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Operating System

Lab : 10

First Come First Serve (FCFS) Scheduling:

FCFS is an operating system process scheduling algorithm that automatically executes queued requests and processes by the order of their arrival.

FCFS also Known as:

FIFO (First in first out)

FCFC (First come first choice)

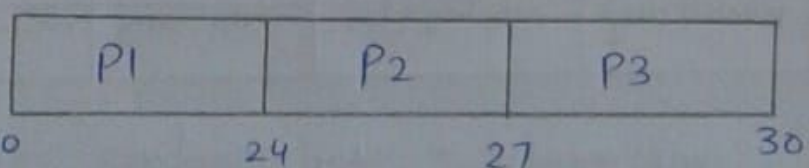
Examples:

Example : 1

PROCESS	ARRIVAL TIME	BURST TIME
P1	0	24
P2	0	3
P3	0	3

Answer:

Gantt chart.



Wait Time = Turn around time − Burst time

Turn around Time = Completion time − Arrival time

Process	Arrival time	Burst time	Completion time	Turn around time	wait time
P1	0	24	24	24	0
P2	0	3	27	27	24
P3	0	3	30	30	27

Total wait time = 0 + 24 + 27 = 51 ms

Average wait time = Total wait time / total no of processes

= 51 / 3 = 17 ms

Total Turn around time = 24 + 27 + 30 = 81 ms

Average Turn around time = Total turn around time / total no of processes

= 81 / 3 = 27 ms

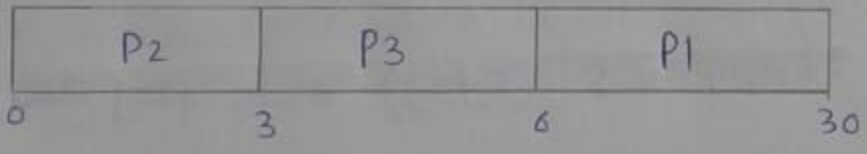
Throughput : 3 jobs / 30 sec = 0.1 jobs / sec

Example : 2

In the above example, if order of process arriving is P2, P3, P1

Answer:

Gantt chart :



Process	Arrival time	Burst time	Completion time	Turn around time	wait time
P2	0	3	3	3	0
P3	0	3	6	6	3
P1	0	24	30	30	6

Total wait time = 6 + 0 + 3 = 9ms

Average waiting time = 9/3 = 3ms

Total turn around time = 3 + 6 + 30 = 39 ms

Average Turn Around time = 39/3 = 13ms

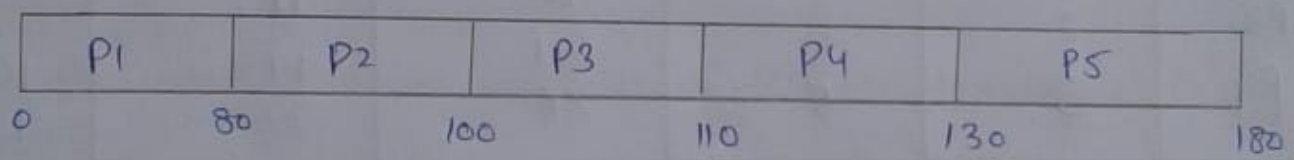
Throughput : 3 jobs/30 sec = 0.1 jobs/sec

Example : 3

PROCESS	ARRIVAL TIME	BURST TIME
P1	0	80
P2	0	20
P3	0	10
P4	0	20
P5	0	50

Answer:

Gantt chart:



Process	Arrival time	Burst time	Completion time	Turn Around time	wait time
P1	0	80	80	80	0
P2	0	20	100	100	80
P3	0	10	110	110	100
P4	0	20	130	130	110
P5	0	50	180	180	130

Total wait time = 0 + 80 + 100 + 110 + 130 = 420 ms

Average waiting time = 420/5 = 84 ms

Total turn around time = 80 + 100 + 110 + 130 + 180 = 600 ms

Average turn around time = 600/5 = 120ms.

