

UNIT -2 Scheduling Algorithms

- A scheduling algorithm **selects a process from the ready queue and the dispatcher sends this process to the CPU** for execution.
- Various Scheduling Algorithms are:
 - First Come First Served (FCFS)
 - Priority Scheduling
 - Shortest Process Next (SPN)
 - Shortest Remaining Time (SRT)
 - Round Robin

UNIT -2 First Come First Served

- There is always a simple approach to maintain a queue, that is, the item that comes first will be served first.
- The arriving process is added onto the tail of the queue and the process at the head of the queue is dispatched to the processor for execution.
- This scheduling policy is non pre-emptive because the process which has arrived first will be executed first for its completion.

UNIT -2 First Come First Served

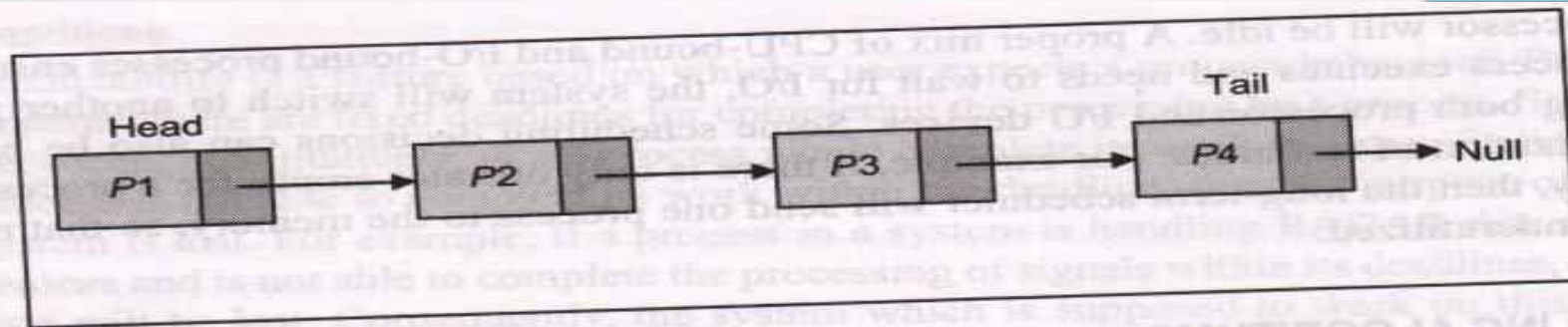


Fig. 6.13 Ready queue of processes

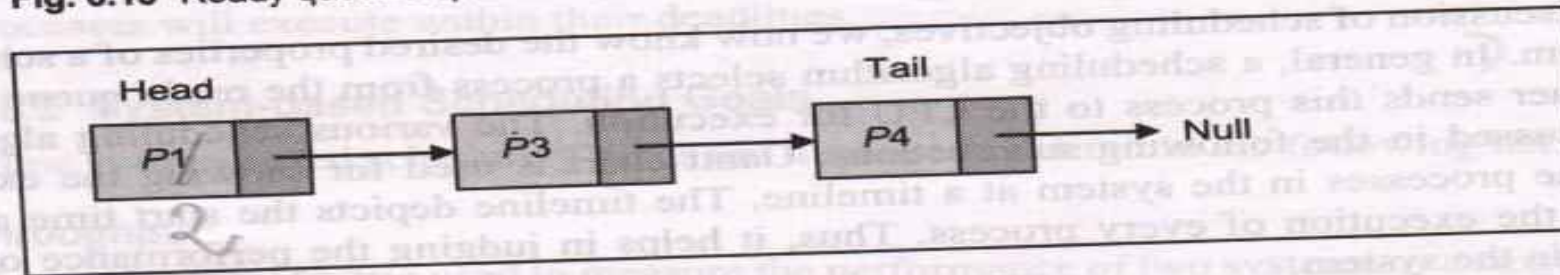
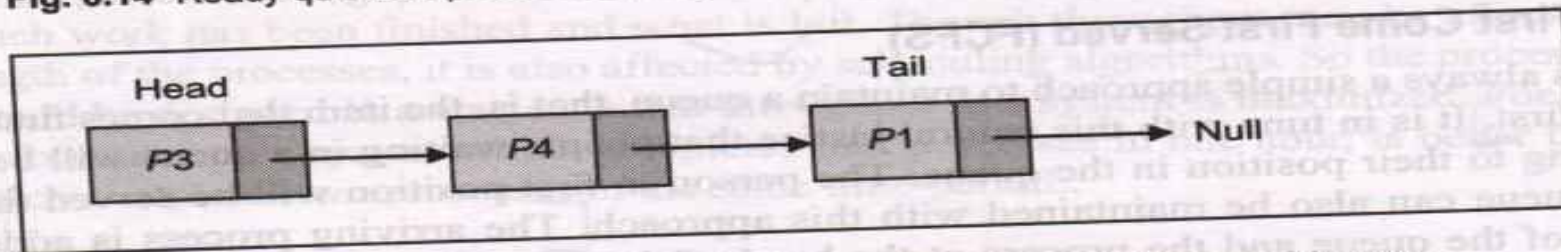


