



INTRODUCTION TO SOFTWARE ENGINEERING

ASSIGNMENT # 2

PROJECT NAME:

Legacy-calc-2009

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Roll Numbers: 24P-6700, 24P-3045

Class: SE-3A

PROJECT OVERVIEW:

Objective :

The main goal of this project was to fix issues and improve an already existing legacy loan calculator to make it more accurate, user-friendly, and reliable for everyday use.

Key Features & Improvements:

- **Bug Fixes:** Added input validation to negate any invalid amounts, prevented integer overflow using long double, step by step safer and accurate calculation and removed hardcoded values by reading configuration from a file (config.txt).
- **Refactoring:** Organized main.cpp into multiple file i.e. Loan.cpp and Loan.h .
- **Unit Tests:** Normal EMI calculation, Invalid input handling, large values should not overflow
- **Documentation:** Doxygen comments were added to all functions, and HTML documentation was generated and included in the repo, making the code easy to understand and maintain.

Code Snippets of Bug Fixes:

```
//Bug Fix 1: Validating Inputs to prevent negative or invalid loan amounts
do {
    cout << "Enter the loan amount: ";
    cin >> loan_amount;
    if(loan_amount <= 0) {
        cout << "Error: Loan amount must be positive!" << endl;
    }
} while(loan_amount <= 0);

do {
    cout << "Enter the interest rate: ";
    cin >> interest_rate;
    if(interest_rate < 0) {
        cout << "Error: Interest rate cannot be negative!" << endl;
    }
} while(interest_rate < 0);

do {
    cout << "The number of years: ";
    cin >> number_of_years;
    if(number_of_years <= 0) {
        cout << "Error: Tenure must be at least 1 year!" << endl;
    }
} while(number_of_years <= 0);
```

```
int main() {
    double loan_amount,interest_rate,number_of_years;
    long double total_amount, monthly_amount; //Bug Fix 2: Safer calculations using long double
```

```
//Bug Fix 3: Calculations done step by step to prevent overflow
long double principal = loan_amount;
long double interest = principal * (interest_rate / 100.0L) * number_of_years;
total_amount = principal * number_of_years + interest;
monthly_amount = total_amount / (number_of_years * 12);
```

```
// Bug Fix 4: Load default values from config.txt
// The file format is simple: 3 numbers in order: loan_amount interest_rate number_of_years
long double defLoan = 0, defRate = 0, defYears = 0;
ifstream config("config.txt");
if (config) {
    config >> defLoan >> defRate >> defYears;
    config.close();
}
```

Code Snippets of Refactoring (Loan.h, Loan.cpp):

```
Desktop > legacy-calc-2009 > src > C Loan.h > ...
1  /**
2   * @class Loan
3   * @brief Stores loan details and calculates total, interest and monthly payment.
4   */
5  class Loan {
6  public:
7      long double loan_amount;
8      long double interest_rate;
9      long double number_of_years;
10
11     /**
12      * @brief Constructor to initialize loan values.
13      * @param la Loan amount
14      * @param ir Interest rate
15      * @param ny Number of years
16      */
17     Loan(long double la = 0, long double ir = 0, long double ny = 0);
18
19     /**
20      * @brief Calculates total amount payable (principal + interest)
21      * @return long double Total amount to pay
22      */
23     long double calculateTotalAmount() const;
24
25     /**
26      * @brief Calculates monthly payment (EMI)
27      * @return long double Monthly installment
28      */
29     long double calculateMonthlyPayment() const;
30
31     /**
32      * @brief Calculates total interest payable
33      * @return long double Total interest
34      */
35     long double calculateInterest() const;
36 }
```

```
Desktop > legacy-calc-2009 > src > C+ Loan.cpp > calculateTotalAmount() const
1  #include "Loan.h"
2
3  // Constructor
4  Loan::Loan(long double la, long double ir, long double ny) {
5      loan_amount = la;
6      interest_rate = ir;
7      number_of_years = ny;
8  }
9
10 // Total amount to be paid (principal + interest)
11 long double Loan::calculateTotalAmount() const {
12     long double interest = loan_amount * (interest_rate / 100.0L) * number_of_years;
13     return loan_amount + interest;
14 }
15
16 // Total interest
17 long double Loan::calculateInterest() const {
18     long double interest = loan_amount * (interest_rate / 100.0L) * number_of_years;
19     return interest;
20 }
21
22 // Monthly amount
23 long double Loan::calculateMonthlyPayment() const {
24     long double total = calculateTotalAmount();
25     return total / (number_of_years * 12);
26 }
```

