

Program Development Process

Step 1: Requirements specification

Read the problem to be solved.

State the problem clearly / Understand the problem.

Describe the problem to be solved in your own words here:

The purpose of the program is to calculate the monthly payment on a home mortgage given the loan amount, rate, and years.

Step 2: Analyze

Describe the data flow and to identify the inputs, outputs, and constants.

Identify what the output is first, and then figure out what input data you need.

This list will eventually lead to the list of variables and constants to be defined.

Inputs

Loan Amount

Interest Rate

Number of years

Outputs

Monthly Payment

Total Payment

Constants

Step 3: Program design

Describe the process for obtaining the output from the input.

Note the steps you are performing.

This will lead to the C++ statements you write.

Your algorithm design is described here.

Show your manual calculations (hand work) here.

Handwritten calculations for a mortgage payment problem. The formula for the monthly payment is shown as:

$$\text{payment} = \frac{\text{Loan} \cdot \frac{\text{Rate}}{12} \cdot \text{Term}}{\text{Term} - 1} \quad \text{Term} = \left(1 + \frac{\text{Rate}}{12}\right)^{\text{Rate} \cdot \text{Years}}$$

The calculations are performed for a loan of 100,000, a rate of 0.005, and a term of 120 months. The term is calculated as:

$$\left(1 + \frac{0.005}{12}\right)^{120} = 1.005^{120} = 1.81932673$$

The monthly payment is then calculated as:

$$\frac{100,000 \cdot 0.005 \cdot 1.81932673}{1.81932673 - 1} = \frac{909.698...}{0.81932673} = 1110.21$$

The total payment is calculated as:

$$1110.21 \times 120 = 133225$$

Step 4: Implementation in C++

Also known as coding

Develop a C++ solution using your work from step 3.

Write the declarations first and then write the C++ statements.

Enter and debug program on the computer.

Show your source code here:

```
// Include Section
#include <iostream>
#include <cstdlib>
using namespace std;
```

```

class Mortgage
{
public:
    // Constructors
    Mortgage(double l, double r, double y);
    Mortgage();

    // Mutators
    void setLoan(double l);
    void setRate(double r);
    void setYear(double y);

    // Accessors
    double getPayment();
    double getLoan();
    double getRate();
    double getYear();
    double getTerm();
    double getTotal();

private:
    double loan;    // Dollar amount of the loan
    double rate;    // Annual interest rate
    double year;    // Number of years of the loan
};

// Main Program
Mortgage Input(Mortgage mort) //Reads inputs
{
    double loan, rate, year;
    cout << "Enter the loan amount($): ";
    cin >> loan;
    cout << "Enter the annual interest rate(%): ";
    cin >> rate;
    cout << "Enter the number of years: ";
    cin >> year;
    mort.setLoan(loan);
    mort.setRate(rate);
    mort.setYear(year);
    return mort;
}

void Output(Mortgage mort) //Outputs solution
{
    cout << "\nLoan: $" << mort.getLoan() << endl;
    cout << "Rate: " << mort.getRate()*100 << "%" << endl;
    cout << "Years: " << mort.getYear() << endl;
    cout << "Monthly Payment: $" << mort.getPayment() << endl;
    cout << "Total Payment: $" << mort.getTotal() << endl;
}

int main()
{
    // Variable Declarations
    double loan = 0, rate = 0, year = 0;
    Mortgage mort;

    // Output Identification
    system("CLS");
    cout << "Assignment 5 Exercise #2 by Aidan Sullivan - "
    << "House Mortgage\n\n";

    mort = Input(mort);
    Output(mort);

    cout << "\nEnd Program.\n";

    return 0;
}

Mortgage::Mortgage(double l, double r, double y)
{
    loan = l;
    rate = r;
    year = y;
}

```

```

}

Mortgage::Mortgage()
{
loan = 0.0;
rate = 0.0;
year = 0.0;
}

void Mortgage::setLoan(double l)
{
if (l >= 0)
loan = l;
else
{
cout << "Invalid Loan\n";
exit(EXIT_FAILURE);
}
}

void Mortgage::setRate(double r)
{
if (r >= 0)
rate = r/100;
else
{
cout << "Invalid Rate\n";
exit(EXIT_FAILURE);
}
}

void Mortgage::setYear(double y)
{
if (y >= 0)
year = y;
else
{
cout << "Invalid Year\n";
exit(EXIT_FAILURE);
}
}

double Mortgage::getPayment()
{
return (loan * (rate/12) * getTerm())/(getTerm()-1); //Payment Equation
}

double Mortgage::getLoan()
{
return loan;
}

double Mortgage::getRate()
{
return rate;
}

double Mortgage::getYear()
{
return year;
}

double Mortgage::getTerm() //For getPayment
{
return pow((1+(rate/12)),12*year);
}

double Mortgage::getTotal()
{
return year*12*getPayment();
}

```

Step 5: Testing

Test your program with sample data set to make sure the output is correct.

Should test multiple data sets including the boundary cases.

Summary and analyze your result.

Show the output screen shots here.

Microsoft Visual Studio Debug Console

Assignment 5 Exercise #2 by Aidan Sullivan - House Mortgage

Enter the loan amount(\$): 240000
Enter the annual interest rate(%): 3.534
Enter the number of years: 30

Loan: \$240000
Rate: 3.534%
Years: 30
Monthly Payment: \$1082.27
Total Payment: \$389616

End Program.

C:\CIS121\ASN5\Debug\ASN5.exe (process 18636) exited with code 0.
Press any key to close this window . . .

Microsoft Visual Studio Debug Console

Assignment 5 Exercise #2 by Aidan Sullivan - House Mortgage

Enter the loan amount(\$): 100000
Enter the annual interest rate(%): 6
Enter the number of years: 10

Loan: \$100000
Rate: 6%
Years: 10
Monthly Payment: \$1110.21
Total Payment: \$133225

End Program.

C:\CIS121\ASN5\Debug\ASN5.exe (process 17344) exited with code 0.
Press any key to close this window . . .