**CMSC 412 Homework 1**

1. **Compare and contrast System Software and Application Software. Give an example of each.**

Both system software and application software are programs that utilize the computer’s processor in order to perform some sort of function, however they are different in many ways. System software works closely with the computer’s hardware and is installed as part of the operating system. It provides services that execute in the background and are not directly controlled by the user. It also serves as the foundation on which application software can run. Examples of system software are: the operating system, hardware drivers, compilers, debuggers, and system utilities.

Application software on the other hand, is installed by the user on top of the system software and performs functions that are directly controlled by the user. Application software is dependent on system software in order to run, but the reverse is not true. Examples of application software include: web browsers, video games, media players, antivirus software, and word processors.

1. **Abstraction is an important quality of an Operating System. Explain how Operating Systems and abstraction are related.**

The term abstraction is defined as the process of removing or narrowing specifics among different things in order to highlight details of higher importance to create a unified concept or outcome. In computer science, this often known as “modeling” and is used to conceptualize how similar programs should run logically as opposed to physically; ignoring a lot of the technicalities. This is especially important as it relates to operating systems.

Operating systems interface all sorts of system and application software that utilizes various hardware. Since hardware has many different specifications and is often interchangeable, it’s essential that the operating system can streamline an application’s interface with certain types of hardware. For example, an application that requires the use of a sound card should not be bothered with the inner workings of all the sound cards that exist on the market. Instead, the operating system handles the work of the sound card and limits an applications involvement to functional requests.

1. **Why do user applications not run at the kernel layer?**

User applications cannot run at the kernel layer because the kernel layer is the lowest layer above the processor and is where core aspects of the operating system such as networking, file management, hardware drivers, memory resources, and CPU resources are managed. These resources are allocated to an application depending on the request of that application. This divide is essential to the operating system because it prevents unlimited access to all of the system’s resources and provides only the necessary resources to be used by a user application. This also allows for multiple applications to share the computer’s resources more evenly. Most importantly, it keeps critical resources such as certain memory areas (like the one with the kernel’s code) out of reach of any user application. You wouldn’t let just anybody have the keys to the city.