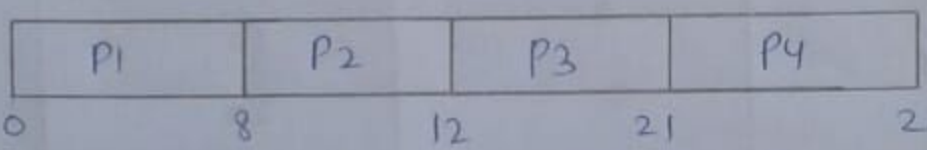
Throughput: 5 jobs/1055ec = 0.2778 jobs/sec

Example.4

PROCESS	ARRIVAL TIME	BURST TIME
P1	0	8
P2	1	4
P3	2	9
P4	3	5

Answer:

Gantt chart:



Process	Arrival time	Burst time	completion time	Turn around time	wait time
P1	0	8	8	8	0
P2	1	4	12	11	7
P3	2	9	21	19	10
P4	3	5	26	23	18

Total wait time = 0 + 7 + 10 + 18 = 35 ms.

Average waiting time = Total wait Time / Total no of processes

= 35/4 = 8.75 ms

Total turn around time = 8 + 11 + 19 + 23 = 61 ms

Average turn around time = Total turn around time / Total no of processes

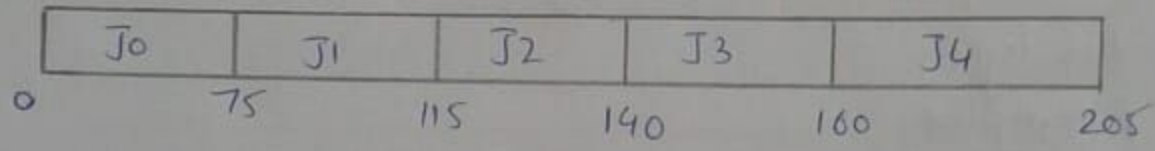
= 61/4 = 15.25 ms

Throughput: 4 jobs/26 sec = 0.15385 jobs/secs

Example: 5

Job	Execution time	Arrival time
0	75	0
1	40	10
2	25	10
3	20	80
4	45	85

Answer:



Job	Arrival Time	Execution Time	Completion time	Turn Around time	wait time
0	0	75	75	5	0
1	10	40	115	105	65
2	10	25	140	130	105
3	80	20	160	80	60
4	85	45	205	120	75

$$\text{Total wait time} = \frac{\text{All jobs waiting time}}{\text{no of jobs}}$$

$$= \frac{0 + 65 + 105 + 60 + 75}{5}$$

$$= \frac{305}{5}$$

$$= 61$$

Throughput: 5 jobs / 205 sec = 0.024 jobs/sec

Shortest Job first Scheduling Algorithm:

For SJF Scheduling algorithm, read the number of processes/jobs in the system, their CPU burst time Arrange all the jobs in order with respect to their burst times. There may be two queues with the same execution time, and then FCFS approach is to be performed. Each process will be executed according to the length of its burst time. Then calculate the waiting time and turn around time of each of the processes accordingly.

it is of two types:

1- Non-Preemptive

2- Pre-emptive

Non-Preemptive:

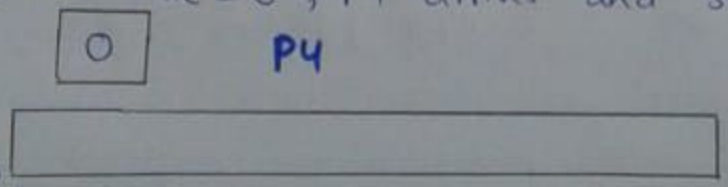
In non-preemptive scheduling, once the CPU cycle is allocated to process, the process holds it, till it reaches a waiting state or terminated

Example:

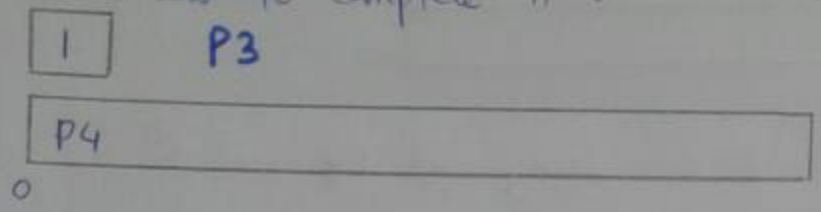
Consider the following 5 processes each having its own unique burst time and arrival time.

