Name: \_\_\_\_\_\_\_\_\_Logan Passi\_  
Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* What is the benefit of having a multi-threaded web server? – 1pt

Once benefit is that it can handle multiple requests at a single time.

* If you are given an array of N numbers, and are asked to determine which of these numbers are prime which type of parallelism would you choose? Please explain. Hint: both is also an acceptable answer. – 2pt

Data parallelism because that focuses on distributing subsets of the same data. This means we could break up the array and work on parts of it at a time.

* Threading is a concept that may require some designing before you start developing (such as keeping threads in sync, managing threads, signaling threads etc). With implicit threading it hands off that implementation to the compiler. What do you think are some pros/cons to this approach? If such a feature was introduced to a popular language say C++ - would you use it?

(Microsoft has introduced such a feature into Visual Studio 2012 - <http://msdn.microsoft.com/en-us/library/hh872235(v=vs.110).aspx>

gcc seems to have such a feature since 4.3 - <http://wiki.apache.org/stdcxx/Parallelization>

Of course there is always the OpenMP library which appears to be built into compilers – but this requires explicit invocation) – 3pt

A pro to implicit threading is that you can let the compiler and runtime libraries handle the creation and management of threads. A con is that you do not have as much control over these threads. I have not thought about threading too much until recently while programming but if it was in C++ I would definitely try it and learn how to utilize it.

**If you put “ctrl + c” or “copy” for either of these questions you will receive an automatic 0. WHAT SIGNAL DOES CTRL+C SEND!**

**If you paste the system call prototype that you find off the internet of kill or pthread\_kill – you will receive NEGATIVE points on this assignment. That is plagiarism.**

**It sends the SIGINT signal which is a signal to interrupt the current running process.**

* Give an example of a signal that is delivered process wide. – 1pt  
    
  An asynchronous signal like SIGINT
* Give an example of a signal that is only delivered to a thread that generated it. – 1pt

A synchronous signal like SIGSEGV

* Give 3 cases where asynchronous thread cancellation can cause a problem – 3pt  
    
  If you are currently saving a file, if you are trying to run a file or if you are trying to delete a file.
* Under Linux is there a difference between a process and a thread? -1pt  
    
    
  They are almost the same but threads share the same virtual memory address space.

Extra credit:

* Multithreaded sorting application (from book) – 4pt

Write a multithreaded sorting program that works as follows: A list of integers is divided into two smaller lists of equal size. Two separate threads (which we will term sorting threads) sort each sublist using a sorting algorithm of your choice. The two sublists are then merged by a third thread—a merging thread —which merges the two sublists into a single sorted list.

Because global data are shared cross all threads, perhaps the easiest way to set up the data is to create a global array. Each sorting thread will work on one half of this array. A second global array of the same size as the unsorted integer array will also be established. The merging thread will then merge the two sublists into this second array. Graphically, this program is structured according to Figure 4.20. This programming project will require passing parameters to each of the sorting threads. In particular, it will be necessary to identify the starting index from which each thread is to begin sorting. Refer to the instructions in Project 1 for details on passing parameters to a thread. The parent thread will output the sorted array once all sorting threads have exited.

Hint: A suggestion might be to perform a sort algorithm, then use the merge sort algorithm in the merge thread. For your convenience I have implemented some algorithms in different languages here: <https://srchub.org/p/algorithms/source/tree/tip/>

