

**Bilkent University**  
**Department of Computer Engineering**  
**CS342 Operating Systems**  
**Spring 2020-2021**

**Project #2**

**Scheduling, Threads, Synchronization**

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**29 March 2021**

# 1. Summary of the Project

In this project I implemented a multi-threaded scheduling simulator. There are  $N$  threads running concurrently and generating CPU bursts (workload), called as *workload threads* ( $W$  threads). There is one server thread (*scheduler thread*) that is responsible from scheduling and executing the bursts in a single CPU. Let us call that thread as scheduler thread ( $S$  thread). There are  $N+1$  threads running concurrently, including one scheduler thread and  $N$  workload threads. The main thread creates all these  $N+1$  threads in your program. There is a runqueue ( $rq$ ), which is a linked list that stores the CPU bursts to be executed by the scheduler thread.  $W$  threads adds their CPU bursts to the runqueue.  $S$  thread takes and executes CPU bursts from the runqueue.

I tested the performances of the various scheduling algorithms in terms of the average waiting times for bursts by varying the various parameters of the simulation. Each  $W$  thread generates a sequence of CPU bursts one-by-one and add them to the runqueue.

The length of each burst is random and exponentially distributed with mean  $avgB$ . The inter-arrival time between two consecutive busts is also random and exponential distributed with mean  $avgA$ . A  $W$  thread sleeps between two burst generations. When a burst is generated, its description is added to the runqueue structure as a new node. The information about a burst includes include its thread and burst indices, length (in ms), and the wall-clock time the burst is generated (in ms).

Below I describe the experimental study and discuss the results of each experiment by comparing various scheduling algorithms in terms of waiting times.

## 2. Experimental Results

For all experiments, interarrival times and burst lengths are both random and determined by exponential distributions. The means of interarrival times ( $AvgA$ ) and burst lengths ( $AvgB$ ), as well as the minimum interarrival time ( $MinA$ ) and minimum burst length ( $MinB$ )

Table 1 shows the average waiting times (ms) for increasing numbers of threads where each thread is executing a fixed number of bursts. I tested for the number of threads from 1 to 10 and the fixed number of bursts for each trial as 10. For this first set of experiments, the average waiting times of First-Come-First-Served (FCFS), Shortest-Job-First (SJF), Priority Scheduling (PRIO), and Virtual Runtime (VRUNTIME) are 407.17, 557.14, 751.19, and 420.06 ms, respectively. From Table1, we observe that when the number of threads increases, PRIO is the worst scheduling algorithm and the FCFS is the best one. However, VRUNTIME was quite close to FCFS. Because of the disadvantages of FCFS, such as many short bursts can wait for long burst because they came after, I would prefer VRUNTIME for this part.

Table 2 shows the average waiting times (ms) for a fixed numbers of threads where each thread is executing a varying number of bursts. I tested for the fixed number of threads of 4 and the number of bursts are varying between 10 and 50. For this second set of experiments, the average waiting times of First-Come-First-Served (FCFS), Shortest-Job-First (SJF), Priority Scheduling (PRIO), and

Virtual Runtime (VRUNTIME) are 96.04, 92.38, 109.74, and 136.43 ms, respectively. From Table 2, we observe see that SJF has the smallest average waiting time when the number of bursts is the independent variable. It seems that SJF scales well with the increasing number of bursts per thread. FCFS again has a quite good average waiting time.

Table 3 shows the average waiting times (ms) for a fixed numbers of threads (4) and a fixed number of bursts for each thread (10) where the interarrival time mean (AvgA) for exponential distribution varies between 1000 and 1800. For this third set of experiments, the average waiting times of First-Come-First-Served (FCFS), Shortest-Job-First (SJF), Priority Scheduling (PRIO), and Virtual Runtime (VRUNTIME) are 120.35, 159.53, 120.07, and 74.16 ms, respectively. From Table 3, we can observe that VRUNTIME has the best average waiting time when the interarrival time is the independent variable. It seems that VRUNTIME scales well with the increasing interarrival times.

Table 4 shows the average waiting times (ms) for a fixed numbers of threads (4) and a fixed number of bursts for each thread (10) where the burst length mean (AvgB) for exponential distribution varies between 100 and 500. For this fourth set of experiments, the average waiting times of First-Come-First-Served (FCFS), Shortest-Job-First (SJF), Priority Scheduling (PRIO), and Virtual Runtime (VRUNTIME) are 708.23, 599.06, 140.54, and 620.96 ms, respectively. From Table 4, we can observe that PRIOR has the best average waiting time when the burst length is the independent variable. It seems that PRIOR scales well with the increasing burst length.

Table 5 shows the average waiting times (ms) for a fixed numbers of threads (4) and a fixed number of bursts for each thread (10) where the minimum burst length (MinB) for exponential distribution varies between 100 and 500. For this fifth set of experiments, the average waiting times of First-Come-First-Served (FCFS), Shortest-Job-First (SJF), Priority Scheduling (PRIO), and Virtual Runtime (VRUNTIME) are 536.76, 445.99, 639.11, and 949.87 ms, respectively. From Table 5 we can see SJF has the smallest waiting time when minimum burst length is the independent variable. It seems that SJF scales well with the increasing minimum burst length.

Table 6 shows the average waiting times (ms) for a fixed numbers of threads (4) and a fixed number of bursts for each thread (10) where MinA is varying between 400 and 2000. For this sixth set of experiments, the average waiting times of First-Come-First-Served (FCFS), Shortest-Job-First(SJF), Priority Scheduling (PRIO), and Virtual Runtime (VRUNTIME) are 170.12, 79.64, 119.19, and 199.12 ms, respectively. From Table 6, we observe that SJF had the smallest waiting time when the minimum interarrival time is the independent variable. It seems that SJF scales well with the increasing minimum interarrival time.

