Operating System Lecture 6

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Question 1: Complete the Sentences

1- The operating system acts as an intermediary between the __User__ and the __Computer hardware__ .

2- The bootstrap program is stored in __ROM__ and is responsible for __loading the operating__ .

3- A program becomes a process when it is __starts execution__ .

4- The two main modes of CPU operation are __User mode__ mode and __Kernel mode__ mode.

5- In asynchronous I/O, the CPU __executing other tasks__ while the I/O operation is in progress.

6- Multiprogramming increases CPU efficiency by __executing multiple jobs__ .

Question 1: Complete the Sentences

7– The system bus connects ___CPU___, ___memory___, and __I/O devices

8– A dual-core processor means ___Two CPU cores on one chip___.

9– The operating system is said to be __Interrupt__-driven because it reacts to signals from hardware or software.

10– Deadlock occurs when __Two or more processes wait for each other's resources

Question2: Name the Definition

1- A program that initializes hardware and loads the operating system during startup.

Bootstrap Program

2- A temporary storage area that keeps frequently used data for faster access.

Cache

3- Hardware signal that temporarily stops CPU execution to handle an event.

Interrupt

4- Memory that loses its contents when power is turned off.

RAM.

5- A unit of work within the system; an active program.

Process

6- A system that uses multiple CPUs sharing one memory.

Multiprocessor System

Question2: Name the Definition

6- A system that uses multiple CPUs sharing one memory.
Multiprocessor System

7- The smallest, fastest type of memory used to store temporary data inside the CPU.
Register

8- The CPU mode that allows full hardware access and executes privileged instructions.

Kernel Mode

9- The method by which OS decides which process gets the CPU next.
Scheduling

10- A table that holds the addresses of all interrupt service routines.
Interrupt Vector

Question 3: Find and Correct the Mistake

1- The operating system runs in   User mode to access all hardware   .

kernel mode **Or** **User Apps**

2- ROM is volatile memory that loses data when power is off.

RAM

3- Asynchronous I/O means the CPU must wait until I/O finishes.

Synchronous   or **the CPU continues other work**

4- Multiprogramming allows only one process in memory at a time.

multiple processes in memory

5- A process and a program are the same thing.

A program is passive; a process is active

6- Kernel mode is used for regular user applications

    User Mode or **Hardware access**

7- Deadlock prevention means the OS allows deadlock to occur and then fixes it.

    Deadlock Detection

8- In symmetric multiprocessing, one CPU is the master and controls all others.

    asymmetric

9- Caching makes data access slower by adding extra steps .

    faster

10- The bootstrap program is stored in main memory (RAM).

    ROM

Question 4: Short Answer

1- Why does the operating system use dual-mode operation?

Answer: To protect the system by separating user code (limited access) from kernel code (full access).

2- What happens when the counter interrupt reaches zero?

Answer: The CPU stops the current process and returns control to the operating system.

3- Give one reason why Direct Memory Access (DMA) improves system performance?

Answer: It transfers data directly between memory and device without CPU involvement.

4- What is the main difference between deadlock avoidance and deadlock detection?

Answer: Avoidance prevents potential deadlocks before they happen; detection finds and resolves them after they occur.

5- Why does the OS use process synchronization?

Answer: To prevent processes from interfering with each other when accessing shared resources.

Question 4: Short Answer

6- Give an example of a hardware interrupt and a software interrupt.
Answer: Hardware → Keyboard input; Software → Division by zero trap.

7- How does multiprogramming improve CPU utilization?
Answer: It ensures the CPU always has a process to run while others wait for I/O.

8- What role does the mode bit play in CPU operation?
Answer: It indicates whether the CPU is running in user mode (1) or kernel mode (0).

9- When a process is paused by the OS and later resumed, which process management activity is this?
Answer: Suspending and resuming processes.

10- Sort storage hierarchy based on speed.
Answer: Registers, Cache, Main memory, SSD, Hard disk, Optical disk, and Magnetic tapes

Question 5: Comparison

1- Compare between Main Memory and Hard Disk based on function, speed, and type.

Feature	**Main Memory (RAM)**	**Hard Disk**
Function	Stores data and programs currently being used by the CPU.	Provides long-term, storage for files and applications.
Speed	Very fast access time.	Much slower access time.
Type	Volatile – data is lost when power is off.	Non-volatile – data is retained after shutdown.

Question 5: Comparison

2- Compare between *Synchronous I/O* and *Asynchronous I/O* based on control return to the user and CPU behavior.

Feature	Synchronous I/O	Asynchronous I/O
Return of Control	Control returns to the user after the I/O operation completes.	Control returns to the user immediately after the I/O starts.
CPU Behavior	CPU waits or loops until I/O finishes (no overlap).	CPU continues executing other tasks while I/O runs (overlap occurs).

Question 5: Comparison

3- Compare between *Single-Processor Systems* and *Special-Purpose Processors based on Definition and give an example.*

Feature	Single-Processor System	Special-Purpose Processors
Definition	System with one general-purpose CPU that executes all user and OS instructions.	Beside CPU, additional processors designed to handle specific.
Example	Simple desktop or embedded system.	GPU (graphics), I/O processor, or network processor.

4- Compare between *Symmetric Multiprocessing (SMP)* and *Asymmetric Multiprocessing (AMP) based on design, Control, Flexibility, and performance .*

Feature	Symmetric Multiprocessing (SMP)	Asymmetric Multiprocessing (AMP)
Design	All processors are equal and perform any task.	One master processor controls the others (slaves).
Control	Shared control under a single operating system.	Master assigns specific tasks to slave CPUs.
Flexibility	More flexible and balanced workload.	Simpler design but less flexible.
Performance	Better — any CPU can take over another's task.	Lower — master CPU is a single point of control.

Question 5: Comparison

5- Compare between *Asymmetric Clustering* and *Symmetric Clustering based on Design, and operation.*

Feature	**Asymmetric Clustering**	**Symmetric Clustering**
Design	One node is active; another is on standby (hot backup).	All nodes are active and share the workload.
Operation	Standby node becomes active only if the main node fails.	Each node performs work and monitors others simultaneously.

Thank you