FCFS CPU scheduler Code and Report

Project objective: To learn more about OS CPU scheduling through a hands-on simulation programming experience. To simulate, compare, and evaluate CPU scheduling algorithms using a consistent set of data.

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Date:
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Language used:
C++

1. Provide clear instructions on how to compile, build, and run the simulator (this will indicate that the application has been tested and works on the engineering student desktop)

   Launch **Video Studio**
   - Click **Create New Product**.
   - Select **Console App**.
   - Click **Next**.
   - Enter pertinent information to start project (Name, Location, Etc.)
   - Click **Create**
   - Copy source code from text file and paste in .cpp file (override all previous text)
   - Build project (Build Menu -> Build [Name]).
   - Run project (Debug Menu -> Start Without Debugging).

2. Introduction

   This program was meant to model the FCFS CPU scheduling algorithm to demonstrate a complete understanding of various scheduling algorithm like FCFS. This program was developed in C++ using structs and other various data structures and concepts to organize and properly process data. The expected results of this scheduling algorithm were those represented in the completed Gantt chart and my understanding of the FCFS algorithm. The program seemed to be straightforward, but I encountered a host of issues that were a result of my failure to make reasonable considerations. I had issues making sure that after every run information was accurate and properly processed but eventually, I was able to work through them with the use of online resources like GeeksforGeeks and the C++ STL library which gave me an insightful understanding of things I was previously unsure of with C++.

3. **Insert one table** that includes the entire simulation results for CPU Utilization, Response Time (RT) , Waiting Time (WT), Turnaround Time (TT) **PER PROCESS and Averages** for both FCFS(710 time units) and SJF (810 time units)

Process (FCFS Results)	RT (Response Time)	WT (Wait Time)	TT (Turnaround Time)
P1	0	298	583
P2	6	233	647
P3	25	249	512
P4	37	231	657
P5	48	298	620
P6	64	243	599
P7	84	315	710
P8	87	341	684
AVG	**43.875**	**276**	**626.5**
CPU Utilization	**95.3521%**		
SJF (FCFS Results)	**RT (Response Time)**	**WT (Wait Time)**	**TT (Turnaround Time)**
P1	3	65	350
P2	104	230	644

P3	20	117	380
P4	9	79	505
P5	79	216	538
P6	431	454	810
P7	0	60	455
P8	41	121	464
AVG	**85.875**	**167.75**	**518.25**
CPU Utilization	**82.35%**		

4. Answer the following questions in full sentences with a brief explanation, IN YOUR OWN WORDS:

    a. Which algorithm (FCFS or SJF) has the best (highest) CPU utilization, why do you think that algorithm has a higher CPU utilization?

    FCFS has the best CPU utilization. I think that this algorithm has higher CPU utilization because there are less context switches as is no preemption.

    b. How many context switches are in the simulation of FCFS?

    There are 71 context switches in the simulation of FCFS.

    c. How many context switches are in the simulation of SJF?

    There are 76 context switches in the simulation of SJF.

    d. How does the number of context switches effect the performance of the algorithm?

    More context switches negatively affect the performance of the algorithm as context switch time is pure overhead and thus the system does not do any useful work.

    e. Which algorithm (FCFS or SJF) has the lowest average waiting time?

    The algorithm with the lowest average waiting time is SJF.

