OS-LAB

Write a C program to simulate the following non-pre-emptive CPU scheduling algorithm to find turnaround time and waiting time.

1. SJF (pre-emptive &; Non-pre-emptive)
2. Priority (pre-emptive &; Non-pre-emptive)
3. Round Robin (Experiment with different quantum sizes for RR algorithm)

```
#include <stdio.h>

#include <stdbool.h>


#define MAX_PROCESSES 10


struct Process {

   int pid;

   int arrival_time;

   int burst_time;

   int priority;

   int remaining_time;

   int turnaround_time;

   int waiting_time;

};


void sjf_nonpreemptive(struct Process processes[], int n) {

   // Sort the processes based on burst time in ascending order

   int i,j,count=0,m;

   for(i=0;i<n;i++)

   {

   if(processes[i].arrival_time==0)

   count++;

}

if(count==n||count==1)

{
```

```
if(count==n)
{
for (i = 0; i < n - 1; i++) {
    for (j = 0; j < n - i - 1; j++) {
      if (processes[j].burst_time > processes[j + 1].burst_time) {
        struct Process temp = processes[j];
        processes[j] = processes[j + 1];
        processes[j + 1] = temp;
      }
    }
  }
}
else
{
for (i = 1; i < n - 1; i++) {
    for (j = 1; j <= n - i - 1; j++) {
      if (processes[j].burst_time > processes[j + 1].burst_time) {
        struct Process temp = processes[j];
        processes[j] = processes[j + 1];
        processes[j + 1] = temp;
      }
    }
  }
}


}

  int total_time = 0;
  double total_turnaround_time = 0;
  double total_waiting_time = 0;
```

```
    for (i = 0; i < n; i++) {
        total_time += processes[i].burst_time;
        processes[i].turnaround_time = total_time - processes[i].arrival_time;
        processes[i].waiting_time = processes[i].turnaround_time - processes[i].burst_time;

        total_turnaround_time += processes[i].turnaround_time;
