

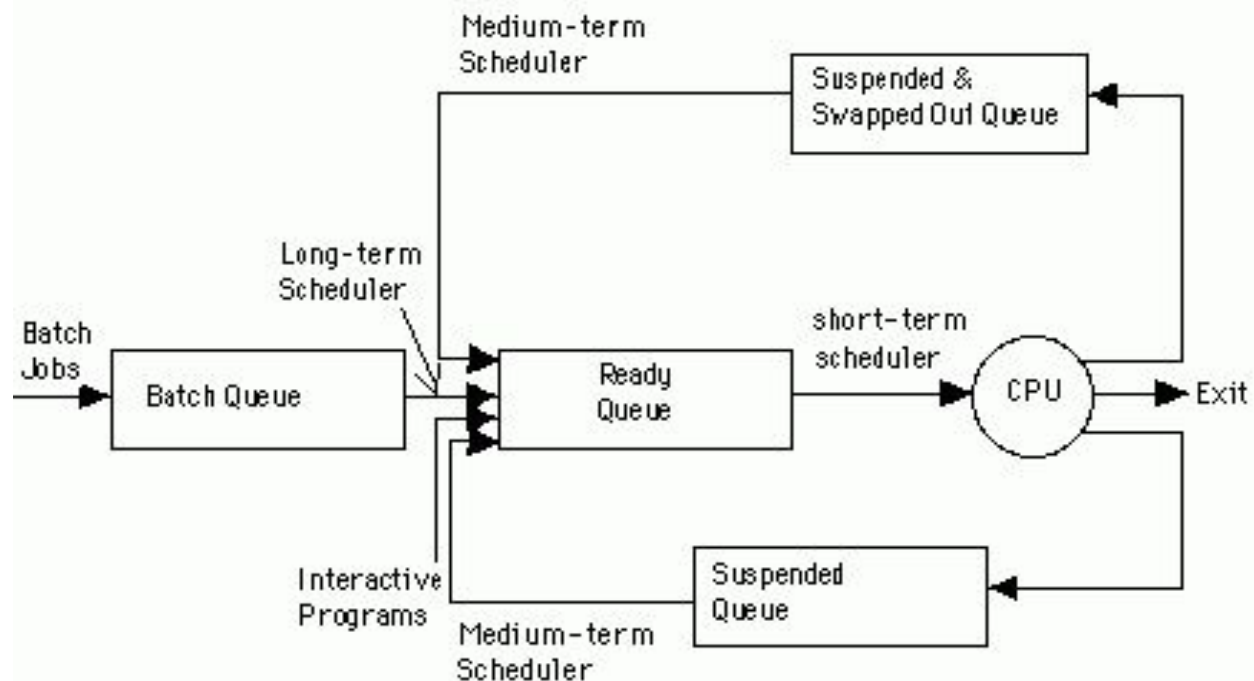
Process Scheduling

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Schedulers

- **Long term scheduler:** This scheduler selects process from secondary memory pool and load them into MM (Main Memory). This invoke very infrequently because when process execute it generally resides in main memory. It controls the degree of multiprogramming. It selects process from batch queue. So more number of processes will be selected. According to that, more CPU degree will be achieved.
- **Short term scheduler:** The job of this scheduler is to select process from ready queue and allocate CPU to them. This scheduler invokes very frequently. short-term scheduler increases the system performance. Short-term scheduler also called dispatcher (make the decision of which process should be executed next).
- **Medium term scheduler:** This scheduler is a part of swapping. So, we can call process swapping scheduler. It does swapping from main memory to disk or vice versa. It works for suspending and resuming the process. We will understand with a diagram. It will be helpful to clear the concept about queues and scheduler.

