Chapter: CPU/ Process Scheduling

Priority Scheduling

- Priority is associated with each process.
- CPU is allocated to the process with highest priority.
- If 2 processes have same priority → FCFS

Disadvantage: **Starvation** (Low priority Processes wait for long)

Solution of Starvation: Aging

Aging: Priority of process is increased gradually **(e.g after every 5 min priority is incremented by 1)**

Priority Scheduling (Preemptive)

Process	Arrival Time	Priority	Burst Time	Completion Time
P1	1	5	4	
P2	2	7	2	
P3	3	4	3	

Consider 4 as Highest and 7 as Lowest Priority0

Priority Scheduling (Preemptive)

Process	Arrival Time	Priority	Burst Time	Completion Time
P1	0	2	10	
P2	2	1	5	
P3	3	0	2	
P4	5	3	20	

Consider 3 as Lowest and 0 as Highest Priority

H.W: Priority Scheduling (Preemptive)

Process	Arrival Time	Priority	Burst Time	Completion Time
P1	1	4	4	
P2	2	5	2	
P3	2	7	3	
P4	3	8	5	
P5	3	5	1	
P6	4	6	2	

Consider 4 as Lowest and 8 as Highest Priority

Priority Scheduling (Preemptive)

Process	Arrival Time	Priority	Burst Time	Completion Time
P1	1	2	4	
P2	1	2	2	
P3	2	10	5	
P4	3	6	3	

Consider 2 as Lowest and 10 as Highest Priority

H.W: Priority Scheduling (Preemptive)

Process	Arrival Time	Priority	Burst Time	Completion Time
P1	0	2	4	
P2	1	4	2	
P3	2	6	3	
P4	3	10	5	
P5	4	8	1	
P6	5	12	4	
P7	6	9	6	

Consider 2 as Lowest and 12 as Highest Priority

Priority Scheduling (Non-Preemptive)

Process	Arrival Time	Priority	Burst Time	Completion Time
P1	0	4	4	
P2	1	5	5	
P3	2	7	1	
P4	3	2	2	
P5	4	1	3	
P6	5	6	6	

Consider 7 as Lowest and 1 as Highest Priority

Round Robin Scheduling

- A Time Quantum is associated to all processes
- Time Quantum: Maximum amount of time for which process can run once it is scheduled.
- RR scheduling is always Pre-emptive.

Round Robin

TQ: 2

Process	Arrival Time	Burst Time	Completion Time
P1	0	5	
P2	1	7	
P3	2	1	

Process	Arrival Time	Burst Time	Completion Time
P1	0	3	
P2	3	4	
P3	4	6	

Round Robin

TQ: 2

Process	Arrival Time	Burst Time	Completion Time
P1	0	4	8
P2	1	5	18
P3	2	2	6
P4	3	1	9
P5	4	6	21
P6	6	3	19

Round Robin

TQ: 2

Process	Arrival Time	Burst Time	Completion Time
P1	0	4	8
P2	1	5	18
P3	2	2	6
P4	3	1	9
P5	4	6	21
P6	6	3	19

RQ: P1 P2 P3 P1 P4 P5 P2 P6 P5 P2 P6 P5

Multilevel Queue

A **multilevel queue** scheduling algorithm partitions the ready queue into several separate queues.

For Example: a multilevel queue scheduling algorithm with five queues, listed below in order of priority:

1. System processes
2. Interactive processes
3. Interactive editing processes
4. Batch processes
5. Student/ user processes

Multilevel Queue

- A process can move between various queues
- Multilevel Queue Scheduler defined by the following parameters:
  - No. of queues
  - Scheduling algorithms for each queue
  - Method used to determine when to upgrade / demote a process
  - Method used to determine which queue a process will enter and when that process needs service.