Fig. 6.14 Ready queue of processes: P1 gets execution



UNIT -2 First Come First Served - Example

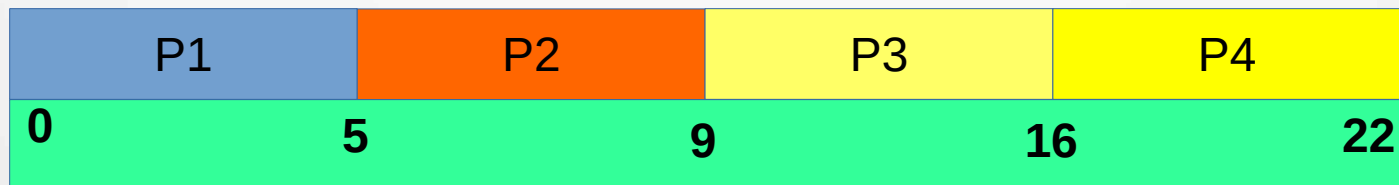
Process	Arrival Time	Execution Time
P1	0	5
P2	2	4
P3	3	7
P4	5	6

- Draw a Gant Chart.
- Show start time, end time using FCFS algorithm.
- Calculate Waiting Time, Turn Around time, Normalized Turnaround Time for each process.
- Average Waiting Time, Turn Around time, Normalized Turnaround Time for the system.

UNIT -2 First Come First Served - Example

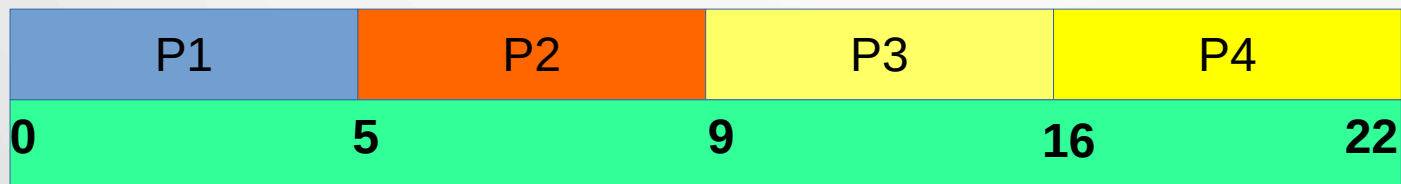
Process	Arrival Time	Execution Time
P1	0	5
P2	2	4
P3	3	7
P4	5	6

- Draw a Gant Chart.



UNIT -2 First Come First Served - Example

Process	Arrival Time	Execution Time (x)	Waiting time = completion time – arrival time – execution time	Turnaround time (tr) (Waiting time + execution time)	Normalized turnaround time (tr / x)
P1	0	5	0	5	1
P2	2	4	3	7	1.75
P3	3	7	6	13	1.85
P4	5	6	11	17	2.84
			Average waiting time = 5	Average turnaround time = 10.5	Average normalized turnaround time = 1.86



UNIT -2 Priority Scheduling

- In some system like real – time systems, each process is well defined with its functionality.
- It has a priority in the system, according to the importance of its functionality.
- If a process with higher priority has arrived late or at its defined time then it will be executed first according to its priority.
- In real time system, the priorities are defined as a number associated with a process. This number scheme is also different in various OS.
- Some system follow lower numbers as higher priorities and other follow higher numbers as higher priorities.
- In general, lower numbers are considered as high priorities.

