



INTRODUCTION TO SOFTWARE ENGINEERING

ASSIGNMENT # 2

PROJECT NAME:

Legacy-calc-2009

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

Class: SE-3A

Github links:

Iffa: <https://github.com/Iffa-Usman/legacy-calc-2009/tree/dev>

Zehra: <https://github.com/Zehra0624/legacy-calc-2009/tree/dev>

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:

```
//Big 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:

Commits			
		All users	All time
↳ Commits on Nov 25, 2025			
Updating README	Zehra0624 committed 1 hour ago	588f96	🔗 ⚡
Adding Doxygen html document	Zehra0624 committed 1 hour ago	beb3d0	🔗 ⚡
Updating test_emi.cpp	Zehra0624 committed 1 hour ago	ca0b27	🔗 ⚡
Updating Loan.h	Zehra0624 committed 1 hour ago	1f2165	🔗 ⚡
Updating Loan.cpp	Zehra0624 committed 1 hour ago	b62ed3	🔗 ⚡
Unit test: test_emi.cpp applied	Zehra0624 committed 2 hours ago	6d526d	🔗 ⚡
Adding config.txt	Zehra0624 committed 18 hours ago	336e52	🔗 ⚡
Refactoring: Loan.h	Zehra0624 committed 18 hours ago	1ac2d5	🔗 ⚡
Refactoring: Loan.cpp	Zehra0624 committed 18 hours ago	53ae02	🔗 ⚡
Refactoring: main.cpp	Zehra0624 committed 18 hours ago	7085de	🔗 ⚡
Bug Fix 4: Load default values from config.txt	Zehra0624 committed 19 hours ago	8a2365	🔗 ⚡
↳ Commits on Nov 24, 2025			
Bug Fix 2+3: using long double and step by step calculation to prevent overflow	Zehra0624 committed 20 hours ago	b55cde	🔗 ⚡
Bug Fix 1: Validating inputs	Zehra0624 committed 20 hours ago	b12d59	🔗 ⚡
Updated README	Zehra0624 committed yesterday	e93964	🔗 ⚡
Added src folder with main.cpp gist version	Zehra0624 committed yesterday	5544557	🔗 ⚡
Updated README with build and run instructions	Zehra0624 committed yesterday	a653e2b	🔗 ⚡
Add .gitignore to ignore build and generate files	Zehra0624 committed yesterday	9961da	🔗 ⚡

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	ceea09 ⌂ < >
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	