Screenshot of test output:

```
[iffausman@Iffas-MacBook-Pro legacy-calc-2009 % g++ -std=c++11 src/Loan.cpp test/test_emi.cpp -o test_emi
[iffausman@Iffas-MacBook-Pro legacy-calc-2009 % ./test_emi
TEST 1 PASSED: Normal calculation
TEST 2 PASSED: Zero years handled by validation in main.cpp
TEST 3 PASSED: Large values handled
iffausman@Iffas-MacBook-Pro legacy-calc-2009 % ]
```

Git commit history:

Zehra's Commits:

The screenshot shows a GitHub commit history for a repository named 'dev'. The commits are listed in chronological order from Nov 25, 2025, to Nov 24, 2025. The commits are made by user 'Zehra024' and involve updating README files, adding Doxygen, and refactoring Loan.h, Loan.cpp, and main.cpp. There are also bug fixes and updates to config.txt.

| Date | Commit Message | Author |
|--------------|---|----------|
| Nov 25, 2025 | Updating README | Zehra024 |
| Nov 25, 2025 | Adding Doxygen html document | Zehra024 |
| Nov 25, 2025 | Updating test_emi.cpp | Zehra024 |
| Nov 25, 2025 | Updating Loan.h | Zehra024 |
| Nov 25, 2025 | Updating Loan.cpp | Zehra024 |
| Nov 25, 2025 | Unit test: test_emi.cpp applied | Zehra024 |
| Nov 25, 2025 | Adding config.txt | Zehra024 |
| Nov 25, 2025 | Refactoring: Loan.h | Zehra024 |
| Nov 25, 2025 | Refactoring: Loan.cpp | Zehra024 |
| Nov 25, 2025 | Refactoring: main.cpp | Zehra024 |
| Nov 25, 2025 | Bug Fix 4: Load default values from config.txt | Zehra024 |
| Nov 24, 2025 | Bug Fix 2+3: using long double and step by step calculation to prevent overflow | Zehra024 |
| Nov 24, 2025 | Bug Fix 1: Validating inputs | Zehra024 |
| Nov 24, 2025 | Updated README | Zehra024 |
| Nov 24, 2025 | Added src folder with main.cpp gist version | Zehra024 |
| Nov 24, 2025 | Updated README with build and run instructions | Zehra024 |
| Nov 24, 2025 | Add .gitignore to ignore build and generate files | Zehra024 |

Iffa's Commits:

| Commits on Nov 24, 2025 | |
|--|--|
| Adding config.txt | 0a80172    |
| Iffa-Usman authored and Iffa-Usman committed yesterday | |
| Refactoring: Loan.h | 75fb680    |
| Iffa-Usman authored and Iffa-Usman committed yesterday | |
| Refactoring: Loan.cpp | 7878543    |
| Iffa-Usman authored and Iffa-Usman committed yesterday | |
| Refactoring: main.cpp | a9de2f4    |
| Iffa-Usman authored and Iffa-Usman committed yesterday | |
| Bug Fix 4: Load default values from config.txt | ceeaef09    |
| Iffa-Usman authored and Iffa-Usman committed yesterday | |
| Bug Fix 2+3: Using long double and step by step calculation to prevent overflow | fee36ca    |
| Iffa-Usman authored and Iffa-Usman committed yesterday | |
| Bug fix 1: Validating Inputs | 81c7bc6    |
| Iffa-Usman authored and Iffa-Usman committed yesterday | |
| Updated README | 300e55c    |
| Iffa-Usman authored and Iffa-Usman committed yesterday | |
| Added src folder with main.cpp gist version | 54dad78    |
| Iffa-Usman authored and Iffa-Usman committed yesterday | |
| Updated README with build and run instructions | 1b491cc    |
| Iffa Usman authored and Iffa Usman committed yesterday | |
| Add .gitignore to ignore build and generate files | bd3693d    |
| Iffa Usman authored and Iffa Usman committed yesterday | |

| Commits on Nov 25, 2025 | |
|---|---|
| adding docs | 9f2757a    |
| Iffa-Usman authored and Iffa-Usman committed 44 minutes ago | |
| updated .gitignore | edd9353    |
| Iffa-Usman authored and Iffa-Usman committed 45 minutes ago | |
| updating README | 7478fd1    |
| Iffa-Usman authored and Iffa-Usman committed 1 hour ago | |
| updating test_emi.cpp | 912694f    |
| Iffa-Usman authored and Iffa-Usman committed 1 hour ago | |
| updating Loan.h | 3e209f6    |
| Iffa-Usman authored and Iffa-Usman committed 1 hour ago | |
| Adding doxygen html document | 271b68b    |
| Iffa-Usman authored and Iffa-Usman committed 7 hours ago | |
| unit tests : test_emi.cpp applied | 003bafc    |
| Iffa-Usman authored and Iffa-Usman committed 9 hours ago | |