Homework 2

Out: 9.19.23
Due: 9.27.23

1. [Asymptotic comparison, 25 points]
For each of these problems enter "yes" or "no" indicating whether A is O, o, Θ, ω, Ω of B. Justify your answers.

A	B	O	o	Θ	ω	Ω
$n^3 + 2n + 100$	$20n^3 - 5n + 2$					
2489^{200}	$\log_{2489}(n)$					
n^7	3^n					
n	$\sum_{i=1}^{n} \frac{50}{i}$					
$200\ n^9$	e^n					

2. [Asymptotics, 25 points]
Place the following functions from asymptotically smallest to largest. When two functions have the same asymptotic order, put an equal sign between them. Provide an explanation for your ordering.

$1,\ n^{\frac{1}{540}},\ (n)^{540},\ \sqrt{n+540},\ \log_n 540,\ log_{540} n,\ \frac{540}{n},\ 540n,\ n!,\ \frac{1}{\log n},\ \left(\frac{540}{549}\right)^n,$
$24^{100},\ n \log n$

~~**3.** [Algorithmic intuition, 50 points]~~
~~Write and briefly explain the following C++ function:~~

~~*long MaxProduct (string file);*~~

~~that accepts an input file containing sequences of integers. Each sequence starts on a new line, may continue on several subsequent lines, contains at most 100 numbers, and ends with the number -999999 (which is not part of the sequence).~~

~~The function outputs to the screen the maximum contiguous sub-sequence product of up to 3 numbers for each sequence, one output per line. A contiguous sub-sequence is a sequence of 1, 2, or 3 numbers that are consecutive in the input. It returns the maximum of all the outputs.~~

~~Sample input:~~
~~*1 2 3 -999999*~~
~~*-5 -2 2 -30 -999999*~~
~~*6 9 -10 1 -999999*~~

-8 -999999

Sample output:

6
120
54
-8
The overall max product is: 120

The *MaxProduct* method is a member function of the *MaxProductClass* class, which should be implemented in *MaxProduct.cpp* and declared in *MaxProduct.h*. Try to make your function as efficient as you can.

Submit your solution, in two files: *MaxProduct.cpp*, containing your function, and *MaxProduct.h*, which is required for your code to compile with the provided main file, *HW2_Q3_main.cpp*. Make sure to write your name in a comment at the top of the program, and verify that your program compiles with the provided file on the lab computers.

As a reminder, in order to compile multiple files on the command-line, you will need to use something like:

```
> scl enable devtoolset-10 bash
> g++ -std=c++17 main.cpp Problem3.cpp
```