Priority (Non-Preemptive)

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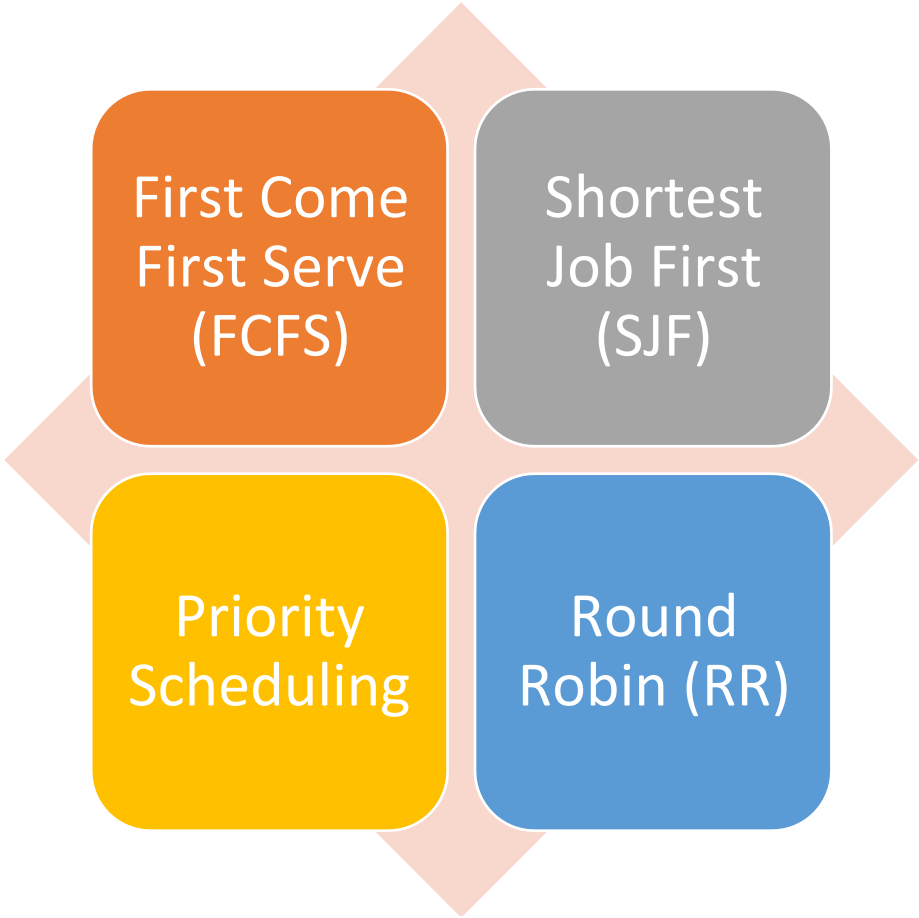
CPU Scheduling Algorithms



Priority-Based Scheduling

- A priority number (integer) is associated with each process
- The CPU is allocated to the process with the highest priority (smallest integer ≡ highest priority).
- When a process arrives at the ready queue,
  - **the priority is compared with priority of the current running process.**
- It can be
  - **pre-emptive**
  - **non pre-emptive**
- **<u>Equal priority processes are scheduled in FCFS order</u>**
  - FCFS can be used to break ties.

Non Pre-emptive Priority Scheduling

- Once a process starts executing, it runs to completion without being interrupted by any other process, even if a new process with a higher priority arrives.
- Scheduling Criteria
  - **Arrival Time**: The time at which a process arrives in the ready queue.
  - **Burst Time**: The total time required by the process to complete execution.
  - **Priority**: The rank assigned to a process to determine its execution order.

Example 1 Non Preemptive Priority-based Scheduling

- Consider the following set of processes, assumed to have arrived at time 0, in the order P1, P2, P3, P4, P5, with the length of the CPU burst given in milliseconds.

Process ID	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	4
P4	1	5
P5	5	2

- Low number represents the high priority.

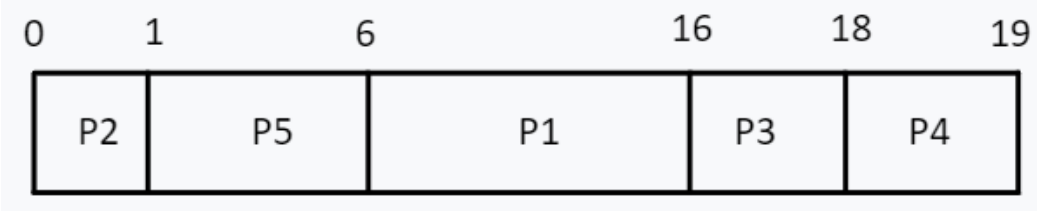
Example 1 Non Preemptive Priority-based Scheduling

