

**Regis University CC&IS**  
**CS210 Introduction to Programming**  
**Java Programming Assignment 3: Expressions, class Methods, and Parameter passing**

***Problem Summary***

A mortgage company would like you to help compute mortgage payments for its customers, when given a mortgage loan.

The mortgage company currently only issues 30-year mortgage loans, and always requires a 10% down payment to obtain a mortgage loan. Therefore, the Loan Amount will always be 90% of the Purchase Price (the price paid for the home).

To protect its interests, the mortgage company handles paying the property taxes and insurance on the property. Therefore, the monthly mortgage payment consists of three parts:

- property taxes
- insurance
- principle and interest for the loan

The **property tax** portion is computed as follows:

Home's Assessed Value = 85% of Purchase Price

Annual Property Taxes = 0.63% of Home's Assessed Value + \$35.00 admin fee

For example, if the home's purchase price was \$101,000.00

The assessed value would be \$85,850.00

The annual property taxes would be \$540.86 + 35.00 = \$575.86

And the monthly property taxes would be \$47.99

The **insurance** portion is computed as follows:

Annual Insurance Premium = 0.49% of Purchase Price

Monthly premiums will be rounded to the nearest dollar.

For example, if the home's purchase price was \$101,000.00

The annual insurance premium would be \$494.90

And the monthly insurance cost would be \$41.00

**NOTES:**

- The tax and insurance percentages are less than 1%, so make sure you enter the values correctly for calculations (i.e. 0.49% == 0.0049)
- Both annual property taxes and annual insurance premiums must be divided by 12 to obtain a monthly cost.

The principle and interest portion is computed as follows:

$$\text{Monthly Loan Payment} = \frac{\text{factor} \times \text{Monthly Interest Rate} \times \text{Loan Amount}}{\text{factor} - 1}$$

where

$$\text{factor} = \exp(\text{Loan Length In Months} \times \log(1 + \text{Monthly Interest Rate}));$$

Predefined **exp** and **log** mathematical functions are located in the built-in **java.lang.Math** class.

The monthly interest rate will be  $1/12^{\text{th}}$  of the loan's annual interest rate. Be sure to *also* convert the percent entered by user (e.g. 5%) to an amount that can be used in calculations (e.g. 0.05).

For example, if the home's purchase price was \$101,000.00 and the annual interest was 5%:

The loan amount would be \$90,900.00 (after subtracting the down payment)

The monthly interest rate would be 0.00417

The loan length would be 360 months

So the monthly loan payment would be \$487.97

NOTE:

For hand calculating results to test your program, the equivalent algebraic equation for **factor** is:

$$\text{factor} = (1 + \text{MonthlyInterestRate})^{\text{TermInMonths}}$$

### ***Overview of Program***

In your last two Alice assignments, you:

- Created programs that were broken down into multiple methods.
- Used variables to store user input and calculation results.
- Used parameters and return values to pass information between methods.

This assignment will require you to do the same things in Java. This program will contain:

- A **main** method to read the inputs from the user, display some values, and call the other methods.
- A method (1) to display a description of what the program will do.
- A method (2) to compute the monthly property tax..
- A method (3) to compute the monthly insurance premium.
- A method (4) to compute the monthly principle and interest loan payment.
- A method (5) to compute and display the results of the program.

NOTE: For an example of a Java program containing multiple methods, see Online Content section 9.11.

### ***Program Requirements***

Given the price paid for a home and the annual interest rate for a 30-year loan (both read from the user), compute the individual parts of a monthly mortgage payment, along with the total, as follows:

1. Create a new Java NetBeans **project** for this program, named as follows:

**LastnameJavaAssn3**

For example: **SmithJavaAssn3**

2. Within the project, create only *one* Java **class**, named as follows:

**LastnameJavaClassName**

For example: **SmithMortgagCalculator**

3. Implement the following methods, within this class:

NOTE: All of these methods should have descriptive names that include a verb, describing the methods action.

**Method 1:** A method to display an explanation of what the program will do to the user.

- This method will not have any parameters or a return value.

**Method 2:** A method to compute the monthly property tax. This method will:

- Have 1 parameter: the purchase price of the home
- Define and use **three** local (non-static) *constants*, that contain the values for:
  - the percentage of the purchase price used to compute the home's assessed value
  - the percentage of the home's assessed value used to compute the property tax
  - the dollar amount of the admin fee
- Compute the monthly property tax using the formulas on page 1
- Return a **double** value: the monthly property tax payment

**Method 3:** A method to compute the monthly insurance premium. This method will:

- Have 1 parameter: the purchase price of the home
- Define and use a local (non-static) *constant* that contains the percentage of the purchase price used to compute the insurance premium.
- Compute the monthly insurance premium using the formulas on page 1
- Use the **round** method in the **java.Math** class to round the monthly insurance premium to a whole dollar amount.
- Return a **double** value: the rounded monthly insurance premium

**Method 4:** A method to compute the monthly principle and interest loan payment for a 30-year loan. This method will:

- Have 2 parameters:
  - the loan amount
  - the *annual* interest rate for the loan
- Define and use a local (non-static) *constant* that is set to the value of:
  - the number of **months** in the loan period
- Use the **exp** and **log** methods from in the **java.lang.Math** class to calculate the **factor**
- Compute the monthly principle and interest loan payment using the formulas on page 1
- Return a **double** value: the monthly loan payment