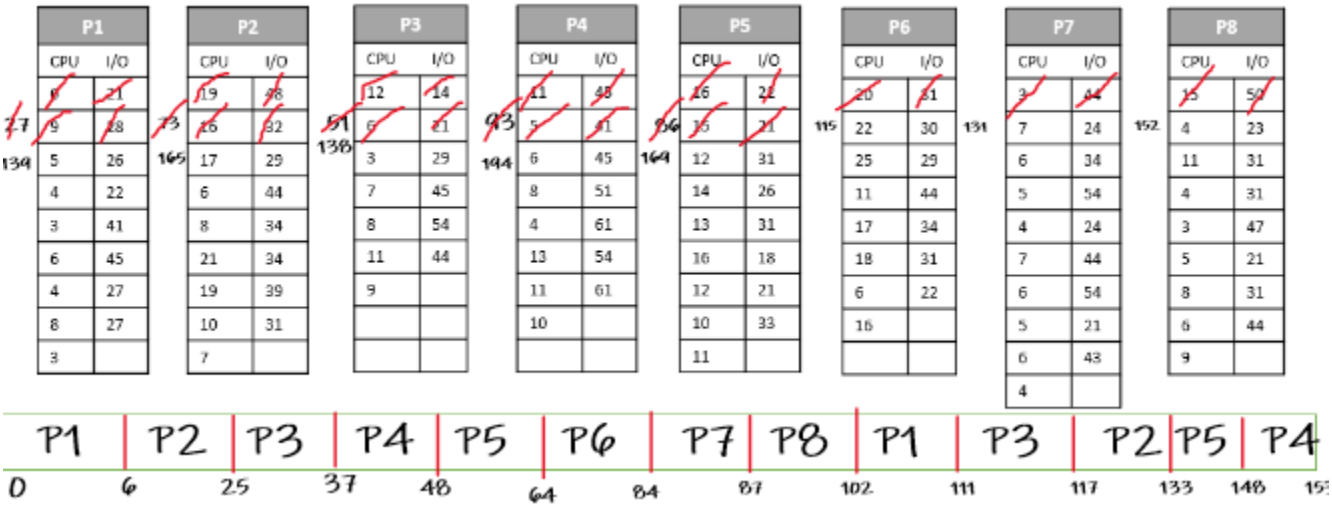
    f. Which algorithm (FCFS or SJF) has the lowest average response time?

    The algorithm with the lowest average response time is FCFS.

    g. Which algorithm (FCFS or SJF) has the lowest average turnaround time?

    The algorithm with the lowest average turnaround time is SJF.

5. Insert a partial or complete Gantt chart for FCFS.



6. Insert the calculated results that were produced by the simulation.

```
Finished

Total Time:             710
CPU Utilization:        95.3521%


Waiting Times           P1      P2      P3      P4      P5      P6      P7      P8
                        298     227     224     194     250     179     231     254
Average Waiting:        232.125

Turnaround Times        P1      P2      P3      P4      P5      P6      P7      P8
                        583     641     487     620     572     535     626     597
Average Turnaround:     582.625

Response Times          P1      P2      P3      P4      P5      P6      P7      P8
                        0       6       25      37      48      64      84      87
    Average Response:       43.875
```

