

AP COMPUTER SCIENCE A – FACTORIAL CLASS WORK

The factorial of a number n (where $n \geq 0$) is denoted as $n!$. Iteratively, it is defined via

$$0! \equiv 1 \quad 1! = 1 \quad 2! = 1 \cdot 2 \quad 3! = 1 \cdot 2 \cdot 3 \quad 4! = 1 \cdot 2 \cdot 3 \cdot 4$$

etc. Recursively, one can define $n!$ as

$$n! = n \cdot (n - 1)!$$

For this class work assignment, you will calculate $n!$ both iteratively and recursively.

It is of interest to note that the largest factorial that can be represented by a `long` is $20! = 2432902008176640000$. Consequently, your programs should enforce that the input integer n satisfies $0 \leq n \leq 20$ (cf., lines 27 through 31 of both `Fibonacci.java` and `RecursiveFibonacci.java`).

- 1) Write a program `Factorial.java` which calculates $n!$ iteratively. Maybe a good place to start is to modify the program `Fibonacci.java`. Since the time to execute the code will be less than 0.5 milliseconds, you can remove lines 1, 55, 58, and 65 from `Fibonacci.java`. You should also modify the routine corresponding to `fibonacci` to return `void`.
 - a) Run your program `Factorial.java` with `java Factorial 15`.
 - b) $15! = ?$ *1,307,674,368,000* ←
 - c) Show me your code and its output.
- 2) Write a program `RecursiveFactorial.java` which calculates $n!$ recursively. Maybe a good place to start is to modify the program `RecursiveFibonacci.java`. Since the time to execute the code will be less than 0.5 milliseconds, you can remove lines 1, 55, 57, and 61 from `RecursiveFibonacci.java`. You should also modify the routine corresponding to `recursiveFibonacci` to return `void`.
 - a) Run your program `RecursiveFactorial.java` with `java RecursiveFactorial 15`.
 - b) $15! = ?$ *1,307,674,368,000* ←
 - c) Show me your code and its output.