IT253 – OPERATING SYSTEMS

ASSIGNMENT 5

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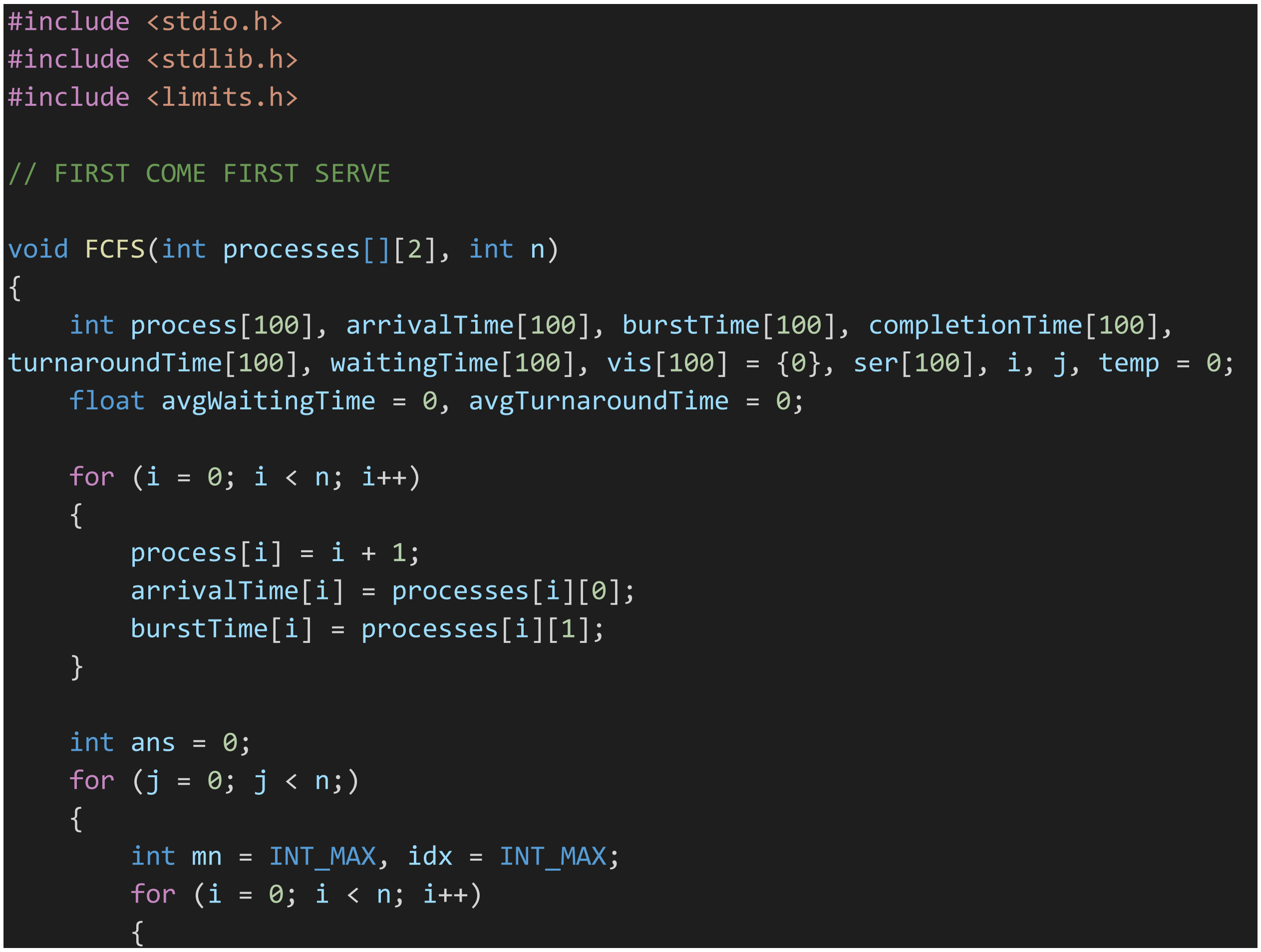
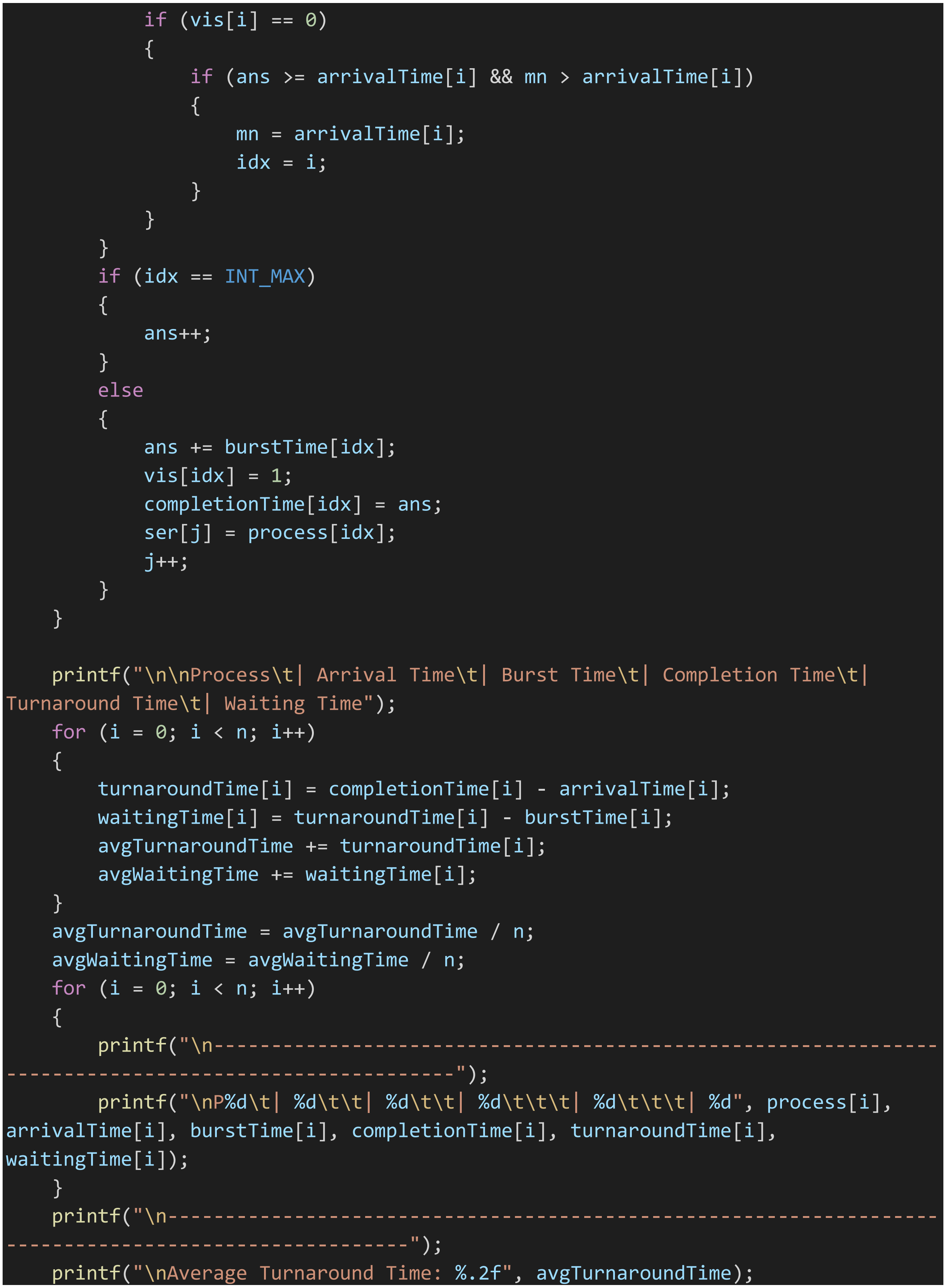
Answers:

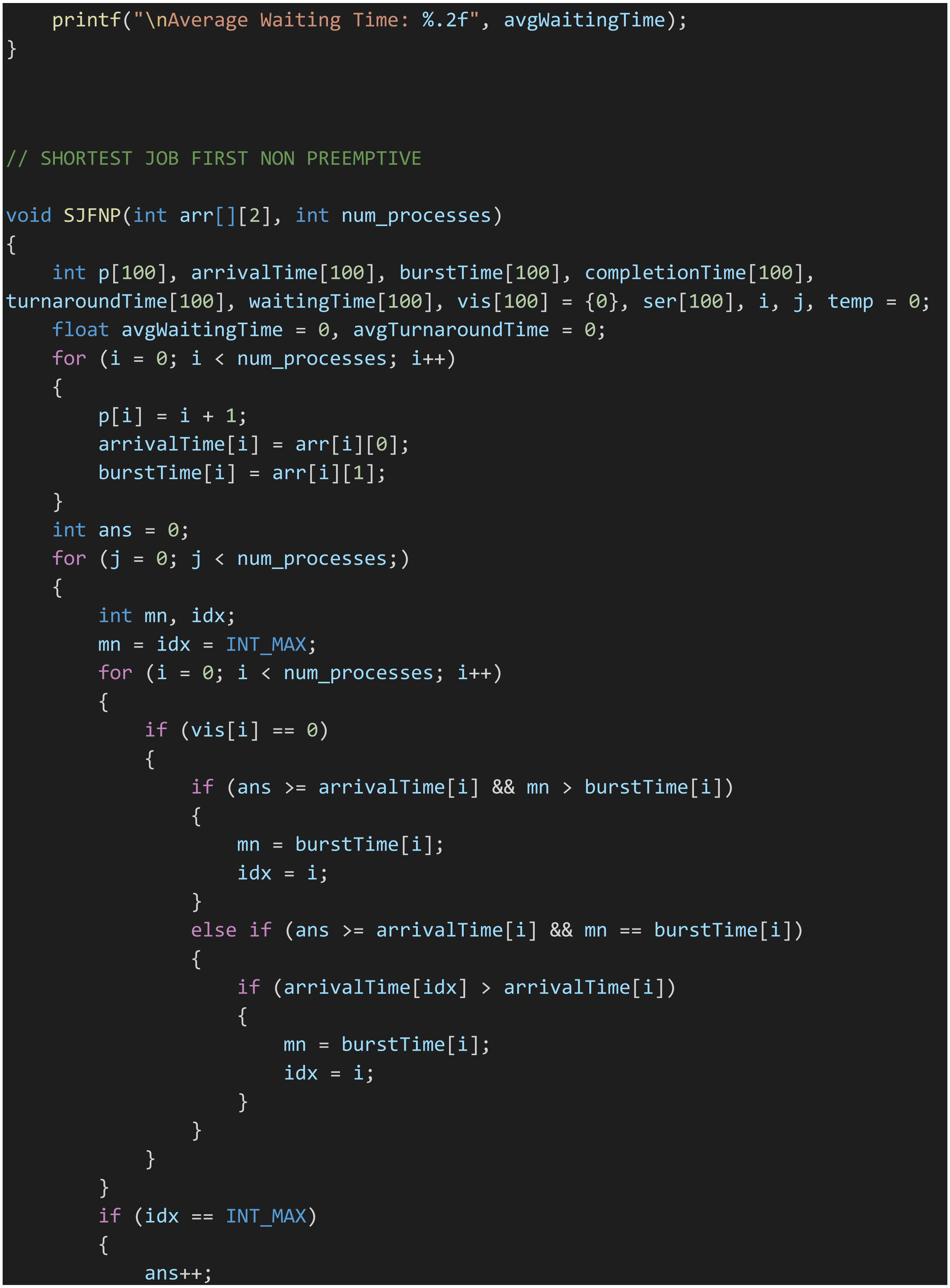
Code Written (C language):



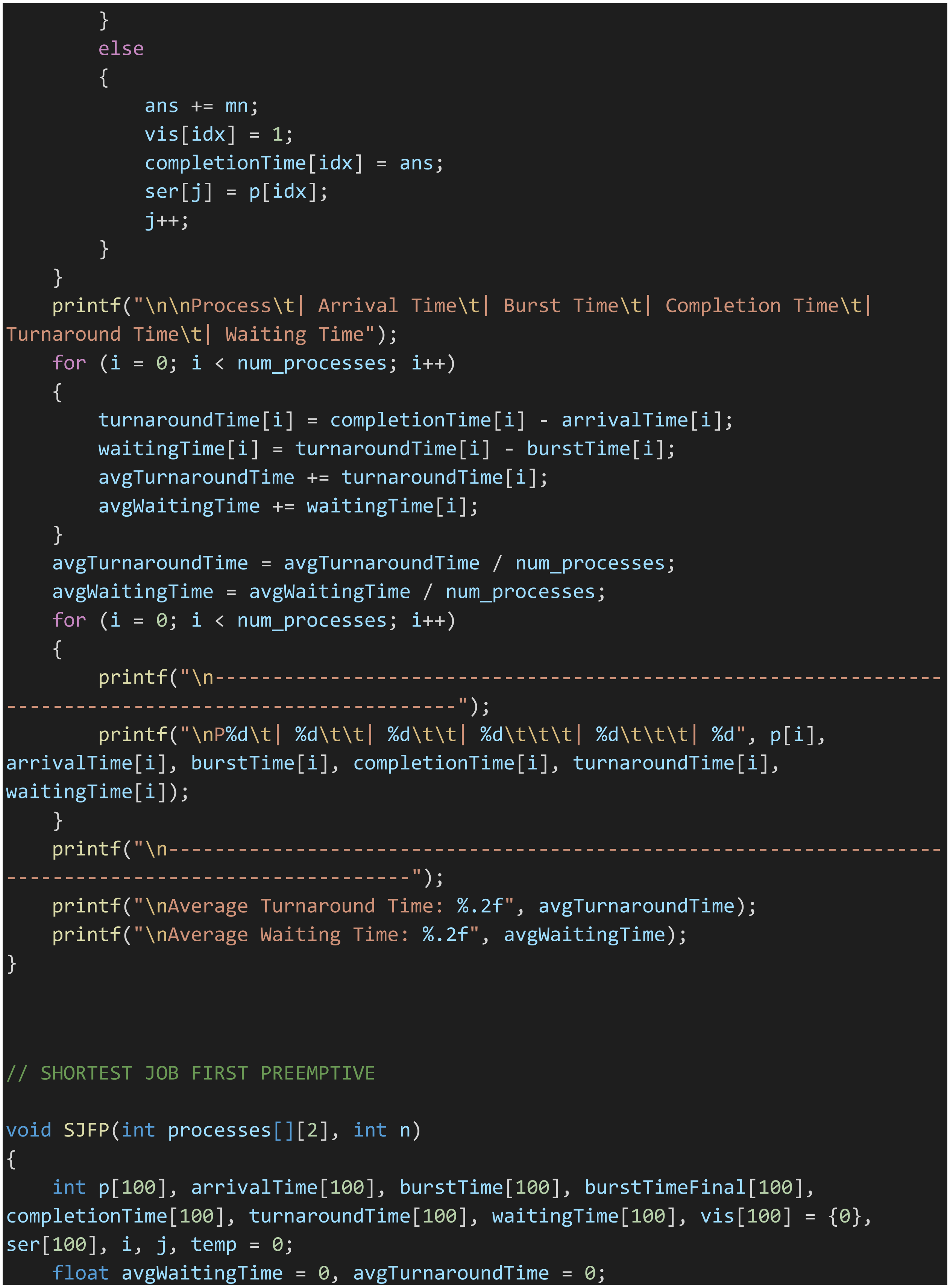
```c
#include <stdio.h>
#include <stdlib.h>
#include <limits.h>

// FIRST COME FIRST SERVE

void FCFS(int processes[][2], int n)
{
    int process[100], arrivalTime[100], burstTime[100], completionTime[100],
turnaroundTime[100], waitingTime[100], vis[100] = {0}, ser[100], i, j, temp = 0;
    float avgWaitingTime = 0, avgTurnaroundTime = 0;

    for (i = 0; i < n; i++)
    {
        process[i] = i + 1;
        arrivalTime[i] = processes[i][0];
        burstTime[i] = processes[i][1];
    }

    int ans = 0;
    for (j = 0; j < n;)
    {
        int mn = INT_MAX, idx = INT_MAX;
        for (i = 0; i < n; i++)
        {
```



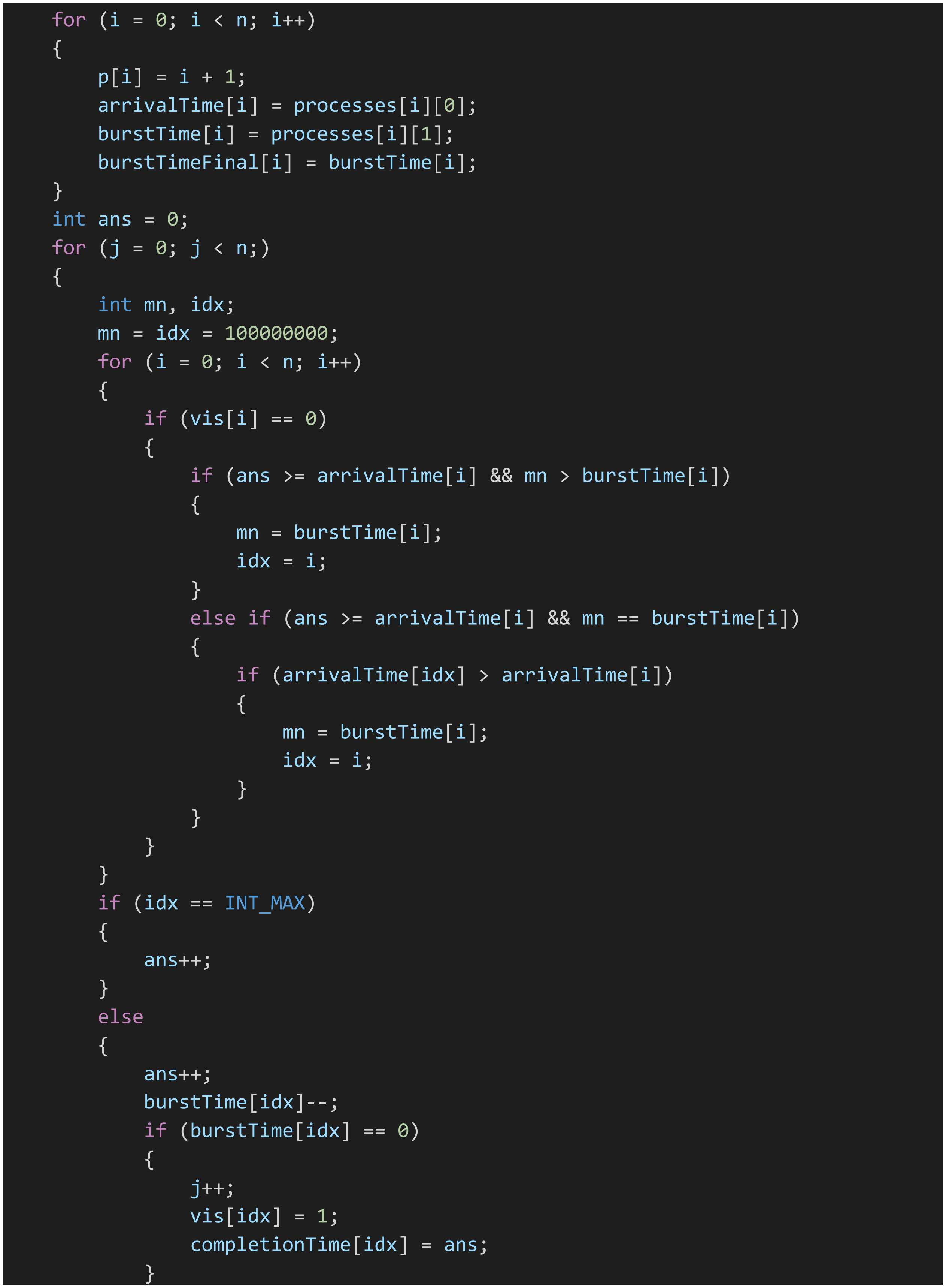
```
            if (vis[i] == 0)
            {
                if (ans >= arrivalTime[i] && mn > arrivalTime[i])
                {
                    mn = arrivalTime[i];
                    idx = i;
                }
            }
        }
        if (idx == INT_MAX)
        {
            ans++;
        }
        else
        {
            ans += burstTime[idx];
            vis[idx] = 1;
            completionTime[idx] = ans;
            ser[j] = process[idx];
            j++;
        }
    }

    printf("\n\nProcess\t| Arrival Time\t| Burst Time\t| Completion Time\t|
Turnaround Time\t| Waiting Time");
    for (i = 0; i < n; i++)
    {
        turnaroundTime[i] = completionTime[i] - arrivalTime[i];
        waitingTime[i] = turnaroundTime[i] - burstTime[i];
        avgTurnaroundTime += turnaroundTime[i];
        avgWaitingTime += waitingTime[i];
    }
    avgTurnaroundTime = avgTurnaroundTime / n;
    avgWaitingTime = avgWaitingTime / n;
    for (i = 0; i < n; i++)
    {
        printf("\n---------------------------------------------------------------
---------------------------------------");
        printf("\nP%d\t| %d\t\t| %d\t\t| %d\t\t\t| %d\t\t\t| %d", process[i],
arrivalTime[i], burstTime[i], completionTime[i], turnaroundTime[i],
waitingTime[i]);
    }
    printf("\n-------------------------------------------------------------------
-----------------------------------");
    printf("\nAverage Turnaround Time: %.2f", avgTurnaroundTime);
```



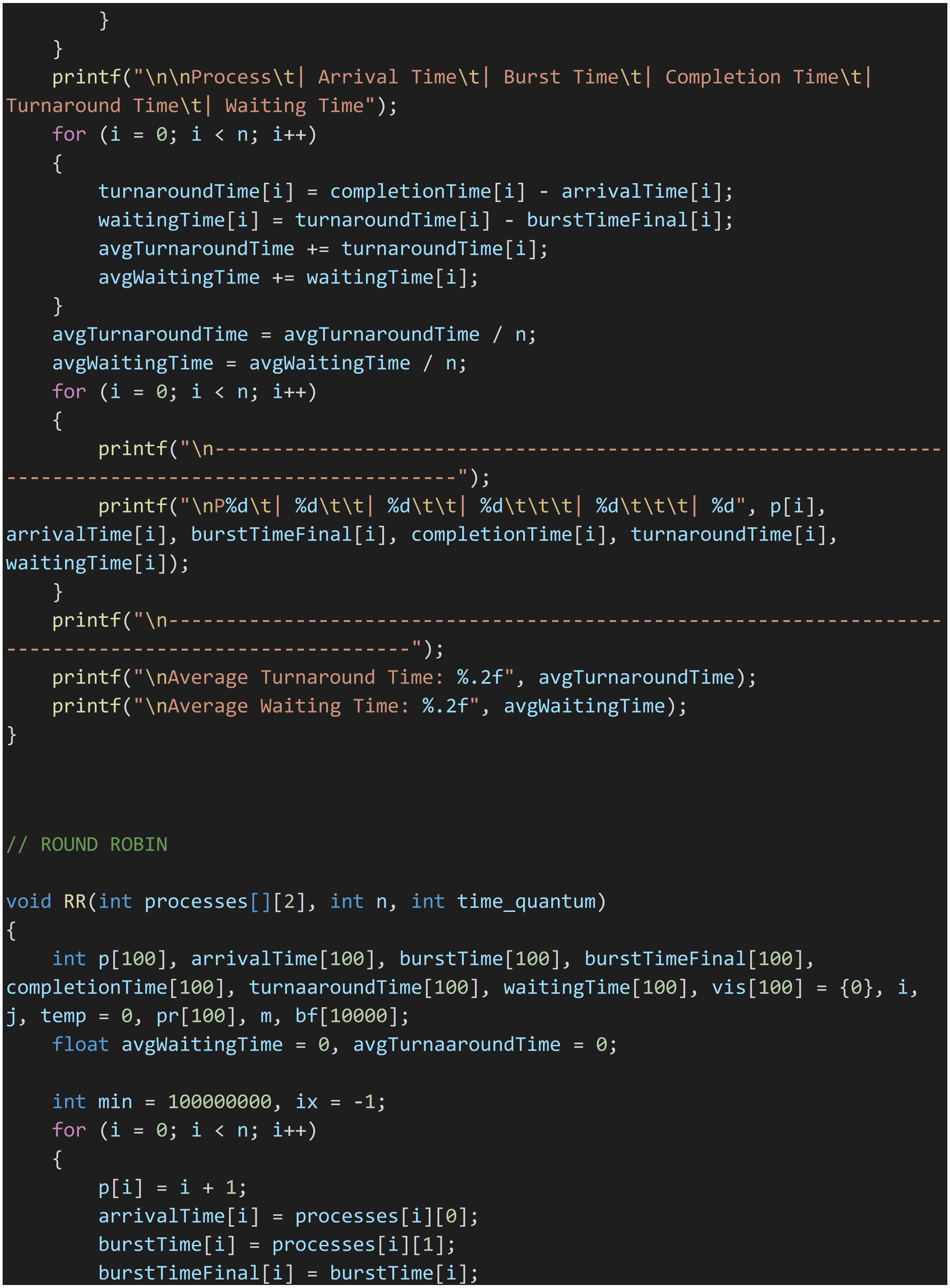
```
    printf("\nAverage Waiting Time: %.2f", avgWaitingTime);
}



// SHORTEST JOB FIRST NON PREEMPTIVE

void SJFNP(int arr[][2], int num_processes)
{
    int p[100], arrivalTime[100], burstTime[100], completionTime[100],
turnaroundTime[100], waitingTime[100], vis[100] = {0}, ser[100], i, j, temp = 0;
    float avgWaitingTime = 0, avgTurnaroundTime = 0;
    for (i = 0; i < num_processes; i++)
    {
        p[i] = i + 1;
        arrivalTime[i] = arr[i][0];
        burstTime[i] = arr[i][1];
    }
    int ans = 0;
    for (j = 0; j < num_processes;)
    {
        int mn, idx;
        mn = idx = INT_MAX;
        for (i = 0; i < num_processes; i++)
        {
            if (vis[i] == 0)
            {
                if (ans >= arrivalTime[i] && mn > burstTime[i])
                {
                    mn = burstTime[i];
                    idx = i;
                }
                else if (ans >= arrivalTime[i] && mn == burstTime[i])
                {
                    if (arrivalTime[idx] > arrivalTime[i])
                    {
                        mn = burstTime[i];
                        idx = i;
                    }
                }
            }
        }
        if (idx == INT_MAX)
        {
            ans++;
```



