First Come First Serve (FCFS) Scheduling Algorithm

(Non-Preemptive)   Execution time   (CT-AT) (TAT-BT)
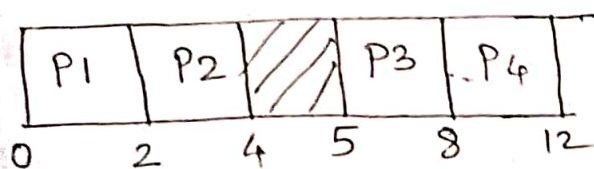
Process No.	Arrival time	Burst time	Completion Time	TAT (Turn Around Time)	WT (Waiting Time)	RT
Criteria = Arrival Time						
P1	0	2	2	2	0	0-0
P2	1	2	4	3	1	2-1=
P3	5	3	8	3	0	5-5=
P4	6	4	12	6	2	8-6=

mode
↓
Non-pre.

① (circled)

Gantt Chart

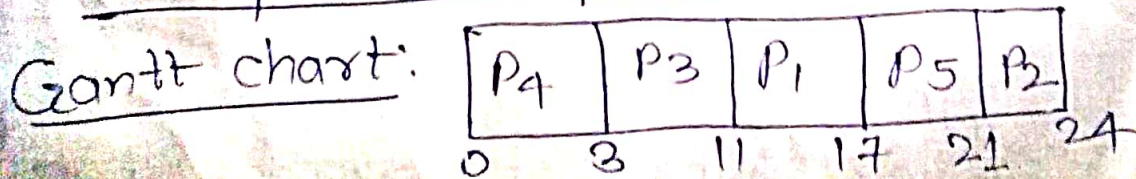| PI	P2	///	P3	P4

0   2   4   5   8   12

Response Time:
Time at which a process got the CPU first time − Arrival Time

$$\text{Avg. turn Around Time} = \frac{2+3+3+6}{\text{Total No. of Processes}} = \frac{14}{4} = 3.5$$

$$\text{Avg. waiting Time} = \frac{2+1}{4} = \frac{3}{4} = 0.75$$

Process ID	AT	BT	CT	TAT	WT	RT
P1	2	6	17	15	9	9
P2	5	3	24	19	16	16
P3	1	8	11	10	2	2
P4	0	3	3	3	0	0
P5	4	4	21	17	13	13

② (circled)

Gantt chart:

P4	P3	P1	P5	P2

0   3   11   17   21   24
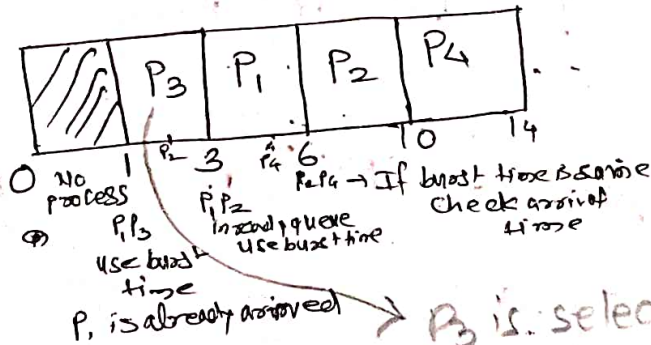
Avg TAT = 12.8
Avg WT = 8

SJF (Shortest Job First)

Criteria = "Burst time"   Mode = Non-preemptive

Process No.	Arrival time AT	Burst time BT	Completion time CT	TAT CT-AT	WT TAT-BT	RT
② - P_1	1	3	6	5	2	2
③ ⑳ P_2	2	4	10	8	4	८
① - P_3	1	2	3	2	0	
⑥ - P_4	4	4	14	10	6	

Criteria : Burst Time   Mode: Non-Pre-emptive

Gantt chart

$$Avg. TAT = \frac{25}{4} = 6.25$$

$$Avg. WT = \frac{12}{4} = 3$$

O No process

Ⓐ $P_1 P_3$ use burst time

P_1 is already arrived

$P_1 P_2$ In ready queue use burst time

$P_4 P_4 \rightarrow$ If burst time same check arrival time

P_3 is selected ∵ its BT is ↓ than P_1

SRTF (Shortest Job first remaining Time first)
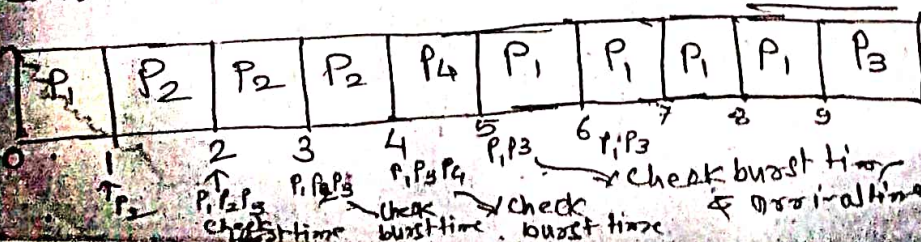### or SJF with pre-emption

