1 Objectives

- Write recursive programs

2 Practice With Recursion

2.1 Factorial

Create a new Java project in Eclipse called `lab06` and import the files in

`~csci204/2008-fall/student/labs/lab06`

into `lab06/src`

Check your `lab06` project into Subversion in the usual labs directory. Run `TestFactorial`. Observe the behavior of the program. Read the `Factorial` class and understand the logic of the program. Create a `readme.txt` file that answers the following questions.

1. If we rewrite the first branch of the `if-else` in the `factorial()` method as

   ```
   if (n == 1)
       return 1;
   ```

   will the final result change? Why?

2. If we rewrite the branch as

   ```
   if (n == 0)
       return 0;
   ```

   will the final result change? Why? Restore the program to its original state before proceeding.

3. If we revise the second branch of the `if-else` in the method as

   ```
   else
       return 2 * n * factorial(n - 1);
   ```

   What will happen to the final result? Can you come up with a closed form mathematical equivalent of it?

Based on the `factorial()` method given above, write a similar recursive method that adds up all the odd numbers between 1 and a given limit. Assume this limit is an odd number. Add a method to the `Factorial` class to do the work, using the signature

```
public static long addOddInts(int n);
```

Uncomment the relevent lines in `main()` to test `addOddInts()`.

2.2 Recursively Listing Files

Recursive algorithms are natural for solutions to problems with hierarchical structure. An example problem is listing all the files in a directory and all of its subdirectories. Since the UNIX file system is hierarchical, we should immediately think of using a recursive approach.

For this part of the lab you are to write a Java program to list all the the files in a directory and, recursively, in all of its subdirectories.

Read, and run the program contained within `PrintDirectory.java`. Observe the behavior of the program.

`PrintDirectory` is a Java program that lists the names of the files and directories in a directory but does *not* recursively list the subdirectories. You are to modify the `PrintDirectory` class to recursively print the names of all the files in all subdirectories. Here are some details.

1. You must use a recursive solution.
2. File names should be printed one per line.
3. Just *before* your recursive call, print out "Entering name" where you fill in the directory name.
4. Just *after* your recursive call, print out "Leaving name" where you fill in the directory name.
5. If you print a `File` object, Java will print the *full* pathname. You can print only the file/directory name by using the `getName()` method.
6. You may check if a `File` object is a file with the method `isFile()` which returns `true` if it is a file and `false` if it is a directory. If you find it more convenient, there is a similar method `isDirectory()` that tests whether a `File` object is a directory.
7. To check your program's output, use the following UNIX command.

   ```
   ls -R ~csci204/2008-fall/student/labs/lab06
   ```

   where the `-R` option recursively lists subdirectories encountered.

Expected output of your program:

```
Factorial.java

Entering Hobbits

Entering Baggins
Bilbo
Frodo
Leaving Baggins

Merry
Pipin
Sam
Leaving Hobbits

PrintDirectory.java
TestFactorial.java

Entering Wizards
Gandalf
Sauraman
Leaving Wizards
```

Your usage of blank lines does not need to match this but the words on each line and ordering of the lines do need to match.

3 Upon Completion

Commit everything, including your `readme.txt`, to your subversion repository.

Note: Be sure to have good Javadoc comments for any methods that you have written.