National Curriculum of Pakistan 2022-23

STATISTICS

Grades 11-12

National Curriculum of Pakistan
2022-23

STATISTICS

Grades 11-12

NATIONAL CURRICULUM COUNCIL SECRETARIAT
MINISTRY OF FEDERAL EDUCATION AND
PROFESSIONAL TRAINING, ISLAMABAD
GOVERNMENT OF PAKISTAN

It is with great pride that we, at the National Curriculum Council Secretariat, present the first core curriculum in Pakistan's 75-year history. Consistent with the right to education guaranteed by Article 25-A of our Constitution, the National Curriculum of Pakistan (2022-23) aspires to equip every child with the necessary tools required to thrive in and adapt to an ever-evolving globalized world.

The National Curriculum is in line with international benchmarks, yet sensitive to the economic, religious, and social needs of young scholars across Pakistan. As such, the National Curriculum aims to shift classroom instruction from rote learning to concept-based learning.

Concept-based learning permeates all aspects of the National Curriculum, aligning textbooks, teaching, classroom practice, and assessments to ensure compliance with contemplated student learning outcomes. Drawing on a rich tapestry of critical thinking exercises, students will acquire the confidence to embark on a journey of lifelong learning. They will further be able to acknowledge their weaknesses and develop an eagerness to build upon their strengths.

The National Curriculum was developed through a nationwide consultative process involving a wide range of stakeholders, including curriculum experts from the public, private, and non-governmental sectors. Representatives from provincial education departments, textbook boards, assessment departments, teacher training departments, *deeni madaris*, public and private publishers, private schools, and private school associations all contributed their expertise to ensure that the National Curriculum could meet the needs of all Pakistani students.

The experiences and collective wisdom of these diverse stakeholders enrich the National Curriculum, fostering the core, nation-building values of inclusion, harmony, and peace, making the National Curriculum truly representative of our nation's educational aspirations and diversity.

I take this opportunity to thank all stakeholders, including students, teachers, and parents who contributed to developing the National Curriculum of Pakistan (2022-23)

Dr. Mariam Chughtai
Director
National Curriculum Council Secretariat
Ministry of Federal Education and Professional Training

Statistics

Progression Grid

Grade 11-12

Domain A: Basics of Statistics

Standard A1: To Understand the Basics of Statistics.

Grade 11	Grade 12
Benchmark I: Students will be able to demonstrate data collection and manipulation in software tools.	
Student Learning Outcomes	
[SLO:Stat-11-A-01]: Define statistics and explain its significance in various fields such as Data Science, Business and Management Sciences, Market Research, etc. [SLO:Stat-11-A-02]: Identify and describe the main branches of statistics, including descriptive and inferential statistics. [SLO:Stat-11-A-03]: Explain the applications of statistics in real-world scenarios	

like health and pharmaceutical sciences, social science, and climate-related policy making.

[SLO:Stat-11-A-04]:

Differentiate between qualitative and quantitative data and provide examples for each type.

[SLO:Stat-11-A-05]:

Distinguish between discrete and continuous data and illustrate with relevant examples.

[SLO:Stat-11-A-06]:

Define primary and secondary data and discuss the importance of each in statistical analysis.

[SLO:Stat-11-A-07]:

Describe the four levels of measurement (nominal, ordinal, interval, and ratio scales) and give examples of variables that fit each scale.

[SLO:Stat-11-A-08]:

Demonstrate the ability to enter and manipulate data in software tools like Minitab and Excel.

[SLO:Stat-11-A-09]:

Create variables and label them appropriately within a dataset. [SLO:Stat-11-A-10]: Develop a basic understanding of data collection by creating and administering a simple questionnaire for primary data collection.	

Domain B: **Descriptive Statistics**
Standard B1: Collection and presentation of data graphically and numerically.

Grade 11	Grade 12
Benchmark I: Students will be able to present data in effective and meaningful ways	
Student Learning Outcomes	
[SLO:Stat-11-B-01]: Students will be able to classify data into qualitative and quantitative types, providing real-world examples for each. [SLO:Stat-11-B-02]: Students will effectively create and interpret simple,	

multiple, and component bar charts, pie charts, and histograms. [SLO:Stat-11-B-03]: Students will demonstrate skills in interpreting results from various types of tables and charts.	

