

Problem 1 BankLoan.java (25%)

Write a program **BankLoan.java** that calculates the bank loan (monthly payment, and total loan to be paid after including the total interest) based on a given initial loan amount, yearly interest rate and number of loan years. You should create a method, `bankLoan`, that takes three parameters (in the same order): 1) number of loan years; 2) initial loan amount; 3) yearly interest rate, which corresponds to a percentage. The formula to compute the monthly payment is as follows:

$$\text{monthly payment} = \frac{i \times r}{1 - (1 + r)^{-n}}$$

r: monthly interest rate
n: number of months
i: initial loan amount

Example: `bankLoan(20, 15000.0, 10.0)` gives the following output (make sure to include the special characters and follow the same exact format):

```

Loan period in months: 240
Annual interest rate: 10.0%
Initial loan: $15000.0
Monthly payment: $144.75
Total loan with interest: $34740.78
  
```

Problem 2 RandomFair.java (30%)

Write a method `isRandomFair` that takes three integers *a*, *b* and *n* as parameters (where *a* < *b* and *n* > 0). The method generates *n* random integers between *a* and *b* (both inclusive), and prints `true` if the difference between (1) the average of the random integers, and (2) the midpoint of *a* and *b*, is less than or equal to 2; it prints `false` otherwise. For example, for *a* = 3, *b* = 40, *n* = 10 and if the generated random integers are: 25 13 8 16 15 25 7 20 6 27, then the method should print the following:

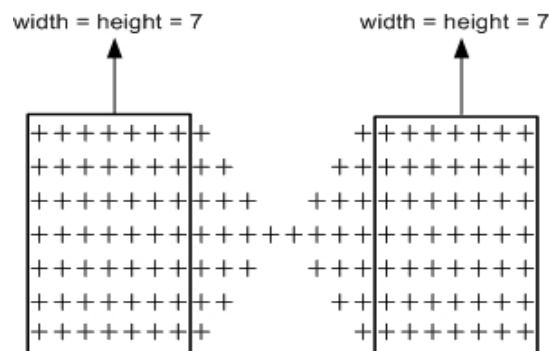
```
For [3, 40] and n = 10 -- random is fair: false
```

In this case, the average of the random integers is equal to 16.2 and the midpoint of *a* and *b* is equal to 21.5. The method prints `false` since the difference between 16.2 and 21.5 is greater than 2.

Write a program **RandomFair.java** that calls `isRandomFair` method for *a* = 1, *b* = 10 and *n* varying from 10 to 100000 in 100 increments.

Problem 3 Bowtie.java (45%)

Write a method, `bowtie`, that takes an integer height as a parameter. It then uses this parameter to draw and appropriately size the figure below. Assume that the height is always an odd number greater than 5. The following pictorial illustrates the figure details when height is equal to 7:



Write a program, **Bowtie.java** that calls the method for different values of height.

Sample Run 1 (when height = 7)

C:> java Bowtie

```
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
```

Sample Run 2 (when height=11)

C:> java Bowtie

```
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
```

Sample Run 3 (when height=15)

C:> java Bowtie

```
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
+++++++      ++++++
```

Submission Instructions

- Your exam submission must consist of a single zip archive named **s#_exam1_netid** that contains your properly commented three source files (.java files) only (**BankLoan.java**, **RandomFair.java**, **Bowtie.java**). No other files will be accepted. We will compile and run your programs.