Process	Burst Time	Arrival time
P1	6	2
P2	2	5
P3	8	1
P4	3	0
P5	4	4

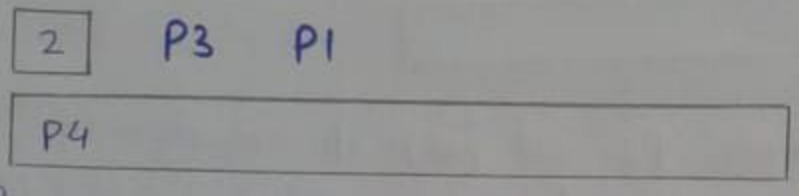
Step 0: At time = 0, P4 arrives and start execution.



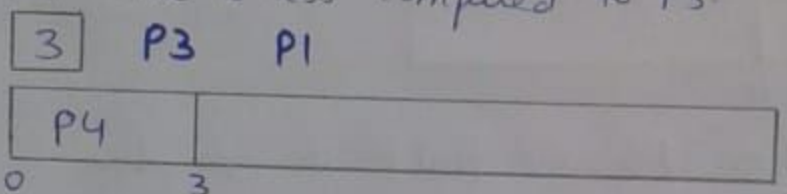
Step 1: At time = 1, Process P3 arrives. But, P4 still needs 2 execution units to complete. it will continue execution.



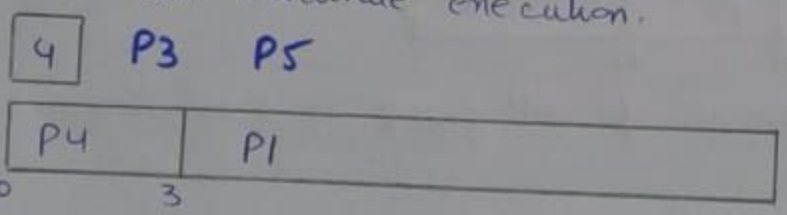
Step 2: At time = 2, process P1 arrives and is added to the waiting queue. P4 will continue execution



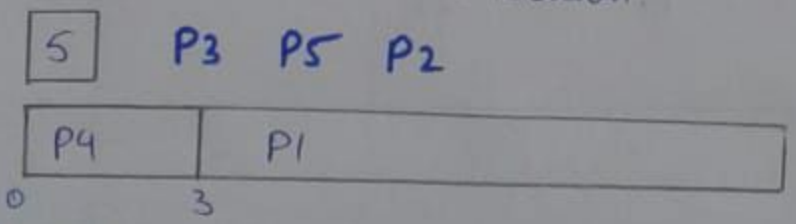
Step 3: At time = 3, process P4 will finish its execution. The burst time of P3 and P1 is compared. Process P1 is executed because its burst time is less compared to P3.



Step 4: At time = 4, process P5 arrives and is added to waiting queue. P1 will continue execution.

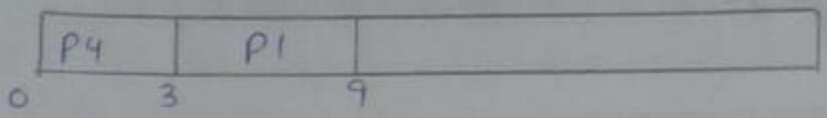


Step 5: At time = 5, process P2 arrives and is added to the waiting queue. P1 will continue execution.



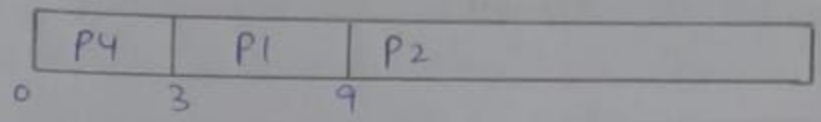
Step 6: At time = 9, process P1 will finish its execution. The burst time of P3, P5, and P2 is compared. Process P2 is executed because its burst time is the lowest.

9	P3 P5 P2



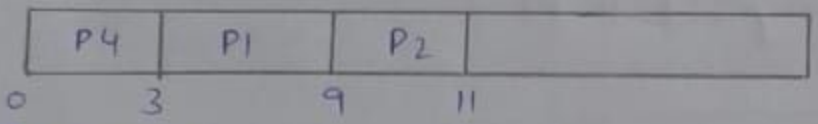
Step 7: At time = 10, P2 is executing and P3 and P5 are in the waiting queue

10	P3 P5



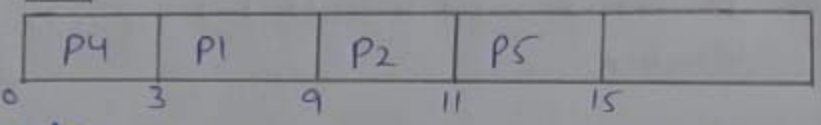
Step 8: At time = 11, Process P2 will finish its execution. The burst time of P3 and P5 is compared. process P5 is executed because its burst time is lower.