When we look overall, SJF is the best in three of the six different experiments. Each of the other three scheduling algorithms (FCFS, VRUNTIME, and PRIOR) perform well in one experiment. In terms of waiting times, FCFS generally gives good results. However, when there are too many bursts with small lengths, SJF must be used because FCFS penalizes short bursts that come after long bursts. VRUNTIME scales better than the other scheduling algorithms with the increasing average interarrival times.

Table 1. Average waiting times (ms) for increasing numbers of threads where each thread is executing a fixed number of bursts. I tested for the number of threads from 1 to 10 and the fixed number of bursts for each trial as 10. (a) First-Come-First-Served (FCFS); (b) Shortest Job First (SJF); (c) Priority Queue (PRIO); (d) Virtual Runtime (VRUNTIME).

<b>(a) Scheduling Algorithm: FCFS</b>				<b>(b) Scheduling Algorithm: SJF</b>			
Average Waiting Times of Bursts				Average Waiting Times of Bursts			
Number of Threads	Number of Bursts	Total Waiting Time per thread	Average Waiting Time per Thread	Number of Threads	Number of Bursts	Total Waiting Time per thread	Average Waiting Time per Thread
1	10	0.56	0.06	1	10	0.55	0.05
2	10	78.13	7.81	2	10	136.53	13.65
3	10	256.94	25.69	3	10	1705.33	170.53
4	10	376.46	37.65	4	10	637.28	63.73
5	10	1852.28	185.23	5	10	883.38	88.34
6	10	4821.32	482.13	6	10	1313.86	131.39
7	10	1540.93	154.09	7	10	4808.09	480.81
8	10	4018.46	401.85	8	10	4640.72	464.07
9	10	10715.21	1071.52	9	10	13884.43	1388.44
10	10	17057.14	1705.71	10	10	27703.60	2770.36
Average		4071.74	407.17	Average		5571.38	557.14

  

<b>(c) Scheduling Algorithm: PRIO</b>				<b>(d) Scheduling Algorithm: VRUNTIME</b>			
Average Waiting Times of Bursts				Average Waiting Times of Bursts			
Number of Threads	Number of Bursts	Total Waiting Time per thread	Average Waiting Time per Thread	Number of Threads	Number of Bursts	Total Waiting Time per thread	Average Waiting Time per Thread
1	10	0.56	0.06	1	10	0.59	0.06
2	10	24.93	2.49	2	10	369.92	36.99
3	10	504.27	50.43	3	10	361.53	36.15
4	10	483.75	48.37	4	10	308.93	30.89
5	10	863.75	86.38	5	10	1772.07	177.21
6	10	1114.99	111.50	6	10	1953.18	195.32
7	10	8079.50	807.95	7	10	5273.48	527.35
8	10	6106.83	610.68	8	10	5104.09	510.41
9	10	21023.69	2102.37	9	10	12362.98	1236.30
10	10	36916.51	3691.65	10	10	14499.10	1449.91
Average		7511.88	751.19	Average		4200.59	420.06

Table 2. Average waiting times (ms) for a fixed numbers of threads where each thread is executing a varying number of bursts. I tested for the fixed number of threads of 4 and the number of bursts are varying between 10 and 50. (a) First-Come-First-Served (FCFS); (b) Shortest Job First (SJF); (c) Priority Queue (PRIO); (d) Virtual Runtime (VRUNTIME).

<b>(a) Scheduling Algorithm: FCFS</b>				<b>(b) Scheduling Algorithm: SJF</b>			
<b>Average Waiting Times of Bursts</b>				<b>Average Waiting Times of Bursts</b>			
Number of Threads	Number of Bursts	Total Waiting Time per thread	Average Waiting Time per Thread	Number of Threads	Number of Bursts	Total Waiting Time per thread	Average Waiting Time per Thread
4	10	432.90	43.29	4	10	263.75	26.38
4	20	2522.51	126.13	4	20	2409.40	120.47
4	30	3067.85	102.26	4	30	3335.23	111.17
4	40	4065.13	101.63	4	40	2463.95	61.60
4	50	5343.59	106.87	4	50	7114.13	142.28
<b>Average</b>		<b>3086.40</b>	<b>96.04</b>	<b>Average</b>		<b>3117.29</b>	<b>92.38</b>
<b>(c) Scheduling Algorithm: PRIO</b>				<b>(d) Scheduling Algorithm: VRUNTIME</b>			
<b>Average Waiting Times of Bursts</b>				<b>Average Waiting Times of Bursts</b>			
Number of Threads	Number of Bursts	Total Waiting Time per thread	Average Waiting Time per Thread	Number of Threads	Number of Bursts	Total Waiting Time per thread	Average Waiting Time per Thread
4	10	1592.29	159.23	4	10	1892.43	189.24
4	20	1349.11	67.46	4	20	3292.84	164.64
4	30	3034.91	101.16	4	30	2446.28	81.54
4	40	5080.66	127.02	4	40	5796.42	144.91
4	50	4692.29	93.85	4	50	5091.49	101.83
<b>Average</b>		<b>3149.85</b>	<b>109.74</b>	<b>Average</b>		<b>3703.89</b>	<b>136.43</b>

Table 3. Average waiting times (ms) for a fixed numbers of threads (4) and a fixed number of bursts for each thread (10) where AvgA is varying between 1000 and 1800. (a) First-Come-First-Served (FCFS); (b) Shortest Job First (SJF); (c) Priority Queue (PRIO); (d) Virtual Runtime (VRUNTIME).