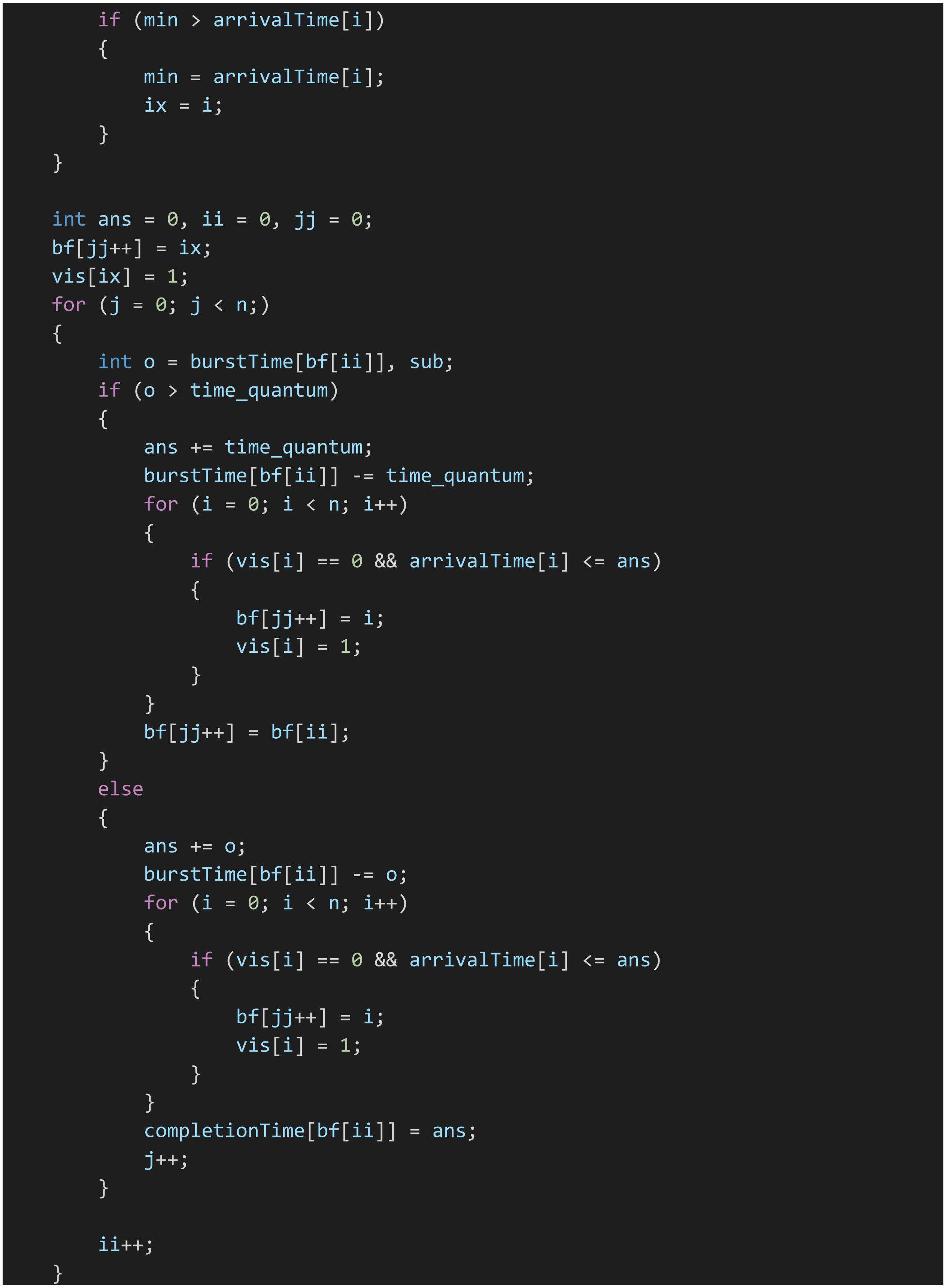
```
        }
        else
        {
            ans += mn;
            vis[idx] = 1;
            completionTime[idx] = ans;
            ser[j] = p[idx];
            j++;
        }
    }
    printf("\n\nProcess\t| Arrival Time\t| Burst Time\t| Completion Time\t|
Turnaround Time\t| Waiting Time");
    for (i = 0; i < num_processes; i++)
    {
        turnaroundTime[i] = completionTime[i] - arrivalTime[i];
        waitingTime[i] = turnaroundTime[i] - burstTime[i];
        avgTurnaroundTime += turnaroundTime[i];
        avgWaitingTime += waitingTime[i];
    }
    avgTurnaroundTime = avgTurnaroundTime / num_processes;
    avgWaitingTime = avgWaitingTime / num_processes;
    for (i = 0; i < num_processes; i++)
    {
        printf("\n---------------------------------------------------------------
---------------------------------------");
        printf("\nP%d\t| %d\t\t| %d\t\t| %d\t\t\t| %d\t\t\t| %d", p[i],
arrivalTime[i], burstTime[i], completionTime[i], turnaroundTime[i],
waitingTime[i]);
    }
    printf("\n-------------------------------------------------------------------
-----------------------------------");
    printf("\nAverage Turnaround Time: %.2f", avgTurnaroundTime);
    printf("\nAverage Waiting Time: %.2f", avgWaitingTime);
}



// SHORTEST JOB FIRST PREEMPTIVE

void SJFP(int processes[][2], int n)
{
    int p[100], arrivalTime[100], burstTime[100], burstTimeFinal[100],
completionTime[100], turnaroundTime[100], waitingTime[100], vis[100] = {0},
ser[100], i, j, temp = 0;
    float avgWaitingTime = 0, avgTurnaroundTime = 0;
```



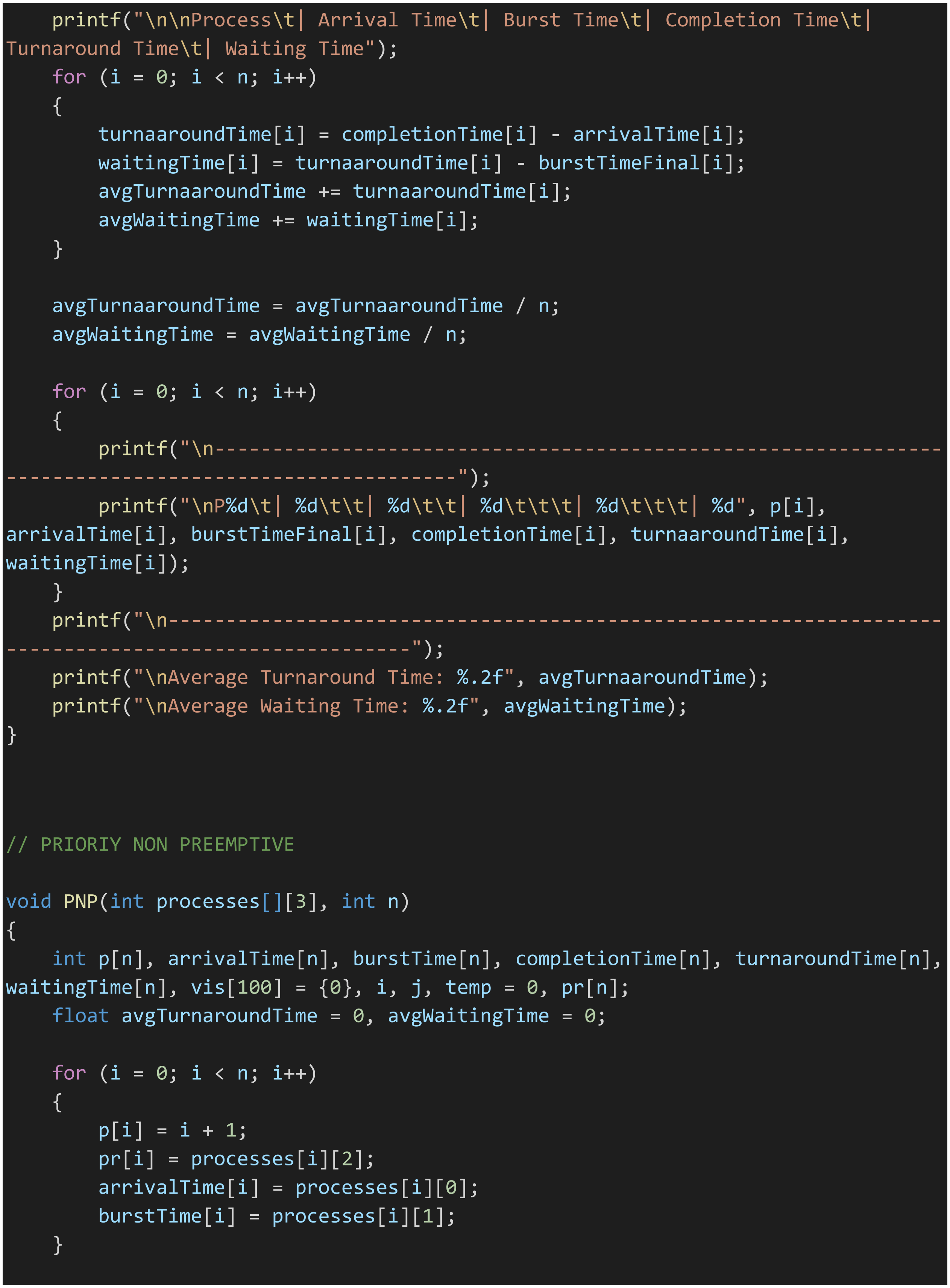
```
    for (i = 0; i < n; i++)
    {
        p[i] = i + 1;
        arrivalTime[i] = processes[i][0];
        burstTime[i] = processes[i][1];
        burstTimeFinal[i] = burstTime[i];
    }
    int ans = 0;
    for (j = 0; j < n;)
    {
        int mn, idx;
        mn = idx = 100000000;
        for (i = 0; i < n; i++)
        {
            if (vis[i] == 0)
            {
                if (ans >= arrivalTime[i] && mn > burstTime[i])
                {
                    mn = burstTime[i];
                    idx = i;
                }
                else if (ans >= arrivalTime[i] && mn == burstTime[i])
                {
                    if (arrivalTime[idx] > arrivalTime[i])
                    {
                        mn = burstTime[i];
                        idx = i;
                    }
                }
            }
        }
        if (idx == INT_MAX)
        {
            ans++;
        }
        else
        {
            ans++;
            burstTime[idx]--;
            if (burstTime[idx] == 0)
            {
                j++;
                vis[idx] = 1;
                completionTime[idx] = ans;
            }
```



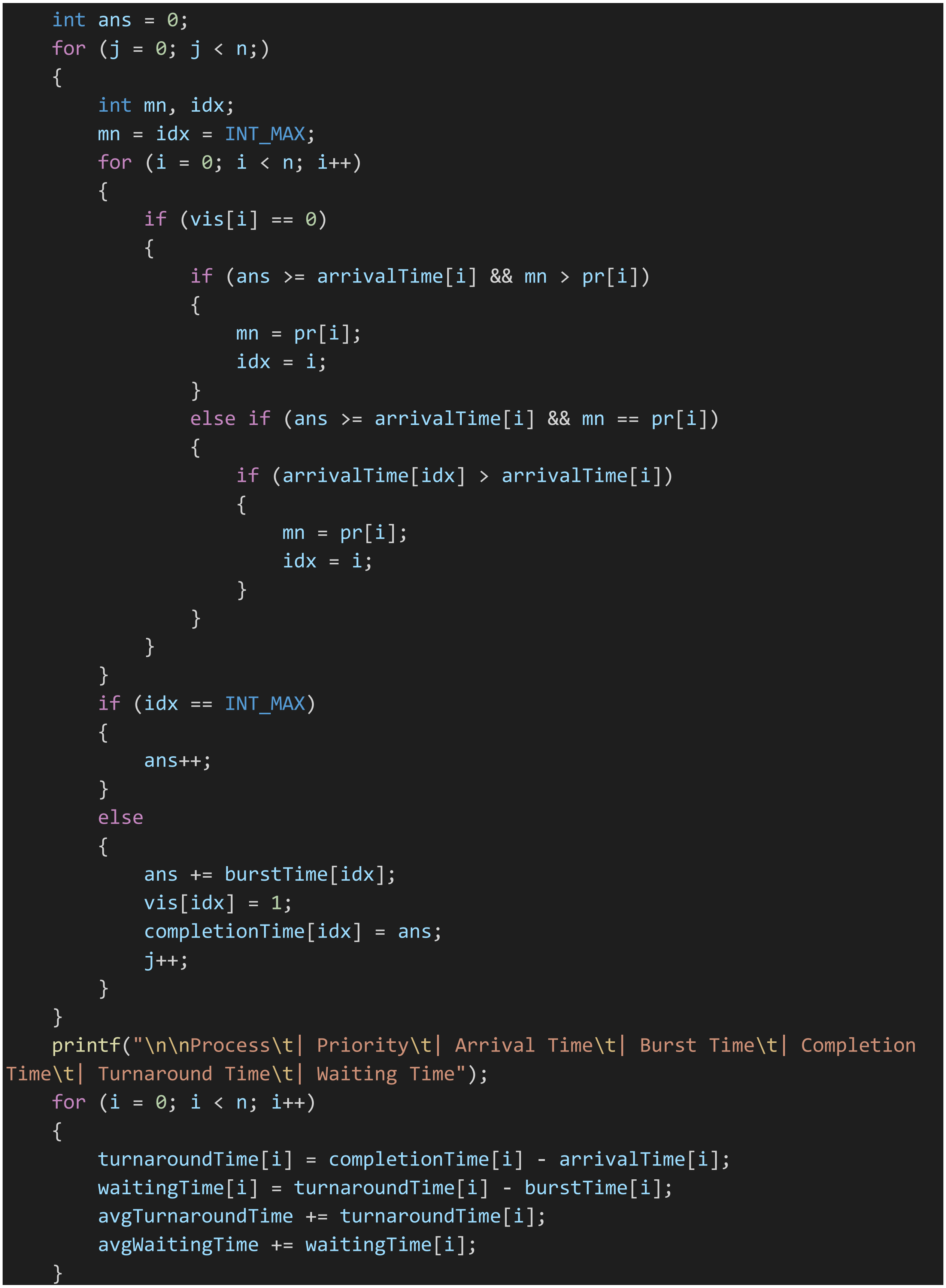
```
        }
    }
    printf("\n\nProcess\t| Arrival Time\t| Burst Time\t| Completion Time\t|
Turnaround Time\t| Waiting Time");
    for (i = 0; i < n; i++)
    {
        turnaroundTime[i] = completionTime[i] - arrivalTime[i];
        waitingTime[i] = turnaroundTime[i] - burstTimeFinal[i];
        avgTurnaroundTime += turnaroundTime[i];
        avgWaitingTime += waitingTime[i];
    }
    avgTurnaroundTime = avgTurnaroundTime / n;
    avgWaitingTime = avgWaitingTime / n;
    for (i = 0; i < n; i++)
    {
        printf("\n--------------------------------------------------------------
---------------------------------------");
        printf("\nP%d\t| %d\t\t| %d\t\t| %d\t\t\t| %d\t\t\t| %d", p[i],
arrivalTime[i], burstTimeFinal[i], completionTime[i], turnaroundTime[i],
waitingTime[i]);
    }
    printf("\n------------------------------------------------------------------
-----------------------------------");
    printf("\nAverage Turnaround Time: %.2f", avgTurnaroundTime);
    printf("\nAverage Waiting Time: %.2f", avgWaitingTime);
}



// ROUND ROBIN

void RR(int processes[][2], int n, int time_quantum)
{
    int p[100], arrivalTime[100], burstTime[100], burstTimeFinal[100],
completionTime[100], turnaaroundTime[100], waitingTime[100], vis[100] = {0}, i,
j, temp = 0, pr[100], m, bf[10000];
    float avgWaitingTime = 0, avgTurnaaroundTime = 0;

    int min = 100000000, ix = -1;
    for (i = 0; i < n; i++)
    {
        p[i] = i + 1;
        arrivalTime[i] = processes[i][0];
        burstTime[i] = processes[i][1];
        burstTimeFinal[i] = burstTime[i];
```



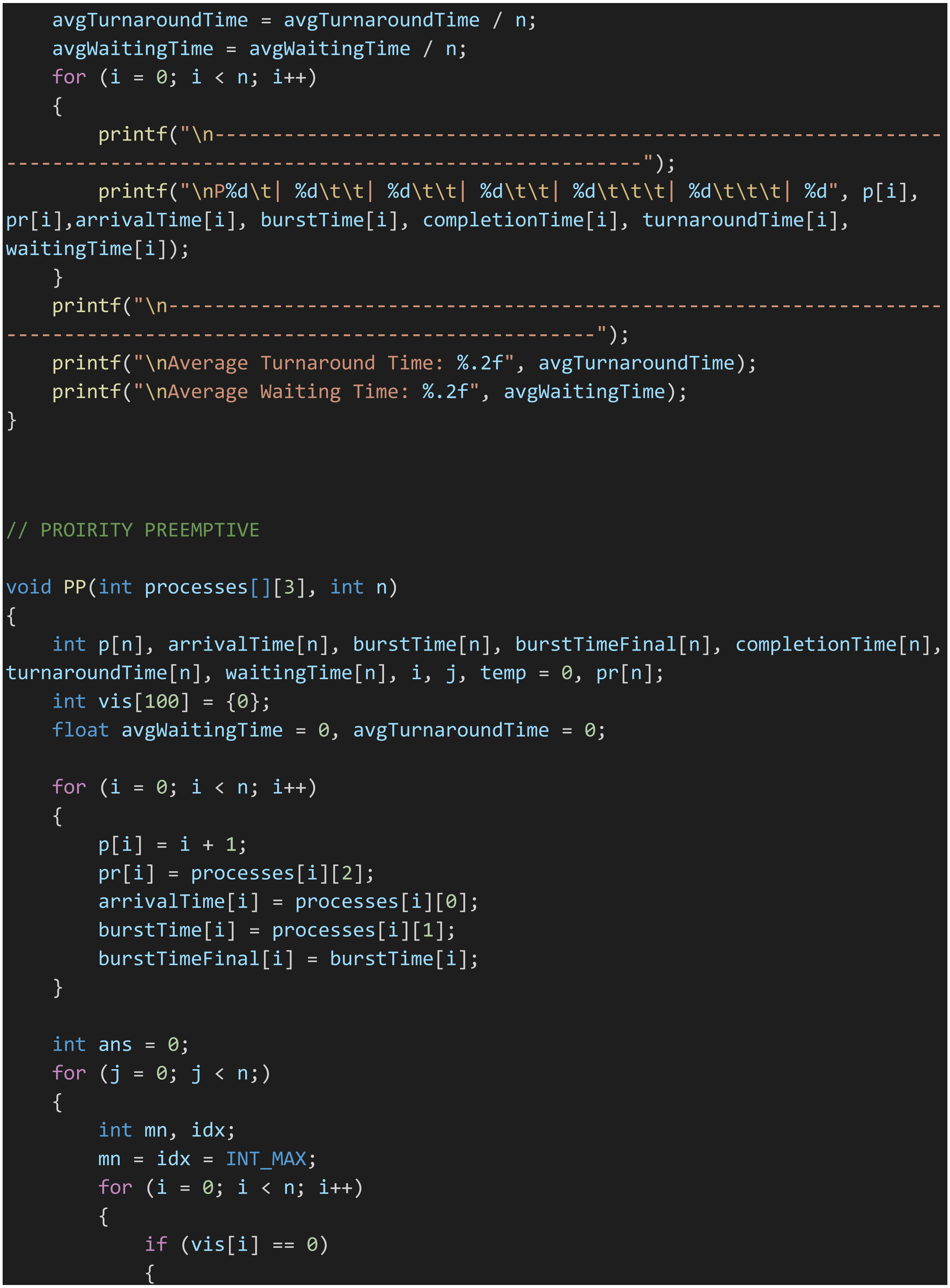
```
        if (min > arrivalTime[i])
        {
            min = arrivalTime[i];
            ix = i;
        }
    }

    int ans = 0, ii = 0, jj = 0;
    bf[jj++] = ix;
    vis[ix] = 1;
    for (j = 0; j < n;)
    {
        int o = burstTime[bf[ii]], sub;
        if (o > time_quantum)
        {
            ans += time_quantum;
            burstTime[bf[ii]] -= time_quantum;
            for (i = 0; i < n; i++)
            {
                if (vis[i] == 0 && arrivalTime[i] <= ans)
                {
                    bf[jj++] = i;
                    vis[i] = 1;
                }
            }
            bf[jj++] = bf[ii];
        }
        else
        {
            ans += o;
            burstTime[bf[ii]] -= o;
            for (i = 0; i < n; i++)
            {
                if (vis[i] == 0 && arrivalTime[i] <= ans)
                {
                    bf[jj++] = i;
                    vis[i] = 1;
                }
            }
            completionTime[bf[ii]] = ans;
            j++;
        }

        ii++;
    }
```



