

1) Write a function to calculate the factorial of a number using a loop

2) Write a function to calculate the factorial of a number using recursion



$0! = 1$
 $1! = 1$
 $2! = 1 * 2 = 2$
 $3! = 1 * 2 * 3 = 6$
 $4! = 1 * 2 * 3 * 4 = 24$
 $5! = 1 * 1 * 2 * 3 * 4 * 5 = 120$

5
return 5*factorial(4)
4*factorial(3)
....

```
void factorialLoop(int number) {  
    int factorialNum = 1;  
    for (int i = 1; i <= number; i++) {  
        factorialNum = factorialNum * i;  
    }  
    std::cout << factorialNum << std::endl;  
}
```

```
int recursiveFact(int number) {  
    if (number > 1) {  
        return number * recursiveFact(number - 1);  
    }  
    else {  
        return 1;  
    }  
}
```

Stirling's approximation

$$n! \sim \sqrt{2\pi n} \left(\frac{n}{e}\right)^n,$$

$$(n+1)! = (n+1) * n!$$

Gamma function

(Leonhard Euler)

$$z = 5 + 4 * i$$

$$z = -5 + 4 * i$$

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

$$\Gamma(z) = \int_0^{\infty} x^{z-1} e^{-x} dx, \quad \Re(z) > 0.$$

functional equality
 $f(n+1) = (n+1) * f(n)$