Benchmark II: Students will be able to summarize data sets based on given parameters

Student Learning Outcomes	
[SLO:Stat-11-B-04]: Students will summarize datasets, emphasizing the importance of accurate data representation in statistical analysis.	

Benchmark III: Students will be able to determine Measure of Central Tendency

Student Learning Outcomes	
[SLO:Stat-11-B-05]: Students will calculate and interpret the arithmetic mean, geometric mean, and harmonic mean of given data sets. [SLO:Stat-11-B-06]: Students will determine the median, quantiles, and mode for	

various datasets and discuss their relevance in different statistical contexts.	

Benchmark IV: Students will be able to evaluate datasets and compute absolute and relative measures of dispersion

<div align="center">

Student Learning Outcomes

</div>

[SLO:Stat-11-B-07]: Students will compute absolute measures of dispersion, including range, interquartile range, mean absolute deviation, variance, and standard deviation. [SLO:Stat-11-B-08]: Students will evaluate datasets using relative measures like the Coefficient of Range and Coefficient of Variation. [SLO:Stat-11-B-09]: Students will understand and apply the concept of five-number summary statistics and interpret boxplots.	

Benchmark V: Students will be able to apply statistical software to demonstrate Skewness and Kurtosis

Student Learning Outcomes	
[SLO:Stat-11-B-10]: Students will explain the concepts of skewness and kurtosis, using real-world datasets to illustrate these concepts. [SLO:Stat-11-B-11]: Students will apply at least one formula for calculating skewness and kurtosis and interpret the results in the context of data analysis. [SLO:Stat-11-B-12]: **Apply Statistical Software**: Demonstrate the ability to effectively utilize statistical software, such as Minitab or Excel, to perform various data analysis tasks, including data manipulation, visualization, and statistical computations, in practical real-world scenarios.	[...]

Domain C: **Probability**
Standard C1: Develop the Discrete and Continuous probability distributions with its applications.

Grade 11	Grade 12

Benchmark I: Students will be able to apply the theory of probability to real world problems	
Student Learning Outcomes	
[SLO:Stat-11-C-01]: Students will revise set theory concepts and apply them to understand random experiments, sample spaces, and events. [SLO:Stat-11-C-02]: Students will differentiate between axiomatic and relative definitions of probability, and apply these concepts in problem-solving. [SLO:Stat-11-C-03]: Students will comprehend and apply the concept of conditional probability and the multiplication theorem. [SLO:Stat-11-C-04]: Students will understand the concept of independence and apply the addition theorem in probability. [SLO:Stat-11-C-05]: Students will use counting rules, permutations, and combinations to solve real-world problems involving the computation of probabilities.	

Benchmark II: Students will be able to calculate the expectation and variance of Random Variables	
Student Learning Outcomes	
[SLO:Stat-11-C-06]: Students will define and distinguish between discrete and continuous random variables. [SLO:Stat-11-C-07]: Students will explore univariate probability distributions, joint and marginal probabilities. [SLO:Stat-11-C-08]: Students will calculate the expectation and variance of discrete random variables.	
Benchmark III: Students will be able to explain and apply Discrete and Continuous Probability Distribution using statistical software	
Student Learning Outcomes	
[SLO:Stat-11-C-09]: Students will be able to apply discrete uniform distribution, Bernoulli, Binomial, Hypergeometric, and Poisson distributions in various contexts.	

[SLO:Stat-11-C-10]:	
Students will demonstrate proficiency in understanding and applying uniform distribution and normal distribution.	
[SLO:Stat-11-C-11]:	
Apply Statistical Software: Demonstrate the ability to effectively utilize statistical software, such as Minitab or Excel, to perform various data analysis tasks, including data manipulation, visualization, and statistical computations, in practical real-world scenarios.	

Domain D. Index Numbers and Time Series Data

Standard D1: Consumer price Index numbers and Time series data..