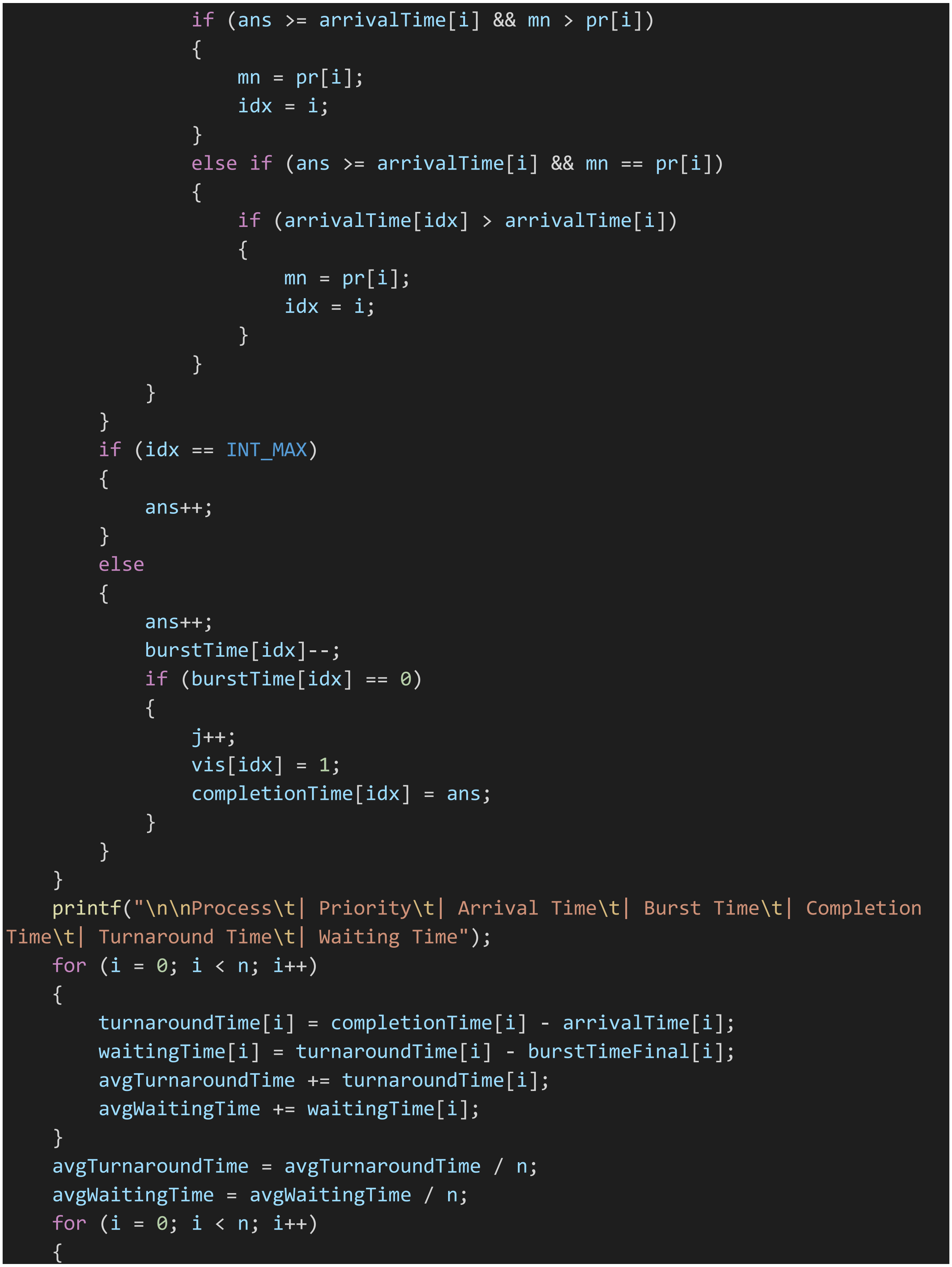
```
    printf("\n\nProcess\t| Arrival Time\t| Burst Time\t| Completion Time\t|
Turnaround Time\t| Waiting Time");
    for (i = 0; i < n; i++)
    {
        turnaroundTime[i] = completionTime[i] - arrivalTime[i];
        waitingTime[i] = turnaroundTime[i] - burstTimeFinal[i];
        avgTurnaaroundTime += turnaroundTime[i];
        avgWaitingTime += waitingTime[i];
    }

    avgTurnaaroundTime = avgTurnaaroundTime / n;
    avgWaitingTime = avgWaitingTime / n;

    for (i = 0; i < n; i++)
    {
        printf("\n---------------------------------------------------------------
---------------------------------------");
        printf("\nP%d\t| %d\t\t| %d\t\t| %d\t\t\t| %d\t\t\t| %d", p[i],
arrivalTime[i], burstTimeFinal[i], completionTime[i], turnaroundTime[i],
waitingTime[i]);
    }
    printf("\n-------------------------------------------------------------------
-----------------------------------");
    printf("\nAverage Turnaround Time: %.2f", avgTurnaaroundTime);
    printf("\nAverage Waiting Time: %.2f", avgWaitingTime);
}



// PRIORIY NON PREEMPTIVE

void PNP(int processes[][3], int n)
{
    int p[n], arrivalTime[n], burstTime[n], completionTime[n], turnaroundTime[n],
waitingTime[n], vis[100] = {0}, i, j, temp = 0, pr[n];
    float avgTurnaroundTime = 0, avgWaitingTime = 0;

    for (i = 0; i < n; i++)
    {
        p[i] = i + 1;
        pr[i] = processes[i][2];
        arrivalTime[i] = processes[i][0];
        burstTime[i] = processes[i][1];
    }
```



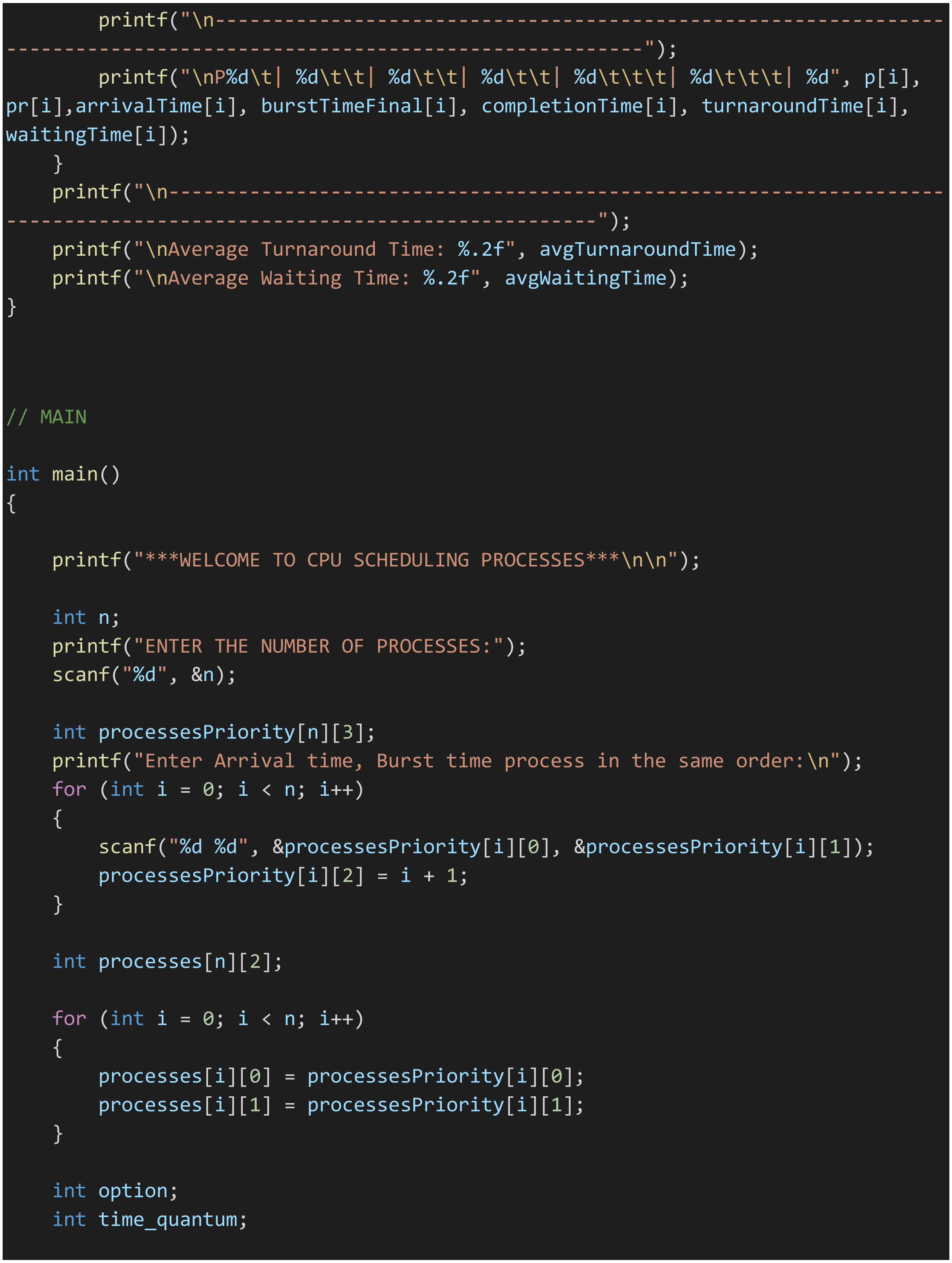
```
    int ans = 0;
    for (j = 0; j < n;)
    {
        int mn, idx;
        mn = idx = INT_MAX;
        for (i = 0; i < n; i++)
        {
            if (vis[i] == 0)
            {
                if (ans >= arrivalTime[i] && mn > pr[i])
                {
                    mn = pr[i];
                    idx = i;
                }
                else if (ans >= arrivalTime[i] && mn == pr[i])
                {
                    if (arrivalTime[idx] > arrivalTime[i])
                    {
                        mn = pr[i];
                        idx = i;
                    }
                }
            }
        }
        if (idx == INT_MAX)
        {
            ans++;
        }
        else
        {
            ans += burstTime[idx];
            vis[idx] = 1;
            completionTime[idx] = ans;
            j++;
        }
    }
    printf("\n\nProcess\t| Priority\t| Arrival Time\t| Burst Time\t| Completion Time\t| Turnaround Time\t| Waiting Time");
    for (i = 0; i < n; i++)
    {
        turnaroundTime[i] = completionTime[i] - arrivalTime[i];
        waitingTime[i] = turnaroundTime[i] - burstTime[i];
        avgTurnaroundTime += turnaroundTime[i];
        avgWaitingTime += waitingTime[i];
    }
```



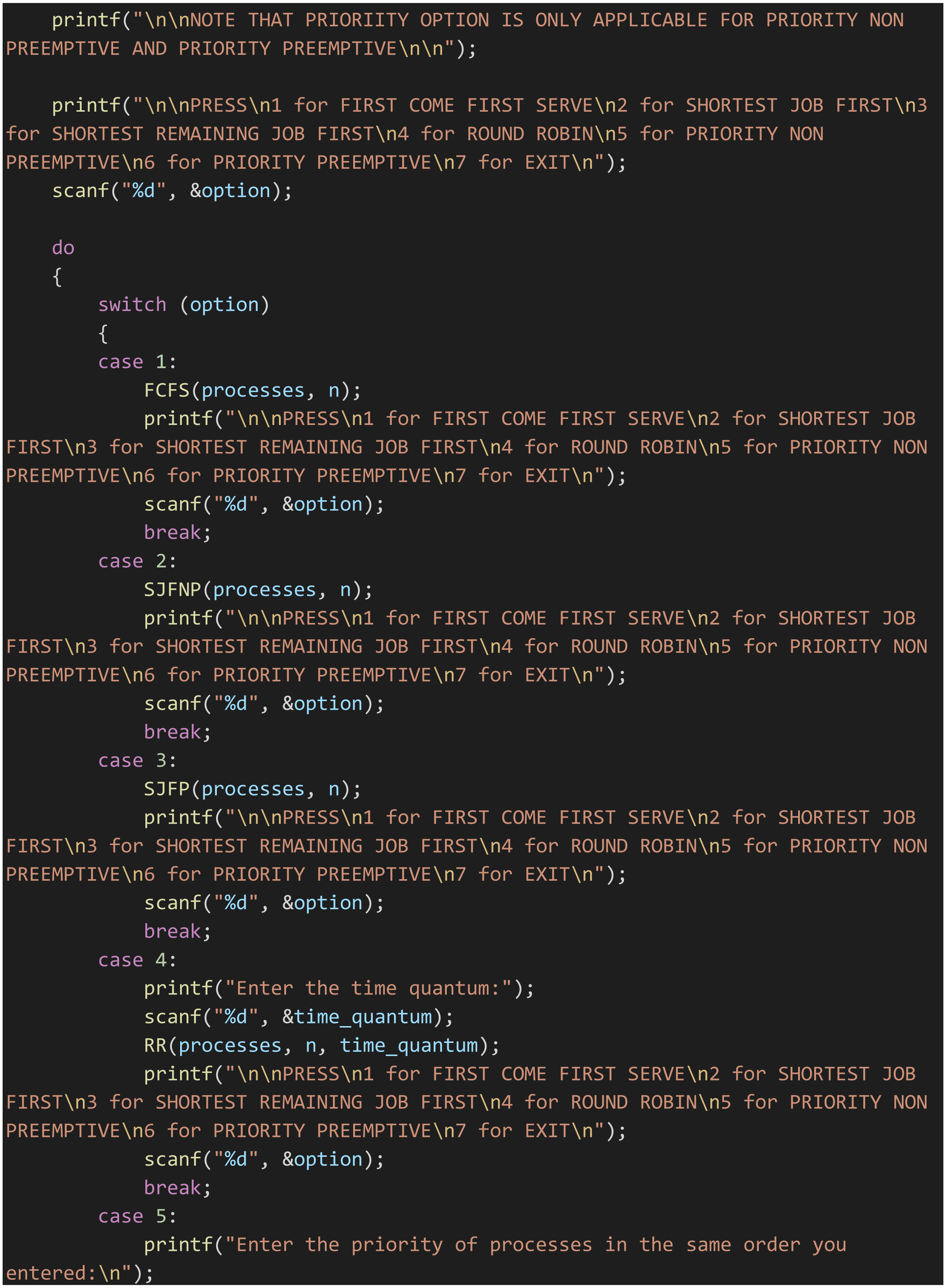
```
    avgTurnaroundTime = avgTurnaroundTime / n;
    avgWaitingTime = avgWaitingTime / n;
    for (i = 0; i < n; i++)
    {
        printf("\n---------------------------------------------------------------
-------------------------------------------------------");
        printf("\nP%d\t| %d\t\t| %d\t\t| %d\t\t| %d\t\t\t| %d\t\t\t| %d", p[i],
pr[i],arrivalTime[i], burstTime[i], completionTime[i], turnaroundTime[i],
waitingTime[i]);
    }
    printf("\n-------------------------------------------------------------------
---------------------------------------------------");
    printf("\nAverage Turnaround Time: %.2f", avgTurnaroundTime);
    printf("\nAverage Waiting Time: %.2f", avgWaitingTime);
}



// PROIRITY PREEMPTIVE

void PP(int processes[][3], int n)
{
    int p[n], arrivalTime[n], burstTime[n], burstTimeFinal[n], completionTime[n],
turnaroundTime[n], waitingTime[n], i, j, temp = 0, pr[n];
    int vis[100] = {0};
    float avgWaitingTime = 0, avgTurnaroundTime = 0;

    for (i = 0; i < n; i++)
    {
        p[i] = i + 1;
        pr[i] = processes[i][2];
        arrivalTime[i] = processes[i][0];
        burstTime[i] = processes[i][1];
        burstTimeFinal[i] = burstTime[i];
    }

    int ans = 0;
    for (j = 0; j < n;)
    {
        int mn, idx;
        mn = idx = INT_MAX;
        for (i = 0; i < n; i++)
        {
            if (vis[i] == 0)
            {
```



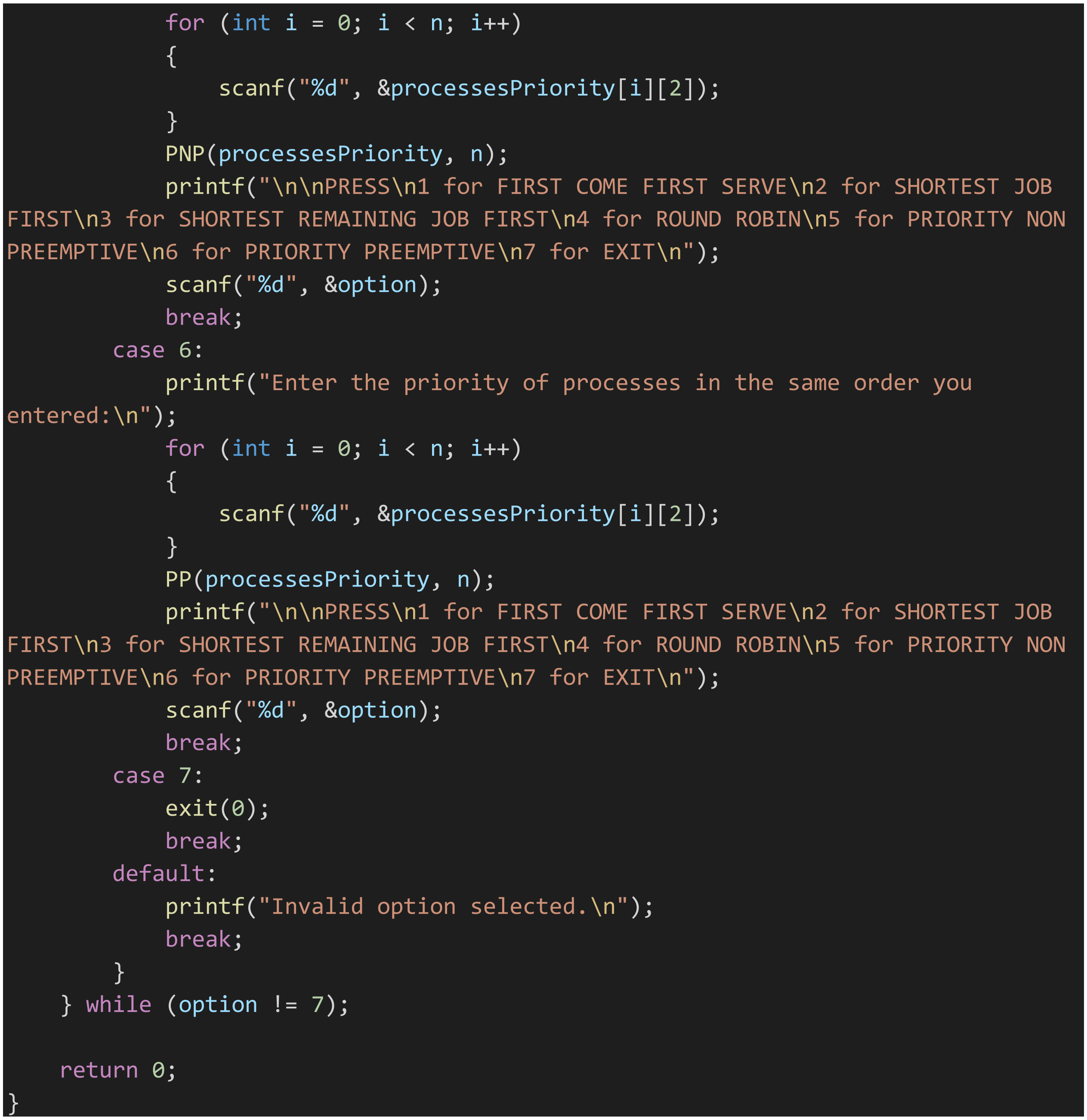
```
                if (ans >= arrivalTime[i] && mn > pr[i])
                {
                    mn = pr[i];
                    idx = i;
                }
                else if (ans >= arrivalTime[i] && mn == pr[i])
                {
                    if (arrivalTime[idx] > arrivalTime[i])
                    {
                        mn = pr[i];
                        idx = i;
                    }
                }
            }
        }
        if (idx == INT_MAX)
        {
            ans++;
        }
        else
        {
            ans++;
            burstTime[idx]--;
            if (burstTime[idx] == 0)
            {
                j++;
                vis[idx] = 1;
                completionTime[idx] = ans;
            }
        }
    }
    printf("\n\nProcess\t| Priority\t| Arrival Time\t| Burst Time\t| Completion Time\t| Turnaround Time\t| Waiting Time");
    for (i = 0; i < n; i++)
    {
        turnaroundTime[i] = completionTime[i] - arrivalTime[i];
        waitingTime[i] = turnaroundTime[i] - burstTimeFinal[i];
        avgTurnaroundTime += turnaroundTime[i];
        avgWaitingTime += waitingTime[i];
    }
    avgTurnaroundTime = avgTurnaroundTime / n;
    avgWaitingTime = avgWaitingTime / n;
    for (i = 0; i < n; i++)
    {
```



```
        printf("\n----------------------------------------------------------------
-------------------------------------------------------");
        printf("\nP%d\t| %d\t\t| %d\t\t| %d\t\t| %d\t\t\t| %d\t\t\t| %d", p[i],
pr[i],arrivalTime[i], burstTimeFinal[i], completionTime[i], turnaroundTime[i],
waitingTime[i]);
    }
    printf("\n--------------------------------------------------------------------
---------------------------------------------------");
    printf("\nAverage Turnaround Time: %.2f", avgTurnaroundTime);
    printf("\nAverage Waiting Time: %.2f", avgWaitingTime);
}



// MAIN

int main()
{

    printf("***WELCOME TO CPU SCHEDULING PROCESSES***\n\n");

    int n;
    printf("ENTER THE NUMBER OF PROCESSES:");
    scanf("%d", &n);

    int processesPriority[n][3];
    printf("Enter Arrival time, Burst time process in the same order:\n");
    for (int i = 0; i < n; i++)
    {
        scanf("%d %d", &processesPriority[i][0], &processesPriority[i][1]);
        processesPriority[i][2] = i + 1;
    }

    int processes[n][2];

    for (int i = 0; i < n; i++)
    {
        processes[i][0] = processesPriority[i][0];
        processes[i][1] = processesPriority[i][1];
    }

    int option;
    int time_quantum;
```



```c
    printf("\n\nNOTE THAT PRIORIITY OPTION IS ONLY APPLICABLE FOR PRIORITY NON PREEMPTIVE AND PRIORITY PREEMPTIVE\n\n");

    printf("\n\nPRESS\n1 for FIRST COME FIRST SERVE\n2 for SHORTEST JOB FIRST\n3 for SHORTEST REMAINING JOB FIRST\n4 for ROUND ROBIN\n5 for PRIORITY NON PREEMPTIVE\n6 for PRIORITY PREEMPTIVE\n7 for EXIT\n");
    scanf("%d", &option);

    do
    {
        switch (option)
        {
        case 1:
            FCFS(processes, n);
            printf("\n\nPRESS\n1 for FIRST COME FIRST SERVE\n2 for SHORTEST JOB FIRST\n3 for SHORTEST REMAINING JOB FIRST\n4 for ROUND ROBIN\n5 for PRIORITY NON PREEMPTIVE\n6 for PRIORITY PREEMPTIVE\n7 for EXIT\n");
            scanf("%d", &option);
            break;
        case 2:
            SJFNP(processes, n);
            printf("\n\nPRESS\n1 for FIRST COME FIRST SERVE\n2 for SHORTEST JOB FIRST\n3 for SHORTEST REMAINING JOB FIRST\n4 for ROUND ROBIN\n5 for PRIORITY NON PREEMPTIVE\n6 for PRIORITY PREEMPTIVE\n7 for EXIT\n");
            scanf("%d", &option);
            break;
        case 3:
            SJFP(processes, n);
            printf("\n\nPRESS\n1 for FIRST COME FIRST SERVE\n2 for SHORTEST JOB FIRST\n3 for SHORTEST REMAINING JOB FIRST\n4 for ROUND ROBIN\n5 for PRIORITY NON PREEMPTIVE\n6 for PRIORITY PREEMPTIVE\n7 for EXIT\n");
            scanf("%d", &option);
            break;
        case 4:
            printf("Enter the time quantum:");
            scanf("%d", &time_quantum);
            RR(processes, n, time_quantum);
            printf("\n\nPRESS\n1 for FIRST COME FIRST SERVE\n2 for SHORTEST JOB FIRST\n3 for SHORTEST REMAINING JOB FIRST\n4 for ROUND ROBIN\n5 for PRIORITY NON PREEMPTIVE\n6 for PRIORITY PREEMPTIVE\n7 for EXIT\n");
            scanf("%d", &option);
            break;
        case 5:
            printf("Enter the priority of processes in the same order you entered:\n");
```



```
            for (int i = 0; i < n; i++)
            {
                scanf("%d", &processesPriority[i][2]);
            }
            PNP(processesPriority, n);
            printf("\n\nPRESS\n1 for FIRST COME FIRST SERVE\n2 for SHORTEST JOB
FIRST\n3 for SHORTEST REMAINING JOB FIRST\n4 for ROUND ROBIN\n5 for PRIORITY NON
PREEMPTIVE\n6 for PRIORITY PREEMPTIVE\n7 for EXIT\n");
            scanf("%d", &option);
            break;
        case 6:
            printf("Enter the priority of processes in the same order you
entered:\n");
            for (int i = 0; i < n; i++)
            {
                scanf("%d", &processesPriority[i][2]);
            }
            PP(processesPriority, n);
            printf("\n\nPRESS\n1 for FIRST COME FIRST SERVE\n2 for SHORTEST JOB
FIRST\n3 for SHORTEST REMAINING JOB FIRST\n4 for ROUND ROBIN\n5 for PRIORITY NON
PREEMPTIVE\n6 for PRIORITY PREEMPTIVE\n7 for EXIT\n");
            scanf("%d", &option);
            break;
        case 7:
            exit(0);
            break;
        default:
            printf("Invalid option selected.\n");
            break;
        }
    } while (option != 7);

    return 0;
}
```

Output Screenshots and Corresponding Gantt Charts:

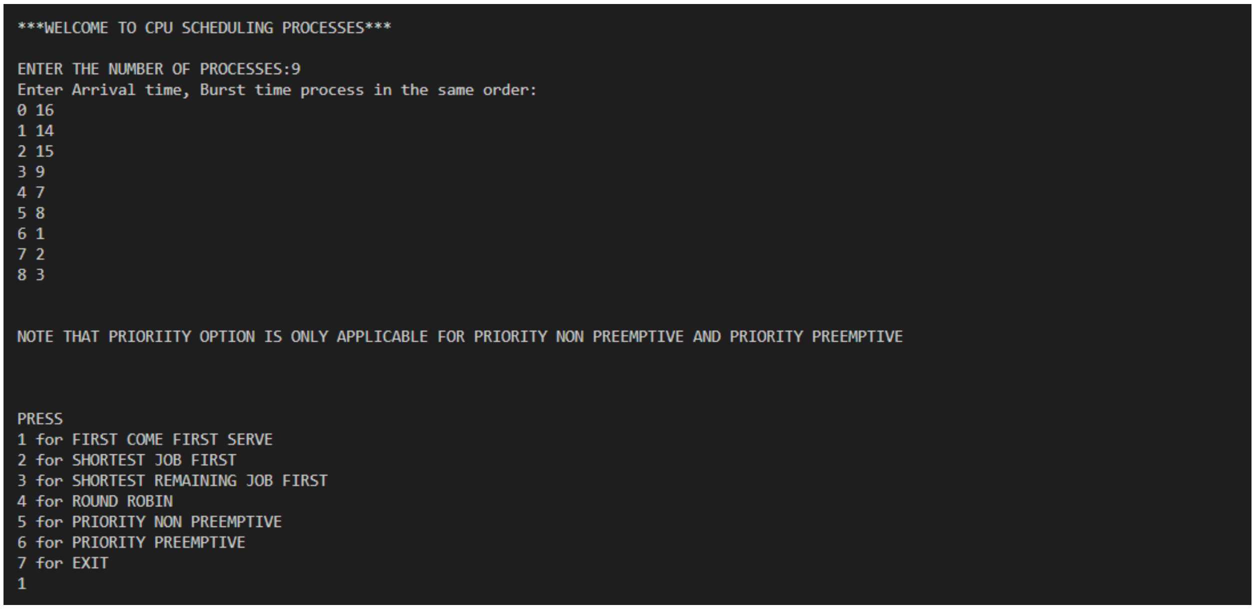
9 processes were considered as per the question. Hence, 3 different cases were taken and observed.