        total_waiting_time += processes[i].waiting_time;
    }

    printf("Process\tTurnaround Time\tWaiting Time\n");
    for (i = 0; i < n; i++) {
        printf("%d\t%d\t\t%d\n", processes[i].pid, processes[i].turnaround_time,
processes[i].waiting_time);
    }

    printf("Average Turnaround Time: %.2f\n", total_turnaround_time / n);
    printf("Average Waiting Time: %.2f\n", total_waiting_time / n);
}

void sjf_preemptive(struct Process processes[], int n) {
    int total_time = 0,i;
    int completed = 0;

    while (completed < n) {
        int shortest_burst = -1;
        int next_process = -1;

        for (i = 0; i < n; i++) {
            if (processes[i].arrival_time <= total_time && processes[i].remaining_time > 0) {
                if (shortest_burst == -1 || processes[i].remaining_time < shortest_burst) {
                    shortest_burst = processes[i].remaining_time;
                    next_process = i;
                }
            }
        }

        if (next_process == -1) {
            total_time++;
            continue;
        }

        processes[next_process].remaining_time--;
        total_time++;

        if (processes[next_process].remaining_time == 0) {
            completed++;
            processes[next_process].turnaround_time = total_time - processes[next_process].arrival_time;
            processes[next_process].waiting_time = processes[next_process].turnaround_time - processes[next_process].burst_time;
        }
    }

    double total_turnaround_time = 0;
    double total_waiting_time = 0;

    printf("Process\tTurnaround Time\tWaiting Time\n");
    for (i = 0; i < n; i++) {
        printf("%d\t%d\t\t%d\n", processes[i].pid, processes[i].turnaround_time, processes[i].waiting_time);