Criteria = Burst Time

Process No.	Arrival Time	Burst Time	Completion Time	TAT CT-AT	WT TAT-BT	RT (CPU first time) -AT
P_1	0	5̶4̶3̶ -2+0	9	8̶ 9	4 (9-5)	0-0=0
P_2	1	3̶ 2̶ 0	4	3	0 (3-3)	1-1=0
P_3	2	4	13	11	7 (11-4)	9-2=7
P_4	4	↑0	5	1	0 (1-1)	4-4=0

criteria : Burst Time

mode : Pre-emptive

Gantt chart

P_1 | P_2 | P_2 | P_2 | P_4 | P_1 | P_1 | P_1 | P_1 | P_3

P_2 $P_1 P_2 P_3$ check burst time $P_1 P_2 P_3$ check burst time $P_1 P_2 P_4$ check burst time $P_1 P_3$ $P_1 P_3$ check burst time & arrival time

$$Avg. TAT = \frac{24}{4} = 6$$

$$Avg. WT = \frac{11}{4} = 2$$

$$Avg. RT = \frac{7}{4} = 1.7$$

B

SJF

Criteria = Burst Time
mode:- Non-preemptive

Process ID	AT	BT	CT	TAT (CT-AT)	WT (TAT-BT)	RT
P1	2	6	9	7	1	1
P2	5	2	11	6	4	4
P3	1	8	23	22	14	14
P4	0	3	3	3	0	0
P5	4	4	15	11	7	7

Gantt chart:

P4	P1	P2	P5	P3
0 3	9	11	15	23

Avg TAT = 9.8
Avg WT = 5.2

SJF = mode: Preemptive = SRTF

Process	AT	BT
P1	0	7
P2	1	4
P3	2	8

Gantt chart

P1	P2	P2	P2	P2	P1	P1	P1	P1	P1	P1	P3
0	1	2	3	4	5	6	7	8	9	10	11 19

P1	P2	P1	P3
0	1	5	11 19
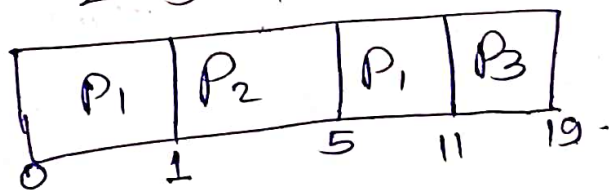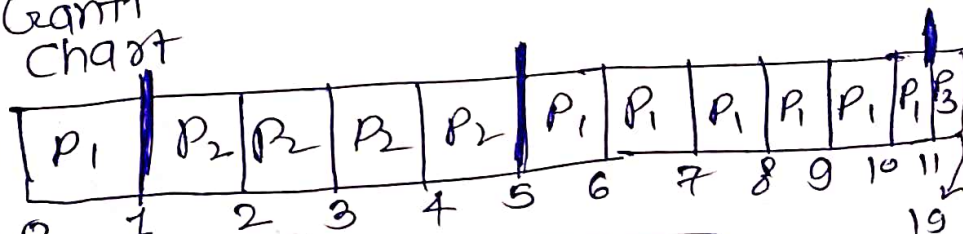
SRTF

Process	AT	BT	CT	TAT	WT	RT	
P1	0	8 7	20	20	12	0	Avg WT = 4
P2	1	4 3 2 1 0	10	9	5	0	
P3	2	2 1 0	4	2	0	0	
P4	3	1 0	5	2	1	1	
P5	4	3	13	9	6	6	
P6	5	2 1 0	7	2	0	0	

Gantt chart:

