

Program development

Problem Statement

Write a loan calculator program that computes both monthly and total payments for a given loan amount, annual interest rate and loan period.

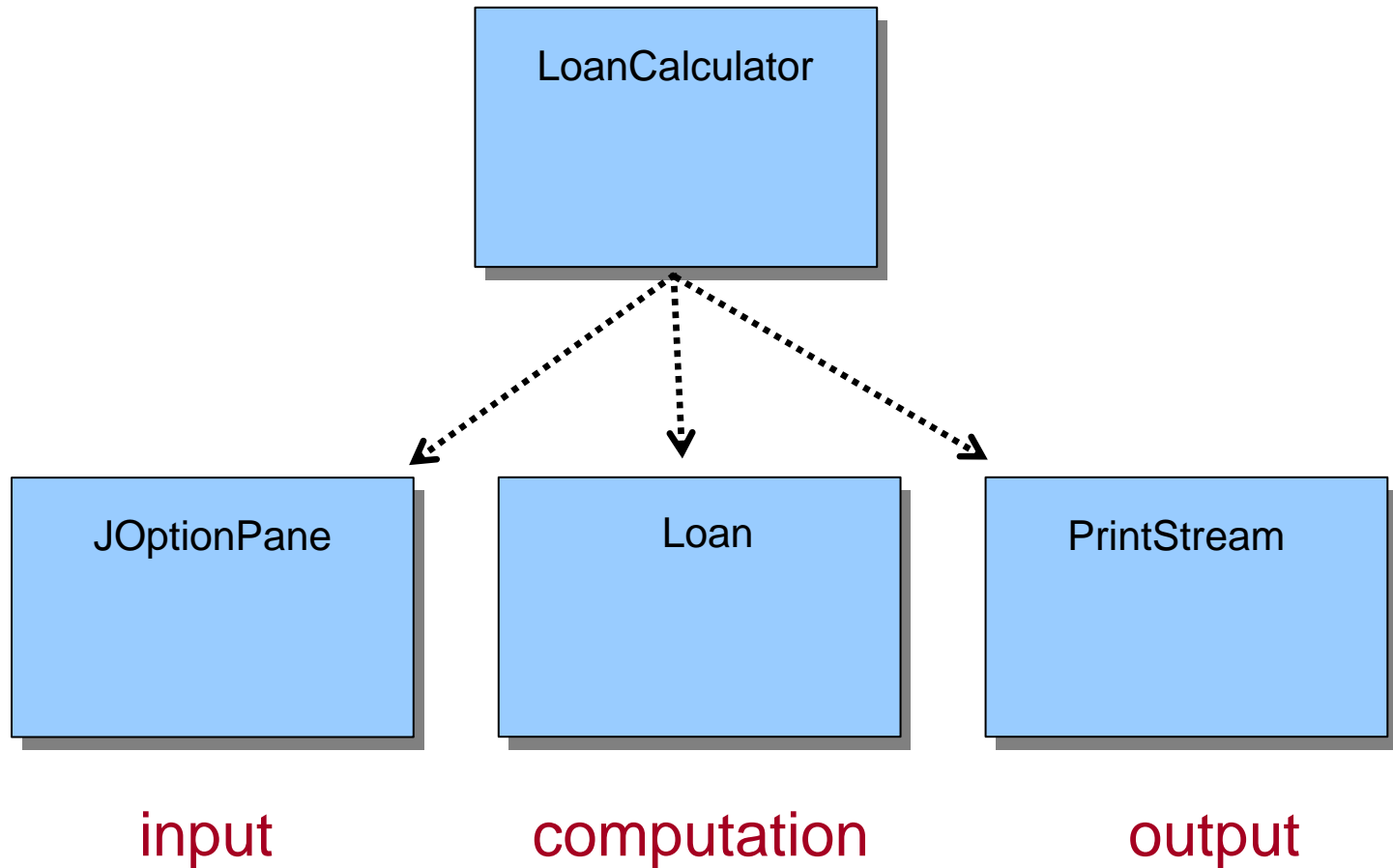
Overall plan

1. Get three input values loanAmount, interestRate and loanPeriod.
2. Compute monthly and Total payments.
3. Output the results

$$\text{Monthly Payment} = \frac{L \times R}{\left[1 - \left(\frac{1}{1+R}\right)^N\right]}$$

L – loan amount
R – monthly interest rate
N – number of payments

Required Classes



Service provider

- Loan class is generic in that it provides loan calculation service to many programs;
- Loan class is not designed for this specific program;
- Loan class is reusable.