<b>(a) Scheduling Algorithm: FCFS</b>					<b>(b) Scheduling Algorithm: SJF</b>				
<b>Average Waiting Times of Bursts</b>					<b>Average Waiting Times of Bursts</b>				
Number of Threads	Number of Bursts	AvgA	Total Waiting Time per Thread	Average Waiting Time per Thread	Number of Threads	Number of Bursts	AvgA	Total Waiting Time per Thread	Average Waiting Time per Thread
4	10	1000	71534.88	71.53	4	10	1000	162610.35	162.61
4	10	1200	93575.27	77.98	4	10	1200	321572.43	267.98
4	10	1400	208274.91	148.77	4	10	1400	134792.60	96.28
4	10	1600	328974.94	205.61	4	10	1600	164419.21	102.76
4	10	1800	176113.34	97.84	4	10	1800	302400.69	168.00
<b>Average</b>			<b>175694.67</b>	<b>120.35</b>	<b>Average</b>			<b>217159.06</b>	<b>159.53</b>
<b>(c) Scheduling Algorithm: PRIO</b>					<b>(d) Scheduling Algorithm: VRUNTIME</b>				
<b>Average Waiting Times of Bursts</b>					<b>Average Waiting Times of Bursts</b>				
Number of Threads	Number of Bursts	AvgA	Total Waiting Time per Thread	Average Waiting Time per Thread	Number of Threads	Number of Bursts	AvgA	Total Waiting Time per Thread	Average Waiting Time per Thread
4	10	1000	121196.61	121.20	4	10	1000	75468.08	75.47
4	10	1200	206597.42	172.16	4	10	1200	108656.02	90.55
4	10	1400	91053.70	65.04	4	10	1400	140106.85	100.08
4	10	1600	244207.92	152.63	4	10	1600	71880.02	44.93
4	10	1800	160733.39	89.30	4	10	1800	107632.77	59.80
<b>Average</b>			<b>164757.81</b>	<b>120.07</b>	<b>Average</b>			<b>100748.75</b>	<b>74.16</b>

Table 4. Average waiting times (ms) for a fixed numbers of threads (4) and a fixed number of bursts for each thread (10) where AvgB is varying between 100 and 500. (a) First-Come-First-Served (FCFS); (b) Shortest Job First (SJF); (c) Priority Queue (PRIO); (d) Virtual Runtime (VRUNTIME).

<b>(a) Scheduling Algorithm: FCFS</b>					<b>(b) Scheduling Algorithm: SJF</b>				
<b>Average Waiting Times of Bursts</b>					<b>Average Waiting Times of Bursts</b>				
Number of Threads	Number of Bursts	AvgB	Total Waiting Time per Thread	Average Waiting Time per Thread	Number of Threads	Number of Bursts	AvgB	Total Waiting Time per Thread	Average Waiting Time per Thread
4	10	100	1710.38	17.10	4	10	100	411.59	4.12
4	10	200	18832.87	94.16	4	10	200	34803.73	174.02
4	10	300	41148.61	137.16	4	10	300	188617.37	628.72
4	10	400	147822.61	369.56	4	10	400	673749.11	1684.37
4	10	500	1461577.20	2923.15	4	10	500	252044.53	504.09
<b>Average</b>			<b>334218.33</b>	<b>708.23</b>	<b>Average</b>			<b>229925.26</b>	<b>599.06</b>
<b>(c) Scheduling Algorithm: PRIO</b>					<b>(d) Scheduling Algorithm: VRUNTIME</b>				
<b>Average Waiting Times of Bursts</b>					<b>Average Waiting Times of Bursts</b>				
Number of Threads	Number of Bursts	AvgB	Total Waiting Time per Thread	Average Waiting Time per Thread	Number of Threads	Number of Bursts	AvgB	Total Waiting Time per Thread	Average Waiting Time per Thread
4	10	100	3197.39	31.97	4	10	100	2590.93	25.91
4	10	200	22504.13	112.52	4	10	200	26451.09	132.26
4	10	300	41925.16	139.75	4	10	300	241852.03	806.17
4	10	400	103726.72	259.32	4	10	400	88236.35	220.59
4	10	500	79559.90	159.12	4	10	500	959925.62	1919.85
<b>Average</b>			<b>50182.66</b>	<b>140.54</b>	<b>Average</b>			<b>263811.20</b>	<b>620.96</b>

Table 5. Average waiting times (ms) for a fixed numbers of threads (4) and a fixed number of bursts for each thread (10) where MinB is varying between 100 and 500. (a) First-Come-First-Served (FCFS); (b) Shortest Job First (SJF); (c) Priority Queue (PRIO); (d) Virtual Runtime (VRUNTIME).

<b>(a) Scheduling Algorithm: FCFS</b>					<b>(b) Scheduling Algorithm: SJF</b>				
<b>Average Waiting Times of Bursts</b>					<b>Average Waiting Times of Bursts</b>				
Number of Threads	Number of Bursts	MinB	Total Waiting Time per Thread	Average Waiting Time per Thread	Number of Threads	Number of Bursts	MinB	Total Waiting Time per Thread	Average Waiting Time per Thread
4	10	100	6066.54	60.67	4	10	100	6581.07	65.81
4	10	200	47499.12	237.50	4	10	200	22864.42	114.32
4	10	300	47628.79	158.76	4	10	300	65841.11	219.47
4	10	400	193770.25	484.43	4	10	400	327302.07	818.26
4	10	500	871225.40	1742.45	4	10	500	506046.50	1012.09
<b>Average</b>			<b>233238.02</b>	<b>536.76</b>	<b>Average</b>			<b>185727.03</b>	<b>445.99</b>
<b>(c) Scheduling Algorithm: PRIO</b>					<b>(d) Scheduling Algorithm: VRUNTIME</b>				
<b>Average Waiting Times of Bursts</b>					<b>Average Waiting Times of Bursts</b>				
Number of Threads	Number of Bursts	MinB	Total Waiting Time per Thread	Average Waiting Time per Thread	Number of Threads	Number of Bursts	MinB	Total Waiting Time per Thread	Average Waiting Time per Thread
4	10	100	6810.06	68.10	4	10	100	5783.36	57.83
4	10	200	202418.60	1012.09	4	10	200	24526.98	122.63
4	10	300	77918.76	259.73	4	10	300	68913.85	229.71
4	10	400	183017.53	457.54	4	10	400	223446.46	558.62
4	10	500	699046.03	1398.09	4	10	500	1890285.51	3780.57
<b>Average</b>			<b>233842.19</b>	<b>639.11</b>	<b>Average</b>			<b>442591.23</b>	<b>949.87</b>



Table 6. Average waiting times (ms) for a fixed numbers of threads (4) and a fixed number of bursts for each thread (10) where MinA is varying between 400 and 2000. (a) First-Come-First-Served (FCFS); (b) Shortest Job First (SJF); (c) Priority Queue (PRIO); (d) Virtual Runtime (VRUNTIME).

