

CPU Scheduling Simulator Report

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Introduction

This is a simulation software which simulates the system behavior of how CPU will schedule processes and execute them while collecting the following statistics: Completed Time, Waiting Time and Turnaround time for various scheduling algorithms.

- First Come First Serve
- Shortest Job First
- Shortest Remaining Time First
- Round Robin

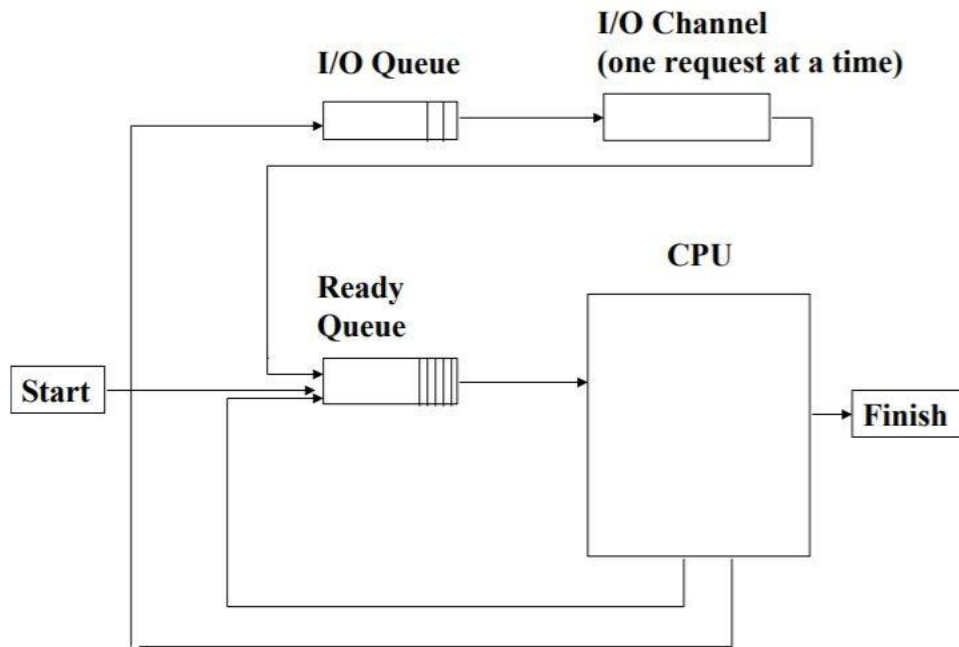


Figure 1: System Architecture

All processes are in the start state with different arrival times. Once the process is in the ready queue they go to CPU for the execution process one by one depending on the scheduling algorithm. From CPU the go to I/O queue if they need input channel. Input channel is provided one by one to the process and in the meantime they wait for their turn and CPU function normally during this time. Once Input has been fetched the process goes back to the ready state in the ready queue and the process continues in the similar fashion. Once the process is complete the completion time is recorded, and the process is terminated.

For different algorithms, we use different strategies:

First Come First Served (FCFS)

As the name suggests all of the processes are executed in the order of their arrival time.

Shortest Job First (SJF)

As the name suggests, all processes are sorted and executed based on their execution time. (Burst time). This scheduling algorithm can be preemptive or non-preemptive. It significantly reduces the average waiting time for other processes awaiting execution.

Shortest Remaining Time First (SRTF)

Shortest Remaining Time First is the preemptive version of Shortest Job First algorithm, where the processor is allocated to the job closest to completion.

This algorithm requires advanced concept and knowledge of CPU time required to process the job in an interactive system, and hence can't be implemented there. But, in a batch system where it is desirable to give preference to short jobs, SRT algorithm is used.

However, SRT involves more overheads than SJN, as the OS is required to frequently monitor the CPU time of the jobs in the ready queue and perform context switching.

Round Robin (RR)

In Round Robin algorithm each process is assigned a fixed time slot in a cyclic way. Round Robin algorithm is a preemptive algorithm as processes are assigned CPU only for a fixed slice of time at most.

Assumptions

- No process will require any I/O operation to be performed.

Design of the Module

CPU Scheduling Simulator

Process ID	Arrival Time	Burst Time
<input type="text" value="Process ID"/>	<input type="text" value="Arrival Time"/>	<input type="text" value="Burst Time"/>

Select Scheduling Method

First Come First Served

Process ID	Arrival Time	Burst Time	Completed Time	Waiting Time	Turnaround Time
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Average Turnaround Time

0

Average Waiting Time

0

Throughput

0

Figure 2: Design of the Module

Test Case Scenarios

First Come First Served: Test Case 1

Inputs

Process ID	Arrival Time	Burst Time
1	4	6
2	3	4
3	5	7
4	2	3

Process ID	Arrival Time	Burst Time	Completed Time	Waiting Time	Turnaround Time
4	2	3	5	0	3
2	3	4	9	2	6
1	4	6	15	5	11
3	5	7	22	10	17

Average Turnaround Time

9.25

Average Waiting Time

4.25

Throughput

0.181818181818182

Figure 3: FCFS Test Case 1 Output

First Come First Served: Test Case 2

Inputs

Process ID	Arrival Time	Burst Time
1	2	1
2	3	2
3	4	3
4	5	4

Process ID	Arrival Time	Burst Time	Completed Time	Waiting Time	Turnaround Time
1	2	1	3	0	1
2	3	2	5	0	2
3	4	3	8	1	4
4	5	4	12	3	7

