

CS4410: Homework 1. Due 9am Feb. 2 via CMS

Ten sub-parts, 10 points each. Short answers: one or two sentences each should suffice. Long rambling answers may have points deducted even if they somehow mention the correct solution!

Q1. Suppose that you plug a new disk into your laptop and boot the machine. But when you try to access the disk, the whole machine freezes, including the power button – the only way to restart it is to physically remove the battery, after which it finally comes back to life. Explain in one or two lines if each of these is a possible culprit:

1. A hardware problem with the disk controller.
2. A bug in the file system browser, which runs in user-mode.

Q2. You are using FireFox. Everything was working properly yesterday, but then your machine crashed. Now FireFox hangs when you run it. With “process explorer” you can see that it is rapidly issuing file I/O operations (very rapidly: about 10,000 per second!). The only open file is called “firefox.cnf.” This file exists, and can definitely be accessed by the application. On the other hand, the file looks a bit strange (it is a small text file, the line of which seems to be truncated).

3. What would be the likely consequence of changing the scheduler priority of FireFox to the maximum value supported by the operating system? (You may assume that this would be higher than the priority of any other process, including the command interface).
4. Presumably, the file was damaged by the crash and this is the root cause of the problem. But what’s your best guess as to why FireFox is performing so many system calls?

Q3. FireFox is a “multi-threaded” program.

5. Is the number of threads FireFox can create limited by the number of cores on your computer?
6. Describe a situation in which, if it were up to you, you would have coded FireFox to create an additional thread. What would be the benefit of doing so?
7. FireFox is an Open Source application. You download the source code and, just for fun, decide to add a new feature. Your new code tries to change the color of a button on the screen from green to red. It compiles, but when tested, throws the following exception: “Windows control can only be updated by the thread that created it.” (NB: a button is a “Windows control.”) Make a guess as to why the Windows O/S imposes this restriction.
8. Suppose that thread A creates a button, and thread B later needs to recolor it. How can thread B do so, in light of the restriction mentioned in (3)?

Q4. Linux and Windows both have system calls for sharing memory between distinct processes.

9. Why is a system call needed for this purpose?
10. Does the same issue arise when two threads share memory, in a single process?