Controller

- LoanCalculator is designed to manage other classes and objects in the program.
- Loan Calculator is the entry point of the program – it has a main method.

Top-down development

- Program is developed in a kind of outside-in fashion.
- Top-level controller class is first developed and tested.
- Dummy services are used for service classes, which will be replaced with real services after the top-level controller class is tested.

Bottom-up development

- Program is developed in inside out fashion.
- Service classes are developed first.
- Temporary code for a controller class are used – which will be developed after services classes the controller class requires are complete.

Development steps

- We will develop this program in five steps:
 1. Start with the main class LoanCalculator. Define a temporary placeholder Loan class.
 2. Implement the input routine to accept three input values.
 3. Implement the output routine to display the results.
 4. Implement the computation routine to compute the monthly and total payments.
 5. Finalize the program.

Step 1 Design

- The methods of the LoanCalculator class

Method	Visibilit	Purpose
start	public	Starts the loan calculation. Calls other methods
computePayme nt	private	Give three parameters, compute the monthly and total payments
describeProgra m	private	Displays a short description of a program
displayOutput	private	Displays the output
getInput	private	Gets three input values

Step 1 Code

Program source file is too big to list here. From now on, we ask you to view the source files using your Java IDE.

Directory: Step1

Source Files:

LoanCalculator.java

Loan.java

Step 1 Test

- In the testing phase, we run the program multiple times and verify that we get the following output

```
inside describeProgram  
inside getInput  
inside computePayment  
inside displayOutput
```

Step 2 Design

- Design the input routines
 - LoanCalculator will handle the user interaction of prompting and getting three input values
 - LoanCalculator calls the setAmount, setRate and setPeriod of a Loan object.

Step 2 Code

Directory: Step2

Source Files:

LoanCalculator.java

Loan.java

Step 2 Test

- We run the program numerous times with different input values
- Check the correctness of input values by echo printing

```
System.out.println("Loan Amount: $"  
                  + loan.getAmount());
```

```
System.out.println("Annual Interest Rate:"  
                  + loan.getRate() + "%");
```

```
System.out.println("Loan Period (years):"  
                  + loan.getPeriod());
```

Step 3 Design

- Implement displayOutput method in LoanCalculator.
- Add dummy getMonthlyPayment and getTotalPayment to Loan class
- Remove computePayment method from LoanCalculator

Only the computed values (and their labels) are shown

```
Monthly payment:      $ 143.47
Total payment:        $ 17216.50
```

Both the input and computed values (and their labels) are shown.

```
For
Loan Amount:          $ 10000.00
Annual Interest Rate: 12.0%
Loan Period (years): 10

Monthly payment is    $ 143.47
TOTAL payment is     $ 17216.50
```

Step 3 Code

Directory: Step3

Source Files:

LoanCalculator.java
Loan.java

Step 3 Test

- We run the program numerous times with different input values and check the output display format.
- Adjust the formatting as appropriate

Step 4 Design

- Two methods `getMonthlyPayment` and `getTotalPayment` are defined for the `Loan` class
- We will implement them so that they work independent of each other.
- It is considered a poor design if the clients must call `getMonthlyPayment` before calling `getTotalPayment`.

Step 4 Code

Directory: Step4

Source Files:

LoanCalculator.java

Loan.java

Step 4 Test

- We run the program numerous times with different types of input values and check the results.

Input			Output (shown up to three decimal places only)	
Loan Amount	Annual Interest Rate	Loan Period (in Years)	Monthly Payment	Total Payment
10000	10	10	132.151	15858.088
15000	7	15	134.824	24268.363
10000	12	10	143.471	17216.514
0	10	5	0.000	0.000
30	8.5	50	0.216	129.373

Step 5: Finalize

- We will implement the describeProgram method
- We will format the monthly and total payments to two decimal places using DecimalFormat.

Directory: Step5

Source Files (final version):

LoanCalculator.java

Loan.java