# Bank Management System in C

## Project Overview

The Bank Management System is a console-based application developed in C language to manage banking operations efficiently. It supports Admin and User functionalities such as account management, deposits, withdrawals, sorting, and EMI calculations. The project demonstrates file handling, sorting algorithms, modular programming, and data security via login features.

## Objectives

- Automate banking operations such as Add, Update, Delete, Deposit, and Withdraw.

- Provide Admin and User interfaces with login authentication.

- Implement Merge Sort and Quick Sort to analyze sorting performance.

- Maintain persistent data storage using CSV files.

- Calculate EMI for loans directly from the system.

## Features

Admin Functionalities:

1. Add, Update, Delete Accounts

2. Display All Accounts

3. Search by Account Number

4. Sorting: Merge Sort by Account Number, Quick Sort by Balance

5. Deposit & Withdraw on behalf of users

6. EMI Calculator for loans

User Functionalities:

1. Login with Account Number & Password

2. Deposit & Withdraw money

3. Check Account Balance

## Technology Stack

- Language: C

- Compiler: GCC

- Data Storage: CSV File (accounts.csv)

- Build Tool: Makefile

## System Modules

1. Authentication Module: Validates Admin/User credentials with password protection.

2. Account Module: Handles account creation, updating, deletion, and search operations.

3. Transaction Module: Supports deposit and withdrawal operations while enforcing minimum balance rules.

4. Sorting Module: Merge Sort for account numbers, Quick Sort for account balances with performance analysis.

5. EMI Module: Calculates monthly installment for given principal, interest rate, and tenure.

6. File Handling Module: Stores account details in accounts.csv for data persistence.

## Algorithm Used

- Merge Sort (O(n log n)): Used for sorting account numbers.

- Quick Sort (O(n log n) average, O(n²) worst): Used for sorting account balances.

## Advantages

- Simple and user-friendly

- Secure with password protection

- Performance analysis of sorting algorithms

- Persistent data storage with CSV file

## Future Enhancements

- Add Graphical User Interface (GUI)

- Implement Database Integration instead of CSV

- Add Online Banking Features like Fund Transfer and Bill Payment

## Conclusion

The Bank Management System successfully demonstrates the use of structured programming in C, file handling, and algorithm analysis. It provides a strong foundation for building more advanced banking applications in the future.