Case 1 (The jobs which needs longer time comes first)

Input was as follows:

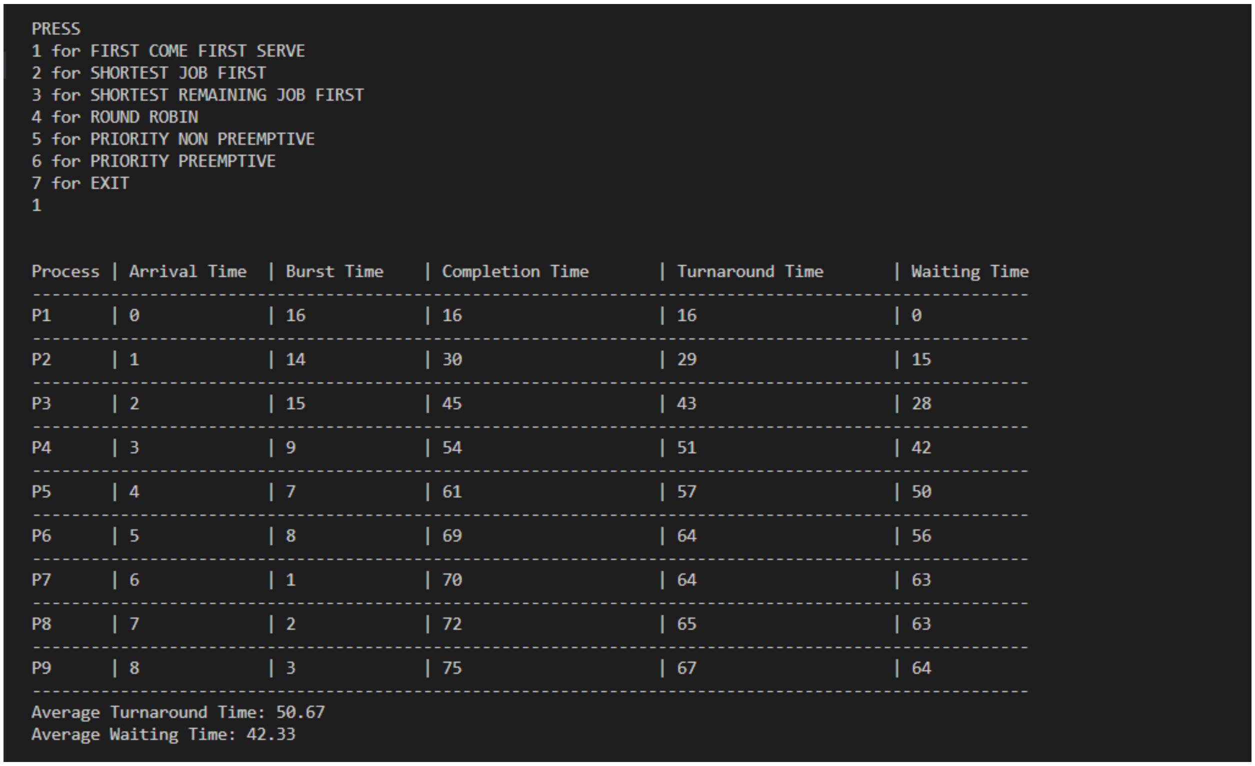
Process	Priority*	Arrival Time	Burst Time
P1/A	1	0	16
P2/B	2	1	14
P3/C	3	2	15
P4/D	4	3	9
P5/E	5	4	7
P6/F	6	5	8
P7/G	7	6	1
P8/H	8	7	2
P9/I	9	8	3

***Only Applicable for Priority non-Preemptive and Priority Preemptive**

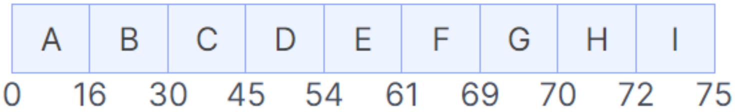


```
***WELCOME TO CPU SCHEDULING PROCESSES***

ENTER THE NUMBER OF PROCESSES:9
Enter Arrival time, Burst time process in the same order:
0 16
1 14
2 15
3 9
4 7
5 8
6 1
7 2
8 3


NOTE THAT PRIORIITY OPTION IS ONLY APPLICABLE FOR PRIORITY NON PREEMPTIVE AND PRIORITY PREEMPTIVE



PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
1
```

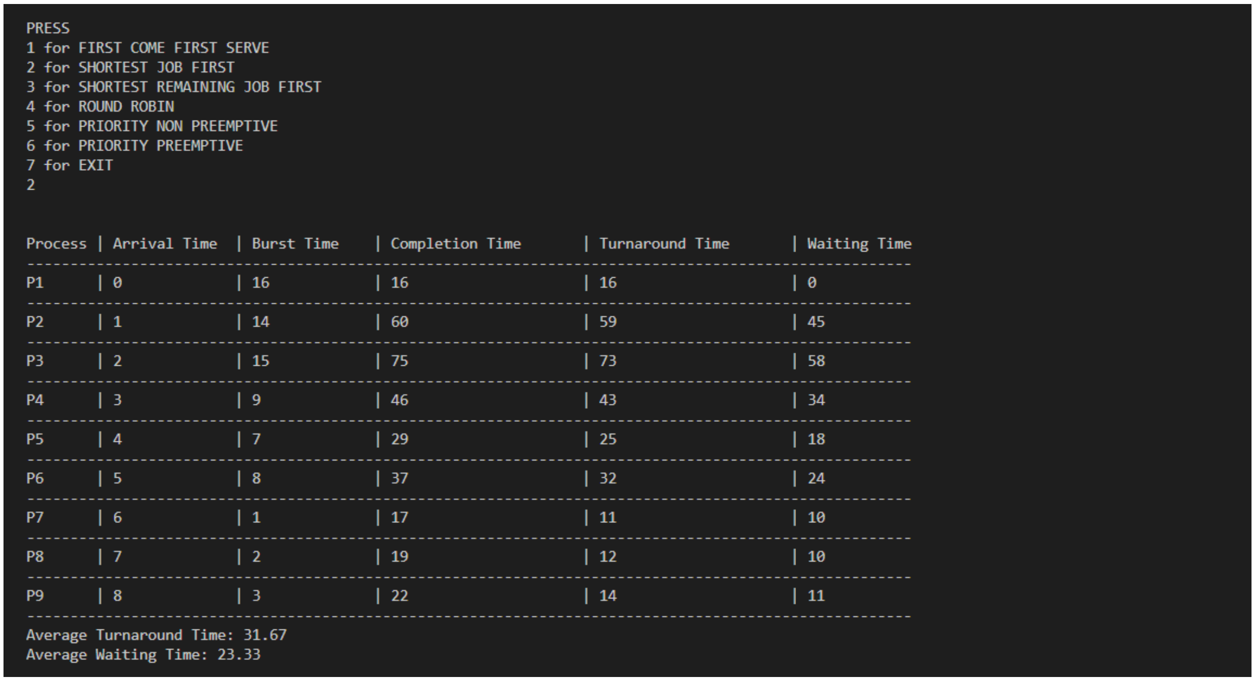
First Come First Serve:



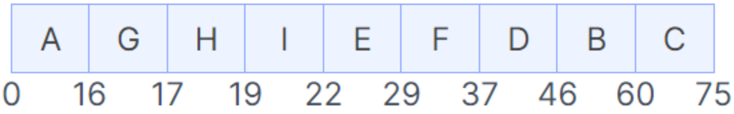
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
1


Process | Arrival Time   | Burst Time    | Completion Time        | Turnaround Time        | Waiting Time
------------------------------------------------------------------------------------------------------------
P1      | 0              | 16            | 16                     | 16                     | 0
------------------------------------------------------------------------------------------------------------
P2      | 1              | 14            | 30                     | 29                     | 15
------------------------------------------------------------------------------------------------------------
P3      | 2              | 15            | 45                     | 43                     | 28
------------------------------------------------------------------------------------------------------------
P4      | 3              | 9             | 54                     | 51                     | 42
------------------------------------------------------------------------------------------------------------
P5      | 4              | 7             | 61                     | 57                     | 50
------------------------------------------------------------------------------------------------------------
P6      | 5              | 8             | 69                     | 64                     | 56
------------------------------------------------------------------------------------------------------------
P7      | 6              | 1             | 70                     | 64                     | 63
------------------------------------------------------------------------------------------------------------
P8      | 7              | 2             | 72                     | 65                     | 63
------------------------------------------------------------------------------------------------------------
P9      | 8              | 3             | 75                     | 67                     | 64
------------------------------------------------------------------------------------------------------------
Average Turnaround Time: 50.67
Average Waiting Time: 42.33
```



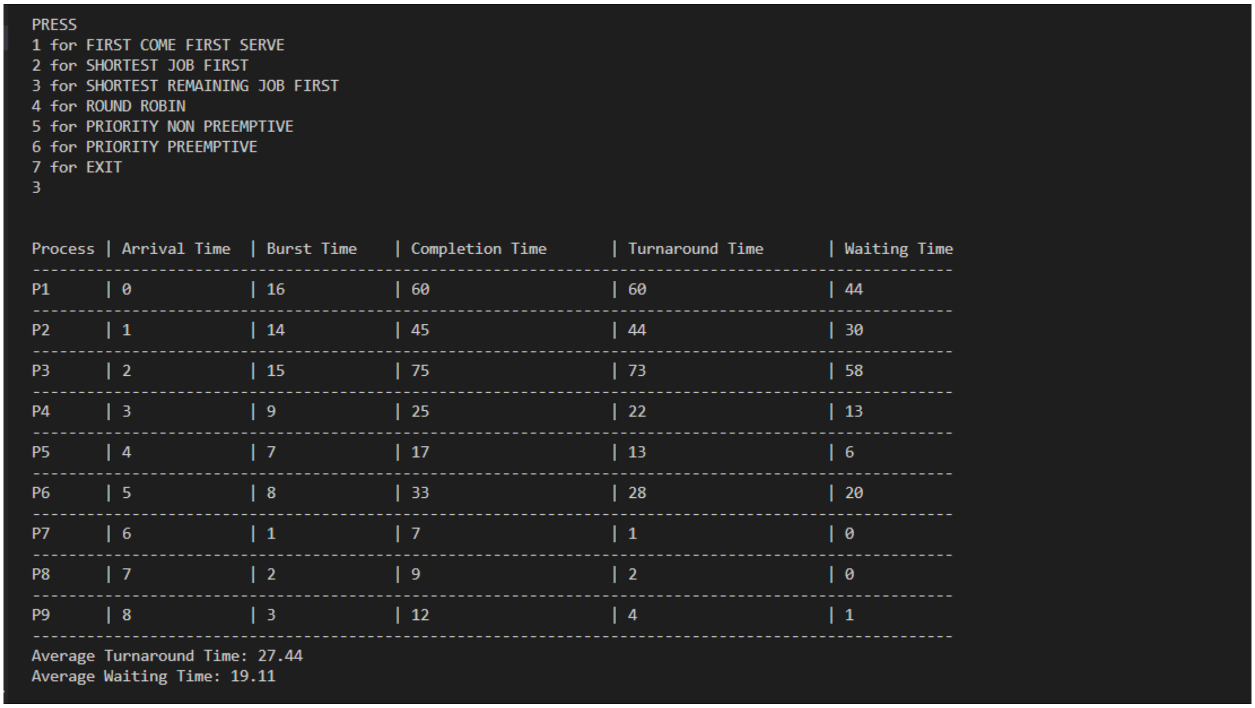
Shortest Job First:



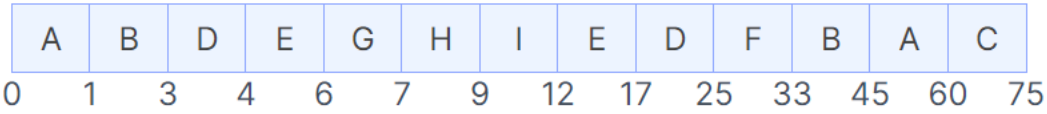
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
2


Process | Arrival Time  | Burst Time    | Completion Time       | Turnaround Time       | Waiting Time
----------------------------------------------------------------------------------------------------
P1      | 0             | 16            | 16                    | 16                    | 0
----------------------------------------------------------------------------------------------------
P2      | 1             | 14            | 60                    | 59                    | 45
----------------------------------------------------------------------------------------------------
P3      | 2             | 15            | 75                    | 73                    | 58
----------------------------------------------------------------------------------------------------
P4      | 3             | 9             | 46                    | 43                    | 34
----------------------------------------------------------------------------------------------------
P5      | 4             | 7             | 29                    | 25                    | 18
----------------------------------------------------------------------------------------------------
P6      | 5             | 8             | 37                    | 32                    | 24
----------------------------------------------------------------------------------------------------
P7      | 6             | 1             | 17                    | 11                    | 10
----------------------------------------------------------------------------------------------------
P8      | 7             | 2             | 19                    | 12                    | 10
----------------------------------------------------------------------------------------------------
P9      | 8             | 3             | 22                    | 14                    | 11
----------------------------------------------------------------------------------------------------
Average Turnaround Time: 31.67
Average Waiting Time: 23.33
```



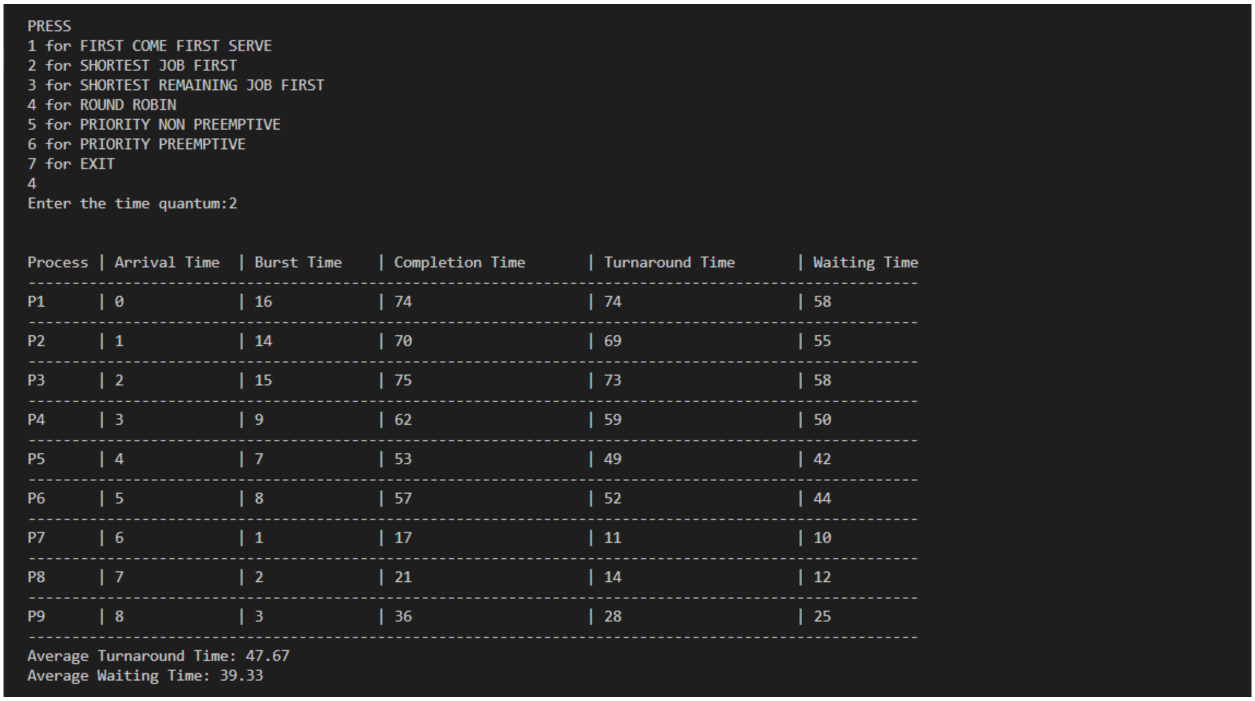
Shortest remaining Job First:



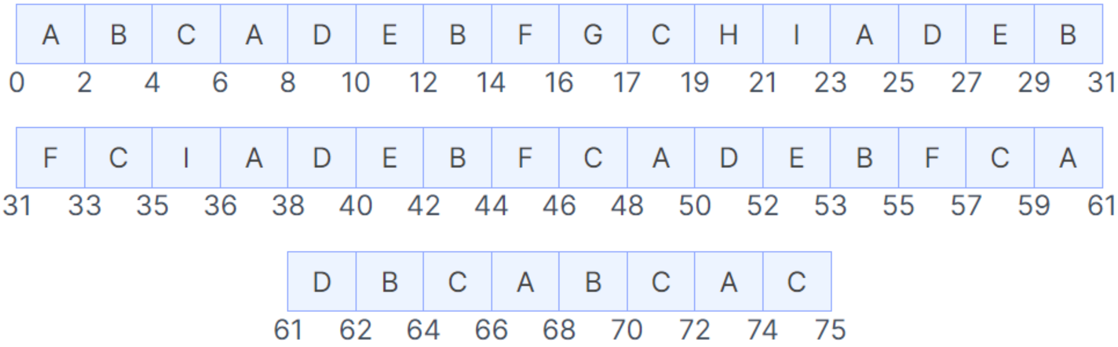
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
3


Process | Arrival Time  | Burst Time    | Completion Time       | Turnaround Time       | Waiting Time
-------------------------------------------------------------------------------------------------------
P1      | 0             | 16            | 60                    | 60                    | 44
-------------------------------------------------------------------------------------------------------
P2      | 1             | 14            | 45                    | 44                    | 30
-------------------------------------------------------------------------------------------------------
P3      | 2             | 15            | 75                    | 73                    | 58
-------------------------------------------------------------------------------------------------------
P4      | 3             | 9             | 25                    | 22                    | 13
-------------------------------------------------------------------------------------------------------
P5      | 4             | 7             | 17                    | 13                    | 6
-------------------------------------------------------------------------------------------------------
P6      | 5             | 8             | 33                    | 28                    | 20
-------------------------------------------------------------------------------------------------------
P7      | 6             | 1             | 7                     | 1                     | 0
-------------------------------------------------------------------------------------------------------
P8      | 7             | 2             | 9                     | 2                     | 0
-------------------------------------------------------------------------------------------------------
P9      | 8             | 3             | 12                    | 4                     | 1
-------------------------------------------------------------------------------------------------------
Average Turnaround Time: 27.44
Average Waiting Time: 19.11
```



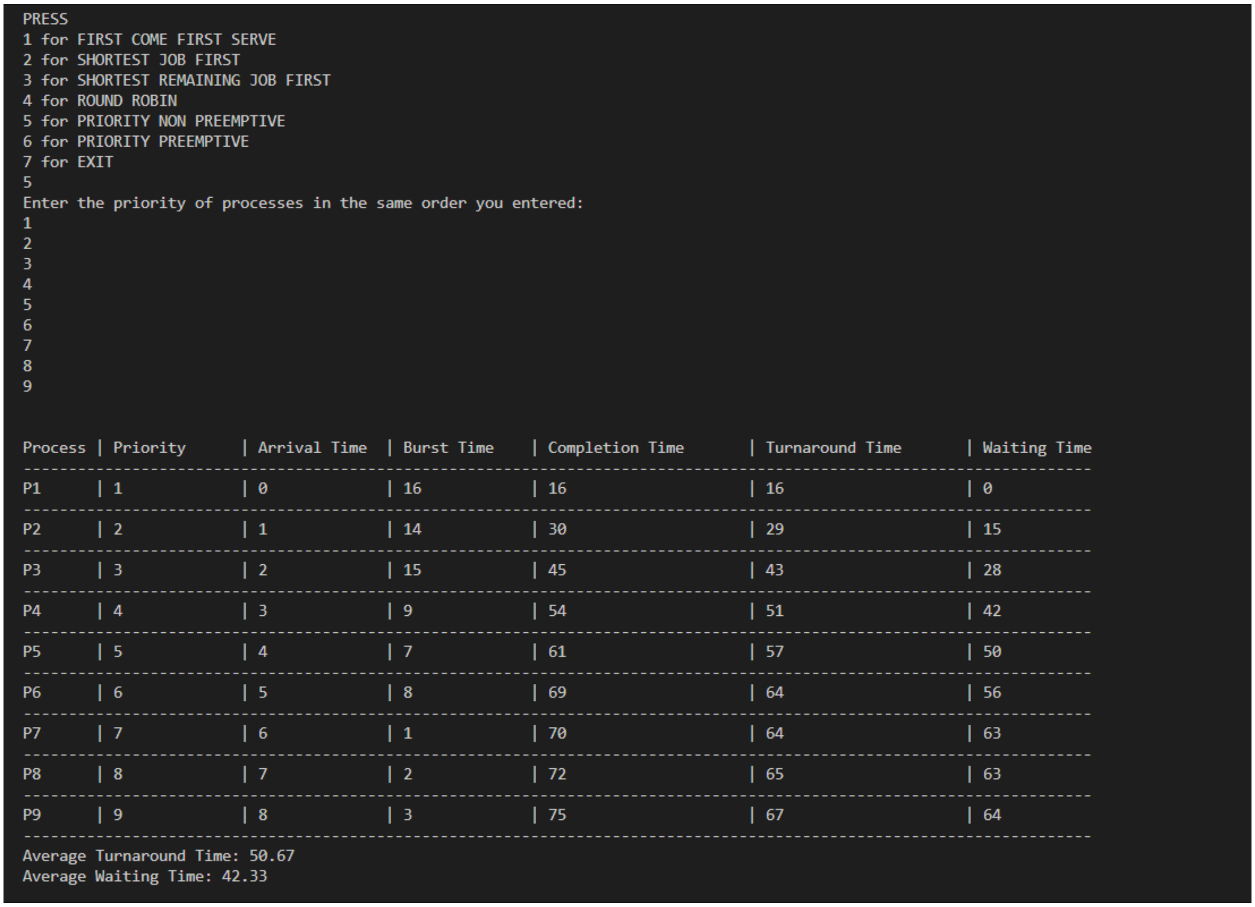
Round Robin:



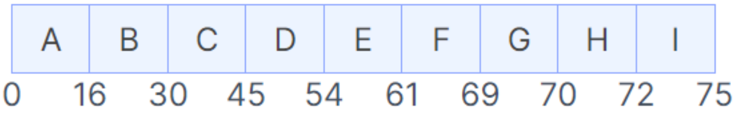
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
4
Enter the time quantum:2


Process | Arrival Time  | Burst Time    | Completion Time        | Turnaround Time        | Waiting Time
--------------------------------------------------------------------------------------------------------
P1      | 0             | 16            | 74                     | 74                     | 58
--------------------------------------------------------------------------------------------------------
P2      | 1             | 14            | 70                     | 69                     | 55
--------------------------------------------------------------------------------------------------------
P3      | 2             | 15            | 75                     | 73                     | 58
--------------------------------------------------------------------------------------------------------
P4      | 3             | 9             | 62                     | 59                     | 50
--------------------------------------------------------------------------------------------------------
P5      | 4             | 7             | 53                     | 49                     | 42
--------------------------------------------------------------------------------------------------------
P6      | 5             | 8             | 57                     | 52                     | 44
--------------------------------------------------------------------------------------------------------
P7      | 6             | 1             | 17                     | 11                     | 10
--------------------------------------------------------------------------------------------------------
P8      | 7             | 2             | 21                     | 14                     | 12
--------------------------------------------------------------------------------------------------------
P9      | 8             | 3             | 36                     | 28                     | 25
--------------------------------------------------------------------------------------------------------
Average Turnaround Time: 47.67
Average Waiting Time: 39.33
```



