COURSE WORK - CS4051

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CS4051

FUNDAMENTALS OF COMPUTING

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## Abstract

*This project presents a tool designed to provide comprehensive insight into students' performance data. Implemented using Python programming language, this tool enables users to input a series of numerical grades and analyze them through statistical measures, such as a mean, median and mode. The application also includes a user-friendly menu system, which guides users through different functionalities, including recalculating new data sets and exiting the tool. Using an intuitive command-line interface, this application ensures accuracy and accessibility in calculating essential statistics. The clear and visually distinct menu structure enhances usability and efficiency.*

## Introduction

The CS4051 course work for the academic year 2023-2024 presents a practical application of Python programming. The application begins by prompting the user to enter a list of numerical marks one at a time. The user is guided through entering grades until they indicate completion by typing “done”. The application verifies that at least two grades have been entered before proceeding. Once the data entry phase is complete, the user is presented with a menu offering the following options: calculating the mean, median and mode. Additionally, the user can choose to re-enter a new set of marks or exit the program entirely. The menu is implemented using a loop to control the display until a valid choice is selected. In the second part of the application, only numerical values are accepted, prompting the users to correct any invalid input, and checks that the minimum numbers of marks are entered. Furthermore, this part introduces the calculation of skewness, which offers additional insight into the dataset’s distribution. For the last part of application, we further extended the flexibility of the application in several ways. First, it allows users to enter multiple marks at once as a comma-separated string. Simplifying data entry. The application also provides an option to append new marks to the existing dataset and read data directly from a file on the computer's hard drive, enhancing data management capabilities.

## Methodology

An Agile methodology was used to guide the development process, emphasizing iterative progress through three primary stages that built upon one another:

1. Part 1: The basic framework for data entry and initial statistical analysis.
2. Part 2: Enhanced robustness by implementing input validation, ensuring meaningful data entry. And introducing more sophisticated calculations.
3. Part 3: Improved data input options and expanded the application’s flexibility through file reading capabilities.

The Agile approach was chosen for its flexibility and ability to incorporate continuous feedback. This allowed iterative refinement and incremental additions to the application, ensuring that each part met specific requirements before moving on.

* **Application Structure**

The Application has a **hierarchical structure** that consists of well-defined functions encapsulated in a modular manner. This structure separates data entry, statistical calculations, and menu interactions into distinct functions, ensuring clarity and maintainability. The main function coordinates the execution flow, invoking specific functions based on user input.

## Implementation

**1. Global Variables:**

**“****student\_grades”:** An empty dictionary used to store student names and their respective grades**.**

**“subjects”:** A predefined list of subjects for which grades are entered.

**2. Adding\_grades\_of\_students() Function:**

* **Purpose:** To collect and store individual student’s grades for each predefined subject.
* **Details**:

1. Prompts the user for a student’s name
2. Initializes a dictionary to store grades for the current student.
3. Iterates over the list of subjects, collecting and storing each grade using user input.
4. Updates the **“students\_grades”** dictionary with this student’s grades.

* **Interaction:** This function uses the **“Subjects”** list and updates the global **“students\_grades”** dictionary.

**3. Loop to collect Student Grades:**

* **Purpose**:
  + - Repeatedly calls “adding\_grades\_of\_students()” to collect data for multiple students.
    - Details:
      * + Prompts the user for the number of students.
        + Iterates to call  **“adding\_grades\_of\_students()”** for each student.

4**. “print” statement to display grades:**

* **Purpose:** Displays all student names and their grades**.**
* **Details:**
  + - Loops through **“students\_grades”** to print each student’s name and their grades.

5. **Statistical Functions:**

* **“calculate\_mean(grades)”:**

Calculates and returns the mean(average) of a list of grades.

* **“calculate\_median(grades)”:**

Returns the median value of a sorted list of grades.

* **“calculate\_mode(grades)”:**

Calculates and returns the mode(s) (most frequently occurring values of a list of grades.

* **“calculate\_skeewness(grades)”:**

Returns the skewness (asymmetry of the distribution) of a list of grades

**6.“display\_menu\_and\_get\_****choice()” Function**:

* + - **Purpose**: Displays a menu to the user and gets their choice.

**Details**:

* + - * Prints five different options to the user.
      * Prompts the user to input a choice and returns it.

**7.** **Main() Function:**

* **Purpose: Starts the entire application workflow.**
* **Details:**

Based on user choice:

Option 1: calculates and prints the mean using **calculate\_mean()**.

Option 2: calculates and prints the median using **calculate\_median()**.

Option 3: calculates and prints the mode using **calculate\_mode()**.

Option 4: clears the list and re-invokes **main()** to restart grade entry.

Option 5: exit the application.

**References**

# Objects First with Java: A Practical Introduction Using BlueJ, Global Edition Paperback – International Edition, 24 Jun. 2016

1. Python Programming: An introduction to computer science by John Zelle
2. Python Programming Third Edition by Michael Dawson.