a. Here are the Gantt charts for the given scheduling algorithms:

**FCFS (First-Come, First-Served):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Time** | **P1** | **P2** | **P3** | **P4** | **P5** |
| 0 | P1 |  |  |  |  |
| 2 |  | P2 |  |  |  |
| 3 |  |  |  |  |  |
| 7 |  |  | P4 |  |  |
| 11 |  |  |  |  | P5 |
| 17 |  |  |  |  |  |
| 26 |  |  |  | P3 |  |

**SJF (Shortest Job First):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Time** | **P2** | **P1** | **P4** | **P5** | **P3** |
| 0 | P2 |  |  |  |  |
| 1 |  | P1 |  |  |  |
| 3 |  |  | P4 |  |  |
| 7 |  |  |  | P5 |  |
| 13 |  |  |  |  | P3 |

**Nonpreemptive Priority (Lower Number = Higher Priority):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Time** | **P2** | **P4** | **P1** | **P5** | **P3** |
| 0 | P2 |  |  |  |  |
| 1 |  |  | P1 |  |  |
| 3 |  | P4 |  |  |  |
| 7 |  |  |  |  | P5 |
| 13 |  |  |  |  |  |
| 26 |  |  |  | P3 |  |

**RR (Round Robin with Quantum = 2):**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Time** | **P1** | **P2** | **P4** | **P5** | **P3** | **P1** | **P4** | **P5** |
| 0 | P1 |  |  |  |  |  |  |  |
| 2 |  | P2 |  |  |  |  |  |  |
| 4 |  |  | P4 |  |  |  |  |  |
| 6 |  |  |  | P5 |  |  |  |  |
| 8 |  |  |  |  | P3 |  |  |  |
| 10 | P1 |  |  |  |  |  |  |  |
| 12 |  |  | P4 |  |  |  |  |  |
| 14 |  |  |  | P5 |  |  |  |  |
| 16 |  |  |  |  | P3 |  |  |  |
| 18 |  |  |  |  |  | P1 |  |  |
| 20 |  |  |  |  |  |  | P4 |  |
| 22 |  |  |  |  |  |  |  | P5 |
| 24 |  |  |  |  |  |  |  |  |
| 26 |  |  |  |  |  |  | P3 |  |

b. To calculate turnaround time and waiting time, you need to know when each process finishes and when it starts. Here are the turnaround time and waiting time for each process for each scheduling algorithm:

**FCFS:**

|  |  |  |
| --- | --- | --- |
| **Process** | **Turnaround Time** | **Waiting Time** |
| P1 | 26 | 0 |
| P2 | 3 | 2 |
| P3 | 17 | 8 |
| P4 | 26 | 22 |
| P5 | 26 | 20 |

**SJF:**

|  |  |  |
| --- | --- | --- |
| **Process** | **Turnaround Time** | **Waiting Time** |
| P1 | 3 | 1 |
| P2 | 7 | 0 |
| P3 | 26 | 17 |
| P4 | 26 | 22 |
| P5 | 13 | 7 |

**Nonpreemptive Priority:**

|  |  |  |
| --- | --- | --- |
| **Process** | **Turnaround Time** | **Waiting Time** |
| P1 | 26 | 0 |
| P2 | 3 | 2 |
| P3 | 26 | 17 |
| P4 | 26 | 22 |
| P5 | 13 | 7 |

**RR (Quantum = 2):**

|  |  |  |
| --- | --- | --- |
| **Process** | **Turnaround Time** | **Waiting Time** |
| P1 | 18 | 16 |
| P2 | 7 | 6 |
| P3 | 26 | 20 |
| P4 | 22 | 18 |
| P5 | 24 | 18 |

**FCFS:**

* Average Turnaround Time: (26 + 3 + 26 + 26 + 26) / 5 = 21.4
* Average Waiting Time: (0 + 2 + 17 + 22 + 20) / 5 = 12.2

**SJF:**

* Average Turnaround Time: (3 + 7 + 26 + 26 + 13) / 5 = 15
* Average Waiting Time: (1 + 0 + 17 + 22 + 7) / 5 = 9.4

**Nonpreemptive Priority:**

* Average Turnaround Time: (26 + 3 + 26 + 26 + 13) / 5 = 18.8
* Average Waiting Time: (0 + 2 + 17 + 22 + 7) / 5 = 10.6

**RR (Quantum = 2):**

* Average Turnaround Time: (18 + 7 + 26 + 22 + 24) / 5 = 19.4
* Average Waiting Time: (16 + 6 + 20 + 18 + 18) / 5 = 15.6