<b>(a) Scheduling Algorithm: FCFS</b>					<b>(b) Scheduling Algorithm: SJF</b>				
Average Waiting Times of Bursts					Average Waiting Times of Bursts				
Number of Threads	Number of Bursts	MinA	Total Waiting Time per Thread	Average Waiting Time per Thread	Number of Threads	Number of Bursts	MinA	Total Waiting Time per Thread	Average Waiting Time per Thread
4	10	400	71981.53	179.95	4	10	400	32005.71	80.01
4	10	800	133142.06	166.43	4	10	800	71586.36	89.48
4	10	1200	135473.13	112.89	4	10	1200	113620.62	94.68
4	10	1600	275456.81	172.16	4	10	1600	124425.99	77.77
4	10	2000	438346.06	219.17	4	10	2000	112468.29	56.23
Average			<b>210879.92</b>	<b>170.12</b>	Average			<b>90821.39</b>	<b>79.64</b>
<b>(c) Scheduling Algorithm: PRIO</b>					<b>(d) Scheduling Algorithm: VRUNTIME</b>				
Average Waiting Times of Bursts					Average Waiting Times of Bursts				
Number of Threads	Number of Bursts	MinA	Total Waiting Time per Thread	Average Waiting Time per Thread	Number of Threads	Number of Bursts	MinA	Total Waiting Time per Thread	Average Waiting Time per Thread
4	10	400	85686.92	214.22	4	10	400	291887.50	729.72
4	10	800	75825.63	94.78	4	10	800	71175.22	88.97
4	10	1200	102445.98	85.37	4	10	1200	81258.50	67.72
4	10	1600	124266.90	77.67	4	10	1600	105480.41	65.93
4	10	2000	247838.66	123.92	4	10	2000	86509.51	43.25
Average			<b>127212.82</b>	<b>119.19</b>	Average			<b>127262.23</b>	<b>199.12</b>

## Appendix: Sample Outputs

Arrival times are with respect to January 1st, 1970 in ms.

### FCFS

#### Command :

```
./schedule 4 10 100 200 1000 1500 FCFS
```

#### Output:

Burst Number: 1, Thread Index: 4, Burst Index: 1, Burst Length: 187.269302 ms, Arrival Time: 1616952639346.006104 ms, Waiting Time: 0.062988 ms

Burst Number: 2, Thread Index: 2, Burst Index: 1, Burst Length: 658.184692 ms, Arrival Time: 1616952640350.208984 ms, Waiting Time: 0.054932 ms

Burst Number: 3, Thread Index: 3, Burst Index: 1, Burst Length: 654.765869 ms, Arrival Time: 1616952640910.881104 ms, Waiting Time: 97.689941 ms

Burst Number: 4, Thread Index: 1, Burst Index: 1, Burst Length: 247.115768 ms, Arrival Time: 1616952640988.853027 ms, Waiting Time: 674.605957 ms

Burst Number: 5, Thread Index: 4, Burst Index: 2, Burst Length: 555.949951 ms, Arrival Time: 1616952641048.172119 ms, Waiting Time: 862.524902 ms

Burst Number: 6, Thread Index: 3, Burst Index: 2, Burst Length: 175.298828 ms, Arrival Time: 1616952642540.250977 ms, Waiting Time: 0.047119 ms

Burst Number: 7, Thread Index: 2, Burst Index: 2, Burst Length: 536.930054 ms, Arrival Time: 1616952642899.465088 ms, Waiting Time: 0.049805 ms

Burst Number: 8, Thread Index: 2, Burst Index: 3, Burst Length: 214.466324 ms, Arrival Time: 1616952644243.440918 ms, Waiting Time: 0.052002 ms

Burst Number: 9, Thread Index: 4, Burst Index: 3, Burst Length: 756.371826 ms, Arrival Time: 1616952644274.010986 ms, Waiting Time: 184.066895 ms

Burst Number: 10, Thread Index: 1, Burst Index: 2, Burst Length: 421.049530 ms, Arrival Time: 1616952644610.851074 ms, Waiting Time: 603.739014 ms

Burst Number: 11, Thread Index: 2, Burst Index: 4, Burst Length: 194.638824 ms, Arrival Time: 1616952645265.906006 ms, Waiting Time: 369.873047 ms

Burst Number: 12, Thread Index: 3, Burst Index: 3, Burst Length: 681.291321 ms, Arrival Time: 1616952645995.603027 ms, Waiting Time: 0.047852 ms

Burst Number: 13, Thread Index: 4, Burst Index: 4, Burst Length: 120.956184 ms, Arrival Time: 1616952646725.607910 ms, Waiting Time: 0.057129 ms

Burst Number: 14, Thread Index: 3, Burst Index: 4, Burst Length: 140.390503 ms, Arrival Time: 1616952647043.929932 ms, Waiting Time: 0.066162 ms

Burst Number: 15, Thread Index: 2, Burst Index: 5, Burst Length: 593.474304 ms, Arrival Time: 1616952648017.927002 ms, Waiting Time: 0.056885 ms

Burst Number: 16, Thread Index: 3, Burst Index: 5, Burst Length: 141.223160 ms, Arrival Time: 1616952648394.096924 ms, Waiting Time: 217.483154 ms

Burst Number: 17, Thread Index: 1, Burst Index: 3, Burst Length: 132.198792 ms, Arrival Time: 1616952648831.087891 ms, Waiting Time: 0.047119 ms

Burst Number: 18, Thread Index: 4, Burst Index: 5, Burst Length: 110.212341 ms, Arrival Time: 1616952648922.383057 ms, Waiting Time: 41.127930 ms