Multilevel Queue

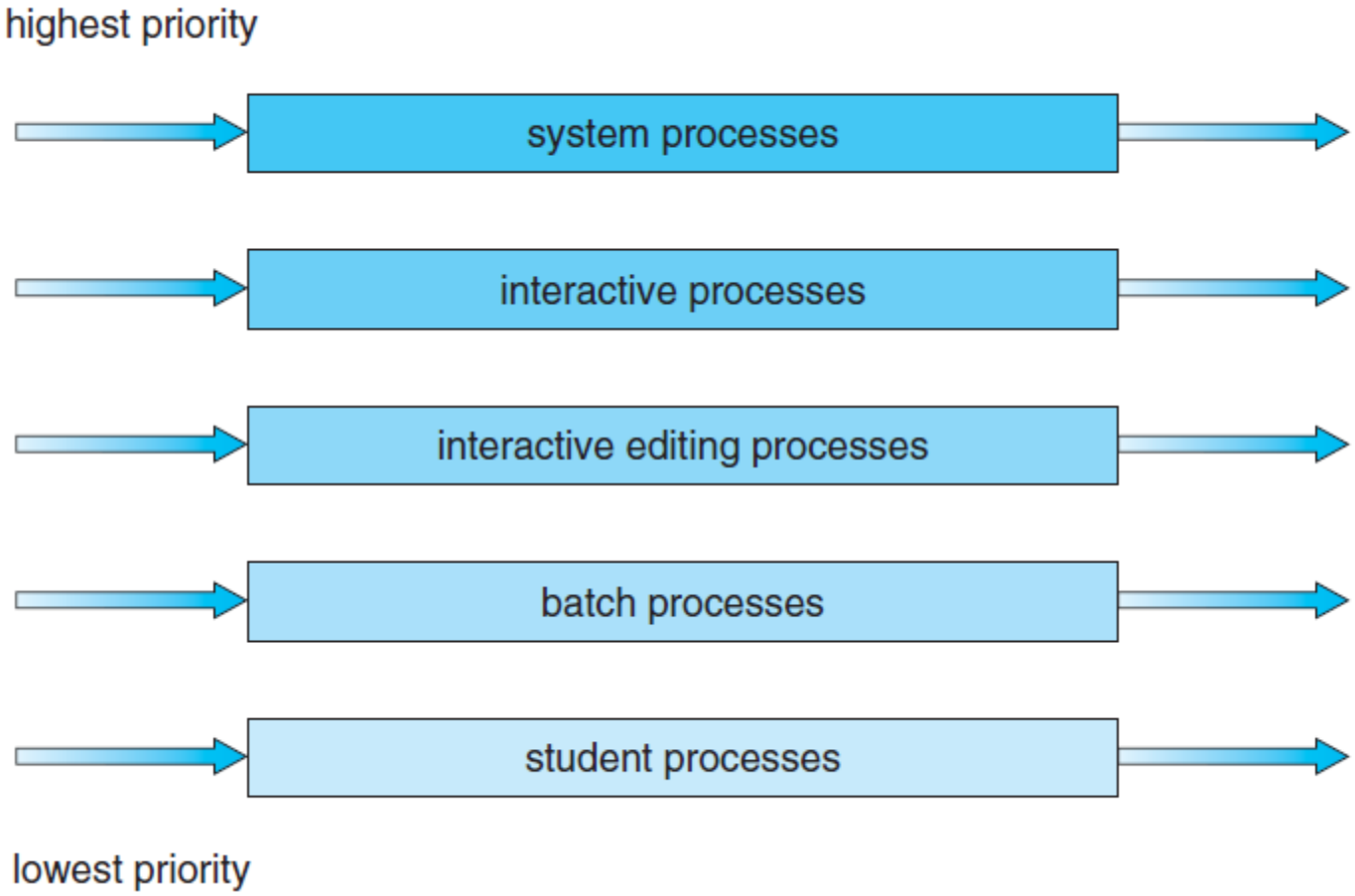
Example:

- No process in the batch queue, could run unless the queues for system processes, interactive processes, and interactive editing processes were all empty.
- If an interactive editing process entered the ready queue while a batch process was running, the batch process would be preempted.

