1. The issue of resource utilization shows up in different forms in different types of operating systems. List what resources must be managed carefully in the following settings [6 marks]:
2. Mainframe or minicomputer systems

For mainframe computers, there are many resources that must be carefully managed. The main ones are the CPU, GPU, RAM, and storage.

1. Workstations connected to servers

For workstations, similar to mainframe computers, CPU, GPU, Ram, and storage but also the network and bandwidth must be managed.

1. Mobile computers

For mobile computers, battery and power usage must be managed in addition to the other things like CPU, GPU, ram, and storage usage.

1. Q2:  Describe the differences between symmetric and asymmetric multiprocessing. [2 marks]

In asymmetric multiprocessing, you’ll have one “master processor” that will tell every other “slave processor” what to do and when. In other words, the master processor is coordinating the workload of the other processors and it is the only one that is running the tasks of the OS.

In symmetric multiprocessing, there is no “master processor”, instead every single processor (or core) operates like a master processor and does tasks in the order it receives from the OS.

1. Q3:  What are three advantages and one disadvantage of multiprocessor systems? [6 marks]

The advantages of multiprocessor systems are they are generally much faster than single processor systems because they can divide the work among multiple processors. They are more reliable, and have a better performance to cost ratio. A disadvantage is some software is no optimized to appropriately use the additional processor/cores.

1. Q4:  What is the purpose of interrupts? How does an interrupt differ from a trap? Can traps be generated intentionally by a user program? If so, for what purpose? [6 marks]

The purpose of an interrupt is to interrupt the CPU from whatever is doing and evaluate why an interrupt was signalled from either hardware of software. When an interrupt is generated by hardware, we tend to call it an interrupt but when it is generated by software we tend to call it an exception or trap. Traps can certainly be generated by software, and they can be generated perhaps to signify something has gone wrong in the program.

1. Q5:  Describe the mechanism for enforcing memory protection in order to prevent a program from modifying the memory associate with other programs. [3 marks]

The mechanism is called Operating System Services or Functions. Once of these services is responsible for ensuring access to system resources is controlled which prevents applications from taking up memory that is not allocated to them.

1. Q6:  Identify several advantages and several disadvantages of open-source operating systems. Include the types of people who would find each aspect to be an advantage or a disadvantage. [8 marks]

One advantage of open-source software is that its source code is freely available so programmers can study it, improve it, and share their improvements freely. Another advantage is since there are many eyes looking at the code, bugs may be fixed at a faster pace than closed source alternatives. Someone who would appreciate open-source software is a programmer who enjoys improving software or wants to make software to help other people at no cost. There are many open-source projects that are not interested in profits but rather improving the digital world.

One disadvantage is because anyone can share their modifications, it could be prone to bugs depending on who created it.

1. Q7:  What is the separation of mechanism and policy and why is it desirable? [4 marks]

Mechanism refers to how to do something, while policy refers to what will be done. The separation is all about abstraction, and its useful for the same reason abstraction is useful in OOP. The policy or implementation can be changed multiple times while the mechanism or concept can stay the same. This makes the system more robust and maintainable.

1. Q8:  How are iOS and Android operating systems similar? How are they different? [4 marks]

They are similar because they were both creating using a layered approach, although their layers are not the same. In terms of functionality, they both do a lot of the same things including allowing touch screen, messaging, cellular calling, GPS etc.

A major difference between the two is iOS is a closed system that is heavily restricted, whereas Android is more open. This allows Android to be much more customizable compared to iOS devices.

1. Q9:  Explain why Java programs running on Android systems do not use the standard Java API and virtual machine. [2 marks]

Instead of using the standard Java API, Java programs running on Android will use the Dalvik Virtual Machine. This allows for more specialized functionality including memory management, power management, and other performance enhancing features.

1. Q10:  Define short-term, medium-term, and long-term scheduling and explain the differences between each. [6 marks]

The short-term scheduler decides which program is suitable for processing. It is referred to as the CPU schedule and is the fastest of the three. The medium-term scheduler is in charge of removing processes from memory in order to make space for other processes. It will move the processes out of main memory and into secondary storage. The long-term scheduler is called the Job Scheduler and it will decide which program is selected to be processed at any given time. Programs are added to a queue and will be selected FIFO.

1. Q11:  Describe what actions are taken by a kernel when if performs a context-switch between processes. [2 marks]

The kernel will need to save the current context (or state) of whatever it is doing on the CPU. Then the scheduler will determine what the next process to be executed is. Once that process is finished executing, a restore operation will take place to restore the previously interrupted process to resume from where it had been interrupted.

1. Q12:  Explain the circumstances under which the line of code marked printf("LINE J") in the code below will be reached. [1 mark]

It will be printed when you are trying to fork a child process but the directory in which you are searching is empty.