ENGR 102
Loan Monthly Payment Calculation in C++

Introduction

This program computes the monthly payment for a loan based on the loan amount, the number of years, and the annual interest rate. It demonstrates a practical application of mathematical formulas and basic arithmetic operations in financial calculations using C++.

Problem Statement

The task is to calculate the monthly payment required to repay a loan, given the loan amount, the duration of the loan in years, and the annual interest rate expressed as a percentage.

Solution Steps

- Define the variables for the loan amount (P), the number of years (y), and the annual interest rate (r).

- Compute the monthly payment (M) using the provided formula for loan amortization.

- Output the calculated monthly payment.

Pseudo Code

1. Begin main function.

   1.1 Define the loan amount (P), number of years (y), and annual interest rate in decimal (r).

   1.2 Calculate the monthly payment (M) using the formula for a fixed-rate mortgage:

$$M = (P * (r / 12)) / (1 - \text{pow}(1 + (r / 12), -12 * y))$$

     1.2.1 Divide the annual interest rate by 12 to get the monthly interest rate.

     1.2.2 Compute the numerator of the mortgage formula: the product of the loan amount and the monthly interest rate.

     1.2.3 Compute the denominator of the mortgage formula: 1 minus the result of raising 1 plus the monthly interest rate to the power of -12 times the number of years.

     1.2.4 Divide the numerator by the denominator to obtain the monthly payment.

   1.3 Output the value of M with the text "Monthly payment: ".

   1.4 End main function.

C++ Code

```cpp
#include <iostream>

#include <cmath>

using namespace std;

int main() {

    double P = 100000; // loan amount

    double y = 30; // number of years

    double r = 3.0 / 100; // interest rate in decimal

    // Monthly payment to be paid

    double M = (P * (r / 12)) / (1 - pow(1 + (r / 12), -12 * y));

    cout << "Monthly payment: " << M << endl;

    return 0;

}
```

Code Explanation

- ❏ **#include <iostream>#include <cmath>using namespace std;**

These lines include necessary header files.

- ❏ **int main() {**

This line marks the beginning of the 'main' function, which is the entry point of the program.

- ❏ **double P = 100000; double y = 30; double r = 3.0 / 100;**

These lines define and initialize variables representing the loan amount ('P'), the number of years ('y'), and the annual interest rate as a decimal ('r').

- ❏ **double M = (P * (r / 12)) / (1 - pow(1 + (r / 12), -12 * y));**

This line calculates the monthly payment (M) using the formula for a fixed-rate mortgage

- ❏ **cout << "Monthly payment: " << M << endl;**

This line outputs the value of 'M 'to the standard output stream preceded by the text "Monthly payment: ".

- ❏ **return 0;}**

This line indicates the end of the main function.

Final Answer

- The calculated monthly payment (M) is the final answer.

$$M = 421.604$$

Output

```
/tmp/WOJfQsw2YH.o

Monthly payment: 421.604
```

Additional Comments/Tips

- Validate the correctness of input values and the formula to ensure accurate computation.

- Test the program with various loan amounts, durations, and interest rates to verify its functionality.

Conclusion

This program demonstrates how to calculate the monthly payment for a loan using basic mathematical formulas and arithmetic operations in C++, providing a practical tool for financial planning and analysis.