Practice Compete Jobs Rank Leaderboard

Dashboard > Algorithms > Implementation > Extra Long Factorials > Editorial

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Extra Long Factorials

by vatsalchanana

Problem Submissions Leaderboard Discussions Editorial

Factorial of a number can be calculated by simply multiplying values N * N-1 * N-2 * ... * 2 * 1. But for N > 20, this value becomes quite large and doesn't fit even in a 64 bit long long variable. Languages like Java, Python, Ruby etc. provide support for Big Integers. We can solve this problem easily in these languages by using the Big integer libraries provided.
But in C / C++, we need to write additional code to handle big integer values. In the simplest form, we can store the factorials in an array with one digit at each index of the array.
For example : To store 245 in the array,

```
a[2]=2
a[1]=4
a[0]=5
```

To multiply a number say k to this value, we start off from the index 0 of the array. At every iteration, we calculate k * a[index]. We also maintain a carry from the previous index which is initialized to 0. Now, at every step, we calculate product = a[index] * k + temp. The new value of a[index] will be product % 10 and the new value of carry will be product/10. We propogate this carry to higher order digits.

```
Example:

arr[1]=3
arr[0]=6

We need to multiply arr by 5. We first multiply 6 by 5.
6*5=30, 30 % 10 = 0, 30/10=3;
arr[0]=0;
carry=3.


We then multiply arr[1] by 5.
prod = arr[1]*5 + carry
prod = 3*5+3=18
arr[1] = prod%10 = 8
carry= prod/10 = 1

Propogating the carry
arr[2]=1

arr[2]=1, arr[1]=8, arr[0]=0
```

To calculate the factorial of a number, we need to multiply N * N-1 * ... * 2 * 1.
100! contains less than 200 digits so we can keep the size of the array to be 200.

Featured Solutions

Python 2

```
from math import factorial as f
print f(input())
```

Statistics

Difficulty: Medium
Required Knowledge: Big Integers
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This is a Practice Challenge

Set by vatsalchanana

Problem Setter's code:

C++

```cpp
#include <vector>
#include <iostream>

using namespace std;

int main() {
    int val;
    int carry = 0;
    cin >> val;
    vector <int> arr(200, 0);
    arr[0] = 1; //Initial product = 1

    int k = 0; //Current size of the number stored in arr

    for(int i = 1; i <= val; i++) {
        for(int j = 0;j <= k; j++) {
            arr[j] = arr[j] * i + carry;
            carry = arr[j] / 10;
            arr[j] = arr[j] % 10;
        }
        while(carry) { //Propogate the remaining carry to higher order digits
            k++;
            arr[k] = carry % 10;
            carry /= 10;
        }
    }
    for(int i = k; i >= 0; i--) {
        cout << arr[i];
    }
    cout << endl;
    return 0;
}
```

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