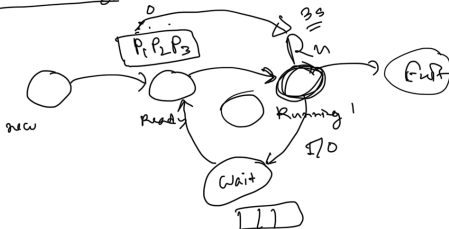


CPU Scheduling



1. Non-preemptive

2. preemptive →

$P_1 \rightarrow 10s \rightarrow \text{Exit}$

time sharing

$P_1 - 10s / 6$

$P_2 - 10s / 4$

$P_3 - 250$

$P_1 - 2+2$

$P_2 - 2+2$

$P_3 - 2$

Non preemptive

Preemptive

1. FCFS
2. SJF ✓
3. Priority
4. Multilevel Queue

1. SJF / SRTF ✓
2. Priority
3. Round-Robin

Arrival

2. Burst time: total time taken by process

3. Completion:

4. turnaround time:

5. Waiting time:

6. Response time:

$(\text{Exit} - \text{Arrival}) \text{ time}$

$(\text{TA} - \text{burst}) \text{ time}$

First time process gets the CPU - Arrival time

Scheduling Criteria:

1. Max CPU utilization:

Algo 1 →

60%

Algo 2 →

80% ✓

2. Max throughput: # of process complete per unit time

$$= \frac{\text{total \# of process}}{\text{total time}} = \frac{10}{70}$$

3. Min turnaround time

$$TA = \text{Burst} + \text{wait}$$

4. Min waiting time

5. Min response time



$$\frac{10}{120}$$

$$\frac{10 \text{ process}}{120 \text{ second}} \rightarrow \frac{10}{120} \text{ 1 sec}$$

FCFS

with arrival time

Process	Arrival	Burst	Completion	TA	wait	Remain
✓ P ₁	3	1	4	1	0	0
✓ P ₂	4	5	16	12	7	7
✓ P ₃	0	2	2	2	0	0
✓ P ₄	3	7	11	8	1	1
✓ P ₅	5	5	21	16	11	11

$$\text{Avg.} = \frac{\text{total comp}}{\text{\# of process}}$$

$$\text{Avg.} = \frac{\text{total TA}}{\text{\# of process}}$$

Gantt Chart:

Ready
P₁ P₄ P₂ P₅

... - Ann

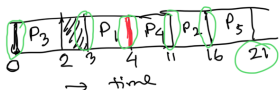
FCFS

with arrival time

Process	Arrival	Burst	Completion	TA	wait	Response
$\checkmark P_1$	3	1	4	1	0	0
$\checkmark P_2$	4	5	16	12	7	7
$\checkmark P_3$	0	2	2	2	0	0
$\checkmark P_4$	3	7	11	8	1	1
$\checkmark P_5$	5	5	21	16	11	11

$\text{Avg. delay} = \frac{\text{total comp}}{\# \text{ of process}}$
 $\text{Avg. delay TA} = \frac{\text{total TA}}{\# \text{ of process}}$

Gantt Chart:



Ready
 P_1, P_4, P_2, P_5
 $\frac{\text{Ready}}{P_1}$

$$TA = \text{Comp} - \text{Arr}$$

$$\text{wait} = TA - \text{burst}$$

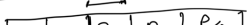
$$\text{Throughput} = \frac{5}{21}$$

SJF

with arrival time

Process	Arrival	Burst	Completion	TA	wait	Response
$\checkmark P_1$	4	5	15	11	6	6
$\checkmark P_2$	0	2	2	2	0	0
$\checkmark P_3$	1	5	10	9	4	4
$\checkmark P_4$	6	7	22	16	9	9
$\checkmark P_5$	2	3	5	3	0	0

Gantt chart:



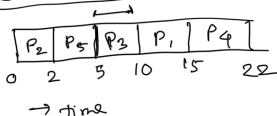
Ready Queue
 P_2

SJF

with arrival time

Process	Arrival	Burst	Completion	TA	Wait	Response
P₁	<u>4</u>	<u>5</u>	15	11	6	6
✓P ₂	0	2	2	2	0	0
✓P ₃	1	5	10	9	4	4
P ₄	<u>6</u>	<u>7</u>	22	16	9	9
✓P ₅	2	3	5	3	0	0

Gantt chart:



- Ready Queue

~~P₂~~
~~P₃~~ ~~P₅~~ ~~P₁~~ ~~P₄~~

Priority

(non-preemptive)

Process	Priority	Arrival	Burst	comp	TA	Wait	Res
✓P ₁	<u>2</u>	3	5				
✓P ₂	1	2	4				
✓P ₃	<u>3</u>	<u>5</u>	1				
✓P ₄	<u>4</u>	4	7				
✓P ₅	<u>3</u>	<u>1</u>	6				
✓P ₆	5	0	2				

highest priority

✓ less value

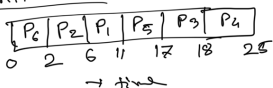
67

Priority (non-preemptive)

Process	Priority	Arrival	Burst	comp	TA	wait	Rev
✓ P ₁	<u>2</u>	3	5				
✓ P ₂	1	2	4				
✓ P ₃	<u>3</u>	<u>5</u>	1				
✓ P ₄	<u>4</u>	4	7				
✓ P ₅	<u>3</u>	<u>1</u>	6				
✓ P ₆	5	0	2				

✓ less value highest priority

Gantt chart:



$$\frac{6}{25}$$

Ready

P₆ P₂ P₅

P₁ P₃ P₄ P₅