

Name:- Parmar Kalpesh P.

Enrollment:- 92400584194 Category:- Premium

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- 1) Discuss scheduling? Explain criteria and purpose of CPU Scheduling.

Defination:- CPU scheduling is the process by which the operating system decides which process gets to use the CPU at any given time. This is crucial for optimizing performance and ensuring that system resources are utilized efficiently.

Purpose of CPU Scheduling:-

1. Maximize CPU Utilization:

Ensure that the CPU is kept as busy as possible, reducing idle time.

2. Maximize Throughput:

Increase the number of processes completed in a given time frame, enhancing overall system efficiency.

3. Minimize Turnaround Time:-

Reduce the total time taken for a process to complete, from submission to termination.

4. Minimize Waiting Time:-

Decrease the amount of time a process spends waiting in the ready queue before it gets CPU time.

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Criteria for CPU Scheduling

1) CPU Burst Time:-

The time a process needs on the CPU before it is either completed or moved to I/O structure.

2) Arrival Time:-

The time at which a process arrives in the ready queue.

3) Process Priority:-

Some processes may be assigned higher priority levels, requiring them to receive CPU time more frequently.

4) I/O Burst time:-

The I/O time a process will spend performing I/O operations, which after scheduling decisions.

5) Context Switching Overhead:-

The time it takes to switch the CPU from one process to another. Minimizing this overhead is crucial for efficient scheduling.

Scheduling Algorithms:

1) First-Come, First-Served (FCFS):

Processes are scheduling in the order they arrive

2) Shortest Job - Next (SJN):

The process with the smallest execution time is scheduling Next

3) Round Robin (RR)

Each process is assigned a fixed time slot in a cyclic order

4) Priority Scheduling.

processes are scheduling based on priority, with higher priority processes being executed first.

5) Multilevel Queue Scheduling:

Different queues are established for different process types, each with its own scheduling algorithm.

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2) Explain the difference between Simple paging and virtual memory paging.

Simple Paging:-

Definition:- Simple paging is a memory management scheme that eliminates the need for contiguous memory allocation by dividing the process's logical address space into fixed-size pages and the physical memory into frames of the same size.

• Mechanism:-

- When a process is executed, its pages are loaded into available frames in physical memory.
- A Page table maps the logical page numbers to physical frame numbers.

Advantages:-

- Simplifies memory allocation and eliminates external fragmentation.
- Allows for efficient utilization of physical memory.

Limitation:-

- If entire process does not fit in memory, it cannot be executed, leading to potential underutilization of resource.

Virtual Memory Paging:

Definition: Virtual Memory paging extends the concept of Simple paging by allowing a process to execute even if its entire address space does not fit in physical memory. It uses disk space as an extension of RAM.

• Mechanism:

- Only a portion of the process's pages are loaded into physical memory, while others reside on disk.
- The operating system uses a page table to keep track of which pages are in memory and which are on disk, facilitating page swapping as needed.

• Advantages:

- Enables larger applications to run on systems with limited physical memory.
- Allows multiple processes to be loaded concurrently, enhancing multitasking.

• Limitations:

- Can introduce performance overhead due to page swapping when too many pages are in use and need frequent loading/unloading.
- Requires more complex management and more memory access time due to potential disk I/O operations.

3) Compare response time and waiting time.

Response Time:

Definition: Response time is the total time from when a request is submitted until the first response is produced.

Components: It includes both the time the process spends waiting in the queue and the time takes to execute.

Importance: It's critical for user satisfaction, especially in interactive systems where users expect immediate feedback.

Response Time = Waiting Time + Execution Time

Waiting Time:

Definition: Waiting time is the amount of time a process spends in the ready queue before it gets CPU time for execution.

Components: It is solely the time spent waiting and does not include any execution time.

Importance: Minimizing waiting time is essential for improving overall system throughput and efficiency.

Waiting Time is a subset of the overall response time.