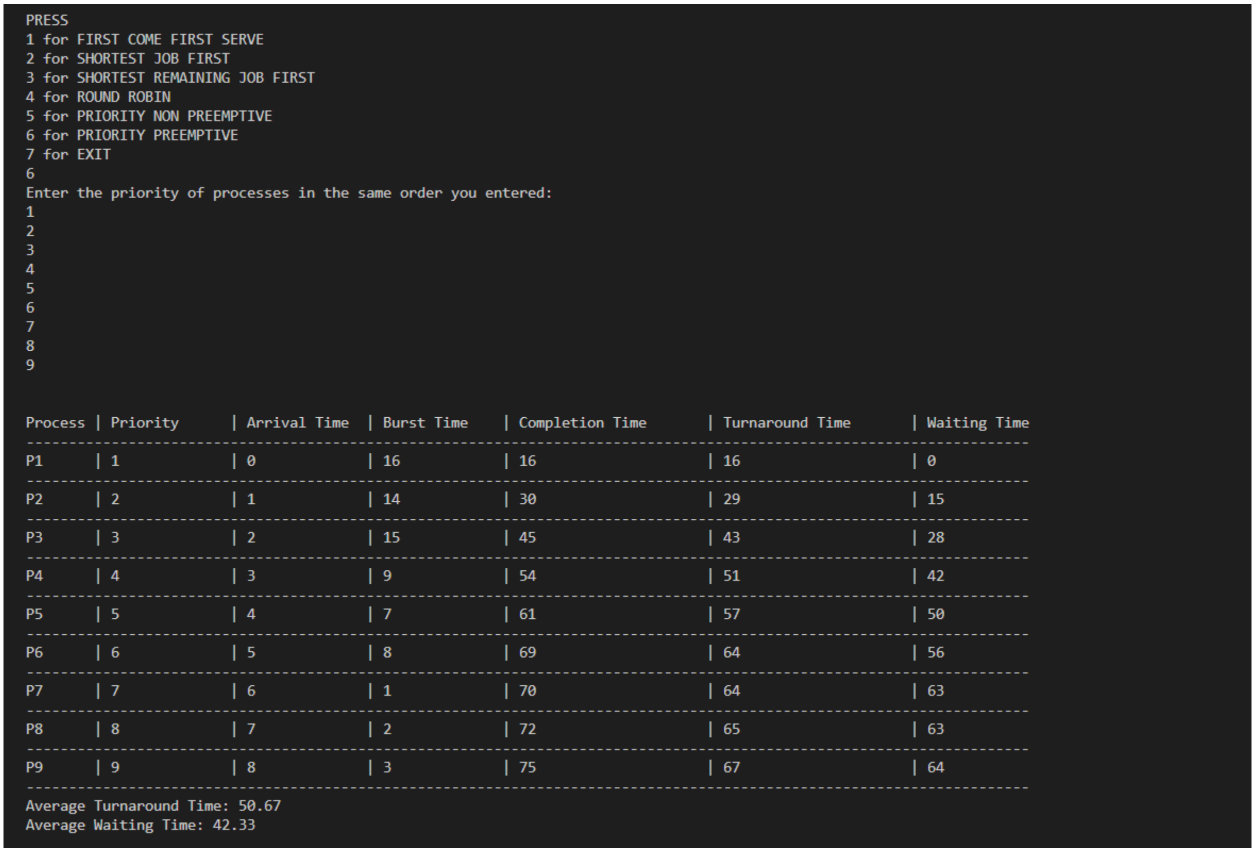
Priority Non-Pre-emptive:



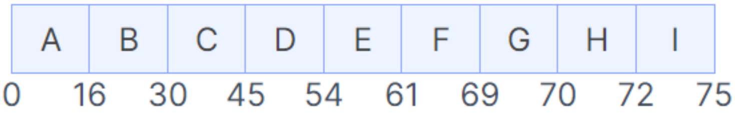
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
5
Enter the priority of processes in the same order you entered:
1
2
3
4
5
6
7
8
9


Process | Priority      | Arrival Time  | Burst Time    | Completion Time        | Turnaround Time        | Waiting Time
----------------------------------------------------------------------------------------------------------------------
P1      | 1             | 0             | 16            | 16                     | 16                     | 0
----------------------------------------------------------------------------------------------------------------------
P2      | 2             | 1             | 14            | 30                     | 29                     | 15
----------------------------------------------------------------------------------------------------------------------
P3      | 3             | 2             | 15            | 45                     | 43                     | 28
----------------------------------------------------------------------------------------------------------------------
P4      | 4             | 3             | 9             | 54                     | 51                     | 42
----------------------------------------------------------------------------------------------------------------------
P5      | 5             | 4             | 7             | 61                     | 57                     | 50
----------------------------------------------------------------------------------------------------------------------
P6      | 6             | 5             | 8             | 69                     | 64                     | 56
----------------------------------------------------------------------------------------------------------------------
P7      | 7             | 6             | 1             | 70                     | 64                     | 63
----------------------------------------------------------------------------------------------------------------------
P8      | 8             | 7             | 2             | 72                     | 65                     | 63
----------------------------------------------------------------------------------------------------------------------
P9      | 9             | 8             | 3             | 75                     | 67                     | 64
----------------------------------------------------------------------------------------------------------------------
Average Turnaround Time: 50.67
Average Waiting Time: 42.33
```



Priority Pre-emptive:



```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
6
Enter the priority of processes in the same order you entered:
1
2
3
4
5
6
7
8
9

Process | Priority        | Arrival Time    | Burst Time      | Completion Time         | Turnaround Time         | Waiting Time
-----------------------------------------------------------------------------------------------------------------------
P1      | 1               | 0               | 16              | 16                      | 16                      | 0
-----------------------------------------------------------------------------------------------------------------------
P2      | 2               | 1               | 14              | 30                      | 29                      | 15
-----------------------------------------------------------------------------------------------------------------------
P3      | 3               | 2               | 15              | 45                      | 43                      | 28
-----------------------------------------------------------------------------------------------------------------------
P4      | 4               | 3               | 9               | 54                      | 51                      | 42
-----------------------------------------------------------------------------------------------------------------------
P5      | 5               | 4               | 7               | 61                      | 57                      | 50
-----------------------------------------------------------------------------------------------------------------------
P6      | 6               | 5               | 8               | 69                      | 64                      | 56
-----------------------------------------------------------------------------------------------------------------------
P7      | 7               | 6               | 1               | 70                      | 64                      | 63
-----------------------------------------------------------------------------------------------------------------------
P8      | 8               | 7               | 2               | 72                      | 65                      | 63
-----------------------------------------------------------------------------------------------------------------------
P9      | 9               | 8               | 3               | 75                      | 67                      | 64
-----------------------------------------------------------------------------------------------------------------------
Average Turnaround Time: 50.67
Average Waiting Time: 42.33
```

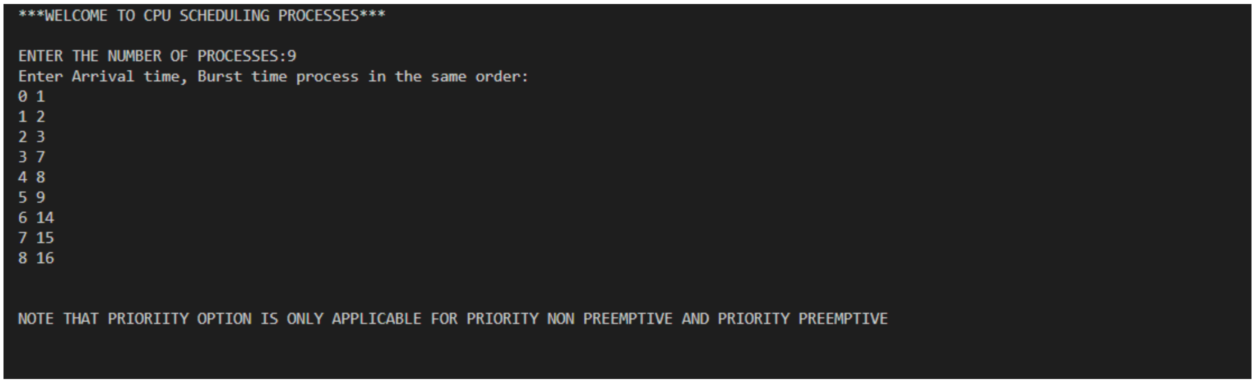


Case 2 (The jobs which needs shorter time comes first)

Input was as follows:

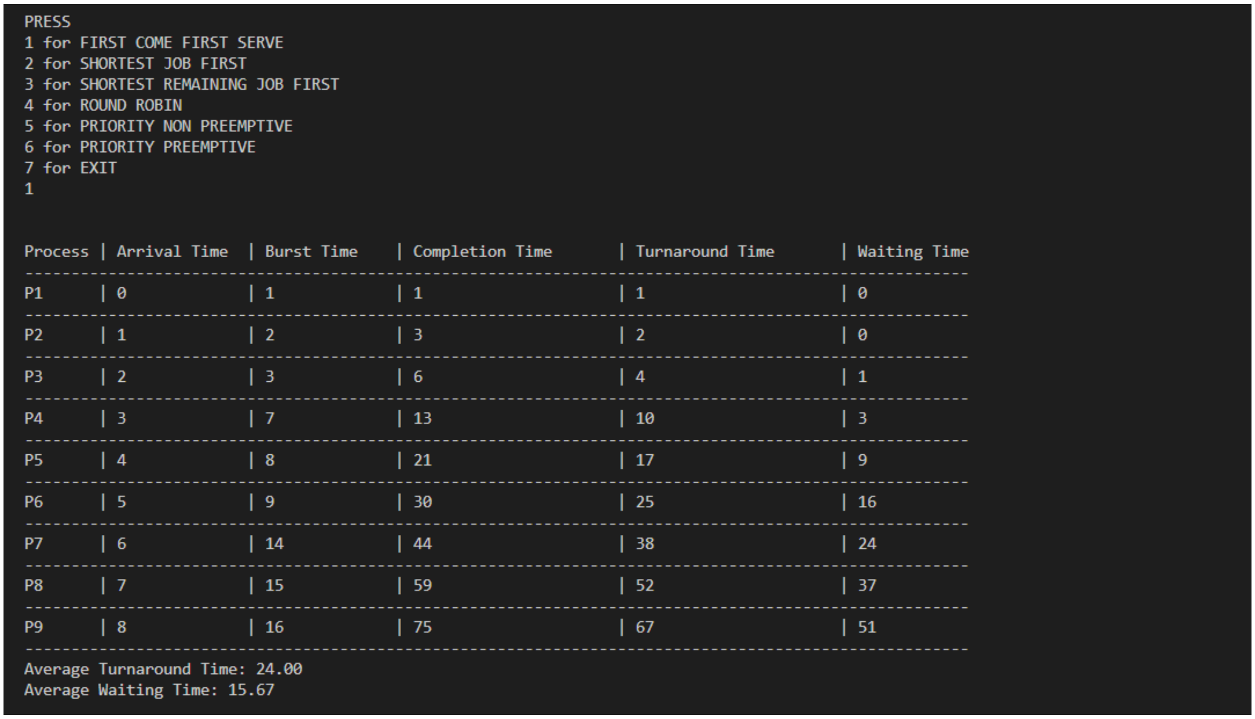
Process	Priority*	Arrival Time	Burst Time
P1/A	7	0	1
P2/B	4	1	2
P3/C	3	2	3
P4/D	8	3	7
P5/E	2	4	8
P6/F	1	5	9
P7/G	5	6	14
P8/H	6	7	15
P9/I	9	8	16

***Only Applicable for Priority non-Preemptive and Priority Preemptive**

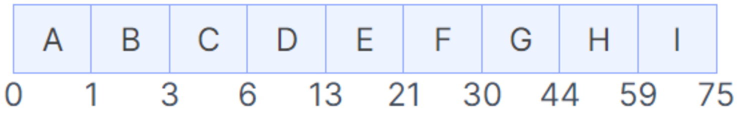


```
***WELCOME TO CPU SCHEDULING PROCESSES***

ENTER THE NUMBER OF PROCESSES:9
Enter Arrival time, Burst time process in the same order:
0 1
1 2
2 3
3 7
4 8
5 9
6 14
7 15
8 16


NOTE THAT PRIORIITY OPTION IS ONLY APPLICABLE FOR PRIORITY NON PREEMPTIVE AND PRIORITY PREEMPTIVE
```

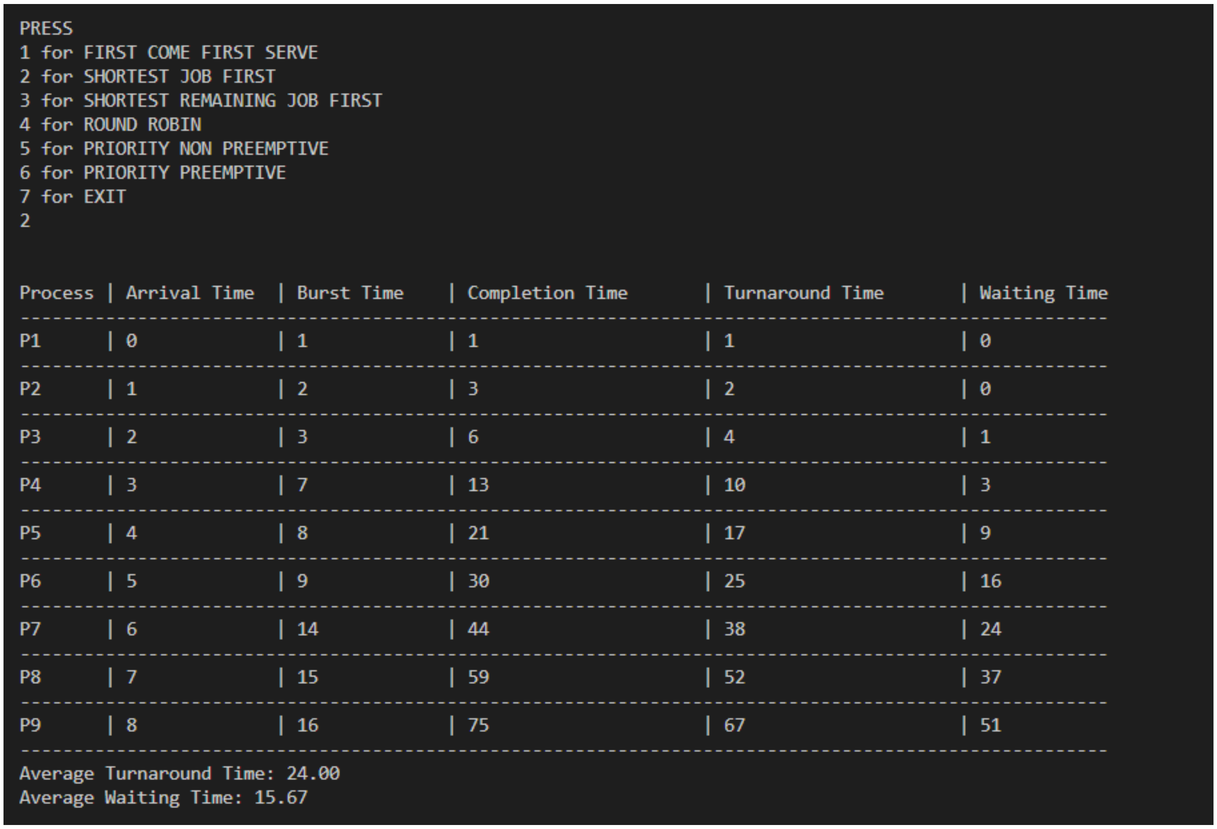
First Come First Serve:



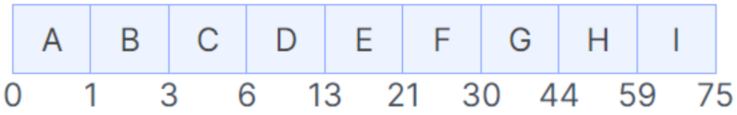
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
1

Process | Arrival Time  | Burst Time    | Completion Time       | Turnaround Time       | Waiting Time
------------------------------------------------------------------------------------------------------
P1      | 0             | 1             | 1                     | 1                     | 0
------------------------------------------------------------------------------------------------------
P2      | 1             | 2             | 3                     | 2                     | 0
------------------------------------------------------------------------------------------------------
P3      | 2             | 3             | 6                     | 4                     | 1
------------------------------------------------------------------------------------------------------
P4      | 3             | 7             | 13                    | 10                    | 3
------------------------------------------------------------------------------------------------------
P5      | 4             | 8             | 21                    | 17                    | 9
------------------------------------------------------------------------------------------------------
P6      | 5             | 9             | 30                    | 25                    | 16
------------------------------------------------------------------------------------------------------
P7      | 6             | 14            | 44                    | 38                    | 24
------------------------------------------------------------------------------------------------------
P8      | 7             | 15            | 59                    | 52                    | 37
------------------------------------------------------------------------------------------------------
P9      | 8             | 16            | 75                    | 67                    | 51
------------------------------------------------------------------------------------------------------
Average Turnaround Time: 24.00
Average Waiting Time: 15.67
```



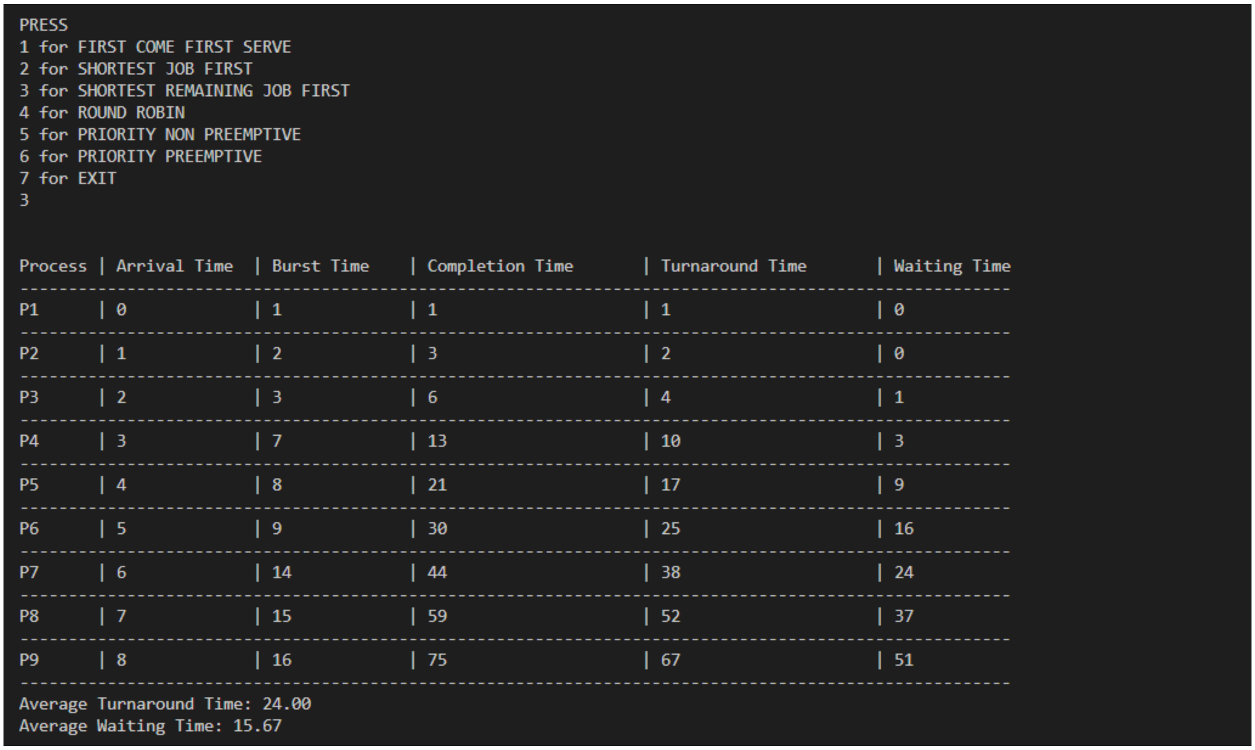
Shortest Job First:



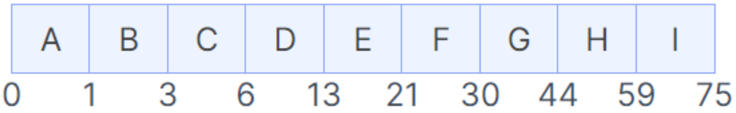
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
2