7. Insert the FCFS Program Output. (**Be mindful that spacing and tabbing is a bit off**)

```
Current Time: 0

Now running: P1

------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P2    19
            P3    12
            P4    11
            P5    16
            P6    20
            P7    3
            P8    15

------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            [empty]

------------------------------------------------------------------------

Completed: [empty]

------------------------------------------------------------------------
------------------------------------------------------------------------

Current Time: 6

Now running: P2

------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P3    12
            P4    11
            P5    16
            P6    20
            P7    3
            P8    15

------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P1    21

------------------------------------------------------------------------

Completed: [empty]

------------------------------------------------------------------------
------------------------------------------------------------------------

Current Time: 25

Now running: P3

------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P4    11
```

```
            P5    16
            P6    20
            P7    3
            P8    15

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P1    2
            P2    48

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 37

Now running: P4

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    9
            P5    16
            P6    20
            P7    3
            P8    15

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P2    36
            P3    14

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 48

Now running: P5

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    9
            P6    20
            P7    3
            P8    15

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P2    25
            P3    3
            P4    45
```

```
--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 64

Now running: P6

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    9
            P3    6
            P7    3
            P8    15

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P2    9
            P4    29
            P5    22

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 84

Now running: P7

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    9
            P2    16
            P3    6
            P8    15

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    9
            P5    2
            P6    31

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 87
```

```
Now running: P8

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    9
            P2    16
            P3    6
            P5    15

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    6
            P6    28
            P7    44

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 102

Now running: P1

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P2    16
            P3    6
            P4    5
            P5    15

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P6    13
            P7    29
            P8    50

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 111

Now running: P3

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P2    16
            P4    5
            P5    15

--------------------------------------------------------------------------
```

```
Now in I/O:Process          Remaining I/O time
           P6    4
           P7    20
           P8    41
           P1    28

------------------------------------------------------------------------

Completed: [empty]

------------------------------------------------------------------------
------------------------------------------------------------------------

Current Time: 117

Now running: P2

------------------------------------------------------------------------

Ready Queue:     Process          Burst
           P4    5
           P5    15
           P6    22

------------------------------------------------------------------------

Now in I/O:Process          Remaining I/O time
           P7    14
           P8    35
           P1    22
           P3    21

------------------------------------------------------------------------

Completed: [empty]

------------------------------------------------------------------------
------------------------------------------------------------------------

Current Time: 133

Now running: P5

------------------------------------------------------------------------

Ready Queue:     Process          Burst
           P4    5
           P6    22
           P7    7

------------------------------------------------------------------------

Now in I/O:Process          Remaining I/O time
           P8    19
           P1    6
           P3    5
           P2    32

------------------------------------------------------------------------

Completed: [empty]
```

```
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Current Time: 148

Now running: P4

--------------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    5
            P3    3
            P6    22
            P7    7

--------------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P8    4
            P2    17
            P5    21

--------------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Current Time: 153

Now running: P6

--------------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    5
            P3    3
            P7    7
            P8    4

--------------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P2    12
            P5    16
            P4    41

--------------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Current Time: 175

Now running: P7

--------------------------------------------------------------------------------
```

```
Ready Queue:     Process          Burst
            P1    5
            P2    17
            P3    3
            P5    12
            P8    4

-------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    19
            P6    30

-------------------------------------------------------------------------

Completed: [empty]

-------------------------------------------------------------------------
-------------------------------------------------------------------------

Current Time: 182

Now running: P3

-------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    5
            P2    17
            P5    12
            P8    4

-------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    12
            P6    23
            P7    24

-------------------------------------------------------------------------

Completed: [empty]

-------------------------------------------------------------------------
-------------------------------------------------------------------------

Current Time: 185

Now running: P1

-------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P2    17
            P5    12
            P8    4

-------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    9
            P6    20
```

```
            P7    21
            P3    29

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 190

Now running: P8

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P2    17
            P5    12

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    4
            P6    15
            P7    16
            P3    24
            P1    26

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 194

Now running: P2

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P4    6
            P5    12

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P6    11
            P7    12
            P3    20
            P1    22
            P8    23

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------
```

```
Current Time: 211

Now running: P5

------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P4    6
            P6    25
            P7    6

------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P3    3
            P1    5
            P8    6
            P2    29

------------------------------------------------------------------------

Completed: [empty]

------------------------------------------------------------------------
------------------------------------------------------------------------

Current Time: 223

Now running: P4

------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    4
            P3    7
            P6    25
            P7    6
            P8    11

------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P2    17
            P5    31

------------------------------------------------------------------------

Completed: [empty]

------------------------------------------------------------------------
------------------------------------------------------------------------

Current Time: 229

Now running: P6

------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    4
            P3    7
            P7    6
```

```
            P8    11

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P2    11
            P5    25
            P4    45

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 254

Now running: P7

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    4
            P2    6
            P3    7
            P5    14
            P8    11

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    20
            P6    29

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 260

Now running: P3

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    4
            P2    6
