Homework 1

Out: 9.12.16
Due: 9.21.16

1. [Sums, 20 points]
   Provide a closed-form solution to the following problems, along with a brief explanation.
   a) $\sum_{i=3}^{30} \left(\frac{1}{8}\right)^i$
   b) $\sum_{i=0}^{\infty} \frac{9}{7^i}$
   c) $\sum_{i=1}^{N} (6i^3 + 3i - 9)$
   d) $\sum_{i=8}^{280} \frac{1}{i}$
   e) $\sum_{i=1}^{\infty} \frac{i}{32^i}$

2. [Exponents and logs, 20 points]
   a) $x^{21} \cdot x^{22} \cdot x^{23} \cdots x^{72}$
   b) $log_{24}(76 \cdot 76 \cdot 76)$
   c) $32^{log_{32}841}$
   d) $log_{49}((7x)^y)$
   e) $\sum_{i=1}^{3^N} log_{54} i$

3. [Combinatorics, 10 points]
   a) How many ways are there to pick 3 groups of 8 students from a class of 48? Assume that there is no order within each group.
   b) In how many ways can we choose three distinct numbers from the set {1, 2, …, 99} so that their sum is even?

4. [Programming, 50 points]
   Your programs must compile and run on the lab computers command-line interface. Make sure to write your name in a comment at the top of the program, along with your collaborator's name, if any.

   a) 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 *Problem4a*, for the provided *TextFile.txt* file, and string "function", your program should be run as follows:

> Problem4a TextFile.txt "function"

and should only print the output of the function, 9 in this case.

Hint: You may want to use the *c_str()* library function.
Submit your solution in a single file, *Problem4a.cpp*.

b) Implement the following C++ function:
void MergeFiles (string file1, string file2)

The function receives as input two file names, of files containing words, one per line, in alphabetical order. The function creates an output file, *output.txt*, which contains the merged content of the two input files, one word per line, in alphabetical order.

Your main function should receive two file names from the command line, call the *MergeFiles* function, and exit.

For example, suppose that you compile your program to the executable *Problem4b*, for the provided *words1.txt* and *words2.txt* files, your program should be run as follows:

> Problem4b words1.txt words2.txt

and should generate an *output.txt* file with the following content:

alphabetical
Containing
file
function
input
names
of
one
receives
two
words

Submit your solution in a single file, *Problem4b.cpp*.