Process | Arrival Time   | Burst Time     | Completion Time       | Turnaround Time       | Waiting Time
-----------------------------------------------------------------------------------------------------
P1      | 0              | 1              | 1                     | 1                     | 0
-----------------------------------------------------------------------------------------------------
P2      | 1              | 2              | 3                     | 2                     | 0
-----------------------------------------------------------------------------------------------------
P3      | 2              | 3              | 6                     | 4                     | 1
-----------------------------------------------------------------------------------------------------
P4      | 3              | 7              | 13                    | 10                    | 3
-----------------------------------------------------------------------------------------------------
P5      | 4              | 8              | 21                    | 17                    | 9
-----------------------------------------------------------------------------------------------------
P6      | 5              | 9              | 30                    | 25                    | 16
-----------------------------------------------------------------------------------------------------
P7      | 6              | 14             | 44                    | 38                    | 24
-----------------------------------------------------------------------------------------------------
P8      | 7              | 15             | 59                    | 52                    | 37
-----------------------------------------------------------------------------------------------------
P9      | 8              | 16             | 75                    | 67                    | 51
-----------------------------------------------------------------------------------------------------
Average Turnaround Time: 24.00
Average Waiting Time: 15.67
```



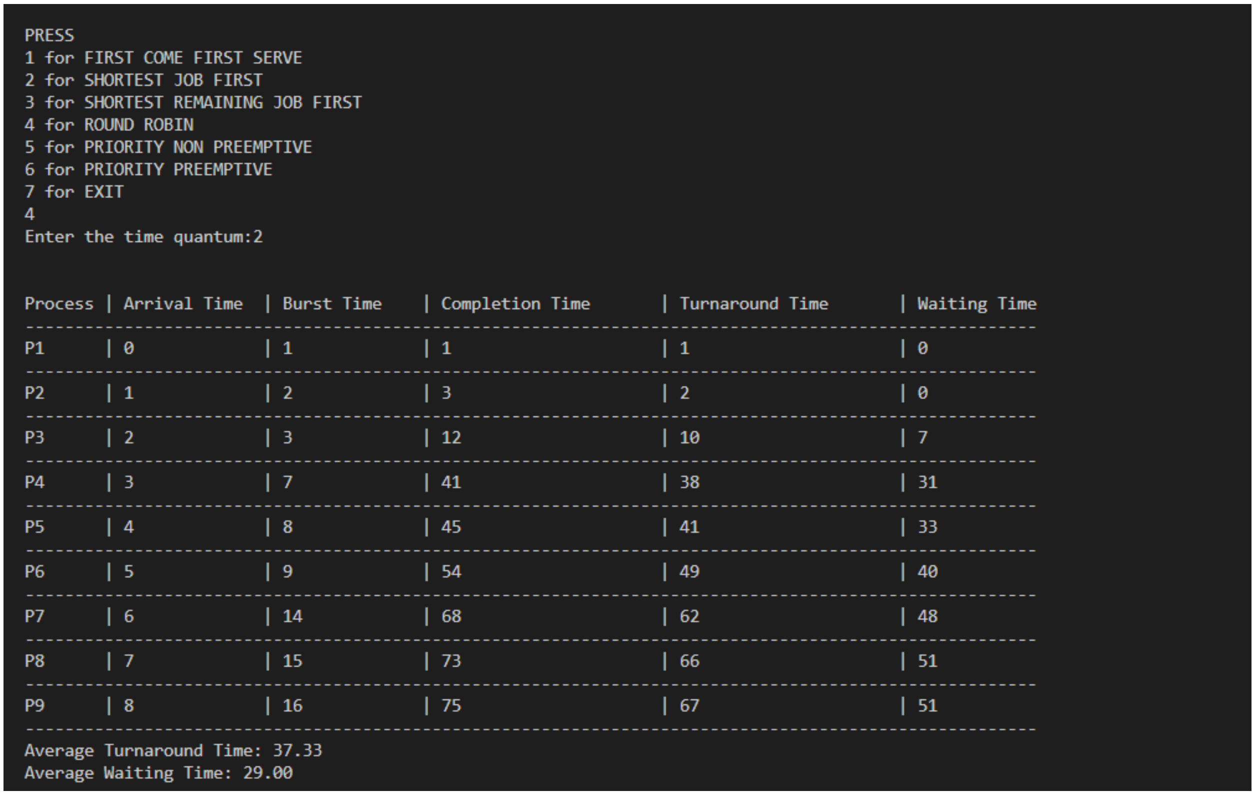
Shortest Remaining Job First:



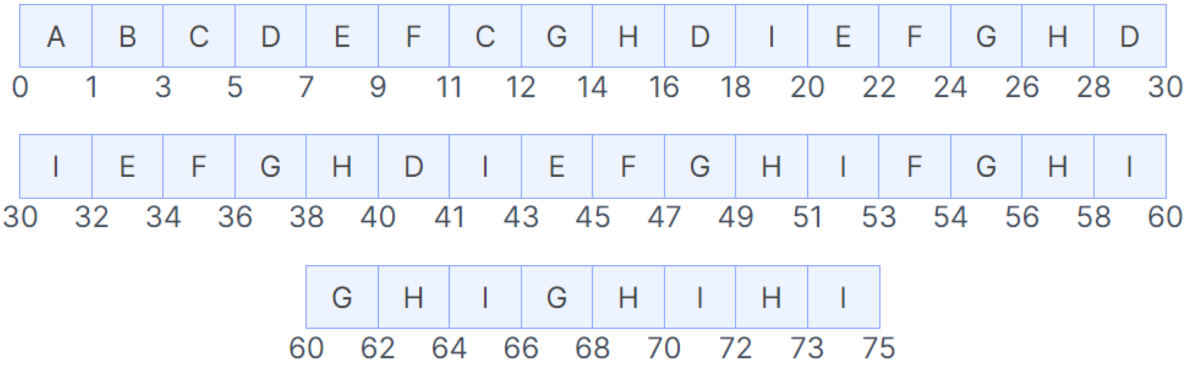
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
3


Process | Arrival Time   | Burst Time     | Completion Time        | Turnaround Time        | Waiting Time
-----------------------------------------------------------------------------------------------------------
P1      | 0              | 1              | 1                      | 1                      | 0
-----------------------------------------------------------------------------------------------------------
P2      | 1              | 2              | 3                      | 2                      | 0
-----------------------------------------------------------------------------------------------------------
P3      | 2              | 3              | 6                      | 4                      | 1
-----------------------------------------------------------------------------------------------------------
P4      | 3              | 7              | 13                     | 10                     | 3
-----------------------------------------------------------------------------------------------------------
P5      | 4              | 8              | 21                     | 17                     | 9
-----------------------------------------------------------------------------------------------------------
P6      | 5              | 9              | 30                     | 25                     | 16
-----------------------------------------------------------------------------------------------------------
P7      | 6              | 14             | 44                     | 38                     | 24
-----------------------------------------------------------------------------------------------------------
P8      | 7              | 15             | 59                     | 52                     | 37
-----------------------------------------------------------------------------------------------------------
P9      | 8              | 16             | 75                     | 67                     | 51
-----------------------------------------------------------------------------------------------------------
Average Turnaround Time: 24.00
Average Waiting Time: 15.67
```



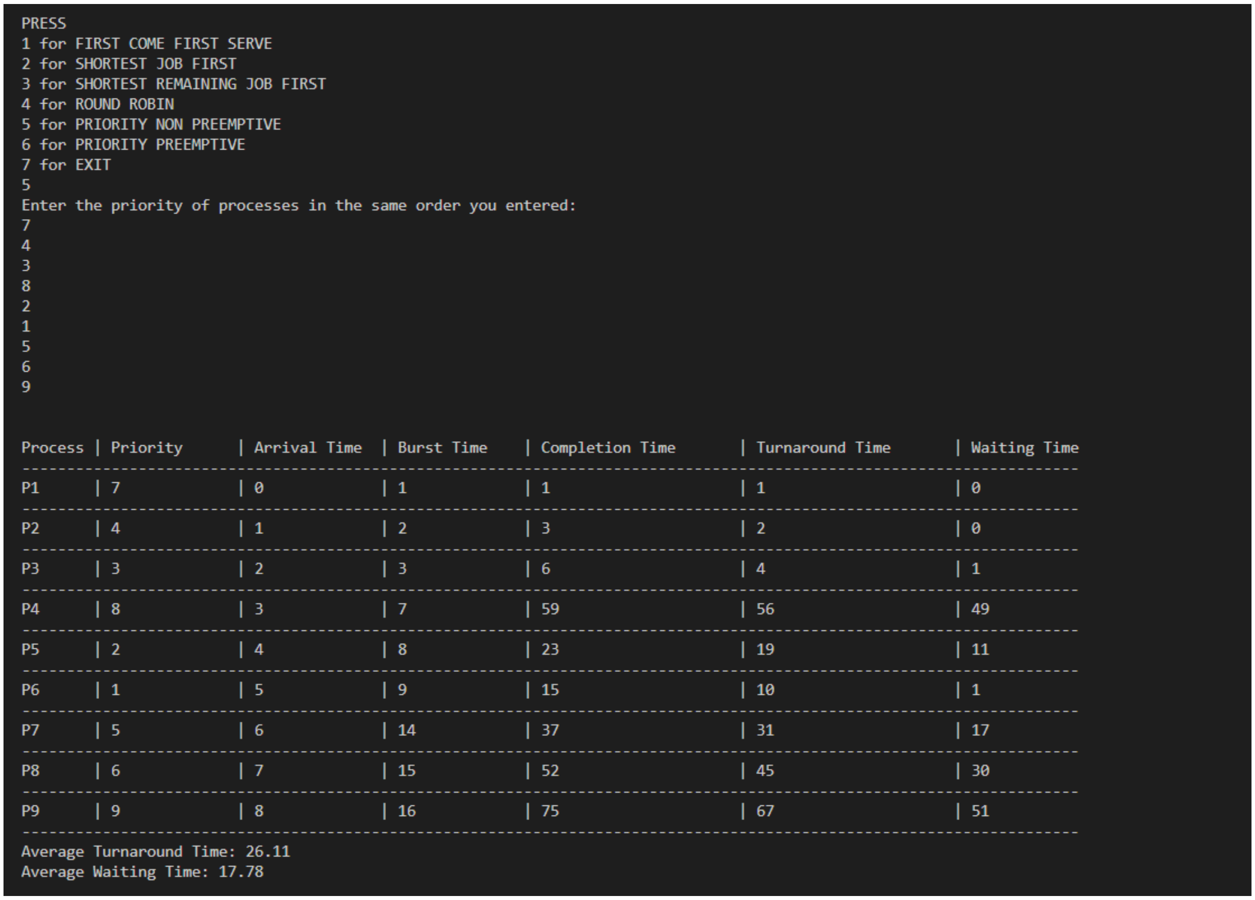
Round Robin:



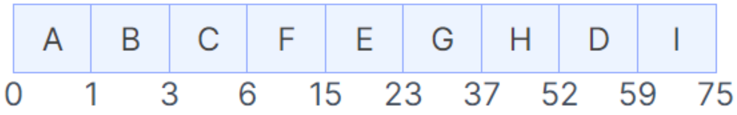
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
4
Enter the time quantum:2


Process | Arrival Time  | Burst Time    | Completion Time        | Turnaround Time        | Waiting Time
---------------------------------------------------------------------------------------------------------
P1      | 0             | 1             | 1                      | 1                      | 0
---------------------------------------------------------------------------------------------------------
P2      | 1             | 2             | 3                      | 2                      | 0
---------------------------------------------------------------------------------------------------------
P3      | 2             | 3             | 12                     | 10                     | 7
---------------------------------------------------------------------------------------------------------
P4      | 3             | 7             | 41                     | 38                     | 31
---------------------------------------------------------------------------------------------------------
P5      | 4             | 8             | 45                     | 41                     | 33
---------------------------------------------------------------------------------------------------------
P6      | 5             | 9             | 54                     | 49                     | 40
---------------------------------------------------------------------------------------------------------
P7      | 6             | 14            | 68                     | 62                     | 48
---------------------------------------------------------------------------------------------------------
P8      | 7             | 15            | 73                     | 66                     | 51
---------------------------------------------------------------------------------------------------------
P9      | 8             | 16            | 75                     | 67                     | 51
---------------------------------------------------------------------------------------------------------
Average Turnaround Time: 37.33
Average Waiting Time: 29.00
```



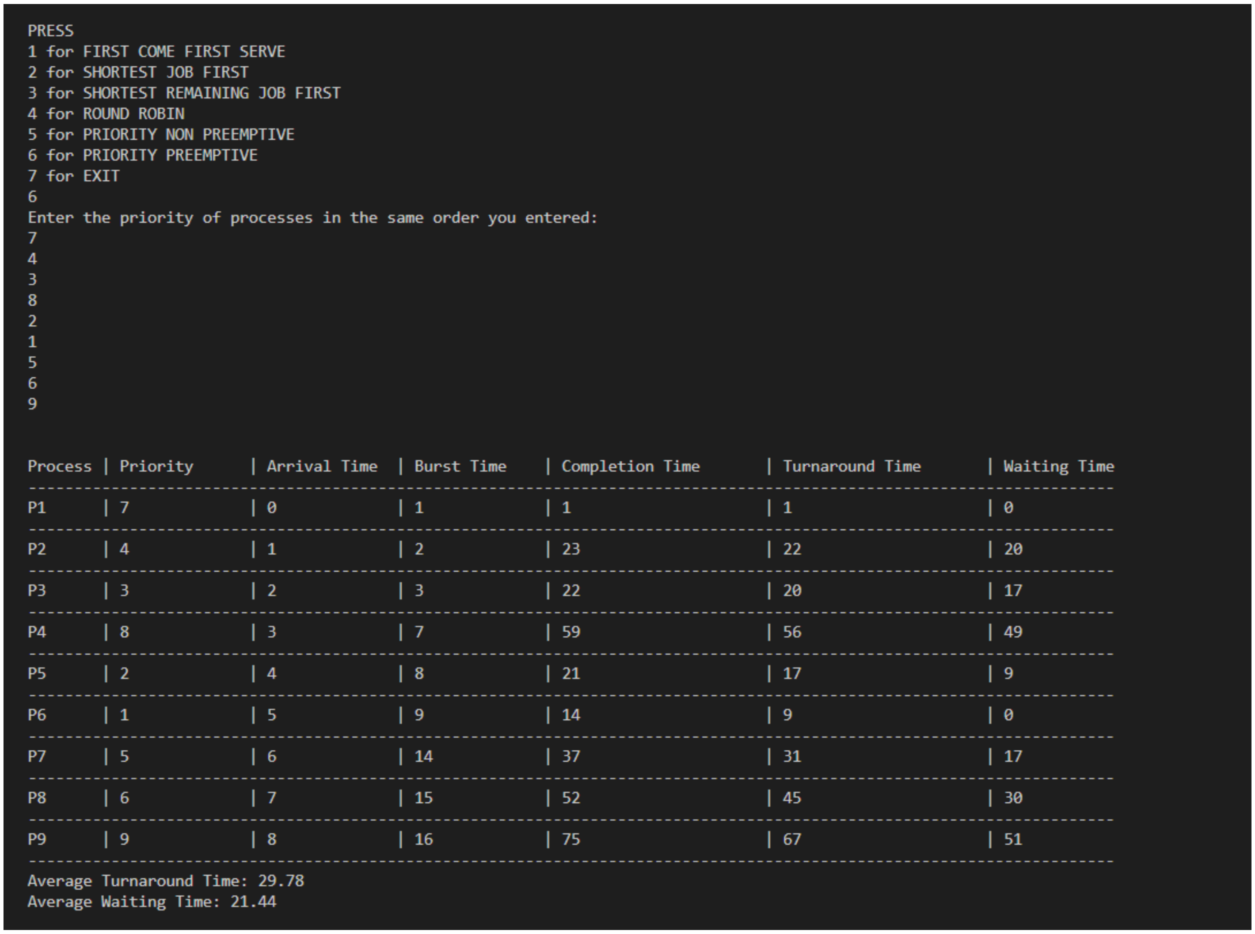
Priority non-Preemptive:



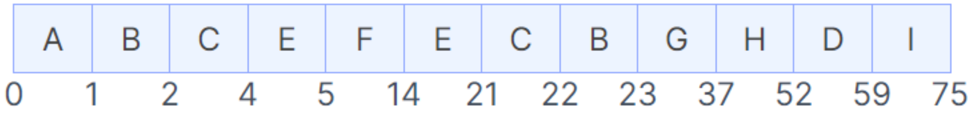
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
5
Enter the priority of processes in the same order you entered:
7
4
3
8
2
1
5
6
9

Process | Priority       | Arrival Time  | Burst Time    | Completion Time       | Turnaround Time       | Waiting Time
-----------------------------------------------------------------------------------------------------------------------
P1      | 7              | 0             | 1             | 1                     | 1                     | 0
-----------------------------------------------------------------------------------------------------------------------
P2      | 4              | 1             | 2             | 3                     | 2                     | 0
-----------------------------------------------------------------------------------------------------------------------
P3      | 3              | 2             | 3             | 6                     | 4                     | 1
-----------------------------------------------------------------------------------------------------------------------
P4      | 8              | 3             | 7             | 59                    | 56                    | 49
-----------------------------------------------------------------------------------------------------------------------
P5      | 2              | 4             | 8             | 23                    | 19                    | 11
-----------------------------------------------------------------------------------------------------------------------
P6      | 1              | 5             | 9             | 15                    | 10                    | 1
-----------------------------------------------------------------------------------------------------------------------
P7      | 5              | 6             | 14            | 37                    | 31                    | 17
-----------------------------------------------------------------------------------------------------------------------
P8      | 6              | 7             | 15            | 52                    | 45                    | 30
-----------------------------------------------------------------------------------------------------------------------
P9      | 9              | 8             | 16            | 75                    | 67                    | 51
-----------------------------------------------------------------------------------------------------------------------
Average Turnaround Time: 26.11
Average Waiting Time: 17.78
```



Priority Preemptive:



```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
6
Enter the priority of processes in the same order you entered:
7
4
3
8
2
1
5
6
9


Process | Priority       | Arrival Time  | Burst Time    | Completion Time       | Turnaround Time       | Waiting Time
-----------------------------------------------------------------------------------------------------------------------
P1      | 7              | 0             | 1             | 1                     | 1                     | 0
-----------------------------------------------------------------------------------------------------------------------
P2      | 4              | 1             | 2             | 23                    | 22                    | 20
-----------------------------------------------------------------------------------------------------------------------
P3      | 3              | 2             | 3             | 22                    | 20                    | 17
-----------------------------------------------------------------------------------------------------------------------
P4      | 8              | 3             | 7             | 59                    | 56                    | 49
-----------------------------------------------------------------------------------------------------------------------
P5      | 2              | 4             | 8             | 21                    | 17                    | 9
-----------------------------------------------------------------------------------------------------------------------
P6      | 1              | 5             | 9             | 14                    | 9                     | 0
-----------------------------------------------------------------------------------------------------------------------
P7      | 5              | 6             | 14            | 37                    | 31                    | 17
-----------------------------------------------------------------------------------------------------------------------
P8      | 6              | 7             | 15            | 52                    | 45                    | 30
-----------------------------------------------------------------------------------------------------------------------
P9      | 9              | 8             | 16            | 75                    | 67                    | 51
-----------------------------------------------------------------------------------------------------------------------
Average Turnaround Time: 29.78
Average Waiting Time: 21.44
```

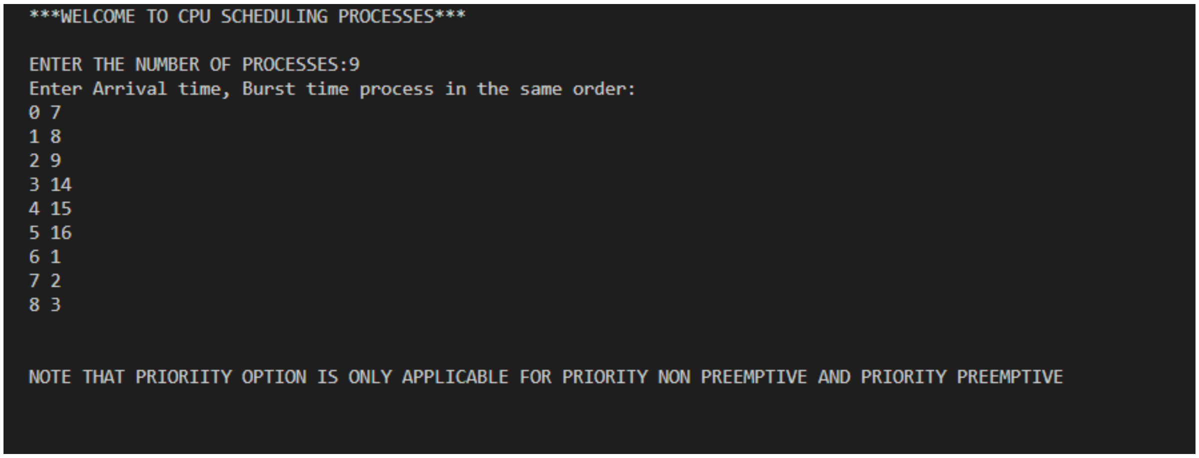


Case 3 (The jobs which needs medium time comes first)

Input was as follows:

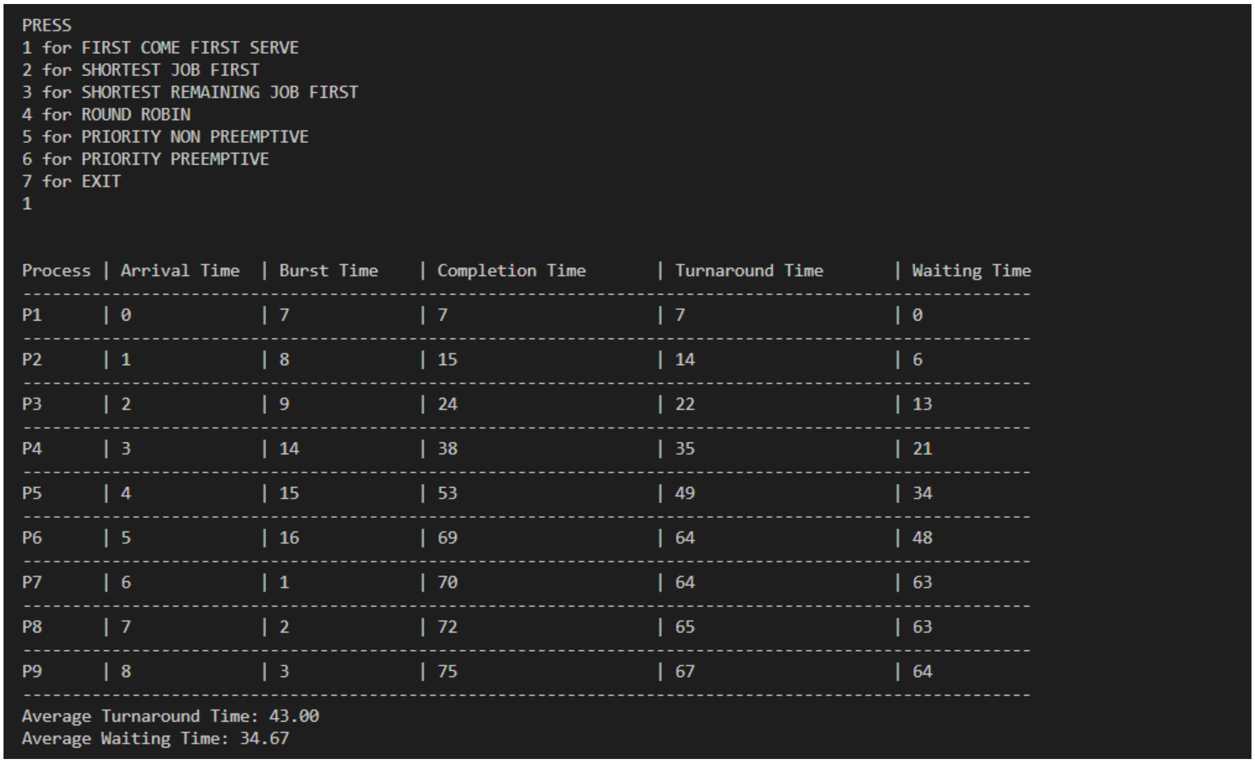
Process	Priority*	Arrival Time	Burst Time
P1/A	7	0	7
P2/B	4	1	8
P3/C	3	2	9
P4/D	8	3	14
P5/E	2	4	15
P6/F	1	5	16
P7/G	5	6	1
P8/H	6	7	2
P9/I	9	8	3

***Only Applicable for Priority non-Preemptive and Priority Preemptive**

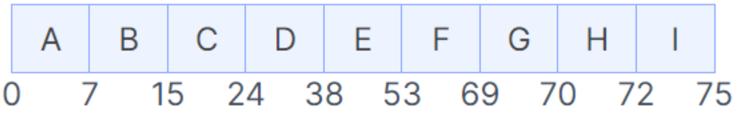


```
***WELCOME TO CPU SCHEDULING PROCESSES***

ENTER THE NUMBER OF PROCESSES:9
Enter Arrival time, Burst time process in the same order:
0 7
1 8
2 9
3 14
4 15
5 16
6 1
7 2
8 3


NOTE THAT PRIORIITY OPTION IS ONLY APPLICABLE FOR PRIORITY NON PREEMPTIVE AND PRIORITY PREEMPTIVE
```