P1	P2	P3	P3	P4	P6	P6	P2	P5	P1
		2	3	4	5	6	7	10	13 20

1. Find average turn-around time using shortest job first (SJF) process. (Non-preemptive)

Process	Arrival Time AT	Burst Time	CT	TAT (CT-AT)	WT (TAT-BT)
P_1	2	6	9	7	1
P_2	5	2	11	6	4
P_3	1	8	19	18	10
P_4	0	3	3	3	0
				34/4=8.5	15/4=3.75

Gantt chart :

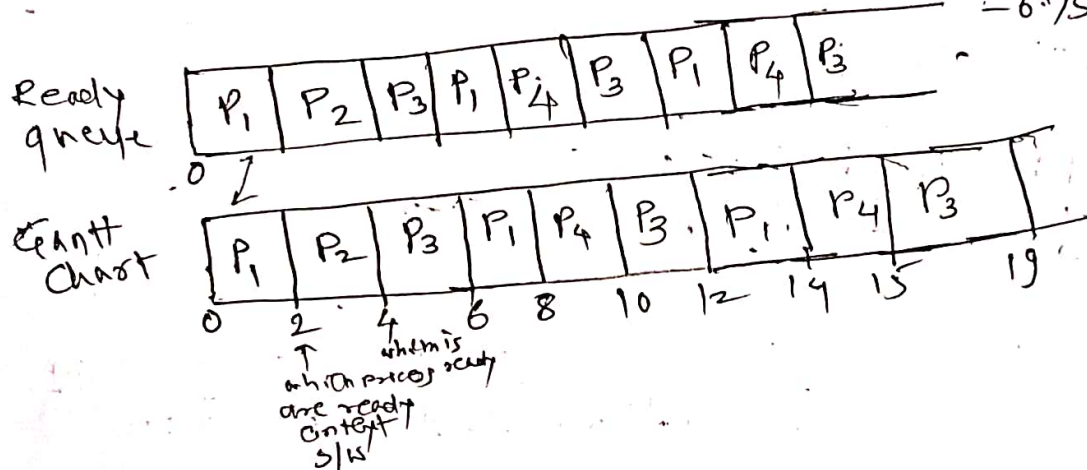| P_4	P_1	P_2	P_3

0 · 3   9   11   19
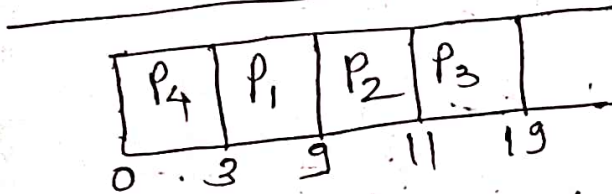
2. Find the average waiting time using SRTF (Shortest remaining time first) (Pre-emptive)

Process	Arrival Time	Burst Time	CT	TAT (CT-AT)	WT TAT-BT
P_1	0	6̶ 5	11	11	5
P_2	1	2̶ to	3	2	0
P_3	2	8	19	1̶7̶	1̶9̶
P_4	3	3̶ to	6	3	0
				14/4=3.5	

P_1	P_2	P_2	P_4	P_4	P_4	P_1		P_3

0   1   2   3   11   19

P_2,P_3 P_1,P_3,P_4 P_1,P_3,P_4 P_1,P_3,P_4 P_1,P_3
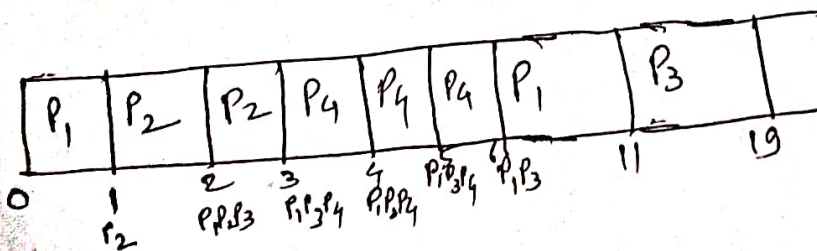
3. Determine the avg. waiting time using Round robin scheduling policy with $TQ = 2ms$

Process	Arrival Time	Burst Time	CT.	TAT CT-AT	WT TAT-BT
P_1	0	6 4 0	14	14	8
P_2	1	2 0	4	3	1
P_3	2	8 6 4 0	19	17	9
P_4	3	3 0	15	12	9
				$\frac{46}{4}$ =11.5	$\frac{27}{4}$ =6.75