Grade 11	Grade 12
Benchmark I: Students will be able to calculate CPI Using Weighted Index Number	
Student Learning Outcomes	
[SLO:Stat-11-D-01]: **Understand Simple and Composite Index Numbers**: Gain a clear understanding of the concepts and differences between simple and composite index numbers.	

[SLO:Stat-11-D-02]: **Price and Quantity Index Numbers**: Learn to calculate and interpret price and quantity index numbers. [SLO:Stat-11-D-03]: **Weighted and Unweighted Index Numbers**: Differentiate between weighted and unweighted index numbers and understand their applications. [SLO:Stat-11-D-04]: **Calculate CPI Using Weighted Index Number**: Acquire skills to calculate the Consumer Price Index (CPI) through the method of Weighted Index Numbers.	

Benchmark II: Students will be able to analyze Trends in Time Series Data

<div align="center">

Student Learning Outcomes

</div>

[SLO:Stat-11-D-05]: **Explain Time Series Data**: Develop an explanation of time series data and its importance in statistical analysis. [SLO:Stat-11-D-06]: **Identify Components of Time Series Data**: Identify and explain the various components of time series data,	

including trend, seasonal, cyclical, and irregular components. [SLO:Stat-11-D-07]: **Analyze Trends in Time Series Data**: Gain proficiency in analyzing and interpreting trends within time series data. [SLO:Stat-11-D-08]: **Apply Statistical Software**: Demonstrate the ability to effectively utilize statistical software, such as Minitab or Excel, to perform various data analysis tasks, including data manipulation, visualization, and statistical computations, in practical real-world scenarios.	

Domain E. Sampling Techniques

Standard E1: sampling methods and its applications.

Grade 11	Grade 12
Benchmark I: Students will be able to explain and apply Sampling Distributions and techniques	
Student Learning Outcomes	
	[SLO:Stat-12-E-01]:

	Understand the distinction between a population and a sample, and identify parameters and statistics in various scenarios.
	[SLO:Stat-12-E-02]:
	Analyze the advantages of sampling in different research contexts.
	[SLO:Stat-12-E-03]:
	Distinguish between sampling error and non-sampling error, and discuss their implications in statistical analysis.
	[SLO:Stat-12-E-04]:
	Compare and contrast probability and non-probability sampling techniques, and justify their use in specific situations.
	[SLO:Stat-12-E-05]:
	Describe the sampling distribution of a sample mean and its properties.
	[SLO:Stat-12-E-06]:
	Analyze the differences between two sample means and understand their applications.
	[SLO:Stat-12-E-07]:
	Calculate and interpret the proportion and difference between

	two proportions in various sampling scenarios, with and without replacement.
	[SLO:Stat-12-E-08]:
	Explain the concept of the Central Limit Theorem and its significance in the field of statistics.
	[SLO:Stat-12-E-09]:
	Apply Statistical Software: Demonstrate the ability to effectively utilize statistical software, such as Minitab or Excel, to perform various data analysis tasks, including data manipulation, visualization, and statistical computations, in practical real-world scenarios.

Domain F: **Statistical Inference**

Standard F1: Draw accurate conclusions about the population characteristics on the basis of sampling.

Grade 11	Grade 12
Benchmark I: Students will be able to apply key concepts related to Estimation	
Student Learning Outcomes	
	[SLO:Stat-12-F-01]:

	Apply Point Estimation: Apply point estimation methods to estimate population mean, variance, and proportion, and explain the concept of unbiasedness in these estimations. [SLO:Stat-12-F-02]: **Interval Estimation for Single Population Mean**: Construct interval estimations for the mean of a single population, considering scenarios with both known and unknown variance. [SLO:Stat-12-F-03]: **Confidence Intervals for Differences in Population Means**: Develop confidence intervals for the difference between two population means, applicable to both dependent and independent samples. [SLO:Stat-F-12-04]: **Confidence Intervals for Population Proportions**: Formulate confidence intervals for a single population proportion and for the difference between two population proportions.
	…

