Homework 2

Out: 9.21.16
Due: 10.3.16

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
4n log n	n log n + 5					
$2^{\log n}$	$(\log n)^2$					
n^n	n!					
n	$\sum_{i=0}^{\infty} \frac{50}{7^i}$					
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.

   $n^5 + 7n, 2^{10}, n \log n, (\log n)^{\log n}, \ln n, n, \sqrt{2}^{\lg n}, 4^{\lg n}, (n+1)!, 2^n$

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 numbers. 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 continuous sub-sequence product of up to 3 numbers for each sequence, one output per line. 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. 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.