Homework 1

Out: 9.7.21
Due: 9.15.21

1. [Summations, 20 points]
   Provide a closed-form solution to the following expressions, along with a brief explanation. Show your work.
   a. $\sum_{i=12}^{n} 5^i$

   b. $\sum_{i=0}^{\infty} \frac{3}{11^i}$

   c. $\sum_{i=1}^{N} (6i^3 + 3i - 9)$

   d. $\sum_{i=91}^{760} \frac{1}{i}$

   e. $\sum_{i=0}^{\infty} \frac{i}{79^i}$

2. [Exponents and logs, 20 points]
   Simplify the following expressions, and provide a brief explanation.
   a. $x^1 \cdot x^2 \cdot x^3 \cdots x^{43}$

   b. $log_4(19 \cdot 19 \cdot 19 \cdot 19)$

   c. $32^{log_{32} 841}$

   d. $log_{49}((7x)^y)$

   e. $\sum_{i=1}^{3^N} log_{18} i$

3. [Combinatorics, 10 points]
   a. How many 12-digit hexadecimal numbers do not contain any letters?
   b. How many ways are there to pick three increasing numbers from a list of numbers from 5 to 32?

For all programming problems in this class:

- Your program must compile and run on the lab computers command-line interface as follows (note that the first command should only be ran once after opening a new terminal window):
  > scl enable devtoolset-10 bash
  > g++ -std=c++17 (-o myProgram) myFile.cpp
- Make sure to write your name and BU email in a comment at the top of the program, along with your collaborator's name and BU email, if any.

4. [Programming I, 20 points]
Implement the following C++ function:
int StringSearch (string filename, string pattern)

The function receives as input a file name for a text file containing English text, and a string of text. It returns the number of occurrences of the specified string in the file.

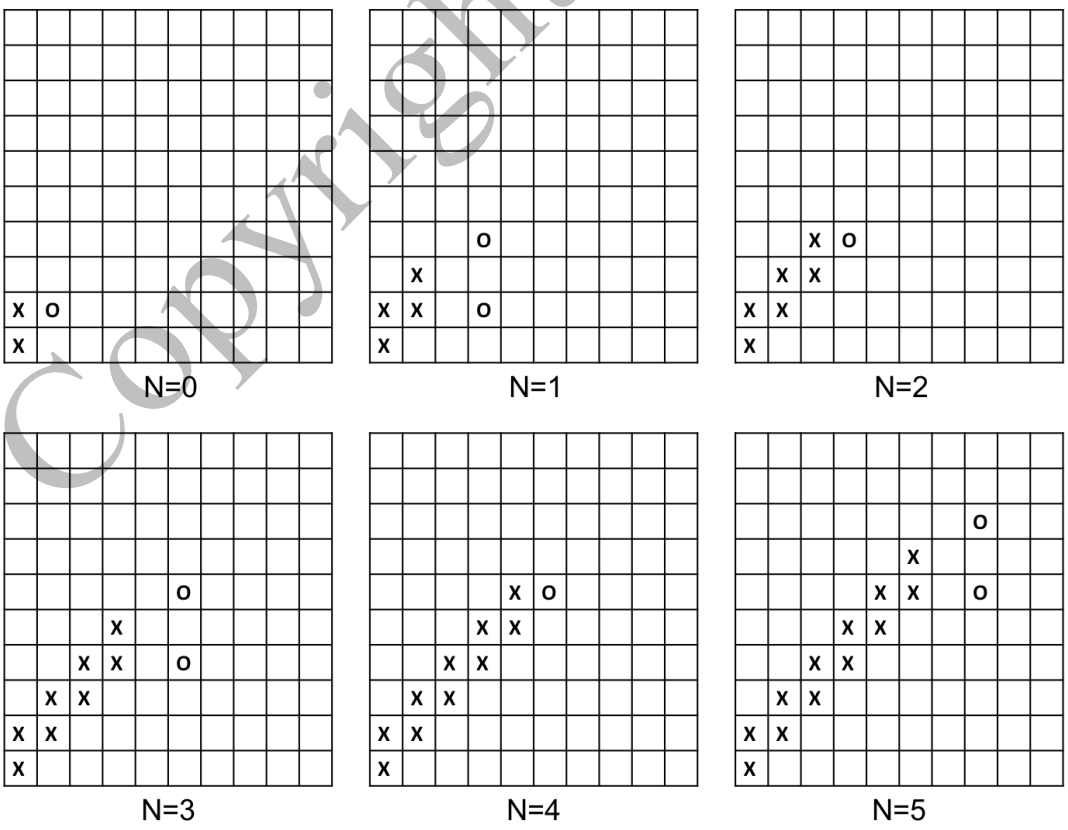
Your main function should receive a file name and a string from the command line, call the *StringSearch* function with the provided file name and string, and print out the output returned by the function.

For example, suppose that you compile your program to the executable *Problem4*, for the provided *TextFile.txt* file, and string "file " (note that the last character is space), your program should be run as follows:
> Problem4 TextFile.txt "file "

and should only print the output of the function, 6 in this case.

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 non-negative integer N<=7 as input from the command line, and prints to the screen the corresponding 10x10 grid of blanks, Xs and Os. Submit your solution in a single file, *Problem5.cpp*.