete variable?**

a) Height

b) Weight

c) Number of children

d) Temperature

17. The term "sampling distribution" refers to:

a) The distribution of all possible samples from a population

b) The distribution of a single sample from a population

c) The distribution of the population itself

d) The distribution of data points within a sample

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18. In a simple linear regression model, what does the slope coefficient represent?

a) The value of the dependent variable when the independent variable is zero

b) The rate of change of the dependent variable with respect to the independent variable

c) The total variability in the dependent variable

d) The intercept of the regression line

19. In the context of hypothesis testing, a Type I error occurs when:

a) The null hypothesis is incorrectly accepted

b) The null hypothesis is incorrectly rejected

c) The p-value is too large

d) The sample size is too small

20. Which of the following is NOT a characteristic of the normal distribution?

a) Symmetric about the mean

b) Mean, median, and mode are all equal
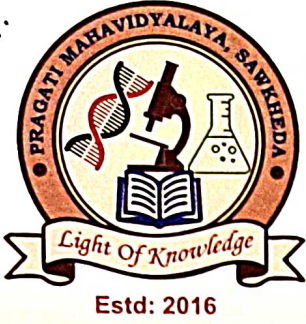
c) Asymptotic to the x-axis

d) Skewed to the right

21. What does a p-value less than 0.05 typically indicate?

a) High probability of the null hypothesis being true

b) Low probability of the null hypothesis being true

c) That the sample size is too small

d) That the test is not significant

22. In ANOVA, what is the purpose of the F-statistic?

a) To test the equality of variances

b) To compare means among multiple groups

c) To test for correlation between variables

d) To estimate population parameters

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Which of the following is an example of a continuous variable?

a) Number of students in a class

b) Shoe size

c) Time taken to complete a task

d) Number of goals scored in a match

24. **Which statistical method is used to determine the relationship between two categorical variables?**

a) t-Test

b) Chi-Square Test

c) ANOVA

d) Regression Analysis

25. **What does the term "standard deviation" measure?**

a) The central value of a dataset

b) The spread or dispersion of a dataset

c) The correlation between two variables

d) The probability of a specific outcome

26. **What is the purpose of using a non-parametric test?**

a) When the data are normally distributed

b) When data do not meet parametric test assumptions

c) When testing for relationships between continuous variables

d) When comparing means across multiple groups

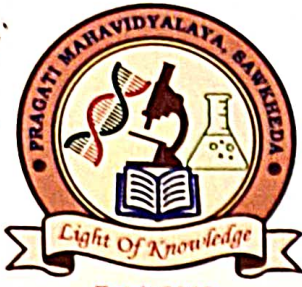27. **The "Law of Large Numbers" states that as the sample size increases, the sample mean:**

a) Approaches the sample standard deviation

b) Approaches the population mean

c) Approaches zero

d) Approaches the median

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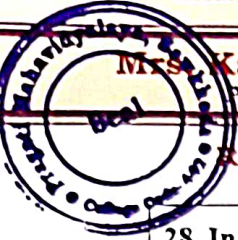Sawkheda, Tq. Sillod, Dist. Aurangabad.

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28. In regression analysis, what is the R-squared value used to measure?

a) The strength of the relationship between two categorical variables

b) The proportion of variance in the dependent variable explained by the independent variable

c) The variability of the sample mean

d) The mean of the residuals

29. What does the term "bias" refer to in the context of statistical estimation?

a) The variability of the estimator

b) The accuracy of the estimator

c) The difference between the expected value of the estimator and the true value of the parameter

d) The sample size used for estimation

30. Which statistical test would you use to compare the means of two independent groups?

a) Paired t-Test

b) Independent t-Test

c) Chi-Square Test

d) ANOVA

Answer Key

1. b) Median
2. c) Median
3. b) 1/6
4. c) Increases
5. a) Alpha level
6. c) ANOVA
7. c) Regression Analysis
8. b) Testing relationships between categorical variables
9. b) 7
10. b) Normal Distribution
11. b) Dependent Variable
12. c) Mann-Whitney U Test
13. a) To estimate the precision of a sample mean
14. b) 25th percentile and 75th percentile
15. b) Less than the median
16. c) Number of children
17. a) The distribution of all possible samples from a population

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18. b) The rate of change of the dependent variable with respect to the independent variable
19. b) The null hypothesis is incorrectly rejected
20. d) Skewed to the right
21. b) Low probability of the null hypothesis being true
22. b) To compare means among multiple groups
23. c) Time taken to complete a task
24. b) Chi-Square Test
25. b) The spread or dispersion of a dataset
26. b) When data do not meet parametric test assumptions
27. b) Approaches the population mean
28. b) The proportion of variance in the dependent variable explained by the independent variable
29. c) The difference between the expected value of the estimator and the true value of the parameter
30. b) Independent t-Test

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