        total_turnaround_time += processes[i].turnaround_time;
        total_waiting_time += processes[i].waiting_time;
    }

    printf("Average Turnaround Time: %.2f\n", total_turnaround_time / n);
    printf("Average Waiting Time: %.2f\n", total_waiting_time / n);
}

void priority_nonpreemptive(struct Process processes[], int n) {
    // Sort the processes based on priority in ascending order
    int i,j,count=0,m;
    for(i=0;i<n;i++)
    {
    if(processes[i].arrival_time==0)
    count++;
}
if(count==n||count==1)
{
if(count==n)
{
for (i = 0; i < n - 1; i++) {
        for (j = 0; j < n - i - 1; j++) {
            if (processes[j].priority > processes[j + 1].priority) {
                struct Process temp = processes[j];
                processes[j] = processes[j + 1];
                processes[j + 1] = temp;
            }
        }
    }
}

else
```

```
{
    for (i = 1; i < n - 1; i++) {
        for (j = 1; j <= n - i - 1; j++) {
            if (processes[j].priority > processes[j + 1].priority) {
                struct Process temp = processes[j];
                processes[j] = processes[j + 1];
                processes[j + 1] = temp;
            }
        }
    }
}
}

    int total_time = 0;
    double total_turnaround_time = 0;
    double total_waiting_time = 0;

    for (i = 0; i < n; i++) {
        total_time += processes[i].burst_time;
        processes[i].turnaround_time = total_time - processes[i].arrival_time;
        processes[i].waiting_time = processes[i].turnaround_time - processes[i].burst_time;

        total_turnaround_time += processes[i].turnaround_time;
        total_waiting_time += processes[i].waiting_time;
    }

    printf("Process\tTurnaround Time\tWaiting Time\n");
    for (i = 0; i < n; i++) {