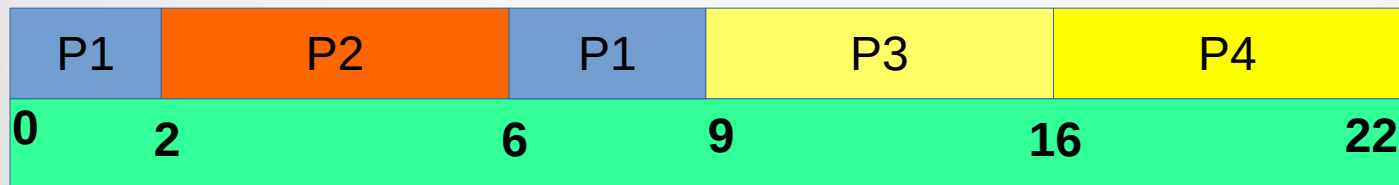
UNIT -2 Priority - Example

Process	Arrival Time	Execution Time	Priority
P1	0	5	2
P2	2	4	1
P3	3	7	3
P4	5	6	4

- Draw a Gant Chart.
- Show start time, end time using Priority algorithm.
- Calculate Waiting Time, Turn Around time, Normalized Turnaround Time for each process.
- Average Waiting Time, Turn Around time, Normalized Turnaround Time for the system.

UNIT -2 Priority - Example

Process	Arrival Time	Execution Time (x)	Priority Number	Turnaround time (tr)	Normalized turnaround time (tr / x)	Waiting time = completion time – arrival time – execution time
P1	0	5	2	9	1.8	4
P2	2	4	1	4	1	0
P3	3	7	3	13	1.85	6
P4	5	6	4	17	2.84	11
				Average turnaround time = 10.75	Average normalized turn around tiem = 1.87	Average waiting time = 5.25



Gant Chart.

UNIT -2 Priority Scheduling- Practice Example

Process	Arrival Time	Execution Time	Priority
P1	0	3	3
P2	2	7	4
P3	3	5	1
P4	5	9	2

UNIT -2 Shortest Job Next (SJN)

- It also called shortest Process Next (SPN)
- Another way to prioritize the processes is to run the processes with shorter execution times.
- In this algorithm, at an instant of time, the processes are compared based on their execution times.
- The process with the shortest execution time is executed first.
- This is a non-preemptive scheduling algorithm.

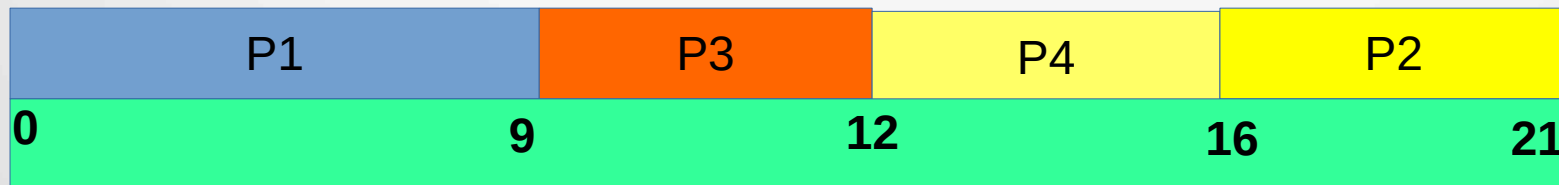
UNIT -2 SJN - Example

Process	Arrival Time	Execution Time
P1	0	9
P2	1	5
P3	2	3
P4	3	4

- Draw a Gant Chart.
- Show start time, end time using Priority algorithm.
- Calculate turnaround time, normalized turnaround time, waiting time for each process.
- Average turnaround time, average normalized turnaround time, average waiting time for the system.

UNIT -2 SJN - Example

Process	Arrival Time	Execution Time (x)	Turnaround time (tr)	Normalized turnaround time (tr / x)	Waiting Time
P1	0	9	9	1	0
P2	1	5	20	4	15
P3	2	3	10	3.34	7
P4	3	4	13	3.25	9
			Average turnaround time = 13	Average normalized turnaround time = 2.89	Average waiting time = 7.75



- Draw a Gant Chart.

UNIT -2 Shortest Remaining Time Next (SRN)

- This algorithm also considers the execution time of processes as in SPN.
- But it is a pre-emptive version of SPN.
- It means, we can pre-empt a process based on the execution time.
- The process with the shortest execution time will always pre-empt other process.
- Since the processes may not be able to complete their execution as they may be pre-empted, the preference for preemption will be based on the remaining execution time of processes.