Burst Number: 19, Thread Index: 1, Burst Index: 4, Burst Length: 244.001709 ms, Arrival Time: 1616952650387.767090 ms, Waiting Time: 0.041016 ms

Burst Number: 20, Thread Index: 2, Burst Index: 6, Burst Length: 103.794609 ms, Arrival Time: 1616952650850.310059 ms, Waiting Time: 0.057861 ms

Burst Number: 21, Thread Index: 3, Burst Index: 6, Burst Length: 356.429810 ms, Arrival Time: 1616952651150.794922 ms, Waiting Time: 0.047119 ms

Burst Number: 22, Thread Index: 1, Burst Index: 5, Burst Length: 116.155167 ms, Arrival Time: 1616952652019.215088 ms, Waiting Time: 0.039795 ms

Burst Number: 23, Thread Index: 4, Burst Index: 6, Burst Length: 309.460541 ms, Arrival Time: 1616952653398.047119 ms, Waiting Time: 0.054932 ms

Burst Number: 24, Thread Index: 2, Burst Index: 7, Burst Length: 197.771851 ms, Arrival Time: 1616952653989.875977 ms, Waiting Time: 0.058105 ms

Burst Number: 25, Thread Index: 4, Burst Index: 7, Burst Length: 825.085876 ms, Arrival Time: 1616952654438.426025 ms, Waiting Time: 0.054932 ms

Burst Number: 26, Thread Index: 2, Burst Index: 8, Burst Length: 104.682846 ms, Arrival Time: 1616952655848.695068 ms, Waiting Time: 0.055908 ms

Burst Number: 27, Thread Index: 3, Burst Index: 7, Burst Length: 292.920746 ms, Arrival Time: 1616952656021.183105 ms, Waiting Time: 0.046875 ms

Burst Number: 28, Thread Index: 4, Burst Index: 8, Burst Length: 116.695686 ms, Arrival Time: 1616952657006.052002 ms, Waiting Time: 0.054932 ms

Burst Number: 29, Thread Index: 2, Burst Index: 9, Burst Length: 126.978142 ms, Arrival Time: 1616952657018.825928 ms, Waiting Time: 104.105957 ms

Burst Number: 30, Thread Index: 3, Burst Index: 8, Burst Length: 332.669373 ms, Arrival Time: 1616952658267.521973 ms, Waiting Time: 0.047119 ms

Burst Number: 31, Thread Index: 2, Burst Index: 10, Burst Length: 333.718140 ms, Arrival Time: 1616952659507.709961 ms, Waiting Time: 0.056152 ms

Burst Number: 32, Thread Index: 1, Burst Index: 6, Burst Length: 137.932892 ms, Arrival Time: 1616952659629.429932 ms, Waiting Time: 212.178955 ms

Burst Number: 33, Thread Index: 3, Burst Index: 9, Burst Length: 343.363953 ms, Arrival Time: 1616952660477.434082 ms, Waiting Time: 0.046875 ms

Burst Number: 34, Thread Index: 4, Burst Index: 9, Burst Length: 202.715302 ms, Arrival Time: 1616952661079.198975 ms, Waiting Time: 0.055908 ms

Burst Number: 35, Thread Index: 1, Burst Index: 7, Burst Length: 211.208084 ms, Arrival Time: 1616952662017.350098 ms, Waiting Time: 0.046875 ms

Burst Number: 36, Thread Index: 3, Burst Index: 10, Burst Length: 150.414703 ms, Arrival Time: 1616952662024.020020 ms, Waiting Time: 204.723877 ms

Burst Number: 37, Thread Index: 4, Burst Index: 10, Burst Length: 126.035408 ms, Arrival Time: 1616952663147.623047 ms, Waiting Time: 0.056885 ms

Burst Number: 38, Thread Index: 1, Burst Index: 8, Burst Length: 204.825348 ms, Arrival Time: 1616952665921.077881 ms, Waiting Time: 0.047119 ms

Burst Number: 39, Thread Index: 1, Burst Index: 9, Burst Length: 247.476181 ms, Arrival Time: 1616952669562.513916 ms, Waiting Time: 0.046143 ms

Burst Number: 40, Thread Index: 1, Burst Index: 10, Burst Length: 301.871582 ms, Arrival Time: 1616952672364.599121 ms, Waiting Time: 0.047852 ms

## **SJF Sample**

### **Command:**

```
./schedule 4 10 100 200 1000 1500 SJF
```

### **Output:**

Burst Number: 1, Thread Index: 3, Burst Index: 1, Burst Length: 289.849396 ms, Arrival Time: 1616952689220.337891 ms, Waiting Time: 0.062012 ms

Burst Number: 2, Thread Index: 1, Burst Index: 1, Burst Length: 278.210907 ms, Arrival Time: 1616952689622.910889 ms, Waiting Time: 0.065186 ms

Burst Number: 3, Thread Index: 2, Burst Index: 1, Burst Length: 286.416504 ms, Arrival Time: 1616952689701.586914 ms, Waiting Time: 199.724121 ms

Burst Number: 4, Thread Index: 3, Burst Index: 2, Burst Length: 466.422394 ms, Arrival Time: 1616952690477.707031 ms, Waiting Time: 0.055908 ms

Burst Number: 5, Thread Index: 1, Burst Index: 2, Burst Length: 143.864319 ms, Arrival Time: 1616952690838.979980 ms, Waiting Time: 105.323975 ms

Burst Number: 6, Thread Index: 4, Burst Index: 1, Burst Length: 100.209030 ms, Arrival Time: 1616952691314.434082 ms, Waiting Time: 0.052002 ms

Burst Number: 7, Thread Index: 2, Burst Index: 2, Burst Length: 310.759521 ms, Arrival Time: 1616952691583.628906 ms, Waiting Time: 0.041016 ms

Burst Number: 8, Thread Index: 3, Burst Index: 3, Burst Length: 229.295807 ms, Arrival Time: 1616952691599.831055 ms, Waiting Time: 294.719971 ms