        printf("%d\t%d\t\t%d\n", processes[i].pid, processes[i].turnaround_time,
processes[i].waiting_time);
    }
```

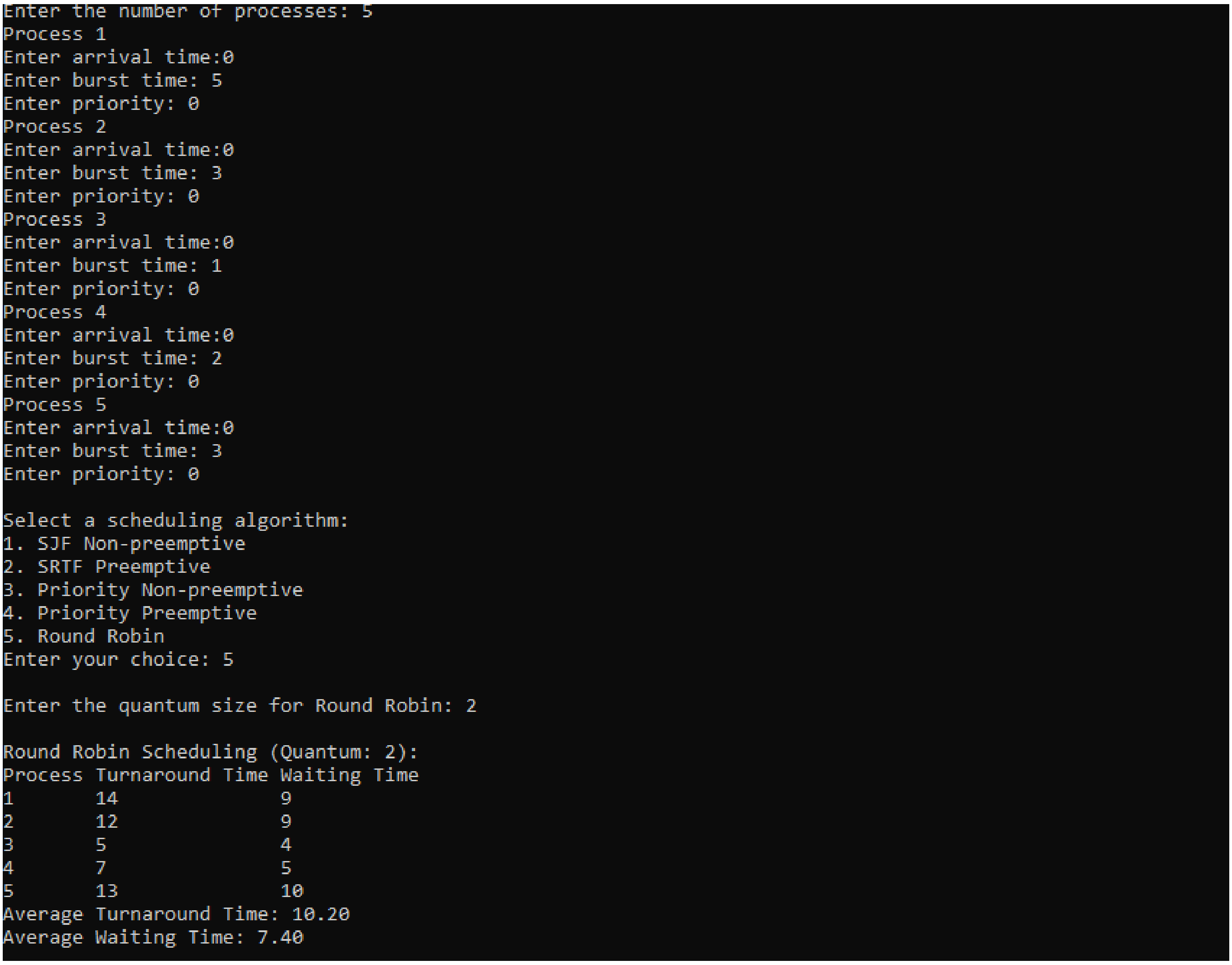
```
  printf("Average Turnaround Time: %.2f\n", total_turnaround_time / n);
  printf("Average Waiting Time: %.2f\n", total_waiting_time / n);
}

void priority_preemptive(struct Process processes[], int n) {
  int total_time = 0,i;
  int completed = 0;

  while (completed < n) {
    int highest_priority = -1;
    int next_process = -1;

    for (i = 0; i < n; i++) {
      if (processes[i].arrival_time <= total_time && processes[i].remaining_time > 0) {
        if (highest_priority == -1 || processes[i].priority < highest_priority) {
          highest_priority = processes[i].priority;
          next_process = i;
        }
      }
    }

    if (next_process == -1) {
      total_time++;
      continue;
    }

    processes[next_process].remaining_time--;
    total_time++;

    if (processes[next_process].remaining_time == 0) {
            completed++;
            processes[next_process].turnaround_time = total_time -
processes[next_process].arrival_time;
            processes[next_process].waiting_time = processes[next_process].turnaround_time -
processes[next_process].burst_time;
        }
    }

    double total_turnaround_time = 0;
    double total_waiting_time = 0;

    printf("Process\tTurnaround Time\tWaiting Time\n");
    for (i = 0; i < n; i++) {
        printf("%d\t%d\t\t%d\n", processes[i].pid, processes[i].turnaround_time,
processes[i].waiting_time);

        total_turnaround_time += processes[i].turnaround_time;
        total_waiting_time += processes[i].waiting_time;
    }

    printf("Average Turnaround Time: %.2f\n", total_turnaround_time / n);
    printf("Average Waiting Time: %.2f\n", total_waiting_time / n);
