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COURSE NAME : 19CSB201 – OPERATING SYSTEMS

II YEAR/ IV SEMESTER

UNIT – II Process Scheduling And Synchronization

Topic: CPU Scheduling : Scheduling Criteria

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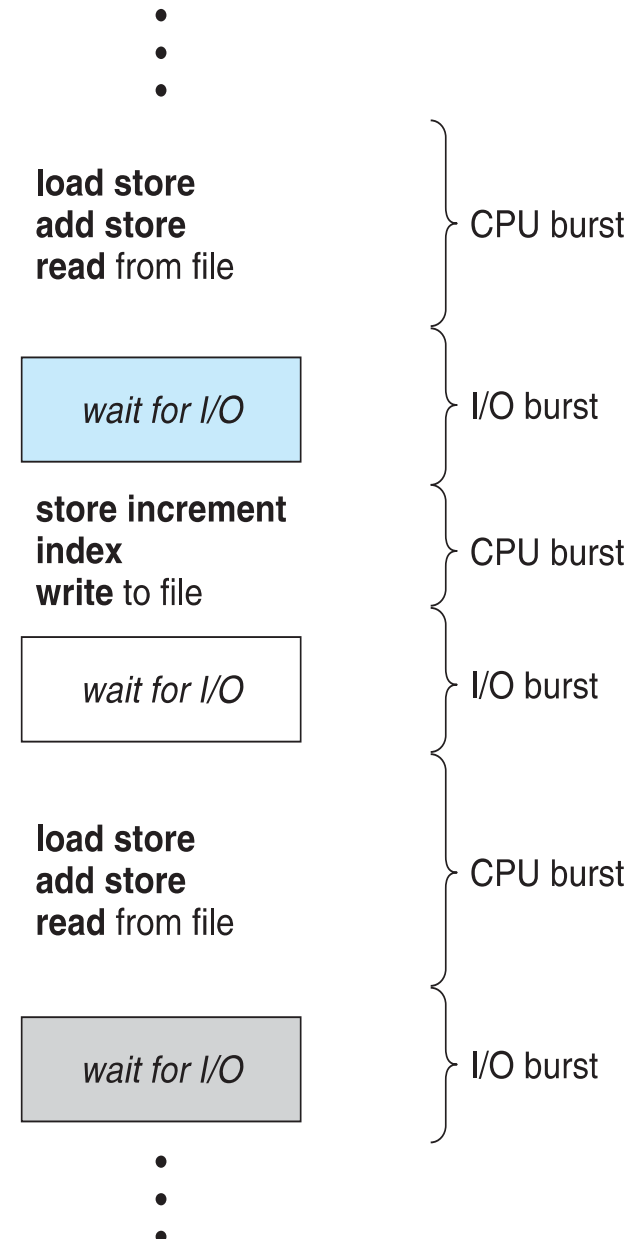
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CPU Scheduling

- Single Processor System – One Processor can run at a time

- Multiprogramming – Maximize CPU Utilization

  Ie) Multiple process in the ready queue are allowed to unitize the CPU time. If a running process is engaged with I/O or waiting for resources, the next operation will be allocated to the CPU.

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Basic Concepts

- Maximum CPU utilization obtained with multiprogramming

- CPU–I/O Burst Cycle – Process execution consists of a **cycle** of CPU execution and I/O wait

- **CPU burst** followed by **I/O burst**

- CPU burst distribution is of main concern

⋮

| load store |
| add store |
| **read** from file | } CPU burst

| *wait for I/O* | } I/O burst

| store increment |
| index |
| **write** to file | } CPU burst

| *wait for I/O* | } I/O burst

| load store |
| add store |
| **read** from file | } CPU burst

| *wait for I/O* | } I/O burst

⋮

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CPU Scheduler

- **Short-term scheduler** selects from among the processes in ready queue, and allocates the CPU to one of them
  - Queue may be ordered in various ways

- CPU scheduling decisions may take place when a process:
  1. Switches from running to waiting state
  2. Switches from running to ready state
  3. Switches from waiting to ready
  4. Terminates

- Scheduling under 1 and 4 is **nonpreemptive**

- All other scheduling is **preemptive**
  - Consider access to shared data
  - Consider preemption while in kernel mode
  - Consider interrupts occurring during crucial OS activities

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Dispatcher

- Dispatcher module gives control of the CPU to the process selected by the short-term scheduler; this involves:
  - switching context
  - switching to user mode
  - jumping to the proper location in the user program to restart that program
- **Dispatch latency** – time it takes for the dispatcher to stop one process and start another running

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Scheduling Criteria

- **CPU utilization** – keep the CPU as busy as possible

- **Throughput** – # of processes that complete their execution per time unit

- **Turnaround time** – amount of time to execute a particular process

- **Waiting time** – amount of time a process has been waiting in the ready queue

- **Response time** – amount of time it takes from when a request was submitted until the first response is produced, not output (for time-sharing environment)

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- **CPU utilization**. We want to keep the CPU as busy as possible. Conceptually, CPU utilization can range from 0 to 100 percent. In a real system, it should range from 40 percent (for a lightly loaded system) to 90 percent (for a heavily loaded system).

- **Throughput**. If the CPU is busy executing processes, then work is being done. One measure of work is the number of processes that are completed per time unit, called **throughput**. For long processes, this ratemay be one process per hour; for short transactions, it may be ten processes per second.

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• **Turnaround time**. From the point of view of a particular process, the important criterion is how long it takes to execute that process. The interval from the time of submission of a process to the time of completion is the turnaround time. Turnaround time is the sum of the periods spent waiting to get into memory, waiting in the ready queue, executing on the CPU, and doing I/O.

• **Waiting time**. The CPU-scheduling algorithm does not affect the amount of time during which a process executes or does I/O. It affects only the amount of time that a process spends waiting in the ready queue. Waiting time is the sum of the periods spent waiting in the ready queue.

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• **Response time**. In an interactive system, turnaround time may not be the best criterion. Often, a process can produce some output fairly early and can continue computing new results while previous results are being output to the user. Thus, another measure is the time from the submission of a request until the first response is produced. This measure, called response time, is the time it takes to start responding, not the time it takes to output the response. The turnaround time is generally limited by the speed of the output device.

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Scheduling Algorithm Optimization Criteria

- Max CPU utilization

- Max throughput

- Min turnaround time

- Min waiting time

- Min response time

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