Homework 1

Out: 9.7.17
Due: 9.19.17

1. [Sums, 20 points]
   Provide a closed-form solution to the following problems, along with a brief explanation.
   a) $\sum_{i=12}^{N} 5^i$
   b) $\sum_{i=0}^{\infty} \frac{3}{11^i}$
   c) $\sum_{i=1}^{N} (8i^2 - 21i + 9)$
   d) $\sum_{i=6}^{315} \frac{1}{i}$
   e) $\sum_{i=1}^{3^N} log_{18} i$

2. [Exponents and logs, 20 points]
   a) $x^{11} \cdot x^{12} \cdot x^{13} \cdots x^N$
   b) $log_{17}(47 \cdot 47 \cdot 47 \cdot 47)$
   c) $log_x((2x)^x)$
   d) $72^{log_{72}152}$

3. [Combinatorics, 10 points]
   a) How many 6-digit decimal numbers do not contain any digits smaller than 3?
   b) How many ways are there to pick 9 different numbers between 17 and 68 (inclusive)? Assume that the order doesn't matter.

For all of the programming problems in this class:

- Your programs must compile and run on the lab computers command-line interface, following the instructions provided in the discussion section:
  > module load gcc
  > gcc -std=c++11 (-o myProgram) myFile.cpp
- Make sure to write your name in a comment at the top of the program, along with your collaborator's name, if any.

4. [Programming I, 20 points]
   Write a C++ program which receives a file name as command line argument, reads all the lines of text in the input file, and prints out the longest line in the file. If there are multiple lines of the same length, the first longest line should be returned. That is, your program should have one single line of output, which is the longest line in the file. If the input file is empty (does not contain any lines) then your program should not print anything.

   For example, suppose that you compile your program to the executable *Problem4*, your program should be run from the command line as follows:

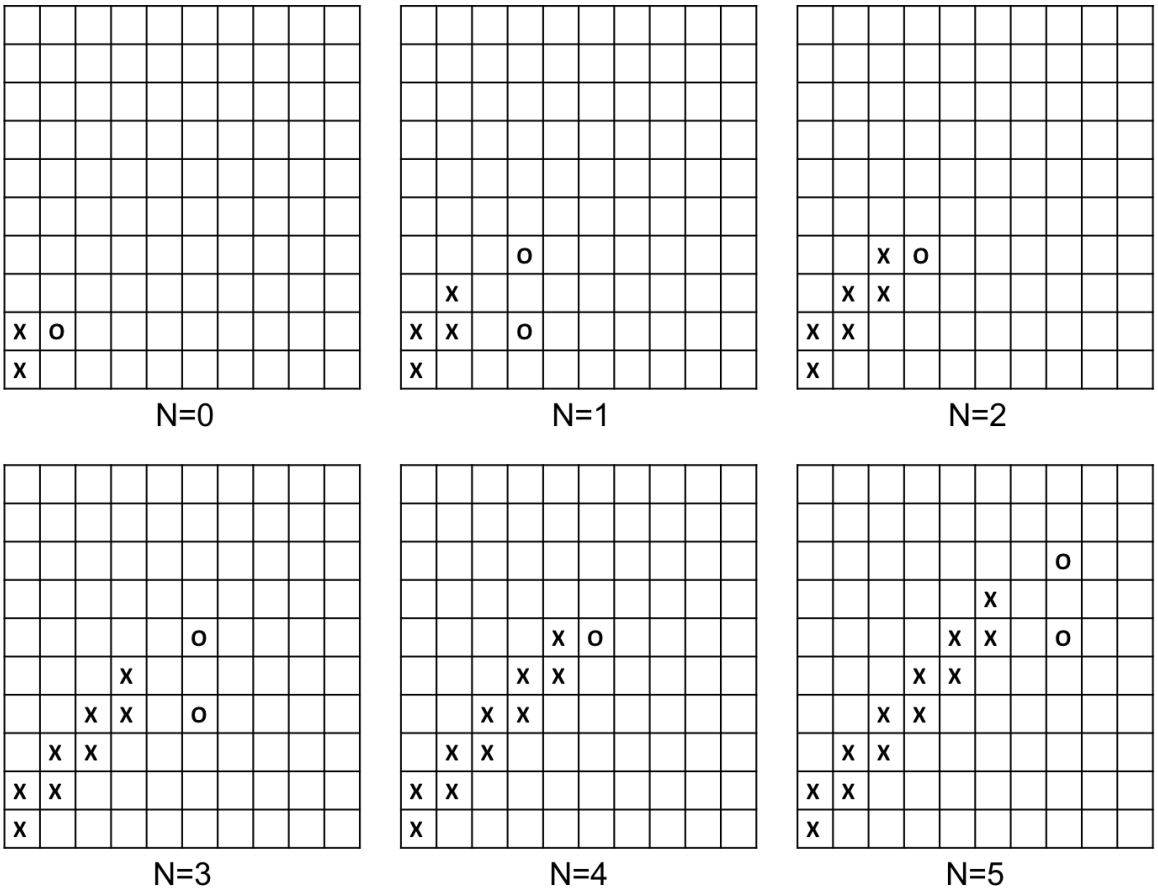
> *Problem4 TextFile.txt*

For the provided sample input file, *TextFile.txt*, your program should print the following output:

> *It then reads all the lines of text in the input file, and prints out the longest line in the file.*

Submit your solution in a single file, *Problem4.cpp*.

5. [Programming II, 30 points]
The diagrams shown below are the result of executing a function, with an input integer parameter 0≤N≤7, which draws Xs and Os on a 10x10 grid of white boxes.



a) Determine the algorithm used to create these diagrams, and write the algorithm in clear step-by-step English for any input N. Assume that the coordinates start from (0,0) on the bottom left. Your algorithm should work on any grid size, not just 10x10.

b) Write a C++ program which receives a positive integer N<=7 as input from the command line, and prints to the screen the corresponding 10x10 grid of blanks (underscores), Xs and Os.

Submit your solution in a single file, *Problem5.cpp*.