            P5    14
            P8    11

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    14
            P6    23
            P7    34

--------------------------------------------------------------------------
```

```
Completed: [empty]

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Current Time: 267

Now running: P1

--------------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P2    6
            P5    14
            P8    11

--------------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    7
            P6    16
            P7    27
            P3    45

--------------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Current Time: 271

Now running: P8

--------------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P2    6
            P5    14

--------------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    3
            P6    12
            P7    23
            P3    41
            P1    22

--------------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Current Time: 282

Now running: P2
```

```
--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P4    8
            P5    14

--------------------------------------------------------------------------

Now in I/O:Process          Remaining I/O time
            P6    1
            P7    12
            P3    30
            P1    11
            P8    31

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 288

Now running: P5

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P4    8
            P6    11

--------------------------------------------------------------------------

Now in I/O:Process          Remaining I/O time
            P7    6
            P3    24
            P1    5
            P8    25
            P2    44

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 302

Now running: P4

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    3
            P6    11
            P7    5

--------------------------------------------------------------------------

Now in I/O:Process          Remaining I/O time
```

```
            P3    10
            P8    11
            P2    30
            P5    26

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 310

Now running: P6

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    3
            P7    5

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P3    2
            P8    3
            P2    22
            P5    18
            P4    51

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 321

Now running: P1

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P3    8
            P7    5
            P8    4

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P2    11
            P5    7
            P4    40
            P6    44

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
```

```
--------------------------------------------------------------------------

Current Time: 324

Now running: P7

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P3    8
            P8    4

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P2    8
            P5    4
            P4    37
            P6    41
            P1    41

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 329

Now running: P3

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P5    13
            P8    4

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P2    3
            P4    32
            P6    36
            P1    36
            P7    54

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 337

Now running: P8

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P2    8
```

```
            P5    13

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    24
            P6    28
            P1    28
            P7    46
            P3    54

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 341

Now running: P5

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P2    8

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    20
            P6    24
            P1    24
            P7    42
            P3    50
            P8    31

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 354

Now running: P2

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            [empty]

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    7
            P6    11
            P1    11
            P7    29
            P3    37
            P8    18
```

```
            P5    31

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 362

Now running: P4

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            [empty]

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P6    3
            P1    3
            P7    21
            P3    29
            P8    10
            P5    23
            P2    34

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 366

Now running: P1

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P6    17

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P7    17
            P3    25
            P8    6
            P5    19
            P2    30
            P4    61

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------
```

```
Current Time: 372

Now running: P6

------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P8    3

------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P7    11
            P3    19
            P5    13
            P2    24
            P4    55
            P1    45

------------------------------------------------------------------------

Completed: [empty]

------------------------------------------------------------------------
------------------------------------------------------------------------

Current Time: 389

Now running: P8

------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P5    16
            P7    4

------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P3    2
            P2    7
            P4    38
            P1    28
            P6    34

------------------------------------------------------------------------

Completed: [empty]

------------------------------------------------------------------------
------------------------------------------------------------------------

Current Time: 392

Now running: P7

------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P3    11
            P5    16
```

```
--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P2    4
            P4    35
            P1    25
            P6    31
            P8    47

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 396

Now running: P5

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P2    21
            P3    11

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    31
            P1    21
            P6    27
            P8    43
            P7    24

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 412

Now running: P3

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P2    21

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    15
            P1    5
            P6    11
            P8    27
            P7    8
            P5    18

--------------------------------------------------------------------------
```

```
Completed: [empty]

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Current Time: 423

Now running: P2

--------------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    4
            P6    18
            P7    7

--------------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    4
            P8    16
            P5    7
            P3    44

--------------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Current Time: 444

Now running: P1

--------------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P4    13
            P5    12
            P6    18
            P7    7
            P8    5

--------------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P3    23
            P2    34

--------------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Current Time: 448

Now running: P7
```

```
--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P4    13
            P5    12
            P6    18
            P8    5

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P3    19
            P2    30
            P1    27

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 455

Now running: P6

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P4    13
            P5    12
            P8    5

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P3    12
            P2    23
            P1    20
            P7    44

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 473

Now running: P4

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P3    9
            P5    12
            P8    5

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
```

```
            P2    5
            P1    2
            P7    26
            P6    31

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 486

Now running: P5

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    8
            P2    19
            P3    9
            P8    5

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P7    13
            P6    18
            P4    54

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 498

Now running: P8

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    8
            P2    19
            P3    9

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P7    1
            P6    6
            P4    42
            P5    21

--------------------------------------------------------------------------

Completed: [empty]

--------------------------------------------------------------------------
```

```