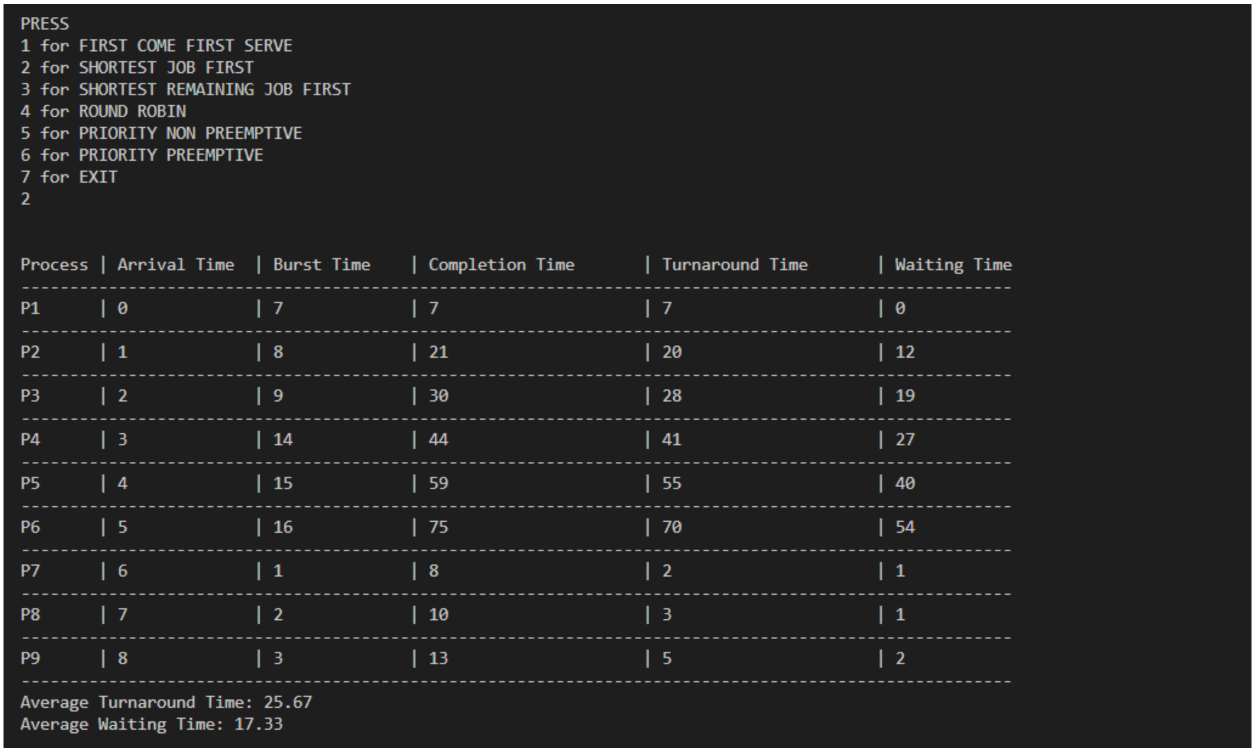
First Come First Serve:



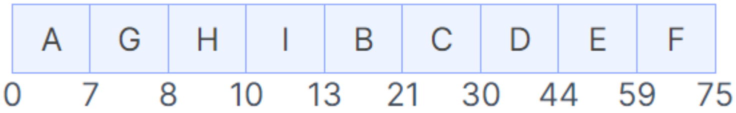
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
1


Process | Arrival Time  | Burst Time    | Completion Time       | Turnaround Time       | Waiting Time
------------------------------------------------------------------------------------------------------
P1      | 0             | 7             | 7                     | 7                     | 0
------------------------------------------------------------------------------------------------------
P2      | 1             | 8             | 15                    | 14                    | 6
------------------------------------------------------------------------------------------------------
P3      | 2             | 9             | 24                    | 22                    | 13
------------------------------------------------------------------------------------------------------
P4      | 3             | 14            | 38                    | 35                    | 21
------------------------------------------------------------------------------------------------------
P5      | 4             | 15            | 53                    | 49                    | 34
------------------------------------------------------------------------------------------------------
P6      | 5             | 16            | 69                    | 64                    | 48
------------------------------------------------------------------------------------------------------
P7      | 6             | 1             | 70                    | 64                    | 63
------------------------------------------------------------------------------------------------------
P8      | 7             | 2             | 72                    | 65                    | 63
------------------------------------------------------------------------------------------------------
P9      | 8             | 3             | 75                    | 67                    | 64
------------------------------------------------------------------------------------------------------
Average Turnaround Time: 43.00
Average Waiting Time: 34.67
```



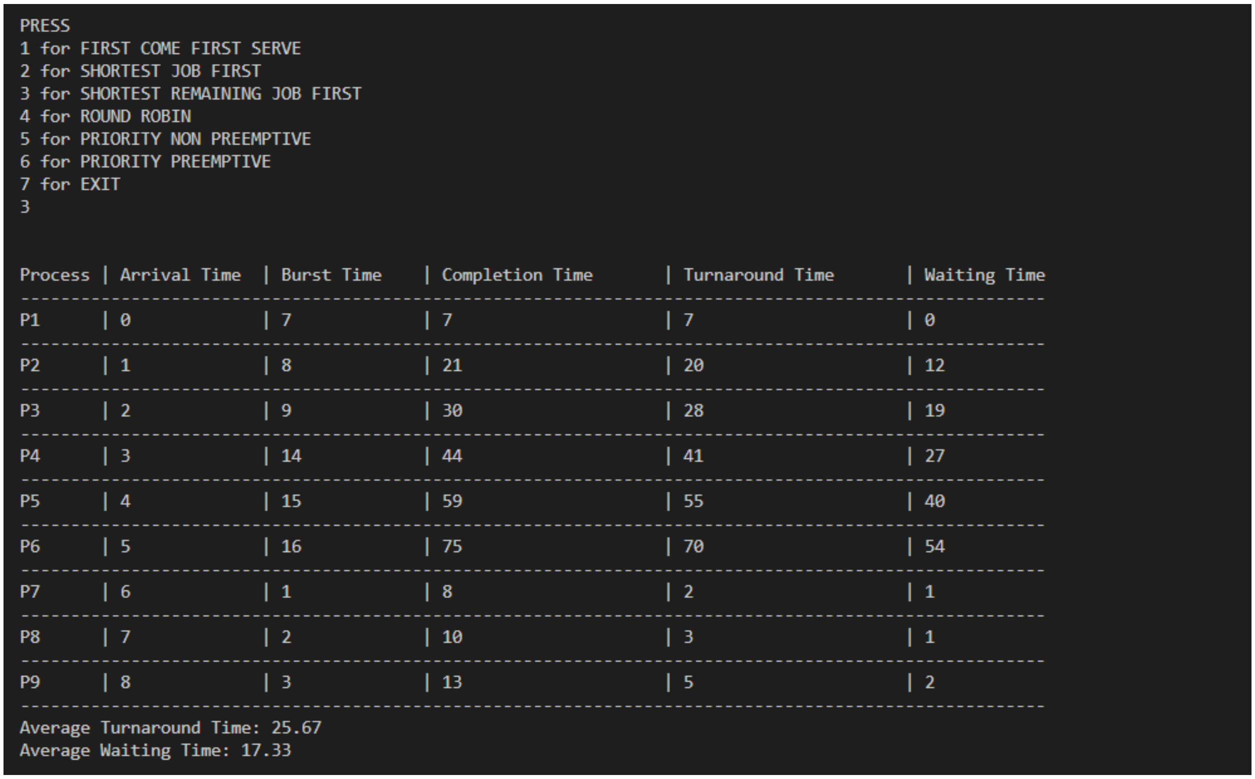
Shortest Job First:



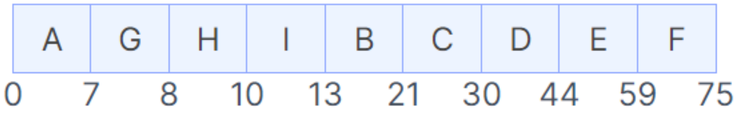
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
2

Process | Arrival Time   | Burst Time    | Completion Time        | Turnaround Time        | Waiting Time
-----------------------------------------------------------------------------------------------------------
P1      | 0              | 7             | 7                      | 7                      | 0
-----------------------------------------------------------------------------------------------------------
P2      | 1              | 8             | 21                     | 20                     | 12
-----------------------------------------------------------------------------------------------------------
P3      | 2              | 9             | 30                     | 28                     | 19
-----------------------------------------------------------------------------------------------------------
P4      | 3              | 14            | 44                     | 41                     | 27
-----------------------------------------------------------------------------------------------------------
P5      | 4              | 15            | 59                     | 55                     | 40
-----------------------------------------------------------------------------------------------------------
P6      | 5              | 16            | 75                     | 70                     | 54
-----------------------------------------------------------------------------------------------------------
P7      | 6              | 1             | 8                      | 2                      | 1
-----------------------------------------------------------------------------------------------------------
P8      | 7              | 2             | 10                     | 3                      | 1
-----------------------------------------------------------------------------------------------------------
P9      | 8              | 3             | 13                     | 5                      | 2
-----------------------------------------------------------------------------------------------------------
Average Turnaround Time: 25.67
Average Waiting Time: 17.33
```



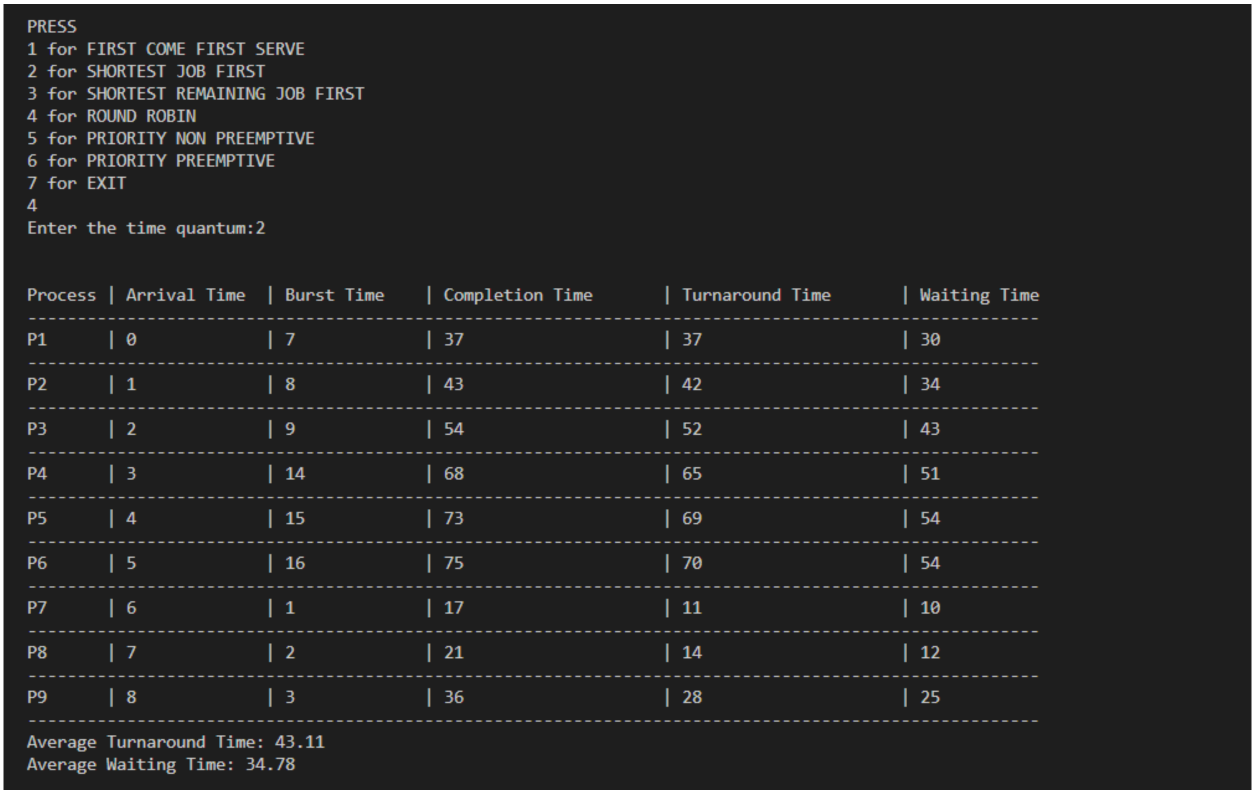
Shortest Remaining Job First:



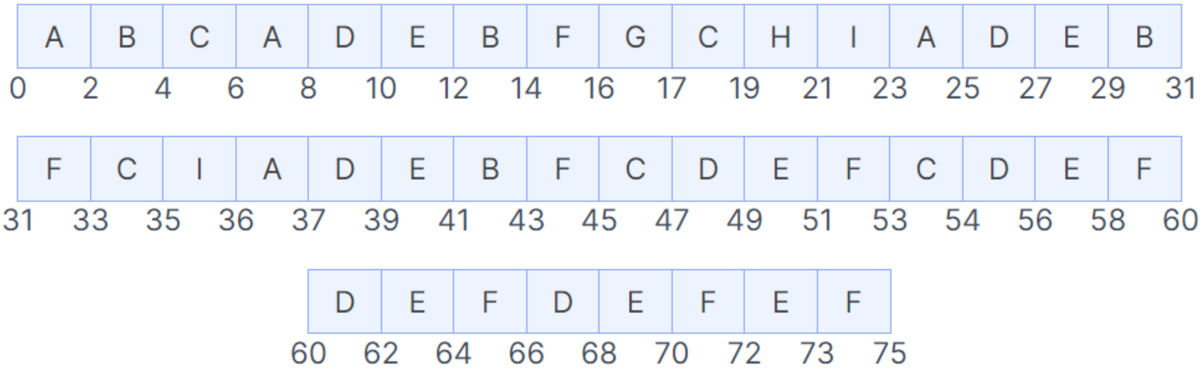
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
3


Process | Arrival Time    | Burst Time     | Completion Time        | Turnaround Time        | Waiting Time
----------------------------------------------------------------------------------------------------------
P1      | 0               | 7              | 7                      | 7                      | 0
----------------------------------------------------------------------------------------------------------
P2      | 1               | 8              | 21                     | 20                     | 12
----------------------------------------------------------------------------------------------------------
P3      | 2               | 9              | 30                     | 28                     | 19
----------------------------------------------------------------------------------------------------------
P4      | 3               | 14             | 44                     | 41                     | 27
----------------------------------------------------------------------------------------------------------
P5      | 4               | 15             | 59                     | 55                     | 40
----------------------------------------------------------------------------------------------------------
P6      | 5               | 16             | 75                     | 70                     | 54
----------------------------------------------------------------------------------------------------------
P7      | 6               | 1              | 8                      | 2                      | 1
----------------------------------------------------------------------------------------------------------
P8      | 7               | 2              | 10                     | 3                      | 1
----------------------------------------------------------------------------------------------------------
P9      | 8               | 3              | 13                     | 5                      | 2
----------------------------------------------------------------------------------------------------------
Average Turnaround Time: 25.67
Average Waiting Time: 17.33
```



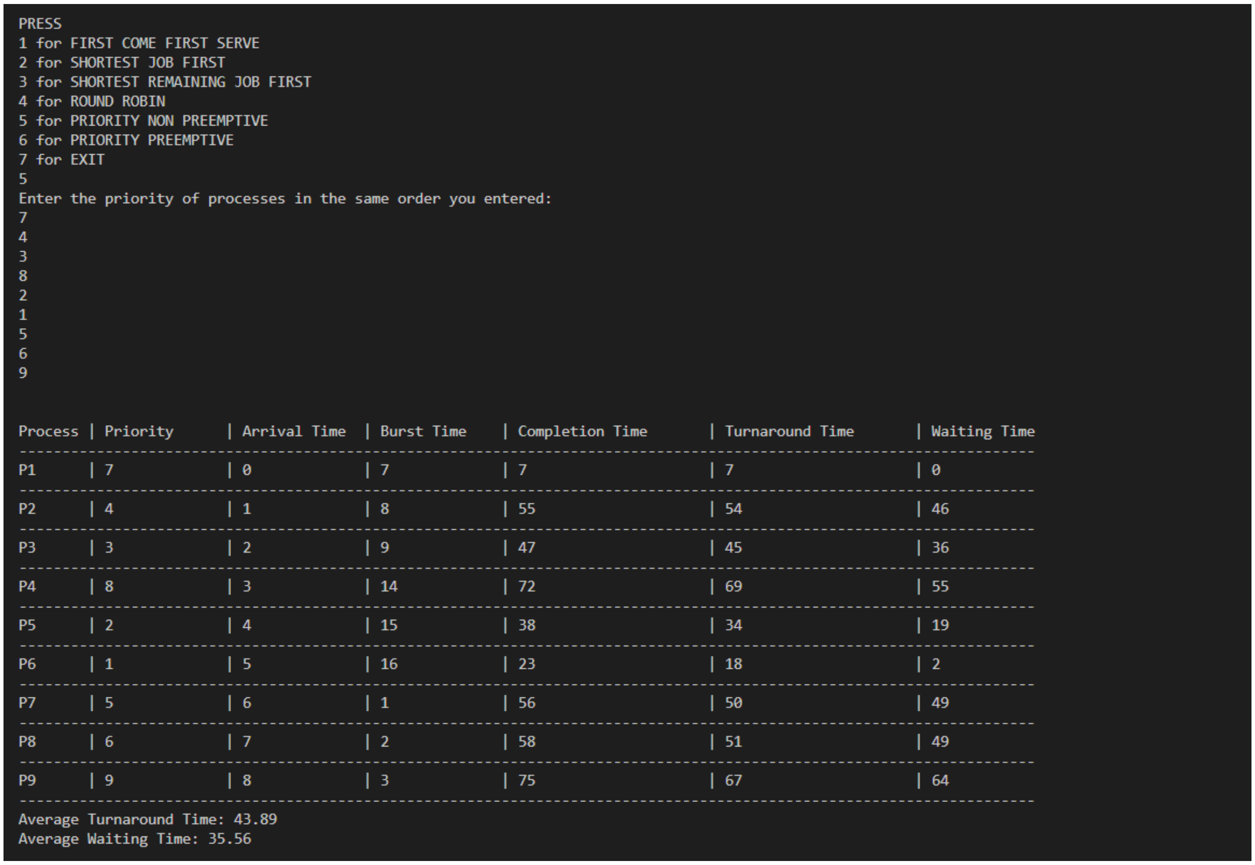
Round Robin:



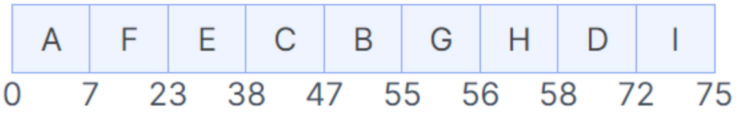
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
4
Enter the time quantum:2


Process | Arrival Time   | Burst Time     | Completion Time        | Turnaround Time        | Waiting Time
----------------------------------------------------------------------------------------------------------
P1      | 0              | 7              | 37                     | 37                     | 30
----------------------------------------------------------------------------------------------------------
P2      | 1              | 8              | 43                     | 42                     | 34
----------------------------------------------------------------------------------------------------------
P3      | 2              | 9              | 54                     | 52                     | 43
----------------------------------------------------------------------------------------------------------
P4      | 3              | 14             | 68                     | 65                     | 51
----------------------------------------------------------------------------------------------------------
P5      | 4              | 15             | 73                     | 69                     | 54
----------------------------------------------------------------------------------------------------------
P6      | 5              | 16             | 75                     | 70                     | 54
----------------------------------------------------------------------------------------------------------
P7      | 6              | 1              | 17                     | 11                     | 10
----------------------------------------------------------------------------------------------------------
P8      | 7              | 2              | 21                     | 14                     | 12
----------------------------------------------------------------------------------------------------------
P9      | 8              | 3              | 36                     | 28                     | 25
----------------------------------------------------------------------------------------------------------
Average Turnaround Time: 43.11
Average Waiting Time: 34.78
```



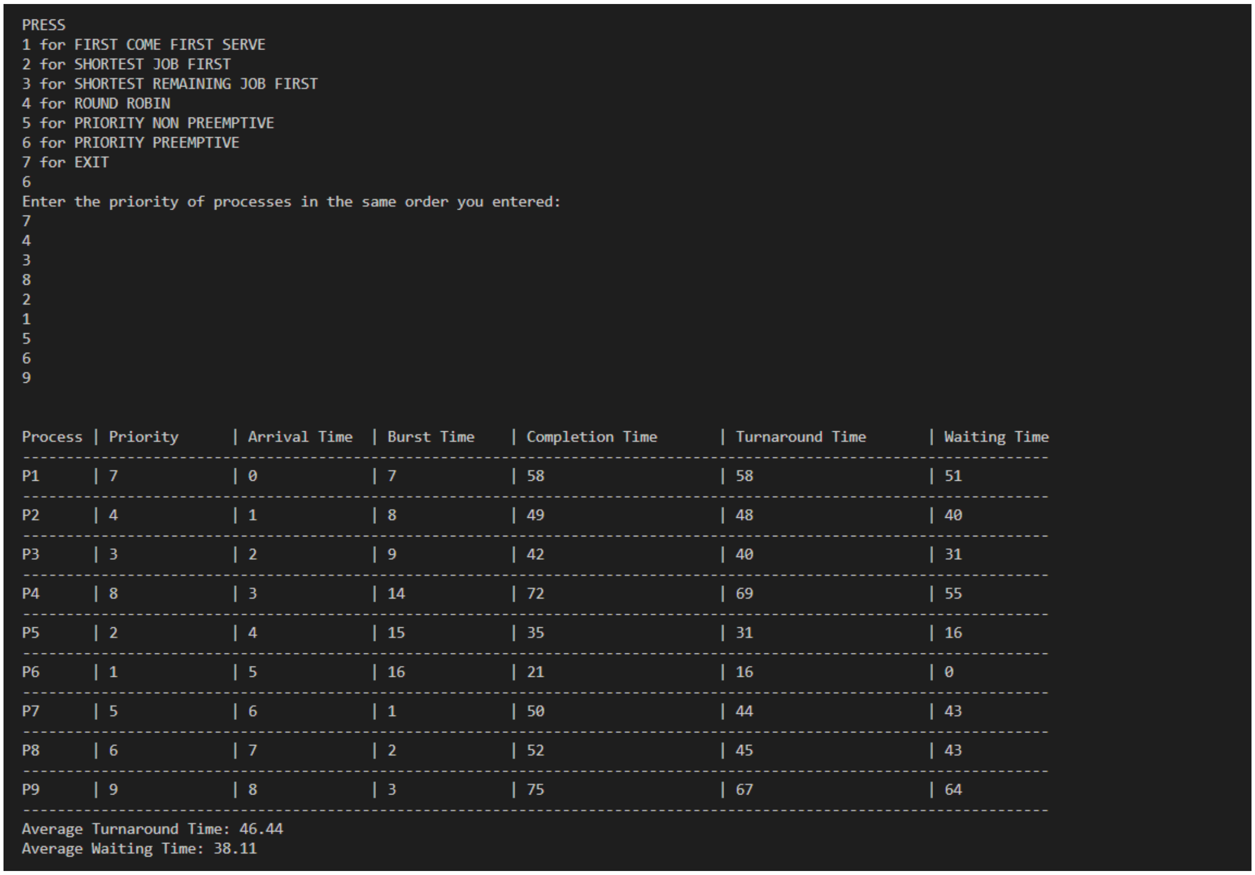
Priority Non-Preemptive:



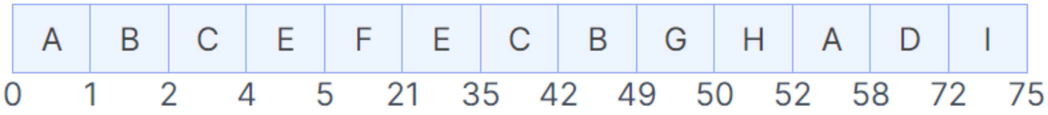
```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
5
Enter the priority of processes in the same order you entered:
7
4
3
8
2
1
5
6
9


Process | Priority       | Arrival Time   | Burst Time     | Completion Time        | Turnaround Time        | Waiting Time
-----------------------------------------------------------------------------------------------------------------------
P1      | 7              | 0              | 7              | 7                      | 7                      | 0
-----------------------------------------------------------------------------------------------------------------------
P2      | 4              | 1              | 8              | 55                     | 54                     | 46
-----------------------------------------------------------------------------------------------------------------------
P3      | 3              | 2              | 9              | 47                     | 45                     | 36
-----------------------------------------------------------------------------------------------------------------------
P4      | 8              | 3              | 14             | 72                     | 69                     | 55
-----------------------------------------------------------------------------------------------------------------------
P5      | 2              | 4              | 15             | 38                     | 34                     | 19
-----------------------------------------------------------------------------------------------------------------------
P6      | 1              | 5              | 16             | 23                     | 18                     | 2
-----------------------------------------------------------------------------------------------------------------------
P7      | 5              | 6              | 1              | 56                     | 50                     | 49
-----------------------------------------------------------------------------------------------------------------------
P8      | 6              | 7              | 2              | 58                     | 51                     | 49
-----------------------------------------------------------------------------------------------------------------------
P9      | 9              | 8              | 3              | 75                     | 67                     | 64
-----------------------------------------------------------------------------------------------------------------------
Average Turnaround Time: 43.89
Average Waiting Time: 35.56
```



