Assignment A5 (50 marks)

Focus: *Recursion*

For each question, **write the base case(s) and the recursive call in English first**, then write your Java code. Make sure to use appropriate code formatting and structure (e.g., indentation, brackets, etc.).

Q1. **[10 marks]** Write a recursive method to compute the following series:

$$f(i) = \frac{1}{2} + \frac{1}{4} + \frac{1}{6} + \cdots \frac{1}{2i}$$

Write a test program that displays *f*(i) for i = 1, 2, 3, 4, and 5.

Sample run

```
i = 1   f(i) = 0.50
i = 2   f(i) = 0.75
i = 3   f(i) = 0.92
i = 4   f(i) = 1.04
i = 5   f(i) = 1.14
```

Q2. **[10 marks]** Write a recursive method, `reverse`, that displays a string in a reverse order. For example, `reverse("UBC-O")` displays O-CBU. Use a helper method to improve the performance of your program.
Write a test program that prompts the user to enter a string and displays its reversal.

Sample run

```
Enter a string: UBC-O
O-CBU
```

Q3. **[10 marks]** Write a recursive method that finds the number of occurrences of a given letter in a string. Use a helper method to improve the performance of your code.
Write a test program that reads from the user a string and a character, and displays the number of occurrences for the character in the string.

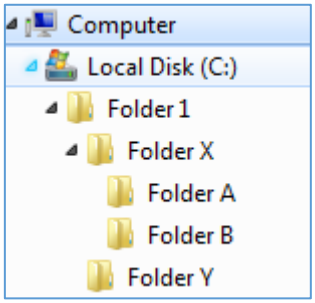
Sample run

```
Enter a string: kelowna is awesome
Enter a character: e
e appears 3 time(s) in "kelowna is awesome"
```

Q4. **[20 marks]** Write a method `void listAllFiles(File dir)` that recursively displays a list of a directory's files and subdirectories. An example is illustrated below. **Note the following in the output**:

- Directory names are all capitalized and written between brackets [ ].
- Files and subdirectories are indented in order to illustrate to which parent directory they belong. Use a helper method `void listAllFiles(File dir, String spaces)` where `dir` represents the root directory (i.e., Folder 1 in the example below) and `spaces` stores a number of spaces " " that is incremented every time the method is recursively called. The helper method should print out `spaces` followed by the file or subdirectory names.

Folder structure on the hard drive



OUTPUT from your Java Program for "Folder 1"

```
[FOLDER 1]
  file 1.pdf
  file 2.pdf
  [FOLDER X]
    file 1.pdf
    file 2.pdf
    file 3.pdf
    [FOLDER A]
      file 1.pdf
      file 2.pdf
    [FOLDER B]
      file 1.pdf
      file 2.pdf
  [FOLDER Y]
    file 1.pdf
    file 2.pdf
```

Grading

- 15 % for logic explanation
- 70 % for proper code structure and logic
- 15 % for correct syntax and formatting

Submission Instructions

For this assignment, you need to do the following:

1- Create a Java project of which name consists of **your student number followed by the assignment number,** e.g., "1234567_A2".
2- Create one class for each question and write your answer inside that class. Your classes should have the same name as the question number (e.g., Q1)
3- After solving all questions, open Windows Explorer (or any other file explorer).
4- Navigate to your Java project folder (can be found inside your Eclipse workspace folder).
5- Locate the "src" folder for this project (the folder that includes the source code for all questions).
6- Zip the "src" folder and rename the zipped file to match your project name (e.g., 1234567_A2.zip).
7- Submit the zipped file **to Canvas**

Note that you can resubmit an assignment, but the new submission overwrites the old submission and receives a new timestamp.