}

void round_robin(struct Process processes[], int n, int quantum) {
    int total_time = 0,i;
    int completed = 0;

    while (completed < n) {
        for (i = 0; i < n; i++) {
            if (processes[i].arrival_time <= total_time && processes[i].remaining_time > 0) {
                if (processes[i].remaining_time <= quantum) {
                    total_time += processes[i].remaining_time;
                    processes[i].remaining_time = 0;
                    processes[i].turnaround_time = total_time - processes[i].arrival_time;
                    processes[i].waiting_time = processes[i].turnaround_time - processes[i].burst_time;
                    completed++;
                } else {
                    total_time += quantum;
                    processes[i].remaining_time -= quantum;
                }
            }
        }
    }

    double total_turnaround_time = 0;
    double total_waiting_time = 0;

    printf("Process\tTurnaround Time\tWaiting Time\n");
    for (i = 0; i < n; i++) {
        printf("%d\t%d\t\t%d\n", processes[i].pid, processes[i].turnaround_time,
processes[i].waiting_time);

        total_turnaround_time += processes[i].turnaround_time;
        total_waiting_time += processes[i].waiting_time;
    }

    printf("Average Turnaround Time: %.2f\n", total_turnaround_time / n);
    printf("Average Waiting Time: %.2f\n", total_waiting_time / n);
}

int main() {
    int n, quantum,i,choice;
```

```
struct Process processes[MAX_PROCESSES];

printf("Enter the number of processes: ");
scanf("%d", &n);

for (i = 0; i < n; i++) {
  printf("Process %d\n", i + 1);
  printf("Enter arrival time:");
  scanf("%d", &processes[i].arrival_time);
  printf("Enter burst time: ");
  scanf("%d", &processes[i].burst_time);