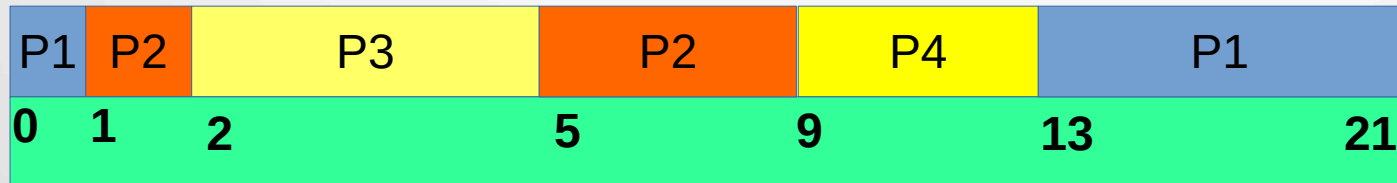
UNIT -2 SRN - Example

Process	Arrival Time	Execution Time
P1	0	9
P2	1	5
P3	2	3
P4	3	4

- Draw a Gant Chart.
- Show start time, end time using Priority algorithm.
- Calculate turnaround time, normalized turnaround time, waiting time for each process.
- Average turnaround time, average normalized turnaround time, average waiting time for the system.

UNIT -2 SRN - Example

Process	Arrival Time	Execution Time (x)	Turnaround time (tr)	Normalized turnaround time (tr / x)	Waiting Time
P1	0	9	21	2.34	12
P2	1	5	8	1.6	3
P3	2	3	3	1	0
P4	3	4	10	2.5	6
			Average turnaround time = 10.5	Average normalized turnaround time = 1.86	Average waiting time = 5.25



- Draw a Gant Chart.

UNIT -2 Round Robin Scheduling

- In multi user time-sharing systems or multi-tasking systems, the requirement of scheduling is different.
- The concept of multi user and multi tasking systems is to share the processor time among processes.
- In this each process gets same processor time, the response will be equally good for all the processes, and neither the short nor long process will suffer from starvation.
- The ready queue can be of the same pattern as that of FCFS, that is, FIFO queue.

UNIT -2 Round Robin Scheduling

- The only issue is that when one process is executing and its fixed allotted time finished, it must be temporarily stopped, and the processor must be given to the next process in the queue.
- In this way, every process gets equal time for execution, and no process can hold the processor for a long time.

UNIT -2 Round Robin Scheduling

- Algorithm:
 1. The ready queue is maintained as a FIFO queue.
 2. A fixed time period is allotted to every arriving process in the queue. This fixed time period is known as time slice or time quantum.
 3. The first arriving process is selected and dispatched to the processor. But if it is not able to complete its execution within its time slice, then an interrupt is generated with the help of the timer.

UNIT -2 Round Robin Scheduling

- Algorithm:

4. As soon as the timer interrupt arrives, the running process is stopped temporarily, and is placed back in the ready queue at the end of the queue. The context of the interrupted process is save, so that it can resume when its turn comes in the future.

5. The scheduler selects another process form the queue and dispatches it to the processor. It is executed until the allotted time slice expires.

6. In this way, scheduling is done in a round robin fashion.

UNIT -2 Round Robin - Example

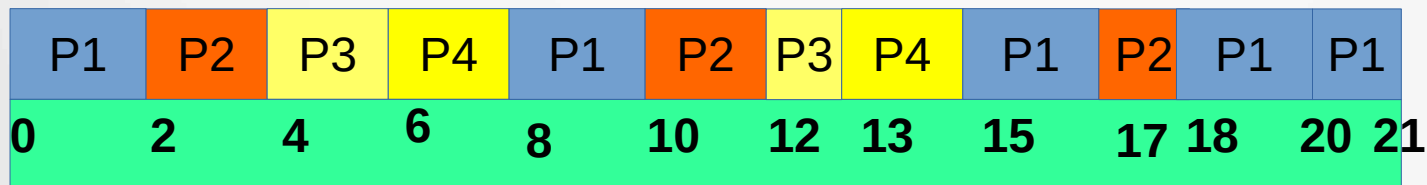
Process	Arrival Time	Execution Time
P1	0	9
P2	1	5
P3	2	3
P4	3	4

- Time quantum = 2
- Draw a Gant Chart.
- Show start time, end time using FCFS algorithm.
- Calculate turnaround time, normalized turnaround time, waiting time for each process.
- Average turnaround time, average normalized turnaround time, average waiting time for the system.

UNIT -2 Round Robin - Example

Process	Arrival Time	Execution Time
P1	0	9
P2	1	5
P3	2	3
P4	3	4

- Draw a Gant Chart.



UNIT -2 Round Robin - Example

Process	Arrival Time	Execution Time (x)	Turnaround time (tr) (Waiting time + execution time)	Normalized turnaround time (tr / x)	Waiting time
P1	0	9	21	2.34	12
P2	1	5	17	3.4	12
P3	2	3	11	3.67	8
P4	3	4	12	3	8
			Average turnaround time= 15.25	Average normalized turnaround time = 3.10	Average waiting time = 10





UNIT 2 COMPLETED