11	P3 P5



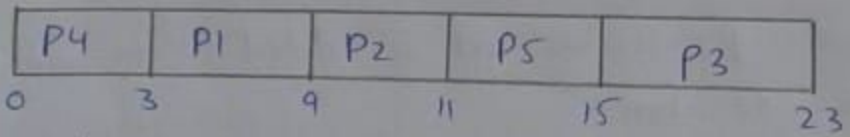
Step 9: At time = 15, process P5 will finish its execution.

15	P3



Step 10: At time = 23, process P3 will finish its execution.

23



wait time:

P4 = 0 - 0 = 0

P1 = 3 - 2 = 1

P2 = 9 - 5 = 4

P5 = 11 - 4 = 7

P3 = 15 - 1 = 14

Average waiting time = 0 + 1 + 4 + 7 + 14 / 5 = 26/5 = 5.2

Preemptive:

In preemptive SJF, jobs are put into ready queue as they come. A process will shortest burst time begins execution. If a process with even a shortest burst time arrives, the current process is removed or preempted from execution, and the shortest job is allocated CPU cycle.

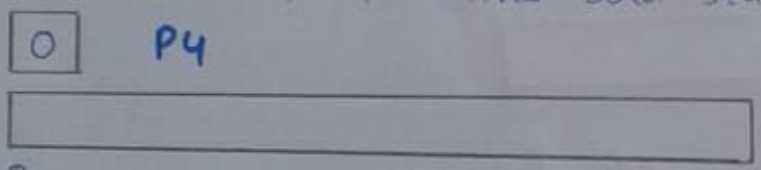
Example:

Consider the following 5 process:

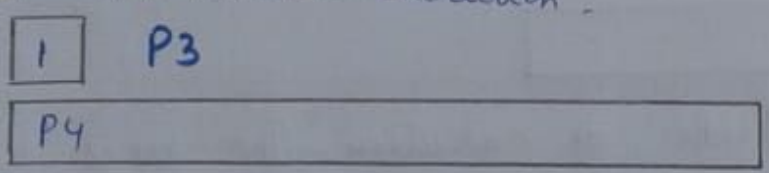
Process	Burst time	Arrival Time
P1	6	2
P2	2	5
P3	8	1
P4	3	0
P5	4	4

Answer:

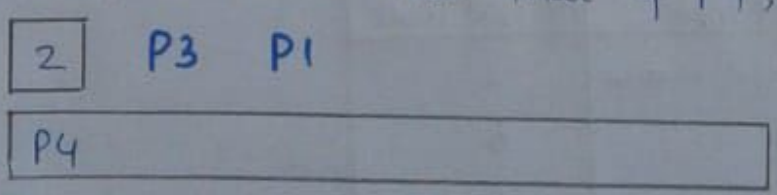
Step 0: At time = 0, P4 arrives and starts execution.



Step 1: At time = 1, Process P3 arrives. But, P4 has a shortest burst time. it will continue execution.

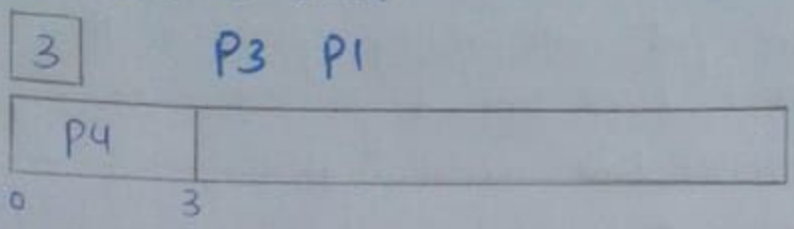


Step 2: At time = 2, process P1 arrives with burst time = 6. The burst time is more than that of P4, Hence P4 will continue execution.