Average Turnaround Time

3.5

Average Waiting Time

1

Throughput

0.333333333333333

Figure 4: FCFS Test Case 2 Output

First Come First Served: Test Case 3

Inputs

Process ID	Arrival Time	Burst Time
1	4	6
2	3	4
3	1	7
4	3	2

Process ID	Arrival Time	Burst Time	Completed Time	Waiting Time	Turnaround Time
3	1	7	8	0	7
4	3	2	10	5	7
2	3	4	14	7	11
1	4	6	20	10	16

Average Turnaround Time

10.25

Average Waiting Time

5.5

Throughput

0.2

Figure 5: FCFS Test Case 3 Output

Shortest Job First: Test Case 1

Inputs

Process ID	Arrival Time	Burst Time
1	6	1
2	1	3
3	4	5
4	2	6

Process ID	Arrival Time	Burst Time	Completed Time	Waiting Time	Turnaround Time
2	1	3	4	0	3
3	4	5	9	0	5
1	6	1	10	3	4
4	2	6	16	8	14

Average Turnaround Time

6.5

Average Waiting Time

2.75

Throughput

0.25

Figure 6: SJF Test Case 1 Output

Shortest Job First: Test Case 2

Inputs

Process ID	Arrival Time	Burst Time
1	2	5
2	1	3
3	4	9
4	3	4

Process ID	Arrival Time	Burst Time	Completed Time	Waiting Time	Turnaround Time
2	1	3	4	0	3
4	3	4	8	1	5
1	2	5	13	6	11
3	4	9	22	9	18

Average Turnaround Time

9.25

Average Waiting Time

4

Throughput

0.181818181818182

Figure 7: SJF Test Case 3 Output

Shortest Job First: Test Case 3

Inputs

Process ID	Arrival Time	Burst Time
1	2	4
2	6	3
3	4	9
4	5	2

Process ID	Arrival Time	Burst Time	Completed Time	Waiting Time	Turnaround Time
1	2	4	6	0	4
4	5	2	8	1	3
2	6	3	11	2	5
3	4	9	20	7	16

Average Turnaround Time

7

Average Waiting Time

2.5

Throughput

0.2

Figure 8: SJF Test Case 3 Output

Shortest Remaining Time First: Test Case 1

Inputs

Process ID	Arrival Time	Burst Time
1	2	4
2	6	3
3	4	9
4	5	2

Process ID	Arrival Time	Burst Time	Completed Time	Waiting Time	Turnaround Time
1	2	4	6	0	4
4	5	2	8	1	3
2	6	3	11	2	5
3	4	9	20	7	16

Average Turnaround Time

7

Average Waiting Time

2.5

Throughput

0.2

Figure 9: SRTF Test Case 1 Output

Shortest Remaining Time First: Test Case 2

Inputs

Process ID	Arrival Time	Burst Time
1	8	3
2	6	5
3	4	2
4	5	7

Process ID	Arrival Time	Burst Time	Completed Time	Waiting Time	Turnaround Time
3	4	2	6	0	2
1	8	3	11	0	3
2	6	5	14	3	8
4	5	7	21	9	16

Average Turnaround Time

7.25

Average Waiting Time

3

Throughput

0.19047619047619047

Figure 10: SRTF Test Case 2 Output

Shortest Remaining Time First: Test Case 3

Inputs

Process ID	Arrival Time	Burst Time
1	3	2
2	1	4
3	5	6
4	2	3

Process ID	Arrival Time	Burst Time	Completed Time	Waiting Time	Turnaround Time
1	3	2	5	0	2
4	2	3	7	2	5
2	1	4	10	5	9
3	5	6	16	5	11

Average Turnaround Time

6.75

Average Waiting Time

3

Throughput

0.25

Figure 11: SRTF Test Case 3 Output

Round Robin: Test Case 1

Inputs

Process ID	Arrival Time	Burst Time
1	2	4
2	6	3
3	4	9
4	5	2

Time quantum: 3

Process ID	Arrival Time	Burst Time	Completed Time	Waiting Time	Turnaround Time
1	2	4	6	0	4
4	5	2	8	1	3
2	6	3	11	2	5
3	4	9	20	7	16

Average Turnaround Time

7

Average Waiting Time

2.5

Throughput

0.2

Figure 12: RR Test Case 1 Output

Round Robin: Test Case 2

Inputs

Process ID	Arrival Time	Burst Time
1	3	4
2	8	7
3	5	6
4	6	1

Time quantum: 2

Process ID	Arrival Time	Burst Time	Completed Time	Waiting Time	Turnaround Time
1	3	4	7	0	4
4	6	1	8	1	2
3	5	6	14	3	9
2	8	7	21	6	13

Average Turnaround Time

7

Average Waiting Time

2.5

Throughput

0.19047619047619047

Figure 13: RR Test Case 2 Output

Round Robin: Test Case 3

Inputs

Process ID	Arrival Time	Burst Time
1	7	3
2	3	4
3	1	6
4	2	5

Time quantum: 4

Process ID	Arrival Time	Burst Time	Completed Time	Waiting Time	Turnaround Time
3	1	6	7	0	6
1	7	3	10	0	3
2	3	4	14	7	11
4	2	5	19	12	17

Average Turnaround Time

9.25

Average Waiting Time

4.75

Throughput

0.21052631578947367

Figure 14: RR Test Case 3 Output

Conclusion

This program consists with easy to graphical user interface which allows user to add n number of processes and calculate the output. Once user entered the inputs and select the algorithm from the dropdown menu, application will calculate the completed time, waiting time and turnaround time for each process. Also, it will calculate the average waiting time, average turnaround time and throughput.