Priority Preemptive:



```
PRESS
1 for FIRST COME FIRST SERVE
2 for SHORTEST JOB FIRST
3 for SHORTEST REMAINING JOB FIRST
4 for ROUND ROBIN
5 for PRIORITY NON PREEMPTIVE
6 for PRIORITY PREEMPTIVE
7 for EXIT
6
Enter the priority of processes in the same order you entered:
7
4
3
8
2
1
5
6
9


Process | Priority      | Arrival Time  | Burst Time    | Completion Time       | Turnaround Time       | Waiting Time
----------------------------------------------------------------------------------------------------------------------
P1      | 7             | 0             | 7             | 58                    | 58                    | 51
----------------------------------------------------------------------------------------------------------------------
P2      | 4             | 1             | 8             | 49                    | 48                    | 40
----------------------------------------------------------------------------------------------------------------------
P3      | 3             | 2             | 9             | 42                    | 40                    | 31
----------------------------------------------------------------------------------------------------------------------
P4      | 8             | 3             | 14            | 72                    | 69                    | 55
----------------------------------------------------------------------------------------------------------------------
P5      | 2             | 4             | 15            | 35                    | 31                    | 16
----------------------------------------------------------------------------------------------------------------------
P6      | 1             | 5             | 16            | 21                    | 16                    | 0
----------------------------------------------------------------------------------------------------------------------
P7      | 5             | 6             | 1             | 50                    | 44                    | 43
----------------------------------------------------------------------------------------------------------------------
P8      | 6             | 7             | 2             | 52                    | 45                    | 43
----------------------------------------------------------------------------------------------------------------------
P9      | 9             | 8             | 3             | 75                    | 67                    | 64
----------------------------------------------------------------------------------------------------------------------
Average Turnaround Time: 46.44
Average Waiting Time: 38.11
```



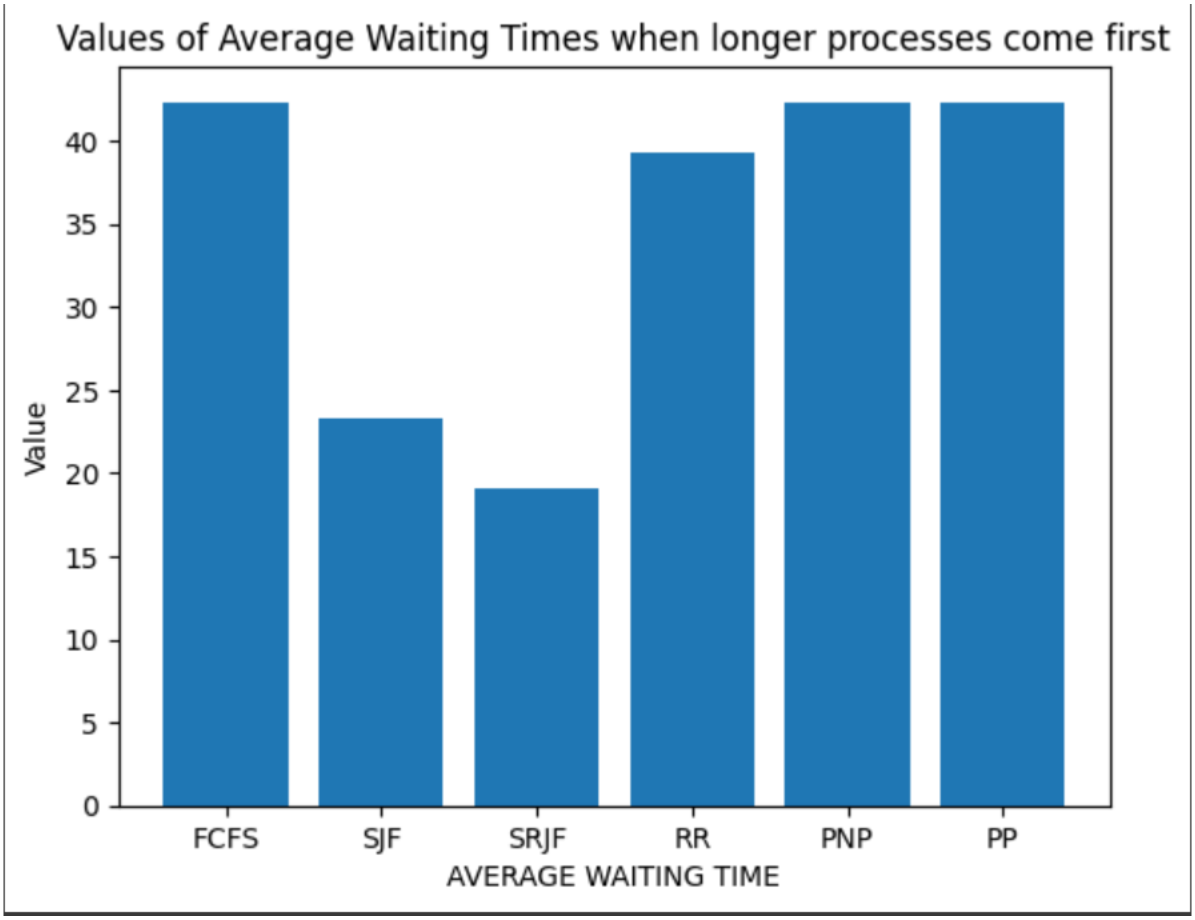
Analysis of each of the plots (with Python):

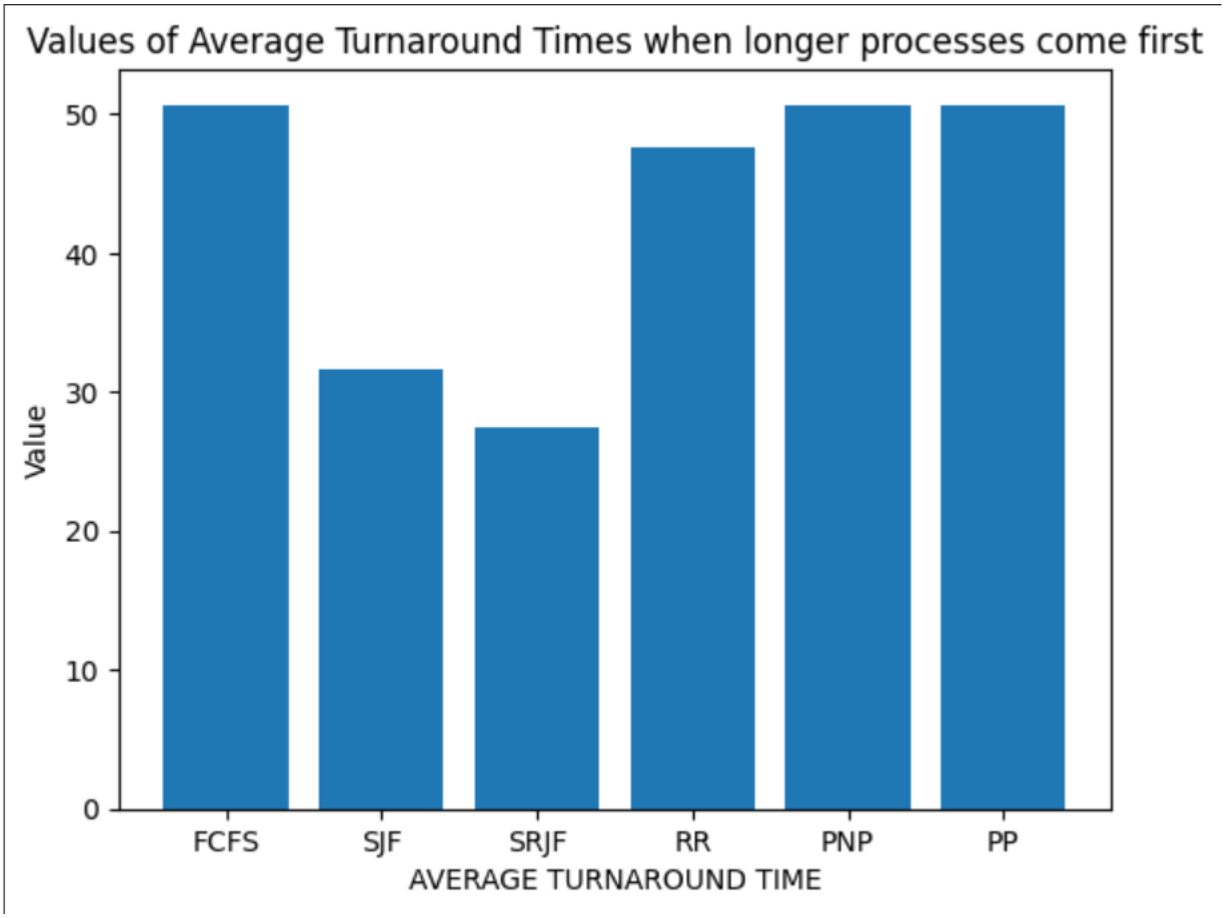
For the analysis, I plotted bar graphs and analysed the average waiting time and average turnaround time for each of the algorithms in each of the scenarios. The values are same as the ones obtained in the output screenshots before. The following plots were obtained when the python script was running:

Legend:

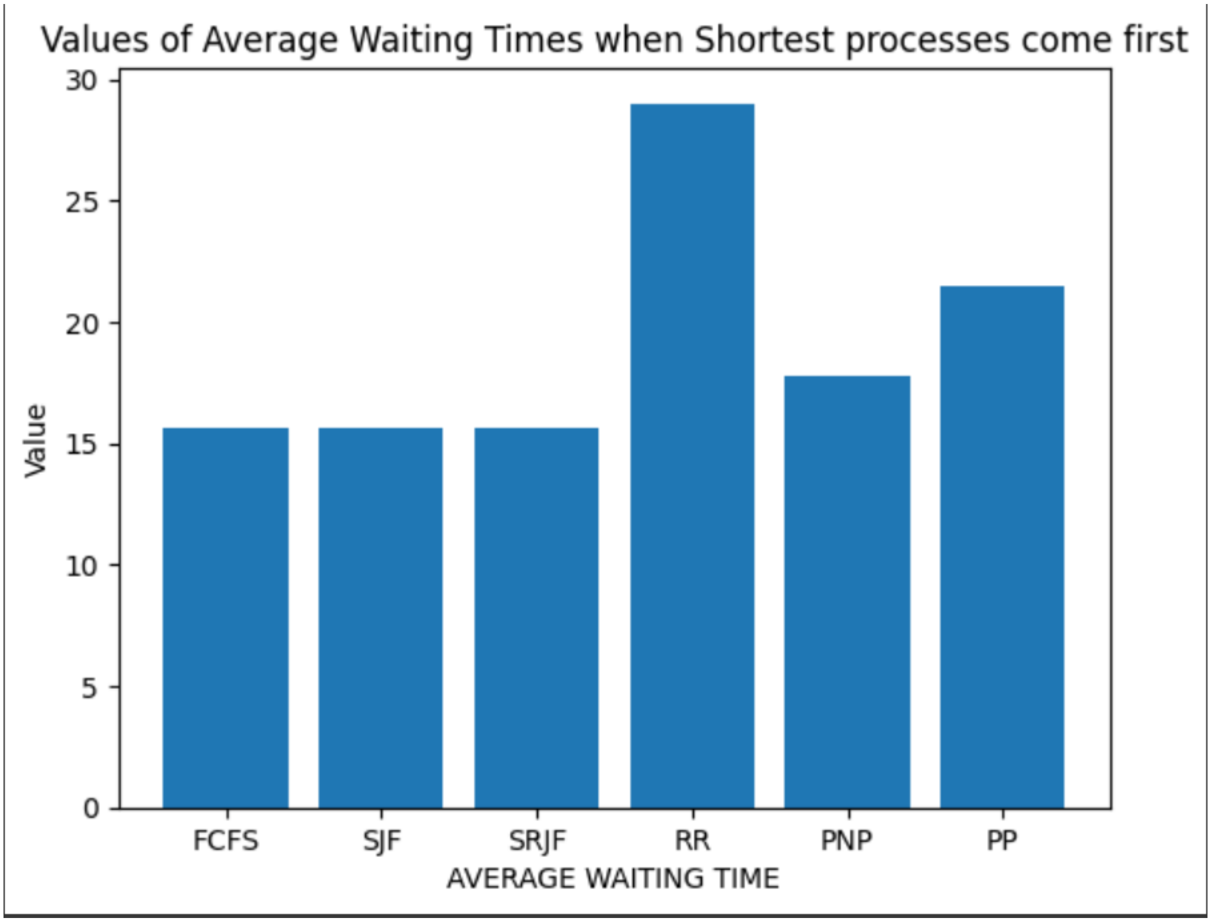
FCFS – First Come First Serve
SJF – Shortest Job First
SRJF – Shortest Remaining Job First
RR – Round Robin
PNP – Priority Non-Preemptive
PP – Priority Preemptive

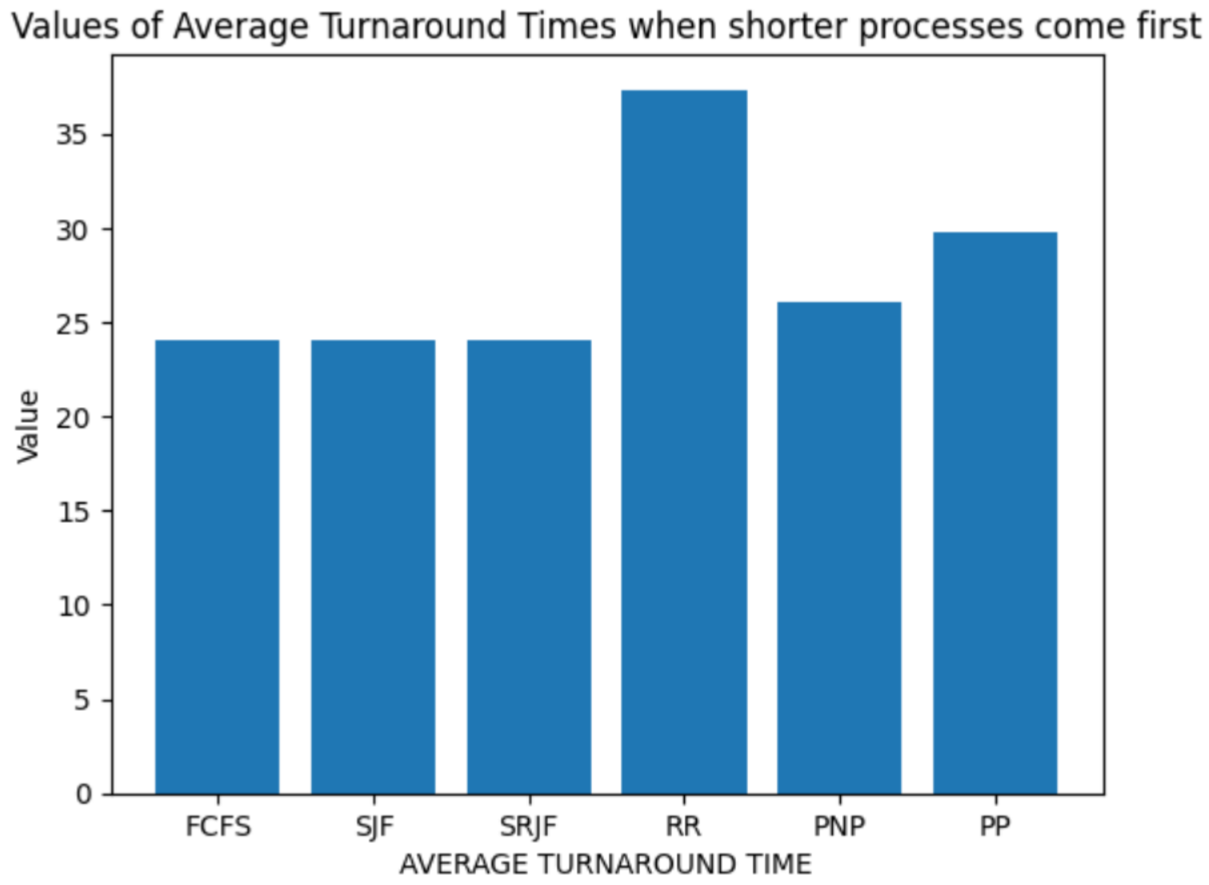
PTO

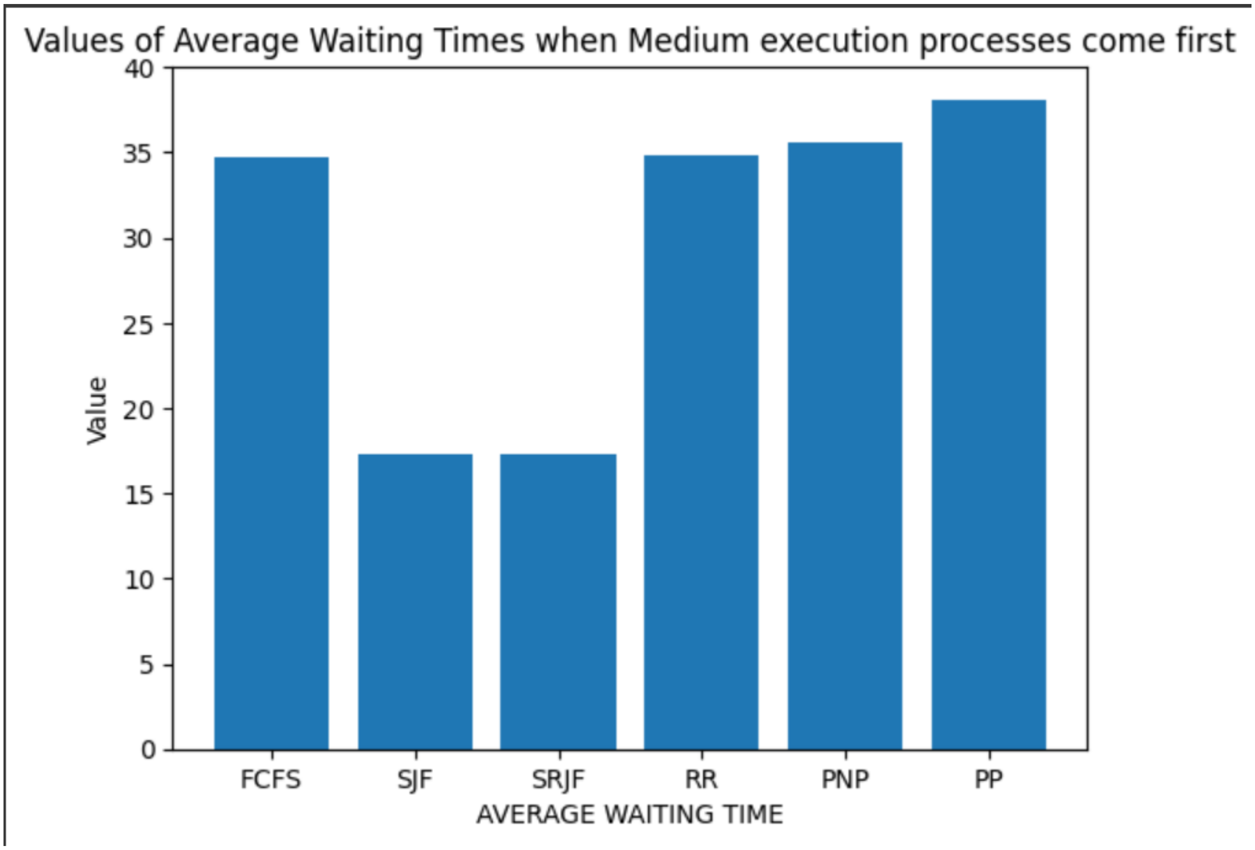

Values of Average Waiting Times when longer processes come first
Value
0
5
10
15
20
25
30
35
40
FCFS
SJF
SRJF
RR
PNP
PP
AVERAGE WAITING TIME

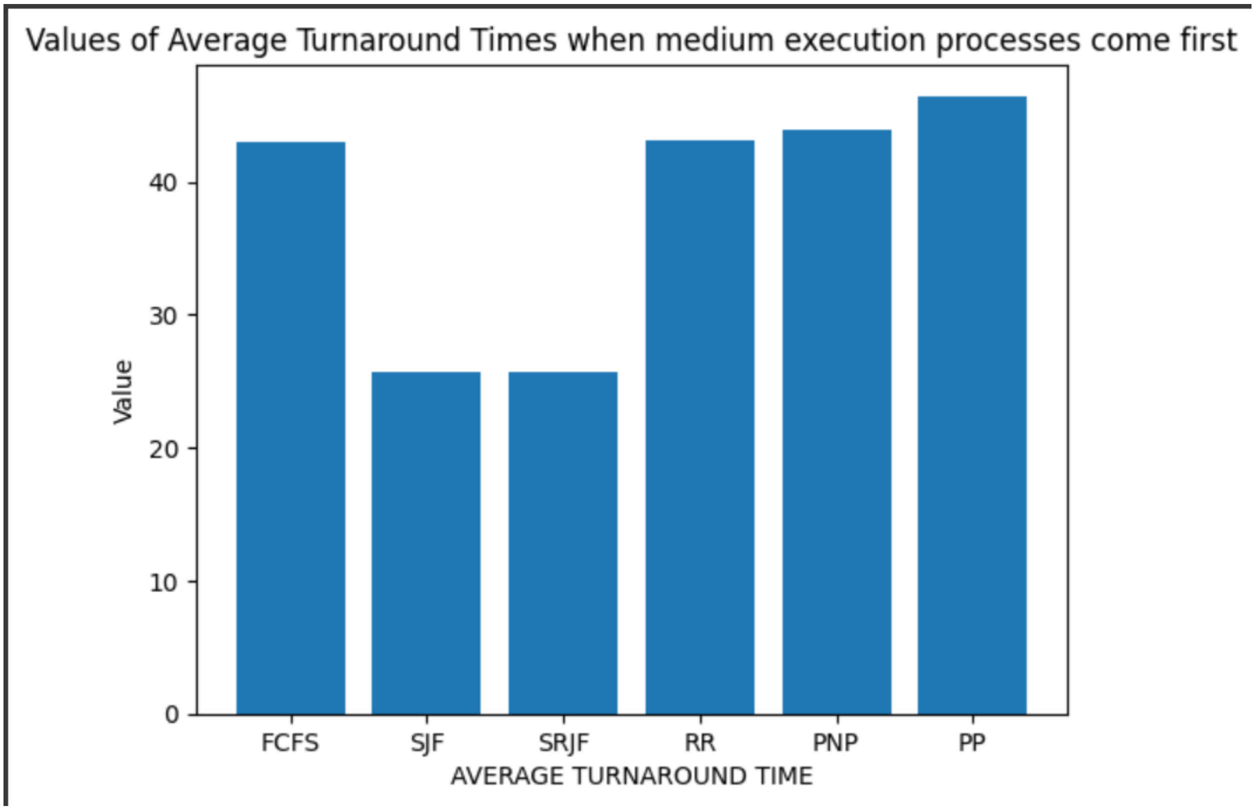


Values of Average Turnaround Times when longer processes come first


Values of Average Waiting Times when Shortest processes come first
Value
0
5
10
15
20
25
30
FCFS
SJF
SRJF
RR
PNP
PP
AVERAGE WAITING TIME


Values of Average Turnaround Times when shorter processes come first
Value
35
30
25
20
15
10
5
0
FCFS
SJF
SRJF
RR
PNP
PP
AVERAGE TURNAROUND TIME


Values of Average Waiting Times when Medium execution processes come first
Value
0
5
10
15
20
25
30
35
40
FCFS
SJF
SRJF
RR
PNP
PP
AVERAGE WAITING TIME


Values of Average Turnaround Times when medium execution processes come first
Value
0
10
20
30
40
FCFS
SJF
SRJF
RR
PNP
PP
AVERAGE TURNAROUND TIME

****