  printf("Enter priority: ");
  scanf("%d", &processes[i].priority);
  processes[i].pid = i + 1;
  processes[i].remaining_time = processes[i].burst_time;
  processes[i].turnaround_time = 0;
  processes[i].waiting_time = 0;
}
printf("\nSelect a scheduling algorithm:\n");
printf("1. SJF Non-preemptive\n");
printf("2. SRTF Preemptive\n");
printf("3. Priority Non-preemptive\n");
printf("4. Priority Preemptive\n");
printf("5. Round Robin\n");
printf("Enter your choice: ");
scanf("%d", &choice);

switch (choice) {
  case 1:
    printf("\nSJF Non-preemptive Scheduling:\n");
    sjf_nonpreemptive(processes, n);
```

```
            break;
        case 2:
            printf("\nSRTF Scheduling:\n");
            sjf_preemptive(processes, n);
            break;
        case 3:
            printf("\nPriority Non-preemptive Scheduling:\n");
            priority_nonpreemptive(processes, n);
            break;
        case 4:
            printf("\nPriority Preemptive Scheduling:\n");
            priority_preemptive(processes, n);
            break;
        case 5:
            printf("\nEnter the quantum size for Round Robin: ");
            scanf("%d", &quantum);
            printf("\nRound Robin Scheduling (Quantum: %d):\n", quantum);
            round_robin(processes, n, quantum);
            break;
        default:
            printf("Invalid choice!\n");
            return 1;
    }

    return 0;
}
```

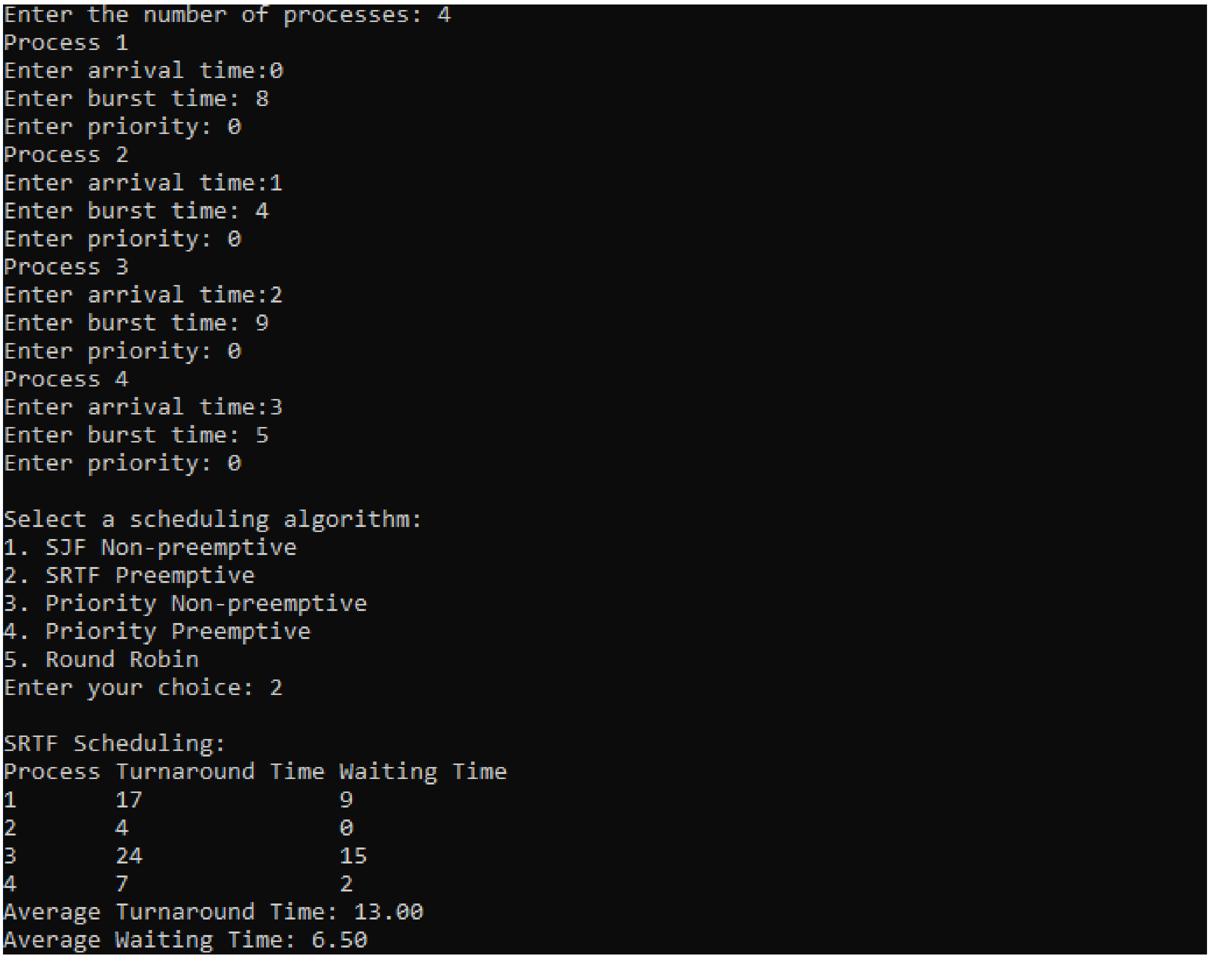
Output:

Round Robin:



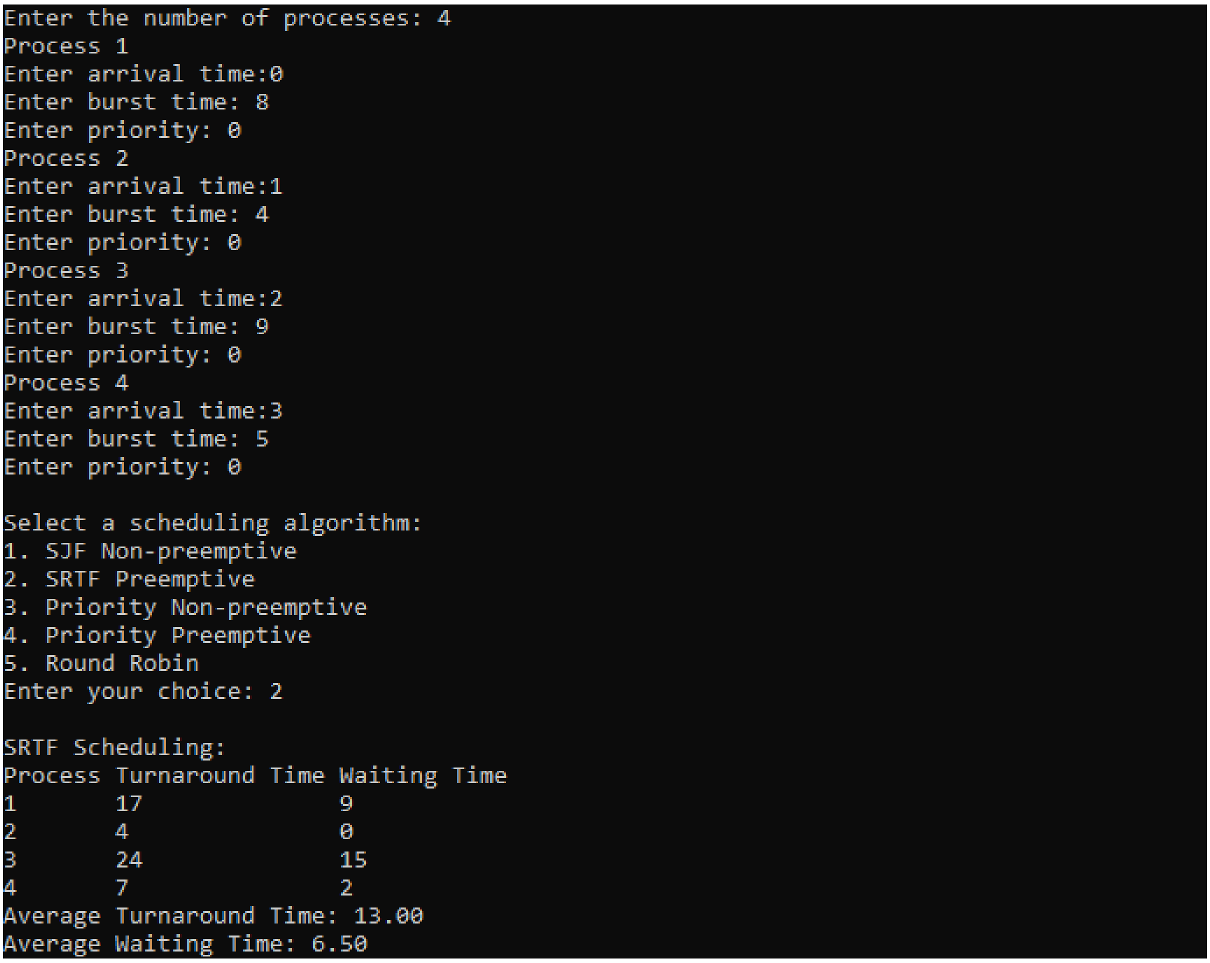
```
Enter the number of processes: 5
Process 1
Enter arrival time:0
Enter burst time: 5
Enter priority: 0
Process 2
Enter arrival time:0
Enter burst time: 3
Enter priority: 0
Process 3
Enter arrival time:0
Enter burst time: 1
Enter priority: 0
Process 4
Enter arrival time:0
