

First Come First Served and Shortest Job First: Wait times with different arrival times in the queue

Consider the following table with a list of processes, their burst times and the point in time in which they arrive in the queue to be scheduled:

Process	Arrival time	Burst time
P1	0	5
P2	2	3
P3	4	2
P4	6	4
P5	7	1

For SJF and FCFS calculate the wait time for each process, as well as the average wait time. Show the Gantt chart for both scheduling algorithms.

Hint: Arrival times are important now because they are different. In all previous examples we had assumed Arrival Time = 0 for all processes but somehow there was an ordering. Here of course P1 will start first because there is no other process in the queue at $t=0$, and it will complete at $t=5$. At that point in time, check and see what processes have arrived at the queue.

Sample Solution

Under Shortest Job First

At $t=0$ there is only one process in the queue (P1) so it gets served first, it needs 5 time units to complete:

P1

$t = 0 \quad 5$

Then at $t=5$ (once P1 has completed) in the queue 2 new processes have arrived: P2 and P3. Because we do SJF, we select P3 next since it has a shorter burst duration than P2:

P1 P3

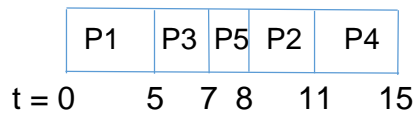
$t = 0 \quad 5 \quad 7$

P3 completes at $t=7$ and at that point in time P4 and P5 have also joined the queue. The queue therefore now contains P2, P4 and P5. Because P5 has the shortest burst it is served next:

P1 P3 P5

$t = 0 \quad 5 \quad 7 \quad 8$

The next process served is P2 with burst 3, and then finally P4 with burst 4:



Based on this Gantt chart we can calculate the wait time for each process and the average wait time:

Process	Arrival time	Burst time	Wait time
P1	0	5	0
P2	2	3	6
P3	4	2	1
P4	6	4	5
P5	7	1	0

For each process, wait time is equal to: **“start of serving” time – arrival time:**

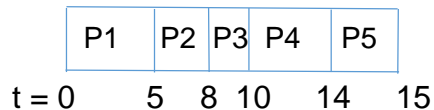
P1 waits 0 as it gets served immediately.

P2 waits for 6 time units, as it arrived at t=2 and started getting served at t=8, so 8-2 = 6, etc.

Average waiting time is therefore: $12/5 = 2.4$

Under First Come First Served

Using the same rationale as before, but with FCFS scheduling instead of SJF, we have the following Gantt chart:



The wait times and average wait time are:

Process	Arrival time	Burst time	Wait time
P1	0	5	0
P2	2	3	3
P3	4	2	4
P4	6	4	4
P5	7	1	7

Average waiting time is therefore: $18/5 = 3.6$