

## Assignment 2 Guidelines

Program:	MTech/MSc in Artificial Intelligence	Module:	Program Essentials for AI
Batch:	AI10	Mentor:	Pradeepta Mishra
Date:	12 <sup>th</sup> April 2025	Max Marks:	25
Type:	Individual Assignment		

### Assignment Description:

In this assignment, students will explore and implement core Python programming concepts through five focused tasks. These assignments are designed to strengthen foundational programming skills in handling data structures, file operations, object-oriented programming, custom exception handling, and iterator/generator design. Students will work with synthetic or open-source datasets to simulate real-world programming challenges and design robust, scalable solutions. Emphasis will be placed on writing clean, maintainable code with appropriate documentation and error-handling mechanisms. By the end of the assignment, students will have developed working prototypes for data sorting, banking transactions, file management, sequence generation, and access control systems using Python.

### Assignment Objectives:

1. Practice working with sequences and JSON data in Python.
2. Implement custom exception handling in a banking scenario.
3. Use object-oriented design for file operations.
4. Create and compare iterators and generators.
5. Design role-based access using advanced class features

### Assignment Guidelines:

**Note: use synthetic data or open source data wherever dataset not provided**

#### 1. Working with Sequences and JSON

Create a program that:

- Reads a JSON file containing a list of students and their grades.
- Sorts the students by their average grade.
- Compares their scores using Python sequence methods.
- Writes the sorted list to a new JSON file.
- Include exception handling for malformed files and missing data.

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### 2. Exception Handling and User-defined Exceptions

Develop a banking application that:

- Allows users to deposit and withdraw money.
- Raises and handles exceptions for:
  - Insufficient funds
  - Negative input
  - Incorrect account operations
- Uses a user-defined exception class for handling custom banking errors.

### 3. File Operations and Object-Oriented Design

Write a class-based program that:

- Reads from and writes to a CSV file.
- Encapsulates file operations in class methods.
- Defines a `FileManager` class with:
  - Private variables
  - Error handling
  - Method documentation
- Demonstrates inheritance for handling different file types (text, CSV).

### 4. Iterators and Generators

Build a custom iterable class that:

- Implements `__iter__()` and `__next__()` to generate Fibonacci numbers up to a limit.
- Also includes:
  - A generator function
  - A generator expression
- Compares performance and code readability between the three approaches.

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### 5. Advanced Class Design and Multiple Inheritance

Design a role-based access system:

- Use classes like `User`, `Admin`, `Guest`, with shared and specific functionality.
- Implement multiple inheritance where appropriate.
- Use class and instance variables to track user states.
- Override methods and demonstrate polymorphism.
- Include documentation strings and error-handling features.