# Lab Five

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# 1 Problem One
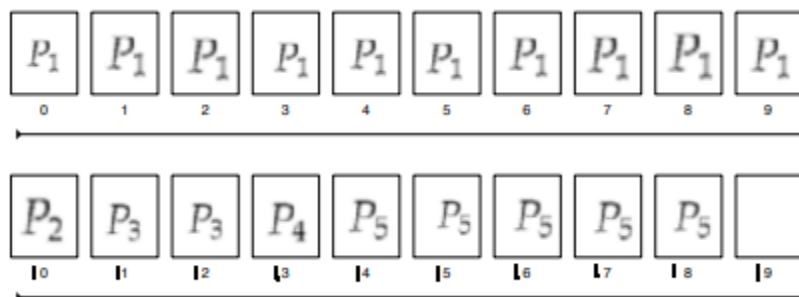
Consider the following set of processes, with the length of the CPU burst given in milliseconds:

| Process | Burst Time | Priority |
|---------|-----------|----------|
| $P_1$ | 10 | 3 |
| $P_2$ | 1 | 1 |
| $P_3$ | 2 | 3 |
| $P_4$ | 1 | 4 |
| $P_5$ | 5 | 2 |

The processes are assumed to have arrived in the order $P_1$, $P_2$, $P_3$, $P_4$, $P_5$, all at the time 0

## 1.1 First Come First Serve

### 1.1.1 Time Chart



### 1.1.2 Turnaround Time
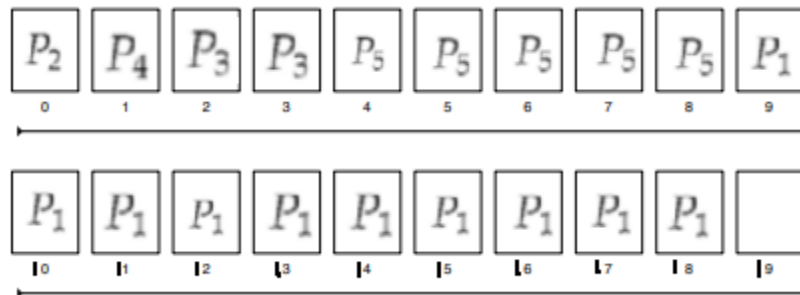
- $P_1$ - 10 milliseconds

- $P_2$ - 11 milliseconds
- $P_3$ - 13 milliseconds
- $P_4$ - 14 milliseconds
- $P_5$ - 19 milliseconds

### 1.1.3 WAITING TIME

- $P_1$ - 0 milliseconds
- $P_2$ - 10 milliseconds
- $P_3$ - 11 milliseconds
- $P_4$ - 13 milliseconds
- $P_5$ - 14 milliseconds

## 1.2 SHORTEST JOB FIRST

### 1.2.1 TIME CHART

| $P_2$ | $P_4$ | $P_3$ | $P_3$ | $P_5$ | $P_5$ | $P_5$ | $P_5$ | $P_5$ | $P_1$ |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

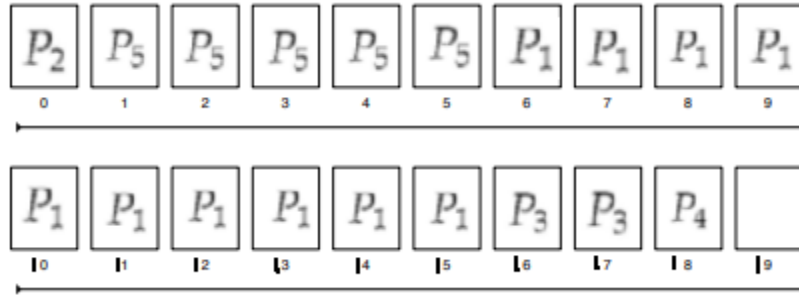| $P_1$ | $P_1$ | $P_1$ | $P_1$ | $P_1$ | $P_1$ | $P_1$ | $P_1$ | $P_1$ | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

### 1.2.2 TURNAROUND TIME

- $P_1$ - 19 milliseconds
- $P_2$ - 1 milliseconds
- $P_3$ - 4 milliseconds
- $P_4$ - 2 milliseconds
- $P_5$ - 9 milliseconds

### 1.2.3 WAITING TIME

- $P_1$ - 9 milliseconds
- $P_2$ - 0 milliseconds
- $P_3$ - 2 milliseconds
- $P_4$ - 1 milliseconds
- $P_5$ - 4 milliseconds

## 1.3 Nonpreemptive Priority

### 1.3.1 Time Chart

| $P_2$ | $P_5$ | $P_5$ | $P_5$ | $P_5$ | $P_5$ | $P_1$ | $P_1$ | $P_1$ | $P_1$ |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

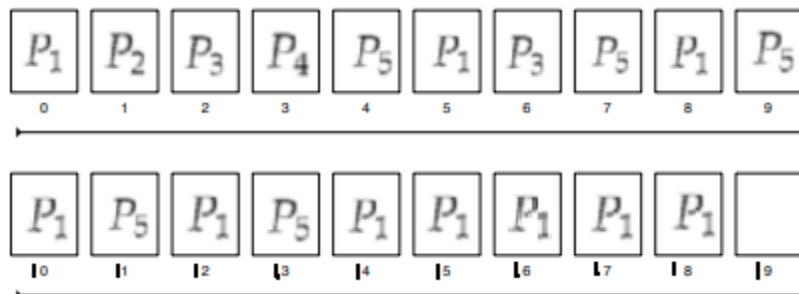| $P_1$ | $P_1$ | $P_1$ | $P_1$ | $P_1$ | $P_1$ | $P_3$ | $P_3$ | $P_4$ | |
|---|---|---|---|---|---|---|---|---|---|
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |

### 1.3.2 Turnaround Time

- $P_1$ - 16 milliseconds
- $P_2$ - 1 milliseconds
- $P_3$ - 18 milliseconds
- $P_4$ - 19 milliseconds
- $P_5$ - 6 milliseconds

### 1.3.3 Waiting Time

- $P_1$ - 6 milliseconds
- $P_2$ - 0 milliseconds
- $P_3$ - 16 milliseconds
- $P_4$ - 18 milliseconds
- $P_5$ - 1 milliseconds

## 1.4 Round Robin (Quantum = 1)

### 1.4.1 Time Chart

| $P_1$ | $P_2$ | $P_3$ | $P_4$ | $P_5$ | $P_1$ | $P_3$ | $P_5$ | $P_1$ | $P_5$ |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

| $P_1$ | $P_5$ | $P_1$ | $P_5$ | $P_1$ | $P_1$ | $P_1$ | $P_1$ | $P_1$ | |
|---|---|---|---|---|---|---|---|---|---|
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |

### 1.4.2 Turnaround Time

- $P_1$ - 19 milliseconds
- $P_2$ - 2 milliseconds
- $P_3$ - 7 milliseconds
- $P_4$ - 4 milliseconds
- $P_5$ - 14 milliseconds

### 1.4.3 Waiting Time

- $P_1$ - 9 milliseconds
- $P_2$ - 1 milliseconds
- $P_3$ - 5 milliseconds
- $P_4$ - 3 milliseconds
- $P_5$ - 9 milliseconds

## 1.5 Results

Average Waiting Times:

- First Come First Serve - $(48/5) = 9.6$ milliseconds
- Shortest Job First - $(16/5) = 3.2$ milliseconds
- Nonpreemptive Priority - $(41/5) = 8.2$ milliseconds
- Round Robin - $(27/5) = 5.4$ milliseconds

As a result, the Shortest Job First scheduling type resulted in the minimum average waiting time.