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Cse321

Operating Systems

Theory Take-Home Quiz-1

Name: Ms Rodsy Tahmid

Id: 20101021

Section: 12

Faculty: Mohammad Badrul Hossain [BDH] Sir.

Deadline: 30 Jan 2024 (Hardcopy → class time).

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Q1) Before playing a game you have updated your graphics driver and adjusted the screen resolution from settings. Then you have launched the game and started recording the screen using a third party recorder. Specify what types of softwares you have used here. Relate them with proper logic. [2 marks]

Ans: To update my graphics driver, graphics driver update software is used. This ensures that my computer's graphics card is compatible with the latest features and improvements. It gives optimum performance in games.

To adjust the screen resolution from settings, system settings or graphics settings is used. This allows us to customize the display settings according to my preferences or requirements of the game. It can affect the visuals during playing.

We have launched the game using a game launcher like Steam. This software manages and launches the game. It ensures that the game starts with the correct configurations and settings, including those related to graphics and resolution.

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Ans 1)

We started recording the screen using a third-party screen recorder to record the screen during gameplay, for example, like OBS Studio. The screen recorder allows us to capture and save the gameplay footage. This can be useful for creating videos, sharing gameplay experiences, or analyzing our performance. It operates independently of the game and captures everything displayed on the screen.

So a total of 4 softwares have been used.
We have used graphics driver update software to ensure compatibility and performance, adjusted screen resolution through system settings or graphics settings for optimal display, launched the game using a game launcher, and recorded the gameplay using a third-pairty screen recorder to capture and share our gaming experience.

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Q2) Briefly explain about kernel and its necessity.

Ans:
- Kernel is the one program running at all times.
- Kernel is the nucleus of an operating system
- It is the central module/ a core part of an operating system that keeps the operating system functional.
- It is the part of operating system that loads first, and it remains in main memory (RAM); meaning kernel is inside RAM.
- The smaller the size of the kernel, the better a PC will run because the kernel occupies a portion of RAM and always runs after turning on the PC.
- Kernel provides all the essential services required by other parts of the operating system and applications and all important tasks happen in kernel.
- Kernel code is usually loaded into a protected area of memory to prevent it from being overwritten

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by any malware software or hazardous code.

- If we turn off PC, everything loaded in kernel will be cleared.

Q3) Explain logically why main memory is typically volatile? [2 marks]

Ans: Main memory or RAM is typically volatile because :-

- Volatility allows quick and easy access to data. Since RAM is used for the temporary storage of actively running programs and data, quick read and write operations are crucial. It allows rapid data retrieval and modification.
- RAM is designed as temporary storage that holds data and instructions actively being used by the CPU. The temporary nature of RAM allows for efficient data management without the need for permanent storage characteristics.
- RAM stores dynamic content, i.e data in the form of electrical charges. Volatility ensures that the

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stored data is dynamically maintained as long as power is supplied.

- Volatile memory is cost-effective and less complex compared to non-volatile memories like hard-drives.
- Volatile memory allows rapid and frequent overwriting of data, which is essential for the dynamic nature of computing. Programs frequently need to read and write to RAM during execution and the ability to quickly overwrite data without concerns of wear or endurance is a critical feature.

Q4) Explain how modern OS are interrupt driven? [1.5 marks]

Ans: Modern operating systems are interrupt-driven, meaning they rely on the use of interrupts to manage and respond to events in a computer system, by :-

- event handling. An interrupt is a signal or event generated by hardware or software that halts

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normal sequence of execution of instructions in a CPU. Modern operating systems use interrupts to handle various events and conditions, including hardware events such as a keypress or mouse movement, or software events such as a time reaching zero.

- Interrupt Service Routine (ISR). When an interrupt occurs, the CPU immediately stops its current execution and transfers control to a specific code known as ISR or interrupt handler. The ISR is a specialized routine designed to handle the specific event or interrupt that occurred.
- Asynchronous Operation. Interrupt-driven systems operate asynchronously, allowing the CPU to respond to events without actively polling or waiting for them. This asynchronous nature is more efficient than a polling-based system because the CPU can continue executing other tasks while waiting for interrupts to occur. This is more efficient and responsive than polling.

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- Priority Handling: Modern OS support multiple types of interrupts, each with its own priority level. The OS prioritizes and manages interrupts so that critical tasks are handled first. Higher-priority interrupts can take precedence over lower-priority ones, allowing the system to respond quickly to urgent events.
- device drivers and hardware interaction. In managing hardware interactions through interrupts, device drivers play a crucial role. When a hardware device, such as a disk, completes an operation or requires attention, it generates an interrupt. The corresponding device driver's ISR is then invoked to handle the specific event.

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Q5) In a doctor's chamber potential patients need to follow 2 steps in order to consult the doctor. First, they have to take a serial over the phone. If they get ~~serials~~ serials then the first 20 patients of the seriel get called for the consultation. After getting called, patients need to maintain a queue of 5 pupils according to their serials and others need to wait. Once a patient gets called by the doctor, a patient from waiting can join in the queue according to the serial. Logically explain which functions from operating systems structure have similarities with the above scenario? [3marks]

Ans: The functions from the operating systems structure that have similarities with the above scenario are:

- process scheduling. The process of taking a serial over the phone and calling the first 20 patients for consultation is similar to process scheduling in the OS. The OS scheduler decides which processes (in this case, patients) get CPU time (in this case, consultation time with the doctor). The scheduling

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ensures fairness and optimal utilization of resources.

