# Week 1 – Core Java and Design Principles

Module 1: Design Patterns & Principles

## **1. Singleton Pattern**

## **Exercise: Logger implementation using the Singleton Design Pattern.**

## **Objective: Ensure that only one instance of the logger exists across the application.**

## **Highlights:**

## **Thread-safe double-checked locking.**

## **Lazy initialization.**

## **Log methods with timestamp support.**

## **2. Factory Method Pattern**

## **Exercise: Document creation using the Factory Method Design Pattern.**

## **Objective: Abstract the document creation logic for different types like Word, PDF, Excel.**

## **Highlights:**

## **Common Document interface.**

## **Factory classes for each document type.**

## **Centralized testing through a factory-based instantiation approach.**

Module 2: Algorithmic Thinking & Java Implementation

## **3. E-commerce Platform Search Function**

## **Exercise: Implementation of search functionalities using Linear and Binary search.**

## **Objective: Develop efficient search for products in an e-commerce platform.**

## **Highlights:**

## **Product class with fields: productid , product Name , product Category , price.**

## **Linear search methods by ID, Name, Category, and Price.**

## **Binary search methods with sorted arrays for optimized performance.**

## **Hybrid binary + linear approach for price range queries.**

## **4. Financial Forecasting**

## **Exercise: Predict future financial value using recursion.**

## **Objective: Forecast future value based on initial value and growth rate.**

## **Highlights:**

## **Recursive implementation for compound growth.**

## **Handles invalid inputs (negative values, unrealistic rates).**

## **Clean and extensible design with Javadoc and validation.**

Notes:

## **All exercises follow OOP principles, and the code is written using clean, modular Java.**