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Homework 1

a. **What functionality does an operating system provide?**
Operating systems like Linux and Windows provides a number of services to users. A few important ones include managing resources, providing hardware abstractions, and providing a secure, stable environment. The end user generally doesn't care about how much memory is being used, how many cores are running on their CPU, etc. They want their applications to work as needed. Operating systems manage the interaction between hardware and software for the end user. In line with this is the fact that operating systems abstract away hardware differences. Whether a computer has so much memory that it doesn't need a hard disk, and has a 8 core processor, or whether it's running off a low speed hard drive with barely enough RAM for the OS, things should still work mostly the same. Finally, the operating system protects the user from accessing things that they don't need to. In Unix-based systems (and in some way, on Windows systems), there is a clear and hard separation between kernel space and user space, allowing the user to modify their own files and applications, but not system utilities and settings.

b. **When do context switches from user-mode to kernel-mode occur on a single processor system?**
In a single processor system, context switches like this would happen if a user has more than one running process. The system needs to call an interrupt on one process in order to let another execute. It also occurs when an interrupt is required, such as reading from a file; the system doesn't need to wait for the read to be finished - it can just interrupt when the read is finished and show the results. Finally, any time a user needs access to privileged instructions, the context switches from user to kernel mode.