

Lab 02

CPSC 1160

January 14, 2020

1 Unassessed exercises

1.1 Factorial limits

Consider the following C++ function, which will compute factorial:

```
1 short factorial(int n) {  
2     short a = 1;  
3     for (int i = 1; i <= n; i++) {  
4         a *= i;  
5     }  
6     return a;  
7 }
```

What is the largest value of n which will not overflow? What if you change all of the types from `short` to `int`? `long`? `long long`?

2 Deliverables

Create a C++ console application which reads in a positive integer k from the user. It must repeatedly read in until it successfully reads in a positive integer. Then, it will print out a table of probabilities, for all numbers n from 1 to k , how likely it is that any two people in a random sample of n will share the same birth month, if there are k months in a year. The formula for calculating this is:

$$p(n) = 1 - \frac{k!}{k^n(k-n)!}$$

You must choose data types large enough to handle $k = 12$, at least. To calculate exponentials, use the `std::pow` function (you will need to include `cmath`). Note: k^n is probably too large to fit in an integer type (even `long long`), so use a `double` for that.

You must print out each probability to 7 digits after the decimal point. The values of n and the probabilities must each be aligned and the output must look *exactly* like the following for $k = 12$:

```
1  0.0000000  
2  8.3333333  
3 23.6111111  
4 42.7083333  
5 61.8055555  
6 77.7199074  
7 88.8599537  
8 95.3583140  
9 98.4527713  
10 99.6131928
```

```
11 99.9355321
12 99.9946277
```

Your project must consist of 3 files:

lab02.cpp — contains the `main` method

functions.cpp — contains a `factorial` function and a `probability` function

functions.h — contains prototypes for `factorial` and `probability`

Each source code file must include a comment at the top with a short description and your name.

For this lab, please zip all of your source files (`.h` and `.cpp` files) together. For Visual Studio 2015 users, you may zip your entire project directory.