Enter burst time: 2
Enter priority: 0
Process 5
Enter arrival time:0
Enter burst time: 3
Enter priority: 0

Select a scheduling algorithm:
1. SJF Non-preemptive
2. SRTF Preemptive
3. Priority Non-preemptive
4. Priority Preemptive
5. Round Robin
Enter your choice: 5

Enter the quantum size for Round Robin: 2

Round Robin Scheduling (Quantum: 2):
Process Turnaround Time Waiting Time
1       14              9
2       12              9
3       5               4
4       7               5
5       13              10
Average Turnaround Time: 10.20
Average Waiting Time: 7.40
```

SRTF:



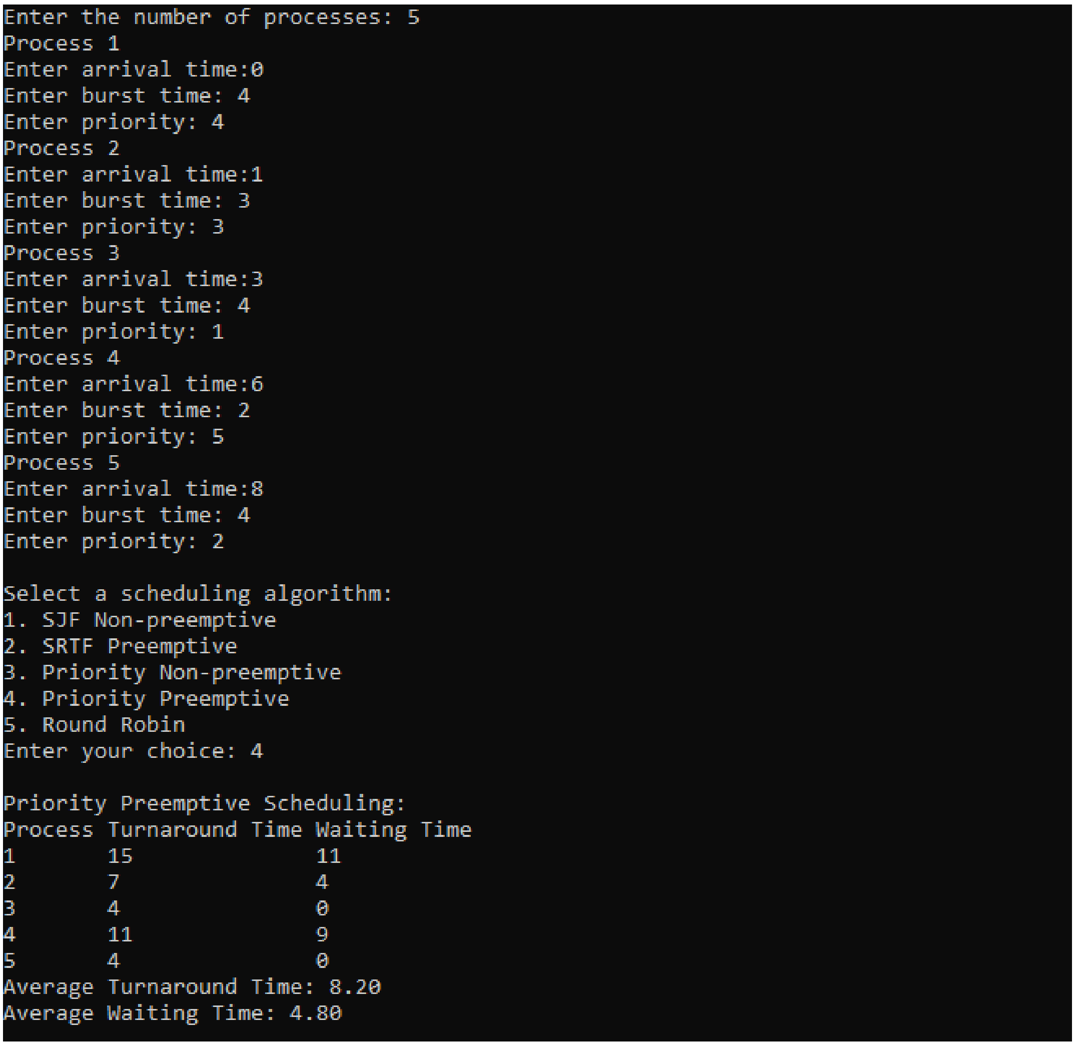
```
Enter the number of processes: 4
Process 1
Enter arrival time:0
Enter burst time: 8
Enter priority: 0
Process 2
Enter arrival time:1
Enter burst time: 4
Enter priority: 0
Process 3
Enter arrival time:2
Enter burst time: 9
Enter priority: 0
Process 4
Enter arrival time:3
Enter burst time: 5
Enter priority: 0

Select a scheduling algorithm:
1. SJF Non-preemptive
2. SRTF Preemptive
3. Priority Non-preemptive
4. Priority Preemptive
5. Round Robin
Enter your choice: 2

SRTF Scheduling:
Process Turnaround Time Waiting Time
1       17              9
2       4               0
3       24              15
4       7               2
Average Turnaround Time: 13.00
Average Waiting Time: 6.50
```

Priority non pre-emptive:



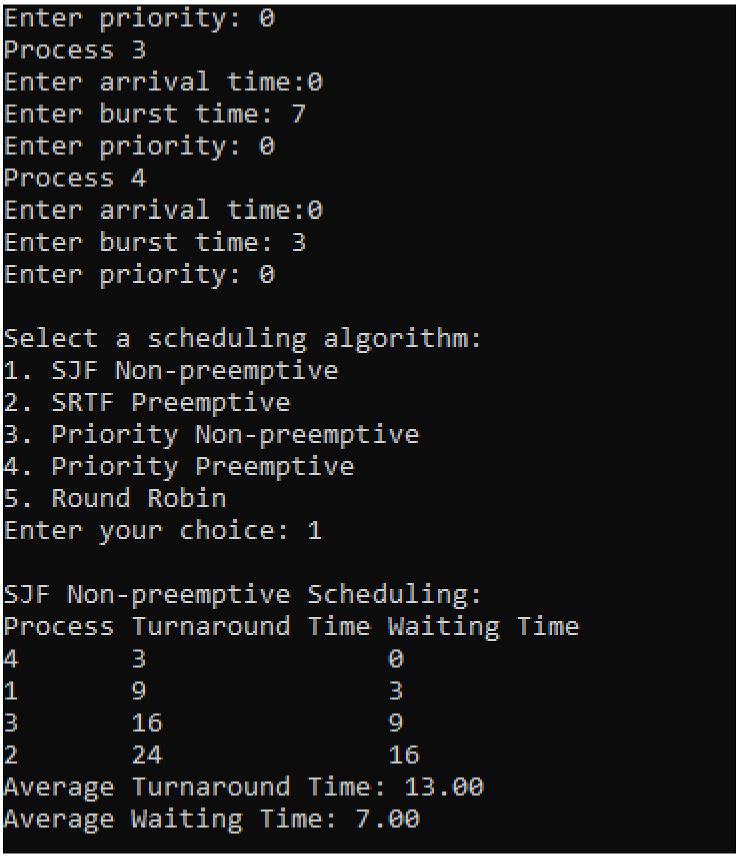
```
Enter the number of processes: 4
Process 1
Enter arrival time:0
Enter burst time: 8
Enter priority: 0
Process 2
Enter arrival time:1
Enter burst time: 4
Enter priority: 0
Process 3
Enter arrival time:2
Enter burst time: 9
Enter priority: 0
Process 4
Enter arrival time:3
Enter burst time: 5
Enter priority: 0

Select a scheduling algorithm:
1. SJF Non-preemptive