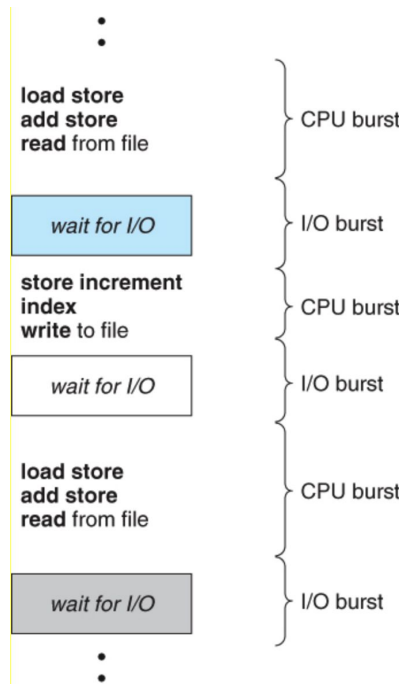
Schedulers



CPU/I/O Burst Cycle

Almost all processes alternate between two states in a continuing cycle :

- A CPU burst of performing calculations, and
- An I/O burst, waiting for data transfer in or out of the system.



Preemptive & Non-preemptive scheduling

CPU scheduling decisions take place under one of four conditions:

- When a process switches from the running state to the waiting state, such as for an I/O request or invocation of the wait() system call.
 - When a process switches from the running state to the ready state, for example in response to an interrupt.
 - When a process switches from the waiting state to the ready state, say at completion of I/O or a return from wait().
 - When a process terminates.
- ❑ For conditions 1 and 4 there is no choice - A new process must be selected.
- ❑ For conditions 2 and 3 there is a choice - To either continue running the current process, or select a different one.

If scheduling takes place only under conditions 1 and 4, the system is said to be **non-preemptive**, or **cooperative**. Under these conditions, once a process starts running it keeps running, until it either voluntarily blocks or until it finishes. Otherwise the system is said to be **preemptive**.

Terminology

1. CPU Utilization:
2. Throughput:
3. Turnaround time: $\text{Completion time} - \text{Arrival time}$
4. Waiting time: $\text{Turnaround time} - \text{Burst time}$
5. Response time: $\text{Time to CPU Allocation} - \text{Arrival Time}$

Scheduling algorithm

1. First Come First Served Scheduling
2. Shortest Job First Scheduling
3. Shortest Remaining Time Scheduling
4. Round Robin Scheduling
5. Priority Scheduling
6. Multilevel Feedback Queue Scheduling

First Come First Served Scheduling (FCFS)

Process ID	Arrival Time	Burst Time
P0	0	3
P1	2	3
P2	8	4
P3	9	4

First Come First Served Scheduling (FCFS)

Process ID	Arrival Time	Burst Time	Completion Time	Turn Around Time	Waiting Time	Response Time
P0	0	3	3	3	0	0
P1	2	3	6	4	1	1
P2	8	4	12	4	0	0
P3	9	4	16	7	3	3

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
p0	p0	p0	p1	p1	p1			p2	p2	p2	p2	p3	p3	p3	p3	p0

Shortest Job First Scheduling (SJF)

Process ID	Arrival Time	Burst Time
P0	0	3
P1	2	4
P2	2	2
P3	4	3

Shortest Job First Scheduling (SJF)

Process ID	Arrival Time	Burst Time	Completion Time	Turn Around Time	Waiting Time	Response Time
P0	0	3	3	3	0	0
P1	2	4	12	10	6	6
P2	2	2	5	3	1	1
P3	4	3	8	4	1	1

0	1	2	3	4	5	6	7	8	9	10	11
p0	p0	p0	p2	p2	p3	p3	p3	p1	p1	p1	p1

Shortest Remaining Time Scheduling

Process ID	Arrival Time	Burst Time
P0	0	3
P1	2	4
P2	3	2
P3	4	3

Round Robin Scheduling

Process ID	Arrival Time	Burst Time
P0	0	3
P1	2	4
P2	3	2
P3	4	3

1. Priority Scheduling (Book -Abraham Silberschatz)
2. Multilevel Feedback Queue Scheduling (Book -Abraham Silberschatz)

Advantages and Disadvantages of the Scheduling algorithms

- Self Study From Book (Abraham Silberschatz)

References

- [1] <https://tutorialwing.com/process-scheduling-and-process-scheduler/>
- [2] Modern Operating System – by Tanenbaum
- [3] Operating System Concepts - by Abraham Silberschatz