Quiz 1: 12 Points

1) Define briefly what an Operating System is? (2 Points)

An operating system provides the following (i) a user friendly environment for using the computer system (ii) an interface that abstracts the complexity of underlying hardware and software (iii) a control program that manages execution of programs and (iv) a resource manager for various resources on a computer system.

Note: Any 2 of these should be fine.

2) Which of the following should be privileged (i.e. should be done by special permissions), or unprivileged (any process should be able to do this) and why? Hint: Yes, the OS does things on processes' behalf but not everything needs security checks.

a) Read the time and date

b) Declare a variable for filename

c) Save a file

d) Dim the computer screen

(4) Points

The background to this is realizing that system calls are used throughout program code (either directly or indirectly). However, there are some tasks for which a computer OS will ask for more security credentials before executing the request. For example, if you wrote a program to write to a file, it will not need any administrator to come in and allow you to save the file (depending on location but usually no need if it saves to user space). However, some things (e.g. install software) will need the OS to check on the privileges before continuing.

From the list provided, most programs can read date and time, declare variables, and save files. (a,b,c)

However, to dim the screen of the computer, it will need privileges.

Historically, there have been wild swings between making users aware of privileged actions and hiding the details. For example, Windows Vista did ask the end-user to confirm whether to allow programs to perform tasks (usually to do with installation or changing system configuration).

These days, there is an option to turn down the number of notices received by the user. Currently, cell-phones are going through the same issues. Current software on most phones will ask user to confirm the privileges being granted to a program. Some programs do not need any extra permissions (i.e. access to contacts, access to location, access to camera) so it hints at what the OS considers privileged.

Finally, note that the definition of privileged has been changing. For example, Android always had a setting to disallow reading/writing to SD cards. However, due to the bad behavior of some

software, version 4.4 of android and above no more allow programs or processes to access anything outside their installation folders. If a program asks for a while, the OS handles the file picking process. If you have a standard "My Files" explorer in android, it can read the SD card (i.e. external card) but most software are limited to just their own installation folders.

Perhaps, in future, things may change, but the trend is likely to be toward more secure practices/behavior.

Reason why the read date time is not privileged is that knowing date and time is not a security issue to the system or to other processes. Another example of information that it can share/read freely is OS name, and OS version. Other types of information such as the file IDs of which files are open by others is not allowed.

Declaring variable for filename is in your own memory. The process already has access to and control of its memory space so no further permissions necessary.

Note that saving file had 2 cases. 1 case concerned files in privileged folders (e.g. system folder, shared binary folder, driver folder, etc). The other case, concerned files and folders available to the user currently running the process. It is assumed the user started the process so it implicitly allows access to the files of the current user.

Dimming screen is a security issue as are most other commands to control screen or keyboard. This is due to the security of having access or control of the screen arbitrarily. It is okay to control what is happening in your own window, but you cannot easily control what is happening in other windows if the processes are not communicating with each other. Dimming the screen can enable a poorly behaving program to prevent viewing of information on the screen or override power management.

Note: Most people left out the reason for their choice, so they had half the allotted point. It is incorrect to say that a process is *privileged* because it involves the operating system. *Unprivileged* processes may also involve the operating system.

3) Give at 2 important reasons why an OS to manage memory instead of allowing processes to do as they please with the entire system memory? (2 Points)

The two reasons are to ensure (a) protection of programs from themselves or malicious behavior (b) good use of memory because if OS manages the memory it has a better chance of making sure that it coordinates the scheduling of different parts of memory so programs can have fair access to it. One part is on security, and another part is fairness. Fairness is important as it is not just about picking memory to run. Many students said using memory, but that is not same as fairness.

Note: Students must be specific. For example, it is not enough to say, "…to ensure efficiency of the system". Some students only repeated the question in their own words without really answering it.

4) Why not have a cache just as large as the hard risk. (2 Points)

The main reason cache is not as large as hard disks are physics and cost. Any of them are okay. The cache is expensive, so it has historically been difficult to simply build cache as large as hard-disks. Similar applies to memory.

The physics argument has to do with how fast a device can be based on its size and the components. The caches tend to be very small, and the larger it gets, the more circuits will be needed to pass information along and determine how to get and put data into the cache. As far as physics, if the cache gets too large, it may not be as fast anymore as it will need more and more cycles to get the data from one part of the cache to another part of the cache.

These are what I have so far, if someone has others, it may be a variation. If you are not sure, please indicate so I can look through.

Note: Students must be specific. Again, cannot just say efficient.

5) Differential b/n client-server and peer-to-peer models. (2 Points)

Client-server are systems where one type of node pushes information to other nodes in terms or request and responses. The types of requests tend to go one way. For example, for a web server and web browsers, the browsers tend to ask the web server for pages and the web server responds with the HTML or content of the pages. It is not the case that the web server will ask for a web page from a browser.

For a peer-to-peer system/model, the types of requests/response can go both ways. For example, in a file-sharing P2P system, a computer may both ask for music or content, as well as send music or content. This means the role of any node in a peer-to-peer is to be both server and client depending on whether they are responding to a request, or making a request themselves.

Note: Having security credentials is not only limited to server-client models. Also, you do not differentiate between the two models if you talk about the cost, when or where the models are used. Also, the issue of cost depends on the types and cost of data transfer. In some countries, it may be cheaper to sent information to and download from a server, than to send information between 2 people in the same country.