Problem 1: Factorial

CS3305 Data Structures

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Algorithm Description

This bit was listed in the assignment description but not in the deliverable section, but I'll include it anyway. Since this one is so simple, I'll just use plain words to describe this rather than pseudo-code or something.

We will have a function called `Factorial` which takes in the user input that we want to compute the factorial of. We then establish the base case, which is whenever the number reaches 1 (or less, just in case); in such a case, we want to just return the number itself, i.e. 1. From there, the definition of factorial is $n! = n(n-1)(n-2)...$, so we want to return the current number multiplied by the function itself with an input of one less than the current input. This will continue chaining back until it reaches the base case, 1, so we end up computing the factorial.

Program Output

```
Enter a nonnegative integer: 4
The factorial of 4 (4!) is: 24
Enter a nonnegative integer: 5
The factorial of 5 (5!) is: 120
Enter a nonnegative integer: 6
The factorial of 6 (6!) is: 720
```

Source Code

```java
/*
 * Name: Casey Hampson
 * Class: CS3305/W01
 * Term: Fall24
 * Instructor: Sharon Perry
 * Assignment: A1 Factorial
 */


import java.util.Scanner;


public class P1 {

    public static long Factorial(int x) {
        // base case; once x gets to be 1 (or less), return just x
        if (x <= 1) return x;
        // otherwise, continue with the factorial
        else return x * Factorial(x-1);

    }

    public static void main(String[] args) {
        // use a try-with-resources for the scanner in case of error when creating it
        // also automatically closes it and frees memory
        try(Scanner sc = new Scanner(System.in);) {
            // grab the user's **non-negative** input
            System.out.printf("Enter a nonnegative integer: ");
            int x = Integer.parseInt(sc.nextLine());
            while (x <= 0) {
                System.out.printf("Please enter a valid input: ");
                x = Integer.parseInt(sc.nextLine());
            }

            // compute the factorial using our recursive algorithm and print the result out
            long fact = Factorial(x);
            System.out.printf("The factorial of %d (%d!) is: %d\n", x, x, fact);
        }
    }
}
```