Benchmark II: Students will be able to demonstrate the application of hypothesis testing methods on real-world data

Student Learning Outcomes

	[SLO:Stat-F-12-11]: **Understanding Categorical Data**: Grasp the concept of categorical or qualitative data, including the differentiation between nominal and ordinal scales. [SLO:Stat-F-12-12]: **Bivariate Categorical Data Analysis**: Analyze bivariate categorical data to understand the concepts of association and independence between two qualitative variables. [SLO:Stat-F-12-13]: **Utilizing Contingency Tables**: Use contingency tables for analyzing relationships between categorical variables. [SLO:Stat-F-12-14]: **Chi-Square Test of Independence**: Apply the chi-square test of independence to assess the relationship between two qualitative variables. [SLO:Stat-F-12-15]: **Measuring Association with Rank Correlation Coefficient**: Measure the association between two qualitative variables using the method of rank correlation coefficient.
Benchmark III: Students will be able to conduct analysis of Variance on real world data	

Student Learning Outcomes	
	[SLO:Stat-F-12-16]: **One-Way Analysis of Variance (ANOVA):** Perform and interpret one-way ANOVA, focusing on calculations and their significance in comparing means across groups. [SLO:Stat-F-12-17]: **Two-Way Analysis of Variance:** Conduct two-way ANOVA calculations and understand their application in analyzing the interaction between two factors. [SLO:Stat-F-12-18]: **Real-World Application of ANOVA:** Demonstrate the application of one-way and two-way ANOVA on real-world data, illustrating their utility in practical statistical analysis. [SLO:Stat-F-12-19]: **Apply Statistical Software:** Demonstrate the ability to effectively utilize statistical software, such as Minitab or Excel, to perform various data analysis tasks, including data manipulation, visualization, and statistical computations, in practical real-world scenarios.

Domain G Regression and Correlation

Standard G1: Identify and establish the relationships between/among the variables

Grade 11	Grade 12
Benchmark I: Students will be able to conduct Simple Linear Regression and differentiate between regression and correlation**.**	
Student Learning Outcomes	
	[SLO:Stat-G-12-01]: **Understand Simple Linear Regression**: Grasp the concept of simple linear regression and its applications in analyzing the relationship between two variables. [SLO:Stat-G-12-02]: **Estimate Regression Parameters**: Accurately estimate the parameters in a simple linear regression model, such as the slope and intercept. [SLO:Stat-G-12-03]: **Prediction Using Regression**: Utilize the simple linear regression model for prediction purposes, applying it to relevant scenarios. [SLO:Stat-G-12-04]:

Practical Application of Regression Models: Apply simple linear regression models to real-world datasets, demonstrating an understanding of how these models can be used to infer relationships and make predictions.

[SLO:Stat-G-12-05]:

Recognize Limitations: Identify and discuss the limitations of simple linear regression analysis.

[SLO:Stat-G-12-06]:

Distinguish Between Correlation and Association: Clearly differentiate between correlation and association in statistical analysis.

[SLO:Stat-G-12-07]:

Differentiate Between Regression and Correlation: Understand and explain the differences between regression and correlation.