- Arrival Time of All Process = 0
- So the process are sorted as per priority in ready queue

Process ID	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	4
P4	1	5
P5	5	2

Turnaround Time = Completion Time – Arrival Time

- Gantt Chart



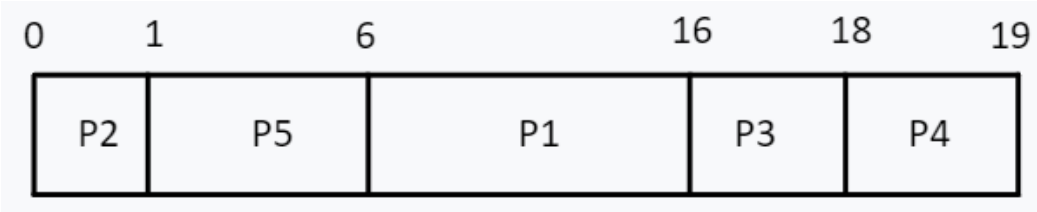
- Turnaround Time p1=16,p2=1,p3=18,p4=19,p5=6
- Average Turnaround Time = (16+1+18+19+6)/5=12ms

Example 1 Non Preemptive Priority-based Scheduling

Process ID	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	4
P4	1	5
P5	5	2

Waiting Time = Turnaround Time – Burst Time

- Gantt Chart



- Turnaround Time p1=16,p2=1,p3=18,p4=19,p5=6
- Waiting Time p1=6,p2=0,p3=16,p4=18,p5=1
- Average Turnaround Time = (6+0+16+18+1)/5=8.2ms

Example 2 Non Preemptive Priority-based Scheduling (continued)

- Consider the following set of processes. Assume all time values in millisecond and small values for priority means higher priority of a process.

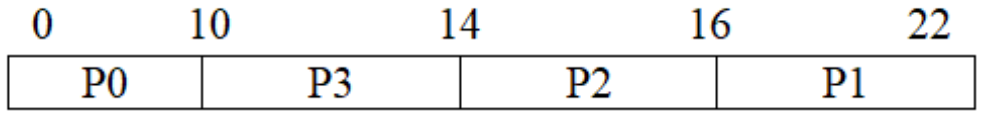
Process	Arrival Time	Burst Time	Priority
P0	0	10	5
P1	1	6	4
P2	3	2	2
P3	5	4	0

Example 2 Non Preemptive Priority-based Scheduling

- Consider the following set of processes. Assume all time values in millisecond and small values for priority means higher priority of a process.

Process	Arrival Time	Burst Time	Priority
P0	0	10	5
P1	1	6	4
P2	3	2	2
P3	5	4	0

- Gantt Chart



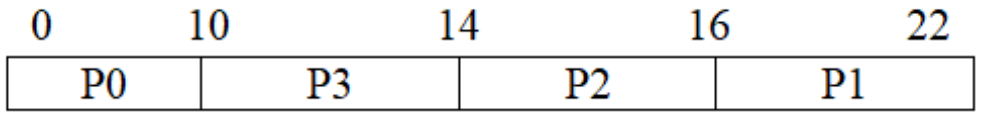
Example 2 Non Preemptive Priority-based Scheduling

Process	Arrival Time	Burst Time	Priority
P0	0	10	5
P1	1	6	4
P2	3	2	2
P3	5	4	0

Turnaround Time = Completion Time – Arrival Time

Waiting Time = Turnaround Time – Burst Time

- Gantt Chart



- Turnaround Time p0=10, p1=21, p2=13,p3=9, Avg. Turnaround Time = 53/4 = 13.25ms
- Waiting Time p0=0, p1=15, p2=11,p3=5, Avg. Turnaround Time = 31/4 = 7.75ms

Non Preemptive Priority-Based Scheduling (continued)

- Problem: Indefinite Blocking (or Starvation) –
  - low priority processes may never execute.
- One solution: *Aging* – as time progresses, increase the priority of the processes that wait in the system for a long time.
- Priority Assignment
  - Internal factors: timing constraints, memory requirements, the ratio of average I/O burst to average CPU burst….
  - External factors: Importance of the process, financial considerations, hierarchy among users…

Example 3 Non Preemptive Priority

- Consider the set of processes with arrival time (in milliseconds), CPU burst time (in milliseconds), and priority shown below. (Higher number represents higher priority).

Process ID	Arrival Time	Burst Time	Priority
P1	0	4	2
P2	1	3	3
P3	2	1	4
P4	3	5	5
P5	4	2	5

Question ?