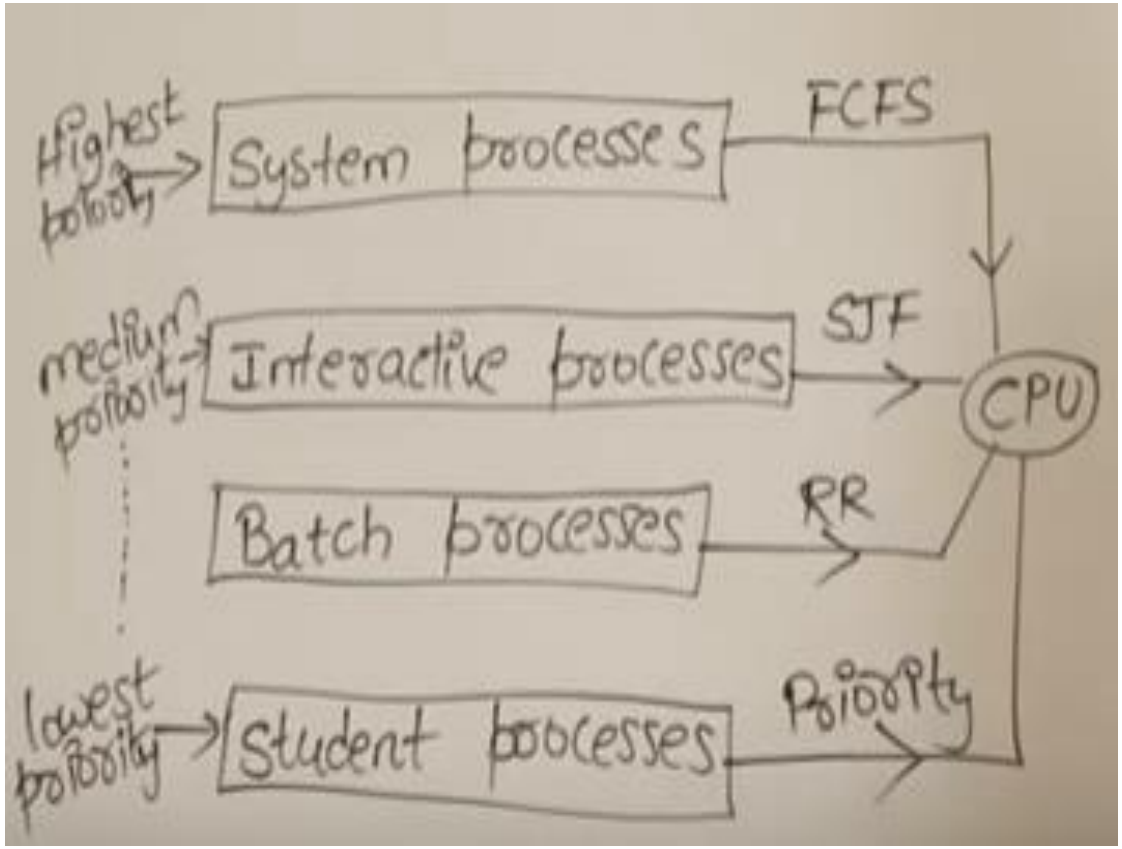
Multilevel Queue

- Processes can be :
  - Foreground Process: processes that are running currently → **RR Scheduling is applied**
  - Background Process: Processes that are running in the background but its effects are not visible to user. →**FCFS**
- Multilevel queue scheduling divides ready queue into several queues.
- Processes are permanently assigned to one queue on some property like memory size, process priority, process type.
- Each queue has its own scheduling algorithm

Multilevel Queue



Multilevel Queue



Multilevel Queue

1. System Processes: These are programs that belong to OS (System Files)

2. Interactive Processes: Real Time Processes e.g. playing game online, listening to music online etc.

3. Batch Processes: Lots of processes are pooled and one process at a time is selected for execution. I/O by Punch Cards

4. Student/User Processes

Multilevel Queue

- As different type of processes are there so all cant be put into same queue and apply same scheduling algorithm.

Disadvantages:

1. **Until high priority queue is not empty**, No process from lower priority queues will be selected.
2. Starvation for lower priority processes

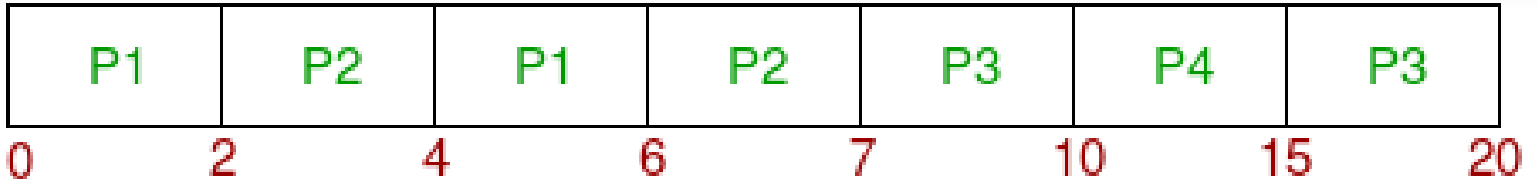
Advantage:

Can apply separate scheduling algorithm for each queue.

Practice: Multilevel Queue

Process	Arrival Time	Burst Time	Queue
P1	0	4	1
P2	0	3	1
P3	0	8	2
P4	10	5	1

Priority of queue 1 is greater than queue 2. queue 1 uses Round Robin (Time Quantum = 2) and queue 2 uses FCFS.


P1
P2
P1
P2
P3
P4
P3
0
2
4
6
7
10
15
20