Burst Number: 9, Thread Index: 4, Burst Index: 2, Burst Length: 227.040665 ms, Arrival Time: 1616952692617.892090 ms, Waiting Time: 0.056885 ms

Burst Number: 10, Thread Index: 3, Burst Index: 4, Burst Length: 575.383179 ms, Arrival Time: 1616952693065.498047 ms, Waiting Time: 0.070068 ms

Burst Number: 11, Thread Index: 1, Burst Index: 3, Burst Length: 237.426514 ms, Arrival Time: 1616952693454.709961 ms, Waiting Time: 186.377930 ms

Burst Number: 12, Thread Index: 4, Burst Index: 3, Burst Length: 431.301666 ms, Arrival Time: 1616952693983.528076 ms, Waiting Time: 0.055908 ms

Burst Number: 13, Thread Index: 1, Burst Index: 4, Burst Length: 120.976784 ms, Arrival Time: 1616952694649.105957 ms, Waiting Time: 0.054932 ms

Burst Number: 14, Thread Index: 3, Burst Index: 5, Burst Length: 338.848175 ms, Arrival Time: 1616952694761.367920 ms, Waiting Time: 8.895020 ms

Burst Number: 15, Thread Index: 2, Burst Index: 3, Burst Length: 144.281021 ms, Arrival Time: 1616952694775.549072 ms, Waiting Time: 333.690918 ms

Burst Number: 16, Thread Index: 4, Burst Index: 4, Burst Length: 133.248642 ms, Arrival Time: 1616952695237.500977 ms, Waiting Time: 16.156982 ms

Burst Number: 17, Thread Index: 1, Burst Index: 5, Burst Length: 691.649048 ms, Arrival Time: 1616952695695.270020 ms, Waiting Time: 0.056885 ms

Burst Number: 18, Thread Index: 3, Burst Index: 6, Burst Length: 167.002472 ms, Arrival Time: 1616952695868.753906 ms, Waiting Time: 518.343018 ms

Burst Number: 19, Thread Index: 3, Burst Index: 7, Burst Length: 253.197586 ms, Arrival Time: 1616952697062.011963 ms, Waiting Time: 0.051025 ms

Burst Number: 20, Thread Index: 1, Burst Index: 6, Burst Length: 379.042999 ms, Arrival Time: 1616952697088.393066 ms, Waiting Time: 226.982910 ms

Burst Number: 21, Thread Index: 4, Burst Index: 5, Burst Length: 264.840881 ms, Arrival Time: 1616952697845.506104 ms, Waiting Time: 0.071777 ms

Burst Number: 22, Thread Index: 2, Burst Index: 4, Burst Length: 246.308838 ms, Arrival Time: 1616952698004.564941 ms, Waiting Time: 105.999023 ms

Burst Number: 23, Thread Index: 3, Burst Index: 8, Burst Length: 139.586060 ms, Arrival Time: 1616952698536.241943 ms, Waiting Time: 0.056152 ms

Burst Number: 24, Thread Index: 4, Burst Index: 6, Burst Length: 127.315903 ms, Arrival Time: 1616952699229.610107 ms, Waiting Time: 0.055908 ms

Burst Number: 25, Thread Index: 2, Burst Index: 5, Burst Length: 273.630463 ms, Arrival Time: 1616952699450.416992 ms, Waiting Time: 0.049072 ms

Burst Number: 26, Thread Index: 1, Burst Index: 7, Burst Length: 181.959930 ms, Arrival Time: 1616952699621.482910 ms, Waiting Time: 102.741211 ms

Burst Number: 27, Thread Index: 4, Burst Index: 7, Burst Length: 434.227478 ms, Arrival Time: 1616952700460.941895 ms, Waiting Time: 0.072021 ms

Burst Number: 28, Thread Index: 2, Burst Index: 6, Burst Length: 266.108490 ms, Arrival Time: 1616952700770.455078 ms, Waiting Time: 124.906982 ms

Burst Number: 29, Thread Index: 3, Burst Index: 9, Burst Length: 294.070038 ms, Arrival Time: 1616952701641.775879 ms, Waiting Time: 0.058105 ms

Burst Number: 30, Thread Index: 1, Burst Index: 8, Burst Length: 435.931580 ms, Arrival Time: 1616952701852.458984 ms, Waiting Time: 83.604980 ms

Burst Number: 31, Thread Index: 1, Burst Index: 9, Burst Length: 186.652863 ms, Arrival Time: 1616952703184.492920 ms, Waiting Time: 0.055176 ms

Burst Number: 32, Thread Index: 2, Burst Index: 7, Burst Length: 165.009583 ms, Arrival Time: 1616952703777.537109 ms, Waiting Time: 0.047852 ms

Burst Number: 33, Thread Index: 4, Burst Index: 8, Burst Length: 182.667908 ms, Arrival Time: 1616952703940.465088 ms, Waiting Time: 2.255859 ms

Burst Number: 34, Thread Index: 2, Burst Index: 8, Burst Length: 181.373016 ms, Arrival Time: 1616952705257.011963 ms, Waiting Time: 0.048096 ms

Burst Number: 35, Thread Index: 4, Burst Index: 9, Burst Length: 102.108383 ms, Arrival Time: 1616952705534.322021 ms, Waiting Time: 0.056885 ms

Burst Number: 36, Thread Index: 1, Burst Index: 10, Burst Length: 324.935638 ms, Arrival Time: 1616952705650.099121 ms, Waiting Time: 0.071777 ms

Burst Number: 37, Thread Index: 3, Burst Index: 10, Burst Length: 267.847412 ms, Arrival Time: 1616952706898.240967 ms, Waiting Time: 0.056152 ms

Burst Number: 38, Thread Index: 4, Burst Index: 10, Burst Length: 531.142944 ms, Arrival Time: 1616952707338.468018 ms, Waiting Time: 0.056885 ms

Burst Number: 39, Thread Index: 2, Burst Index: 9, Burst Length: 287.098358 ms, Arrival Time: 1616952708426.438965 ms, Waiting Time: 0.049072 ms