2. SRTF Preemptive
3. Priority Non-preemptive
4. Priority Preemptive
5. Round Robin
Enter your choice: 2

SRTF Scheduling:
Process Turnaround Time Waiting Time
1       17              9
2       4               0
3       24              15
4       7               2
Average Turnaround Time: 13.00
Average Waiting Time: 6.50
```

Priority pre-emptive



```
Enter the number of processes: 5
Process 1
Enter arrival time:0
Enter burst time: 4
Enter priority: 4
Process 2
Enter arrival time:1
Enter burst time: 3
Enter priority: 3
Process 3
Enter arrival time:3
Enter burst time: 4
Enter priority: 1
Process 4
Enter arrival time:6
Enter burst time: 2
Enter priority: 5
Process 5
Enter arrival time:8
Enter burst time: 4
Enter priority: 2

Select a scheduling algorithm:
1. SJF Non-preemptive
2. SRTF Preemptive
3. Priority Non-preemptive
4. Priority Preemptive
5. Round Robin
Enter your choice: 4

Priority Preemptive Scheduling:
Process Turnaround Time Waiting Time
1       15              11
2       7               4
3       4               0
4       11              9
5       4               0
Average Turnaround Time: 8.20
Average Waiting Time: 4.80
```

SJF:



```
Enter priority: 0
Process 3
Enter arrival time:0
Enter burst time: 7
Enter priority: 0
Process 4
Enter arrival time:0
Enter burst time: 3
Enter priority: 0

Select a scheduling algorithm:
1. SJF Non-preemptive
2. SRTF Preemptive
3. Priority Non-preemptive
4. Priority Preemptive
5. Round Robin
Enter your choice: 1

SJF Non-preemptive Scheduling:
Process Turnaround Time Waiting Time
4       3               0
1       9               3
3       16              9
2       24              16
Average Turnaround Time: 13.00
Average Waiting Time: 7.00
```

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SECTION 4D