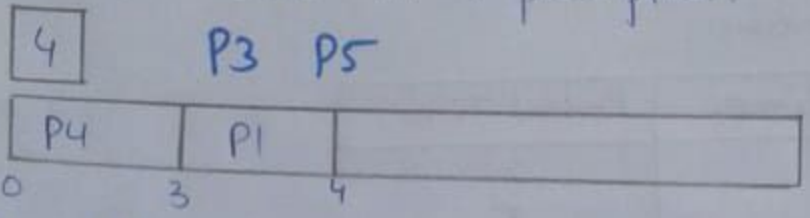


Step 3: At time = 3, process P4 will finish its execution. The Burst time of P3 and P1 is compared. P1 is executed bcz its

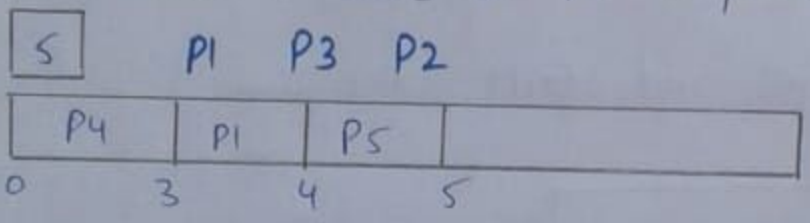
burst time is lower.



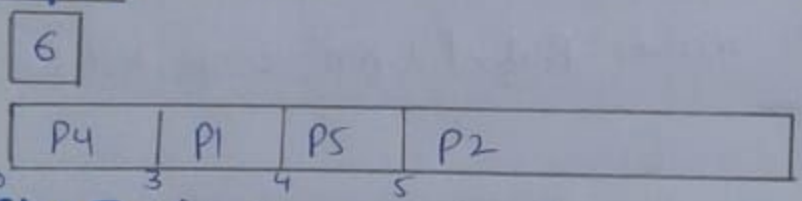
Step 4: At time = 4, process P5 will arrive. The burst time of P3, P5, and P1 is compared. process P5 is executed bcz its burst time is lowest. P1 is preempted.



Step 5: At time = 5, process P2 will arrive. The burst time of P1, P2, P3, and P5 is compared. process P2 is executed bcz its burst time is least. so P5 is preempted.



Step 6: At time = 6, P2 is executing.

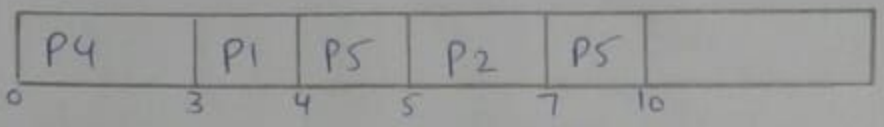


Step 7: At time = 7, P2 finishes its execution. The burst time of P1, P3 and P5 is compared. process P5 is executed bcz its burst time is lesser.

Process Queue	Burst time	Arrival time
P1	5 out of 6 remain	2
P2	2	5
P3	8	1
P4	3	0
P5	3 out of 4 remain	4

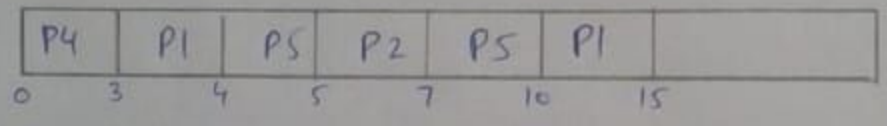
Step 8: At time = 10, P5 will finish its execution. The burst time of P1 and P3 is compared. process P1 is executed bcz its burst time is less.

10	P1	P3



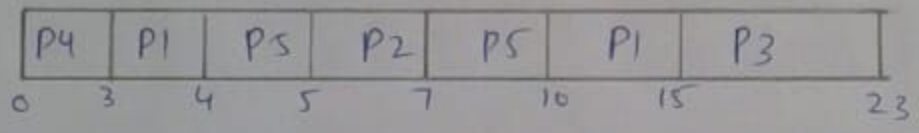
Step 9: At time = 15, P1 finishes its execution. P3 is the only process left. it will start execution.

15	P3



Step 10: At time = 23, P3 finishes its execution.

23



let's calculate the average waiting time of above example.

wait time:

P4 = 0 − 0 = 0

P1 = (3 − 2) + 6 = 7

P2 = 5 − 5 = 0

P5 = 4 − 4 + 2 = 2

P3 = 15 − 1 = 14

Average waiting time = 0 + 7 + 0 + 2 + 14 / 5

= 23/5

= 4.6