--------------------------------------------------------------------------

Current Time: 503

Now running: P3

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    8
            P2    19
            P7    6

--------------------------------------------------------------------------

Now in I/O:Process          Remaining I/O time
            P6    1
            P4    37
            P5    16
            P8    21

--------------------------------------------------------------------------

Completed: P3
--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 512

Now running: P1

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P2    19
            P6    6
            P7    6

--------------------------------------------------------------------------

Now in I/O:Process          Remaining I/O time
            P4    28
            P5    7
            P8    12

--------------------------------------------------------------------------

Completed: P3
--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 520

Now running: P2

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P5    10
            P6    6
            P7    6
```

```
--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    20
            P8    4
            P1    27

--------------------------------------------------------------------------

Completed: P3
--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 539

Now running: P7

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P5    10
            P6    6
            P8    8

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    1
            P1    8
            P2    39

--------------------------------------------------------------------------

Completed: P3
--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 545

Now running: P6

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P4    11
            P5    10
            P8    8

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P1    2
            P2    33
            P7    54

--------------------------------------------------------------------------

Completed: P3
--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 551
```

```
Now running: P5

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    3
            P4    11
            P8    8

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P2    27
            P7    48
            P6    22

--------------------------------------------------------------------------

Completed: P3
--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 561

Now running: P8

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    3
            P4    11

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P2    17
            P7    38
            P6    12
            P5    33

--------------------------------------------------------------------------

Completed: P3
--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 569

Now running: P4

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P1    3

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P2    9
            P7    30
            P6    4
```

```
            P5    25
            P8    31

--------------------------------------------------------------------------

Completed:  P3
--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 580

Now running: P1

--------------------------------------------------------------------------

Ready Queue:      Process          Burst
            P2    10
            P6    16

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P7    19
            P5    14
            P8    20
            P4    61

--------------------------------------------------------------------------

Completed:  P1    P3
--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 583

Now running: P6

--------------------------------------------------------------------------

Ready Queue:      Process          Burst
            P2    10

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P7    16
            P5    11
            P8    17
            P4    58

--------------------------------------------------------------------------

Completed:  P1    P3    P6
--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 599

Now running: P2

--------------------------------------------------------------------------
```

```
Ready Queue:     Process          Burst
            P5    11
            P7    5

-------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P8    1
            P4    42

-------------------------------------------------------------------------

Completed:  P1    P3    P6
-------------------------------------------------------------------------
-------------------------------------------------------------------------

Current Time: 609

Now running: P5

-------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P7    5
            P8    6

-------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    32
            P2    31

-------------------------------------------------------------------------

Completed:  P1    P3    P5    P6
-------------------------------------------------------------------------
-------------------------------------------------------------------------

Current Time: 620

Now running: P7

-------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P8    6

-------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    21
            P2    20

-------------------------------------------------------------------------

Completed:  P1    P3    P5    P6
-------------------------------------------------------------------------
-------------------------------------------------------------------------

Current Time: 625

Now running: P8
```

```
--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            [empty]

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    16
            P2    15
            P7    21

--------------------------------------------------------------------------

Completed:  P1    P3    P5    P6
--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 640

Now running: P2

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            [empty]

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P4    10
            P7    15
            P8    44

--------------------------------------------------------------------------

Completed:  P1    P2    P3    P5    P6
--------------------------------------------------------------------------
--------------------------------------------------------------------------

Current Time: 647

Now running: P4

--------------------------------------------------------------------------

Ready Queue:     Process          Burst
            [empty]

--------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P7    8
            P8    37

--------------------------------------------------------------------------

Completed:  P1    P2    P3    P4    P5    P6
--------------------------------------------------------------------------
--------------------------------------------------------------------------
```

```
Current Time: 657

Now running: P7

------------------------------------------------------------------------

Ready Queue:     Process          Burst
            P4    10

------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P8    27

------------------------------------------------------------------------

Completed: P1    P2    P3    P4    P5    P6
------------------------------------------------------------------------
------------------------------------------------------------------------

Current Time: 663

Now running: P4

------------------------------------------------------------------------

Ready Queue:     Process          Burst
            [empty]

------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P8    21
            P7    43

------------------------------------------------------------------------

Completed: P1    P2    P3    P5    P6
------------------------------------------------------------------------
------------------------------------------------------------------------

Current Time: 675

Now running: P8

------------------------------------------------------------------------

Ready Queue:     Process          Burst
            [empty]

------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time
            P7    33

------------------------------------------------------------------------

Completed: P1    P2    P3    P4    P5    P6
------------------------------------------------------------------------
------------------------------------------------------------------------

Current Time: 706
```

```
Now running: P7

-------------------------------------------------------------------------

Ready Queue:     Process          Burst
            [empty]

-------------------------------------------------------------------------

Now in I/O: Process          Remaining I/O time

-------------------------------------------------------------------------

Completed:  P1    P2    P3    P4    P5    P6    P8
-------------------------------------------------------------------------
-------------------------------------------------------------------------

Finished

Total Time:      710
CPU Utilization: 95.3521%


Waiting Times          P1    P2    P3    P4    P5    P6    P7    P8
                  298   233   249   231   298   243   315   341
Average Waiting: 276

Turnaround Times P1    P2    P3    P4    P5    P6    P7    P8
                  583   647   512   657   620   599   710   684
Average Turnaround:    626.5

Response Times         P1    P2    P3    P4    P5    P6    P7    P8
                  0     6     25    37    48    64    84    87
Average Response:43.875
```