

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 $0 \leq n \leq 20$ (like was done in method `readNth` 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 the timer, *i.e.*, the `Date` object. You should also modify the routine corresponding to `fibonacci` to return `void`.
 - a) Run your program `Factorial.java` to calculate $15!$.
 - b) $15! = ?$
 - 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 the timer. You should also modify the routine corresponding to `recursiveFibonacci` to return `void`.
 - a) Run your program `RecursiveFactorial.java` to calculate $15!$.
 - b) $15! = ?$
 - c) Show me your code and its output.