

Calculating Factorial

Factorial (Getting the Product of Numbers)

In mathematics the factorial of a number is that number multiplied by every number smaller than itself down to the number one, so, for example:

$$5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$$

Or, in general terms, for any number N:

$$N! = N \times (N-1) \times (N-2) \times \dots \times 2 \times 1$$

To write a Python program to calculate the factorial of a number, it is very similar to the program to sum all of the numbers up to a certain values, but you are multiplying instead of adding. So the first thing we need is a new variable, let's call it `ProductTotal`, and we will set its starting value (also called the "initial value") to one (1). We'll also have the counting variable `X`, that starts at one (1) and continues counting up to the desired value. So let's multiply the variable `X` by the variable `ProductTotal` during each execution of the loop. So the first time in the loop `X` is 1 and `ProductTotal` is 1 ($1 * 1 = 1$), the next time around the loop `X` is 2 and `ProductTotal` is 2 ($2 * 1 = 2$), the next time around the loop `X` is 3 and `ProductTotal` is 6 ($3 * 2 = 6$), the next time around the loop `X` is 4 and `ProductTotal` is 24 ($4 * 6 = 24$), the next time around the loop `X` is 5 and `ProductTotal` is 120 ($5 * 24 = 120$), the loop then stops executing.

X	1	2	3	4	5
ProductTotal	1	2	6	24	120

So the code below shows how we could write this program, it is very similar to the Adding program, but we are using multiplication instead of addition.

Summing Numbers Using the WHILE Statement

```
# PROGRAM Product1To5:
X = 1
ProductTotal = 1
while (X < 6):
    ProductTotal = ProductTotal * X
    X = X + 1
# EndWhile;
print(ProductTotal)
# END.
```

So the output we will get from this program is:

120

This is just calculating to five (5), but we can use this to do any product to get that factorial.

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