**Method 5:** A method to compute and display the results, with no return value. This method will:

- Have 3 parameters:
  - the monthly tax payment
  - the monthly insurance premium
  - the monthly principle and interest loan payment
- Calculate the total monthly mortgage payment
- Use the **println** and **printf** statements to:
  - Display the header "Monthly Mortgage Payment"
  - Display each of the parameter values (the three parts of the mortgage payment), to 2 decimal places, *indented* under the header and lined up on the decimal points
  - Display a dashed addition line below the parts of the mortgage payment.
  - Then display the total monthly mortgage payment. This total also be displayed to 2 decimal places, *indented* under the header, and should line up with the figures above.

4. Within the **main** method, write the Java code to:

NOTE: The **main** method will be defined *first*, at the top of the class, before all the other methods.

- Define and use a local (non-static) **constant** to hold the percentage of a home's purchase price that a loan will be issued for (used to compute loan amount), set to 90%.
- Call method 1 to display the program description.
- Prompt for (using descriptive prompts) and read the user inputs (home's purchase price and loan's annual interest rate).

*Sample Display and Input from main method*

```
This program implements a Mortgage Payment Calculator

Given a home's purchase price and loan's annual interest rate,
it will compute the monthly mortgage payment, which includes
taxes, insurance, principle and interest.

Please enter the home's purchase price: 200000
Please enter the loan's annual interest rate: 5.25
```

- Display a few blank lines to separate the input from the output.
- Calculate and *display* the **loan amount** to 2 decimal places.

```
Loan amount is $ 180000.00
```

- Call all the calculation methods (methods 2 - 4) to compute the three parts of the monthly mortgage payment, and *save the results returned* from each.
- Call the method 5 to *display* the final results.

*Sample Output from method 5*

```
Monthly Mortgage Payment
  Monthly Taxes                92.17
  Monthly Insurance            82.00
  Monthly Principle & Interest  993.97
                               -----
  Total Monthly Mortgage Payment 1168.13
```

Output must display exactly as shown: All decimal points in the payment components and total payment must line up with each other. And the descriptions must be indented 2 spaces.

5. You must also define and use:
- Local **variables** for each input or computed value, defined using descriptive names and appropriate data types.

**WARNING:** The methods must be implemented exactly as specified in these requirements.

If your program produces correct output, but you did not implement the methods as specified (with correct parameter passing and return values), you will lose a significant number of points.

[See next page for an outline of what your code should look like.](#)

## Coding Standards

The program must also follow the **CS210 Coding Standards** from Content section 6.10.

You must *include* the following comments:

- Comments at the *top of the file, above* the **main** class, describing what the class does
  - Include **tags** with the author's name (i.e. your full name) and the version of the code (e.g. @version 1.0, Java Assn 3)
- Comments at the *top of each method, above* the method header, describing what the method does (*only* this method – do not refer to actions of any other methods)
  - Include **tags** with names and descriptions of *each* parameter and return value.

*Delete* any default comments supplied by the IDE that you did not use.

## Debugging and Testing

Run, test, and debug your Java program, until it works.

Then test your program with different inputs to make sure it provides correct results.

## Outline of what your .java program code should look like

```
/*
 * The mortgage calculator program will do the following:
 *   Put program description here (expand to as many lines as needed)
 */

import java.util.Scanner;

/**
 * @author Mary Jones           // your full name
 * @version 1.0, Java Assn 3
 */
public class JonesMortgageCalculator {

    public static void main(String[] args) {
        // Constant definition goes here

        // Call to method 1 goes here

        // Statements to read user inputs go here

        // Statements to call other methods go here
    }

    /**
     * Method 1 description
     */
    public static datatype methodName () {
        // Method 1 body statements go here
    }
}
```

```

/**
 * Method 2 description
 *
 * @param name - description of parameter
 * @return name - description of return value
 */
public static datatype method2name (parameterList) {
    // Constant definitions goes here

    // Method 2 body statements go here
}

/**
 * Method 3 description
 *
 * @param name - description of parameter
 * @return name - description of return value
 */
public static datatype method3name (parameterList) {
    // Constant definition goes here

    // Method 3 body statements go here
}

/**
 * Method 4 description
 *
 * @param name - description of parameter
 *          (one @param comment line for each parameter)
 * @return name - description of return value
 */
public static datatype method4name (parameterList) {
    // Constant definition goes here

    // Method 4 body statements go here here
}

/**
 * Method 5 description
 *
 * @param name - description of parameter
 *          (one @param comment line for each parameter)
 */
public static datatype method5name (parameterList) {
    // Method 5 body statements go here
}
}

```

## Submission

This programming assignment is due by midnight of the date listed in the **Course Assignments by Week**.

Submit your program source code (the **.java** file) to the **Java Prog Assn 3** assignment submission folder (located under the **Assignments/Dropbox** tab in the online course).

For example: **SmithMortgagCalculator.java**

## Grading

Programs will be graded using the **rubric** that is linked on the same assignment page as this file.

### **WARNING:**

*Programs submitted more than 5 days past the due date will **not** be accepted,  
and will receive a grade of 0.*