Benchmark II: Students will be able to conduct Correlation Analysis

Student Learning Outcomes

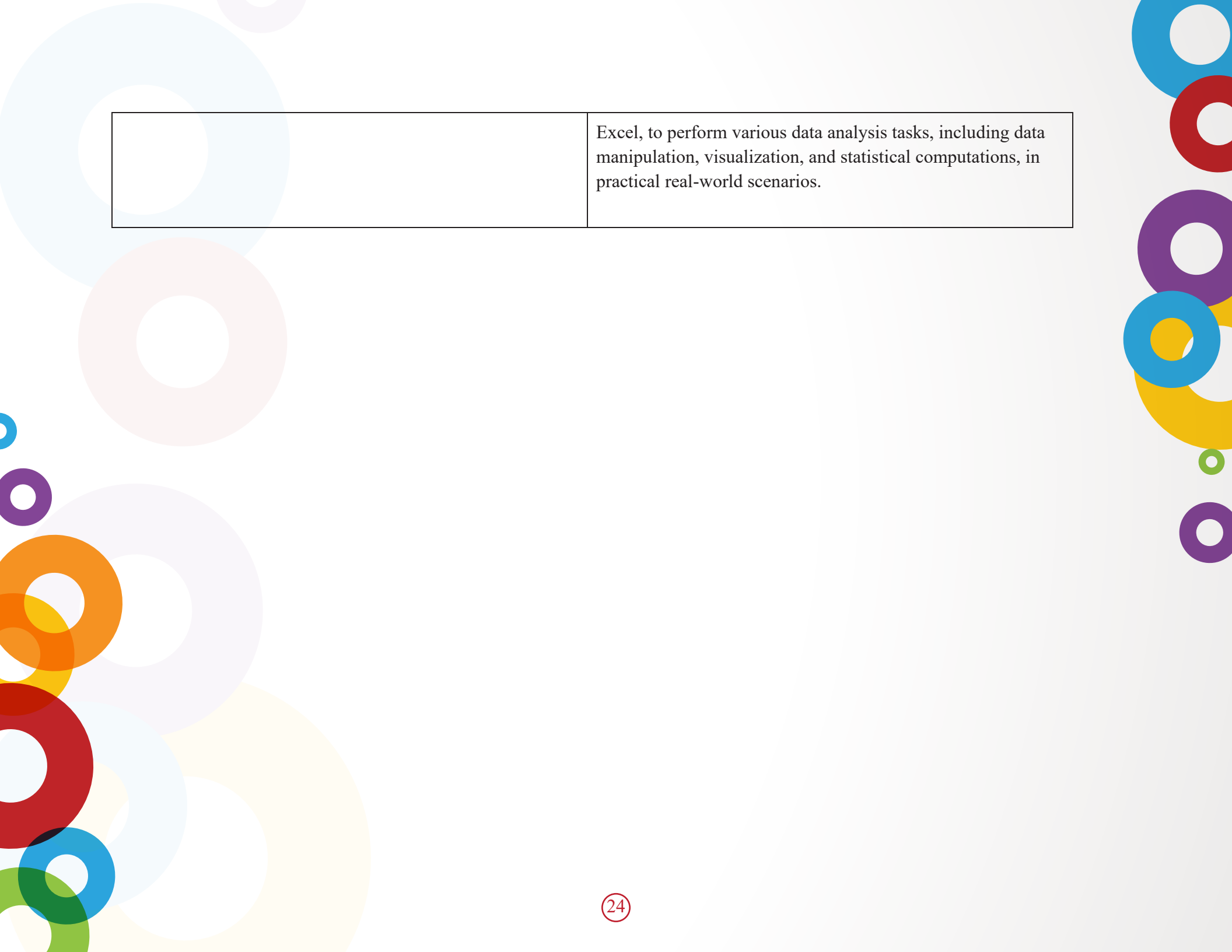|	[SLO:Stat-G-12-08]:
	Apply Pearson Correlation: Utilize Pearson correlation coefficient to measure the strength and direction of the linear relationship between two variables.
	[SLO:Stat-G-12-09]:
	Interpretation of Correlation Results: Interpret the results of Pearson correlation analysis, understanding its implications for the relationship between variables.
	[SLO:Stat-G-12-10]:
	Apply Pearson Correlation: Utilize Pearson correlation coefficient to measure the strength and direction of the linear relationship between two variables.
	[SLO:Stat-G-12-11]:
	Interpretation of Correlation Results: Interpret the results of Pearson correlation analysis, understanding its implications for the relationship between variables.
	[SLO:Stat-G-12-12]:
	Apply Statistical Software: Demonstrate the ability to effectively utilize statistical software, such as Minitab or

	Excel, to perform various data analysis tasks, including data manipulation, visualization, and statistical computations, in practical real-world scenarios.

NATIONAL CURRICULUM COUNCIL SECRETARIAT

MINISTRY OF FEDERAL EDUCATION AND
PROFESSIONAL TRAINING, ISLAMABAD
GOVERNMENT OF PAKISTAN