- queue management. The maintenance of a queue of 5 patients according to their serials is similar to queue management in operating systems. The operating System often manages queues for processes waiting for CPU time or other resources. In this scenario, the queue represents the order in which patients will be called for consultation.

- interrupt handling. When a patient gets called by the doctor, it's similar to an interrupt being generated. The OS must handle this interrupt and adjust the state of the system accordingly. In this case, the interrupt involves a change in the state of the consultation process.

- memory management. While not explicitly mentioned in the scenario, memory management in the OS ensures efficient utilization of memory resources. In a healthcare context, this could relate to managing the information about patients, their serials and their current state in the system.

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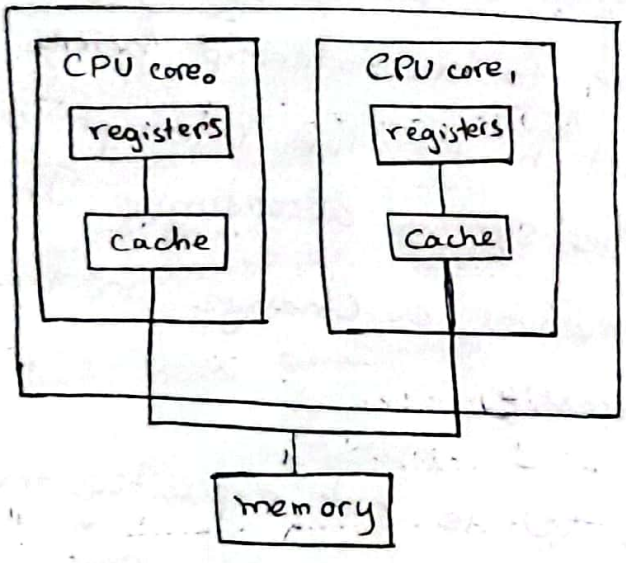
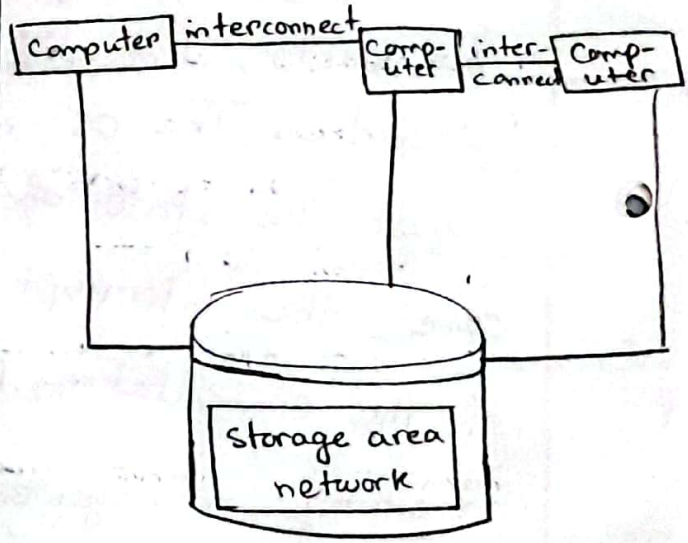
. file system. The information about patients and their serials could be stored in a file or database, representing a file system aspect. The OS manages file access and ensures the integrity of the stored data.

Q6) Differentiate between multiprocessor and clustered systems. [2.5 marks]

Multiprocessor Systems	Clustered Systems.
	
① A multiprocessor system, also known as a parallel system, involves multiple processors (or CPUs) sharing a common memory. These processors P.T.O	① A clustered system consists of multiple independent systems (nodes or servers) connected through a network. These systems work together to P.T.O

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Microprocessor	Clustered
Can execute independent tasks concurrently.	provide a unified computing environment but maintain their own local memory.
(2) Processors communicate with each other through a shared memory. They can exchange information by reading and writing to the same shared address space.	(2) Communication occurs through message passing over a network. Each node has its own local memory, and processes communicate by sending messages between nodes.
(3) Synchronization is crucial to avoid conflicts and ensure data consistency. Techniques like locks, semaphores, and barriers are used to synchronize access to shared resources.	(3) Synchronization is often more challenging than in microprocessors. Coordination between nodes requires efficient message passing and may involve additional complexities.
(4) They are designed to improve overall system performance by parallelizing tasks. They can handle multiple processes simultaneously, distributing the workload across multiple processors.	(4) They are designed to enhance reliability, availability, and scalability rather than raw processing power. They provide increased fault tolerance by distributing tasks across different nodes.