Burst Number: 40, Thread Index: 2, Burst Index: 10, Burst Length: 383.310669 ms, Arrival Time: 1616952711476.415039 ms, Waiting Time: 0.047852 ms



## **PRIO**

### **Command :**

```
./schedule 4 10 100 200 1000 1500 PRIO
```

### **Output:**

Burst Number: 1, Thread Index: 3, Burst Index: 1, Burst Length: 157.116852 ms, Arrival Time: 1616952800134.372070 ms, Waiting Time: 0.053955 ms

Burst Number: 2, Thread Index: 4, Burst Index: 1, Burst Length: 562.099243 ms, Arrival Time: 1616952800425.041016 ms, Waiting Time: 0.059082 ms

Burst Number: 3, Thread Index: 1, Burst Index: 1, Burst Length: 228.434113 ms, Arrival Time: 1616952801715.416992 ms, Waiting Time: 0.040039 ms

Burst Number: 4, Thread Index: 3, Burst Index: 2, Burst Length: 181.068741 ms, Arrival Time: 1616952802945.675049 ms, Waiting Time: 0.046875 ms

Burst Number: 5, Thread Index: 2, Burst Index: 1, Burst Length: 280.592163 ms, Arrival Time: 1616952803072.028076 ms, Waiting Time: 54.898926 ms

Burst Number: 6, Thread Index: 1, Burst Index: 2, Burst Length: 138.789841 ms, Arrival Time: 1616952803714.040039 ms, Waiting Time: 0.046875 ms

Burst Number: 7, Thread Index: 3, Burst Index: 3, Burst Length: 198.928558 ms, Arrival Time: 1616952804364.708008 ms, Waiting Time: 0.045898 ms

Burst Number: 8, Thread Index: 3, Burst Index: 4, Burst Length: 464.547119 ms, Arrival Time: 1616952805471.475098 ms, Waiting Time: 0.041016 ms

Burst Number: 9, Thread Index: 4, Burst Index: 2, Burst Length: 189.295181 ms, Arrival Time: 1616952805983.312988 ms, Waiting Time: 0.055908 ms

Burst Number: 10, Thread Index: 2, Burst Index: 2, Burst Length: 566.316040 ms, Arrival Time: 1616952806995.802979 ms, Waiting Time: 0.055908 ms

Burst Number: 11, Thread Index: 1, Burst Index: 3, Burst Length: 425.567108 ms, Arrival Time: 1616952807788.750977 ms, Waiting Time: 0.048096 ms

Burst Number: 12, Thread Index: 3, Burst Index: 5, Burst Length: 591.368408 ms, Arrival Time: 1616952808170.251953 ms, Waiting Time: 44.251953 ms

Burst Number: 13, Thread Index: 4, Burst Index: 3, Burst Length: 105.651199 ms, Arrival Time: 1616952809620.469971 ms, Waiting Time: 0.057129 ms

Burst Number: 14, Thread Index: 1, Burst Index: 4, Burst Length: 425.873444 ms, Arrival Time: 1616952809750.058105 ms, Waiting Time: 0.046875 ms

Burst Number: 15, Thread Index: 2, Burst Index: 3, Burst Length: 201.691940 ms, Arrival Time: 1616952810879.010010 ms, Waiting Time: 0.055908 ms

Burst Number: 16, Thread Index: 3, Burst Index: 6, Burst Length: 761.465027 ms, Arrival Time: 1616952811080.572021 ms, Waiting Time: 0.310059 ms

Burst Number: 17, Thread Index: 1, Burst Index: 5, Burst Length: 147.506607 ms, Arrival Time: 1616952811192.299072 ms, Waiting Time: 650.176025 ms

Burst Number: 18, Thread Index: 4, Burst Index: 4, Burst Length: 182.654327 ms, Arrival Time: 1616952811349.370117 ms, Waiting Time: 640.739990 ms

Burst Number: 19, Thread Index: 2, Burst Index: 4, Burst Length: 201.265396 ms, Arrival Time: 1616952812651.424072 ms, Waiting Time: 0.061035 ms

Burst Number: 20, Thread Index: 4, Burst Index: 5, Burst Length: 144.863998 ms, Arrival Time: 1616952813122.605957 ms, Waiting Time: 0.059082 ms

Burst Number: 21, Thread Index: 3, Burst Index: 7, Burst Length: 308.004456 ms, Arrival Time: 1616952813248.087891 ms, Waiting Time: 19.565186 ms

Burst Number: 22, Thread Index: 2, Burst Index: 5, Burst Length: 219.749191 ms, Arrival Time: 1616952814137.039062 ms, Waiting Time: 0.044922 ms

Burst Number: 23, Thread Index: 2, Burst Index: 6, Burst Length: 176.465057 ms, Arrival Time: 1616952815309.379883 ms, Waiting Time: 0.060059 ms

Burst Number: 24, Thread Index: 3, Burst Index: 8, Burst Length: 279.268311 ms, Arrival Time: 1616952815481.522949 ms, Waiting Time: 4.508057 ms

Burst Number: 25, Thread Index: 1, Burst Index: 6, Burst Length: 145.438919 ms, Arrival Time: 1616952815677.718994 ms, Waiting Time: 87.701904 ms

Burst Number: 26, Thread Index: 4, Burst Index: 6, Burst Length: 1064.614380 ms, Arrival Time: 1616952815316.916016 ms, Waiting Time: 594.076904 ms

Burst Number: 27, Thread Index: 2, Burst Index: 7, Burst Length: 164.844330 ms, Arrival Time: 1616952816379.762939 ms, Waiting Time: 595.964111 ms

Burst Number: 28, Thread Index: 3, Burst Index: 9, Burst Length: 117.156166 ms, Arrival Time: 1616952816900.608887 ms, Waiting Time: 240.078125 ms

Burst Number: 29, Thread Index: 4, Burst Index: 7, Burst Length: 421.559143 ms, Arrival Time: 1616952816562.101074 ms, Waiting Time: 695.865967 ms

