Name: _____

PO: _____

COS 301: Exam 1 take home

Some things to note:

1. You must not talk to anyone else besides me about this assignment.
2. You cannot Google for solutions, but you can use any of the programs we wrote
3. Sign this statement: I did not talk to anyone else besides Dr. Thomas about this exam. The only resources I used were lecture notes, codealongs and homework assignments.

   Signed_____

This program generates an array of chars. Then it creates a set of threads to count the number of vowels in the array. The details are below.

1. Download the code on Moodle
2. You should be compiled it by saying g++ -lpthread Exam2.cpp -o Exam2
3. You will run the program by saying ./Exam 2 x y
   a. x = Number of threads
   b. y = Size of array

4. Run the program for the following combination of inputs and record your counts here

Input number	Number of threads = 1	Number of threads = 2	Number of threads = 2	Number of threads = 10	Number of threads = 10
100	a = e = I = o = u =	a = e = I = o = u =	a = e = I = o = u =	a = e = I = o = u =	a = e = I = o = u =
1000	a = e = I = o = u =	a = e = I = o = u =	a = e = I = o = u =	a = e = I = o = u =	a = e = I = o = u =

10000	a = e = I = o = u =	a = e = I = o = u =	a = e = I = o = u =	a = e = I = o = u =	a = e = I = o = u =
100000	a = e = I = o = u =	a = e = I = o = u =	a = e = I = o = u =	a = e = I = o = u =	a = e = I = o = u =

5. If the code worked correctly, you should see the same number of vowels in every execution (across the entire row). However, you may not.
    a. Explain why there is a difference between the number of vowels when the number of threads change

    b. Explain the difference (if any) between the number of vowels in the pairs of executions for Number of threads equal to 2 and number of threads equal to 10.

6. Fix the code by protecting the section that needs to be protected. Make it as efficient as possible. Since we have five elements that are shared (each of the five counts), you must use an array of five mutexes. They can be created as a static array

7. Also add in timing information, by adding the start of the clock right before the threads are created and the end of the clock right after all the threads are joined. Repeat the above experiments and fill in the results in the following table

	Number of threads = 1	Number of threads = 2	Number of threads = 10
100	a = e = I = o = u =	a = e = I = o = u =	a = e = I = o = u =

	Time taken	Time taken	Time taken
1000	a = e = I = o = u = Time taken	a = e = I = o = u = Time taken	a = e = I = o = u = Time taken
10000	a = e = I = o = u = Time taken	a = e = I = o = u = Time taken	a = e = I = o = u = Time taken
100000	a = e = I = o = u = Time taken	a = e = I = o = u = Time taken	a = e = I = o = u = Time taken

8. Comment on the time taken as the number of threads and input number increase.

9. Submit your updated code on Moodle. Print out and submit the writeup in my office by 4:00 PM. Slip it under my door if I am not available.