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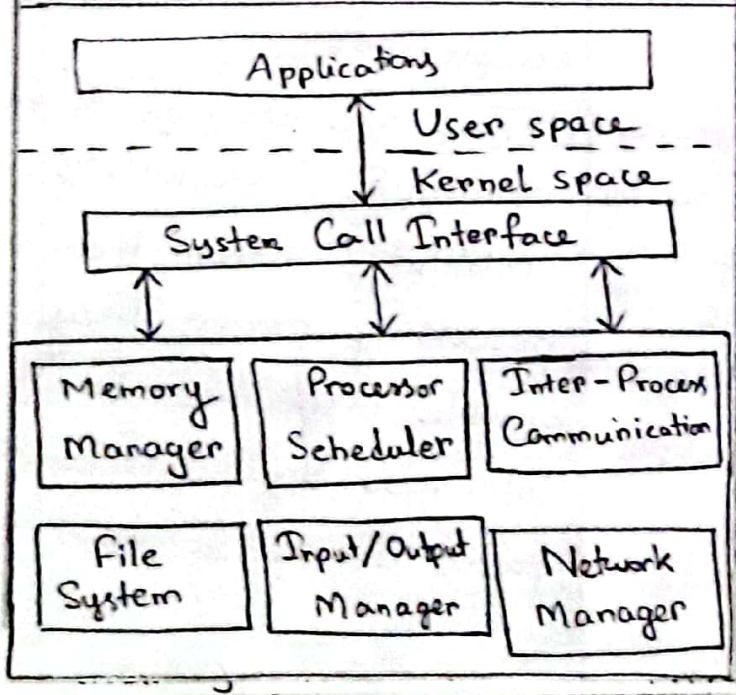
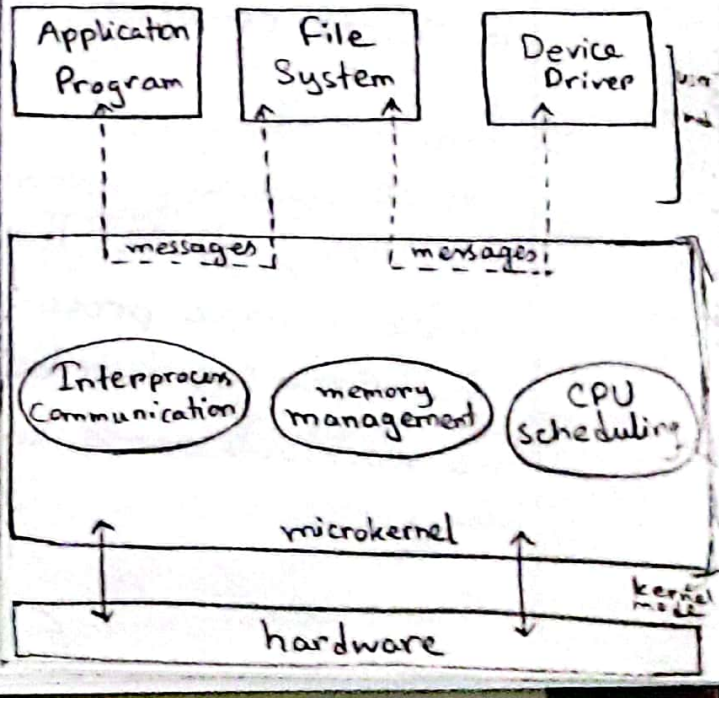
Microprocessors	Clustered
(5) Symmetric Multiprocessing (SMP) is a common architecture for multiprocessor systems, where each processor has equal access to the shared memory. This is widely used in servers, workstations, and high-performance computing environments.	(5) High-Performance Computing (HPC) clusters, web server farms, and load-balanced systems are examples of clustered systems. In a cluster, each node operates independently, and tasks are distributed among nodes to achieve better resource utilization.

Q7) Differentiate between monolithic and microkernel structures. [2.5 marks]

Simple/Monolithic structure



Microkernel structure.



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Monolithic	Microkernel
① In this structure, the entire OS, including the core functionalities and device drivers, operates in a single address space. All components are tightly integrated into a single, large executable.	① In this structure, the OS is designed with a small and essential core (microkernel) that provides only basic functionalities such as process scheduling and inter-process communication. Additional services, including device drivers, are implemented as separate, user-space processes or servers.
② Communication between various components is direct, as they share the same address space. Function calls and data exchanges occur with minimal overhead.	② Communication between components involves message passing. Services provided by separate user-space processes communicate through well-defined message-based interfaces.
③ Extending or adding new functionalities often requires modifying and recompiling the entire kernel. This makes monolithic kernels less modular and more challenging to maintain.	③ Microkernels are highly modular, allowing for easy extensibility and addition of new functionalities without requiring changes to the core microkernel. This modular approach enhances system flexibility.

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Monolithic	Microkernel
④ They generally exhibit better raw performance because of the direct communication and minimal overhead associated with inter-component communication.	④ They may introduce higher overhead due to the need for inter-process communication. However, this design can lead to better system stability and easier maintenance.
⑤ Linux and traditional versions of UNIX often use monolithic kernels. Windows operating systems prior to Windows NT also used monolithic kernels.	⑤ QNX and MINIX are examples of OS that adopt a microkernel architecture. Additionally, modern versions of macOS (XNU kernel) use a hybrid approach with microkernel characteristics.