List of the Possible Questions

#1: What are the six main OS functional components CS314 (Spring 2023) covers?

- Process management
- I/O device management
- Memory space management
- User management
- File management (“file systems”)
- Security and reliability support

#2: What are the two primary roles of operating systems?

- Operating systems as middlemen (i.e., extended machine)
- Operating systems as governments (i.e., resource managers)

#3: What are the typical three structural layers in a computer system?

The typical computer systems consist of the three layers of (1) the hardware layer, (2) the operating system layer, and (3) the application layers (as shown below).

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Computer Hardware

Operating System

Application Programs
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#4: What is “extended machine”? This question does not ask how we can use extended machine. A definition of “extended machine” is needed.

The term, “extended machine”, means imaginary computer systems that can be manipulated by “high level commands”, which is theoretically impossible to have without an operating system. It is because none of the hardware components in a computer system understands any high level commands issued by human users. However, by having an operating system on top of computer hardware, such a computer system can be manipulated even by high level commands with the help from an operating system. Today, virtually all (decent) computer systems are “extended machine”.

#5: What does “high level commands” mean (in computer science in general)? What does “low level commands” mean?

High level commands (used for computer systems) mean those are close (similar) to human languages in that:

- They specify what you want (i.e., what should be performed by a computer system).
- Easy for (human) users to understand.

Low level commands are opposite of high level commands (close to hardware) in that:

- They specify how the tasks should be performed (instead of what).
- Hard for (human) users to understand.

#6: What are “multi-tasking systems”?

Multi-taking is a way computer systems execute computer programs in such a way that (1) a processor executes one program at a time, but a computer system provides human users (2) an illusion of multiple computer programs seemingly running all at a time, when (3) a processor switches execution of computer programs in extremely short time intervals (e.g., 1/100 of a second each).

Note: For a solution to earn full credit for this question, it is expected that one should cover all the three different properties in multi-tasking.

#7: What is “context switching”?

As also covered in CS286, context-switching is the act of switching a processor from one program to another (the program a processor is switched away will stop running and the program a processor is witched to will start running).
#8: What was the primary disadvantage and advantage in “Pre Operating System (no OS)”?
Mention at least (primary) one for each of the primary disadvantage and advantage.

The primary disadvantages in “Pre Operating Systems” are:

- Each human user who is using a computer system should (need) attend the computer system from the beginning to end (e.g., a user needs to manually load a program, a user needs to manually start a program, and a user has to wait for his/her program to be finished at the computer system for the user to manually download the outputs from the program).
- Hardware (processor) utilization is usually poor. For example, when a user program starts waiting for user’s inputs, the processor stops running the program (since there is no other program which can utilize the processor).

The primary advantage in “Pre Operating Systems” is:

- Each user program will run as fast as it can, since each user program can use all the hardware resources available at each computer system.

#9: What is “batch system”? Show how a computer host with a typical batch is organized.

A batch system is a computer system that has “the program loader” on top of “Pre Operating System”.

#10: Briefly describe what problem in “pre operating system” a batch system fixes and how.

The batch system was introduced to eliminate the problem of “attending a computer system” in “pre operating systems”. Since the program loader automatically starts the next program in the “user program buffer after a previous program finishes running (the batch system also automatically saves the outputs of each program as soon as one finishes running). Thus, using a batch system, human (computer) users are no longer required to attend a computer system while a computer system is executing the user’s programs.
#11: What are the two primary problems in batch system?

- Since a processor still executes one program at a time, when a user program stops running, waiting for any external inputs (inputs from users through a keyboard or inputs from storage devices, such as hard drives), the processor will stay idle, making the utilization of a processor poor (low).

- If a user program stops running in its middle (i.e., “bugs”), a batch system stops running the program, kicks out the program from the memory (most of the existing batch systems save their intermediate outputs to “core dumps).

#12: What problem in “batch system” do “multi-programming (multitasking) OSes” fix and how?

#13: What problem in “multi-programming (multitasking) OSes” do “multitasking timesharing OSes” fix and how?

#14: Look up the meaning of the following word using your textbook: “degree of multitasking”.

#15: What is “process”?

#16: Describe how processes differ from programs by mentioning at least three differences between them.

#17: What does “PCB” stand for? Why do operating systems need PCB?

#17: Mention at least five different information contained in a PCB (you do not have to describe them).

#18: What is “monolithic structure OS” (define the one)? Mention at least one primary advantage and disadvantage.

#19: What is “layered (or modularized) structure OS” (define the one)? Mention at least one primary advantage and disadvantage.

#20: What is “Virtual Machine” (define the concept)?

#21: What is the primary motivation(s) to use VM’s?

#22: Sketch how VM is implemented in memory.

#23: Look up the meaning of the following word using your textbook: “OS kernel”.

#24: Many operating systems use “external commands”. What are they? What is the primary reason to adopt them? What is the primary difference between “external commands” and
“micro-kernel architecture”?

#25: Describe how “micro-kernel architecture” and “non micro-kernel architecture” are different in how system calls issued by user applications will be executed.

#26: What are the advantages in using “micro-kernel architecture”? What is the primary disadvantage in “micro-kernel architecture”? 

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CS314 Operating System, Spring 2023 – List of the possible questions for Quiz #1 (January 17, 2023)