Scheduling Algo

Premptive (Can interfere)

- → SRTF
- → LRTF
- → Round Robin
- → Priority based

Non-Preemptive (No Interfere)

- → FCFS
- → SJF
- → LJF
- → HRRN
- → Multilevel queue

Scheulding Criteria

Arrival Time : At which process enter the ready queue or stole

Brust Time (Duration) : Time required by a process to get execute on CPU

Completion time: The time at which process complete its execution

Turn around time: { Completion Time − Arrival Time }

Waiting Time: { Turn around time − Brust time }

Response time: { The time at which process get CPU First time − Arrival time }

First come First Serve (FCFS)

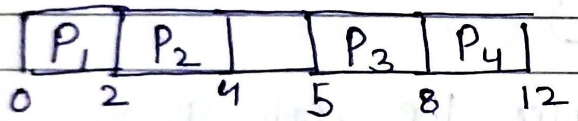
Process	AT	BT	CT	TAT	WT	RT
P_1	0	2	2	2	0	0
P_2	1	2	4	3	1	1
P_3	5	3	8	3	0	0
P_4	6	4	12	6	2	2

Criteria : Arrival Time
Mode : Non-premtive

Avg TAT =

Avg WT

Gantt chart

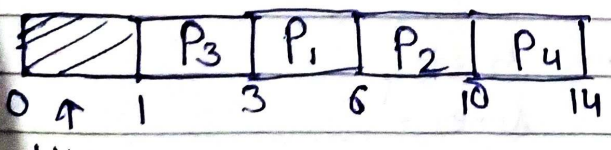


Shortest Job First

Process	AT	BT	CT	TAT	WT	RT
P_1	1	3	6	5	2	2
P_2	2	4	10	8	4	4
P_3	1	2	3	2	0	0
P_4	4	4	14	10	6	6

Criteria : Brust Time
Mode : Non premptive

Gantt chart



Shortest Remaing Time First

Criteria: Brust Time
Mode: Premptive

Process	AT	BT	CT	TAT	WT	RT
P_1	0	~~6~~ 4	9	9	4	0
P_2	1	~~3~~ 2 ~~1~~	~~4~~ 4	3	0	0
P_3	2	4	~~13~~	11	7	7
P_4	4	1	5	1	0	0

Gantt chart

P_1	P_2	P_2	P_2	P_4	P_1	P_1	P_1	P_1	P_3

0 1 2 3 4 5 6 7 8 9 13

Round Robin

Process	AT	BT	CT
P_1	0	~~5~~ 3 ~~1~~	12
P_2	1	4 2	11
P_3	2	~~2~~ 0	6
P_4	4	1	9

Given TQ = 2

Cretria: Time Quantm
Mod: Premptive

Ready queue

~~P_1~~	~~P_2~~	~~P_3~~	~~P_1~~	~~P_4~~	~~P_2~~	P_1

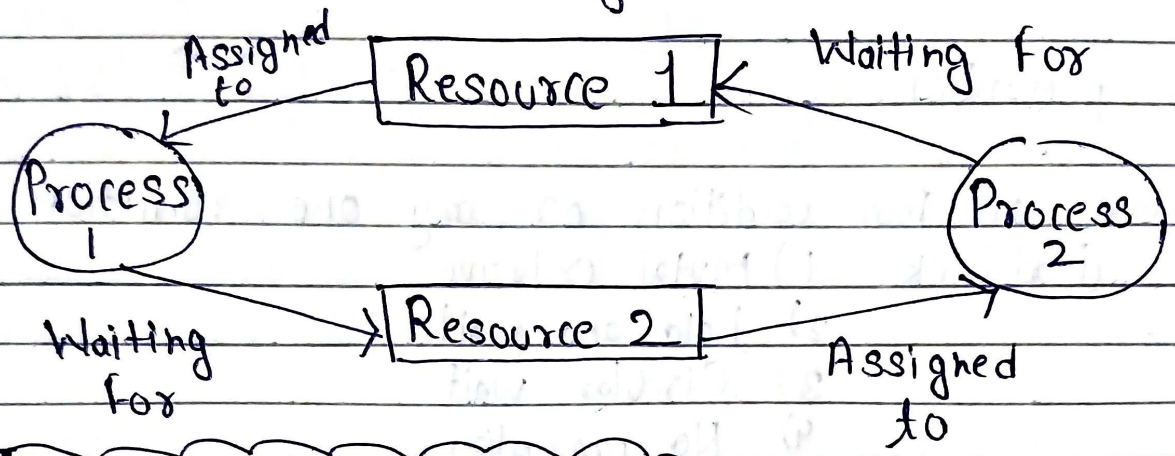
0

Running queue (Gantt chart)

P_1	P_2	P_3	P_1	P_4	P_2	P_1

0 2 4 6 8 9 11 12

Deadlock: It is a situation in computer system where multiple process or threads are unable to proceed because each is waiting for a resource that the others are holding.



Characterization of Deadlock

1) **Mutal Exclusion**: Process compete for exclusive access to resources, meaning that only one process can use a resource at a time.

2) **Hold and Wait**: Process hold resources while waiting for additional ones, creating the potential for resource contention

3) **No Preemption**: Resource cannot be forcibly taken from a process; they must be released voluntarily by the process holding them.

4) **Circular Wait**: A circular ~~wait~~ chain of two or more process exists with each process waiting for a resource held by the next process in chain

Handling deadlock

1) Deadlock Ignorance (Ostrich method)

- Don't affect performance

2) Deadlock prevention

- Remove all four condition or any one condition of dead lock
  1) Mutal exclusive
  2) hold and wait
  3) Circular wait
  4) No preemption

3) Deadlock Avoidance (Banker's Algo)

Date ..../..../.....

Banker's Algo (Deadlock Avoidance)
Deadlock Detection

Process	Allocation			Max need			Available			Remaing (max-alloca)			
	A	B	C	A	B	C	A	B	C	A	B	C	
P_1	0	1	0	7	5	3	3	3	2	7	4	3	✓
P_2	2	0	0	3	2	2	5	3	2	1	2	2	✓
P_3	3	0	2	9	0	2				6	0	0	X
P_4	2	1	1	4	2	2	7	4	3	2	1	1	✓
P_5	0	0	2	5	3	3	7	4	5	5	3	1	✓
	7	2	5				0	1	0				
							7	5	5				
							3	0	2				
							10	5	7				

Total A = 10 B = 5 C = 7

$10 - 7 = 3$ $\quad 5 - 2 = 3$ $\quad 7 - 5 = 2$

$P_2 \rightarrow P_4 \rightarrow P_5 \rightarrow P_1 \rightarrow P_6$

Safe sequence

Safe → No deadlock

Unsafe → Deadlock