# 

BAHRIA UNIVERSITY KARACHI CAMPUS

**Department of Software Engineering**

**COURSE: GSL 321**

**NUMERICAL ANALYSIS**

**PROJECT Proposal**

**CLASS: BSE – 7A (FALL - 2023)**

Interactive Visualization of Interpolation and Differentiation Methods

**Group Members**

|  |  |  |
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## **1. INTRODUCTION & BACKGROUND**

In today's data-driven world, numerical analysis plays a crucial role in various fields, from engineering to finance. The ability to interpolate data accurately and perform differentiation is fundamental for decision-making and system optimization. However, understanding and visualizing these numerical methods can be challenging. This project, aims to address this challenge by providing an interactive platform for visualizing interpolation and differentiation methods.

## **2. PROBLEM STATEMENT**

The lack of accessible tools for visualizing interpolation and differentiation methods impedes the understanding of these fundamental numerical techniques. Users often struggle to grasp the nuances of different algorithms and their impact on data. This project seeks to bridge this gap by offering an intuitive and interactive solution.

## **3. PROPOSED SOLUTION**

## **3.1 FEATURES OF THE PROJECT**

**Interactive Visualization:**

Users can input their own data points and interactively visualize how interpolation and differentiation methods operate on the data.

**Multiple Methods:**

The project supports various interpolation methods, including Newton's Forward and Backward Interpolation, Divided Differences, and Lagrange's Interpolation. It also includes Newton's Forward and Backward Differentiation.

**Intuitive User Interface:**

The interface allows users to easily select the desired method, input their data, and observe the results in real-time.

## **3.2 METHODOLOGY**

The project employs Python programming language and utilizes popular libraries such as NumPy for numerical computations and Matplotlib for interactive data visualization. The algorithms for interpolation and differentiation are implemented in a modular and extensible manner to accommodate future enhancements.

## **3.3 TECHNOLOGIES TO BE USED**

**Python:**

The core programming language for algorithm implementation and application development.

**Libraries:**

**NumPy:**

Used for efficient numerical computations and data manipulation.

**Matplotlib:**

Enables the creation of interactive and informative visualizations.

## **4. PROJECT SCOPE**

The project scope encompasses educational, scientific, and practical applications. It serves as a learning tool for students studying numerical analysis while providing valuable insights for professionals and researchers working in diverse fields such as engineering, finance, and medical imaging.

## **5. PROJECT ABSTRACT**

This project is an interactive platform designed to facilitate the understanding of interpolation and differentiation methods. By allowing users to input their own data and visualize the impact of different algorithms, the project aims users to understand numerical analysis techniques. This tool caters to a wide audience, from students learning the basics to professionals seeking insights into complex data patterns.

## **6. MODULE DISTRIBUTION**

**1. User Input Module:**

Facilitates user input for data points and method selection.

**2. Interpolation Modules:**

Implement various interpolation methods (Newton's Forward and Backward, Divided Differences, Lagrange).

**3. Differentiation Modules:**

Implement differentiation methods (Newton's Forward and Backward).

**4. Visualization Module:**

Utilizes Matplotlib for interactive visualization of interpolation and differentiation results.

## **7. REFERENCES**

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3. Kincaid, D., & Cheney, W. (2009). Numerical Analysis: Mathematics of Scientific Computing. American Mathematical Society.

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