Ready queue

P_1	P_2	P_3	P_1	P_4	P_3	P_1	P_4	P_3

0 2

Gantt chart

P_1	P_2	P_3	P_1	P_4	P_3	P_1	P_4	P_3

0   2   4   6   8   10   12   14   15   19

↑
when is
which process ready
are ready
context
S/W

5

Round Robin scheduling

Process No	Arrival Time	Burst Time	Completion Time	TAT (CT-AT)	WT (TAT-BT)	RT (CPU first time - AT)
P_1	0	5̶ 3 1	12	12	7	0-0=0
P_2	1	4̶ 2	11	10	6	2-1=1
P_3	2	2̶ 0	6	4	2	4-2=2
P_4	4	4̶ 0	9	5	4	8-4=4

criteria : Time Quantum, Mode: Pre-emptive

Given TQ = 2

Ready
queue

$P̶_1$	$P̶_2$	$P̶_3$	$P̶_1$	$P̶_4$	$P̶_2$	P_1	

0

Running
queue
(Gantt chart)

P_1	P_2	P_8	P_1	P_4	P_2	P_1	

0   2   4   6   8   9   11   12
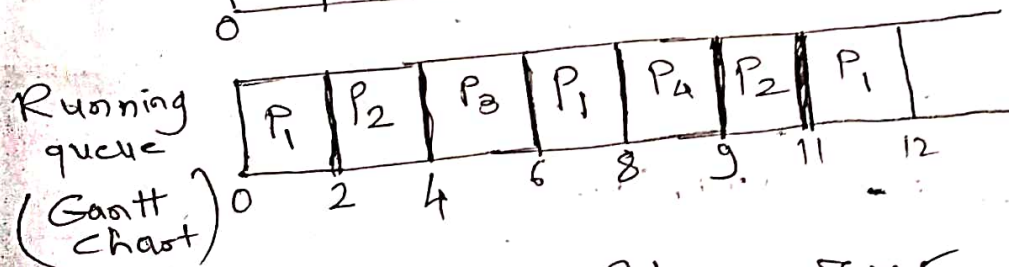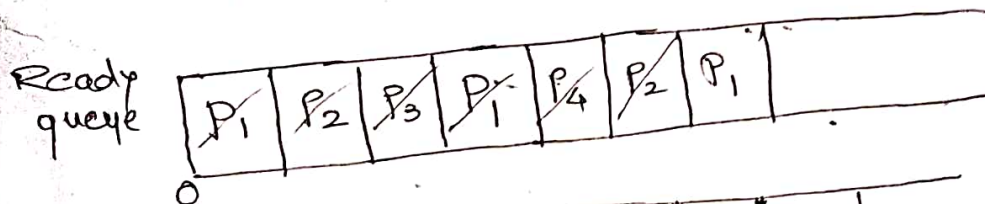
$$\text{Avg. TAT} = \frac{31}{4} = 7.75$$

$$\text{Avg. WT} = \frac{19}{4} = 4.75$$

$$\text{Avg. RT} = \frac{7}{4} = 1.75$$
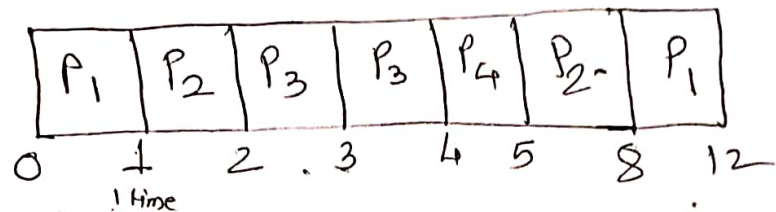
How many times context switching happen?
= 6

6

Priority Scheduling Algorithm (Preemptive)

Priority	Process No.	Arrival Time	Burst Time	Completion Time	TAT	WT
10	P_1	0	~~5~~4	12	12	7
20	P_2	1	~~4~~3	8	7	3
30	P_3	2	~~2~~0	4	2	0
40	P_4	4	~~1~~0	5	1	0

Criteria: "Priority"   Mode: Preemptive

Higher the no.
Higher the Priority

P_1	P_2	P_3	P_3	P_4	P_2	P_1

0 1 2 .3 4 5 8 12

1 time

$$\text{Avg. TAT} = \frac{22}{4}$$

$$\text{Avg. WT} = \frac{10}{4}$$

Run for 1 time quantum.

7