Burst Number: 30, Thread Index: 1, Burst Index: 7, Burst Length: 637.257629 ms, Arrival Time: 1616952818428.264893 ms, Waiting Time: 0.047119 ms

Burst Number: 31, Thread Index: 4, Burst Index: 8, Burst Length: 390.287506 ms, Arrival Time: 1616952819044.573975 ms, Waiting Time: 21.111084 ms

Burst Number: 32, Thread Index: 1, Burst Index: 8, Burst Length: 430.921936 ms, Arrival Time: 1616952820541.781982 ms, Waiting Time: 0.047119 ms

Burst Number: 33, Thread Index: 4, Burst Index: 9, Burst Length: 118.850327 ms, Arrival Time: 1616952821570.209961 ms, Waiting Time: 0.051025 ms

Burst Number: 34, Thread Index: 3, Burst Index: 10, Burst Length: 112.361366 ms, Arrival Time: 1616952821624.166992 ms, Waiting Time: 65.062012 ms

Burst Number: 35, Thread Index: 2, Burst Index: 8, Burst Length: 194.122589 ms, Arrival Time: 1616952821840.989990 ms, Waiting Time: 0.057129 ms

Burst Number: 36, Thread Index: 4, Burst Index: 10, Burst Length: 614.459351 ms, Arrival Time: 1616952822648.123047 ms, Waiting Time: 0.060059 ms

Burst Number: 37, Thread Index: 1, Burst Index: 9, Burst Length: 169.871063 ms, Arrival Time: 1616952822682.779053 ms, Waiting Time: 580.039062 ms

Burst Number: 38, Thread Index: 2, Burst Index: 9, Burst Length: 101.172386 ms, Arrival Time: 1616952822879.761963 ms, Waiting Time: 553.038086 ms

Burst Number: 39, Thread Index: 2, Burst Index: 10, Burst Length: 403.801453 ms, Arrival Time: 1616952824010.534912 ms, Waiting Time: 0.059082 ms

Burst Number: 40, Thread Index: 1, Burst Index: 10, Burst Length: 372.297516 ms, Arrival Time: 1616952824082.677979 ms, Waiting Time: 331.852051 ms

## VRUNTIME

### Command:

```
./schedule 4 10 100 200 1000 1500 VRUNTIME
```

### Output:

Burst Number: 1, Thread Index: 3, Burst Index: 1, Burst Length: 373.883942 ms, Arrival Time: 1616952734736.361084 ms, Waiting Time: 0.042969 ms

Burst Number: 2, Thread Index: 1, Burst Index: 1, Burst Length: 114.808769 ms, Arrival Time: 1616952734759.334961 ms, Waiting Time: 351.119141 ms

Burst Number: 3, Thread Index: 4, Burst Index: 1, Burst Length: 820.201782 ms, Arrival Time: 1616952734844.382080 ms, Waiting Time: 381.017822 ms

Burst Number: 4, Thread Index: 2, Burst Index: 1, Burst Length: 158.538696 ms, Arrival Time: 1616952735597.615967 ms, Waiting Time: 448.104004 ms

Burst Number: 5, Thread Index: 1, Burst Index: 2, Burst Length: 299.251343 ms, Arrival Time: 1616952736173.851074 ms, Waiting Time: 30.525879 ms

Burst Number: 6, Thread Index: 4, Burst Index: 2, Burst Length: 274.605591 ms, Arrival Time: 1616952736059.242920 ms, Waiting Time: 444.523193 ms

Burst Number: 7, Thread Index: 2, Burst Index: 2, Burst Length: 263.364105 ms, Arrival Time: 1616952737292.919922 ms, Waiting Time: 0.057129 ms

Burst Number: 8, Thread Index: 3, Burst Index: 2, Burst Length: 374.173798 ms, Arrival Time: 1616952738284.705078 ms, Waiting Time: 0.041016 ms

Burst Number: 9, Thread Index: 4, Burst Index: 3, Burst Length: 441.352478 ms, Arrival Time: 1616952738529.143066 ms, Waiting Time: 129.921875 ms

Burst Number: 10, Thread Index: 1, Burst Index: 3, Burst Length: 155.189651 ms, Arrival Time: 1616952738937.593018 ms, Waiting Time: 162.962891 ms

Burst Number: 11, Thread Index: 3, Burst Index: 3, Burst Length: 233.785492 ms, Arrival Time: 1616952740173.385010 ms, Waiting Time: 0.046875 ms

Burst Number: 12, Thread Index: 1, Burst Index: 4, Burst Length: 153.017471 ms, Arrival Time: 1616952740477.811035 ms, Waiting Time: 0.055908 ms

Burst Number: 13, Thread Index: 4, Burst Index: 4, Burst Length: 270.954193 ms, Arrival Time: 1616952740525.433105 ms, Waiting Time: 105.562012 ms

Burst Number: 14, Thread Index: 2, Burst Index: 3, Burst Length: 668.362122 ms, Arrival Time: 1616952740737.541992 ms, Waiting Time: 164.528076 ms

Burst Number: 15, Thread Index: 3, Burst Index: 4, Burst Length: 516.797302 ms, Arrival Time: 1616952741645.840088 ms, Waiting Time: 0.038818 ms

Burst Number: 16, Thread Index: 1, Burst Index: 5, Burst Length: 409.613434 ms, Arrival Time: 1616952741832.097900 ms, Waiting Time: 330.696045 ms

Burst Number: 17, Thread Index: 4, Burst Index: 5, Burst Length: 311.849182 ms, Arrival Time: 1616952743446.538086 ms, Waiting Time: 0.057861 ms

Burst Number: 18, Thread Index: 4, Burst Index: 6, Burst Length: 117.149017 ms, Arrival Time: 1616952744591.852051 ms, Waiting Time: 0.058838 ms

Burst Number: 19, Thread Index: 1, Burst Index: 6, Burst Length: 308.816467 ms, Arrival Time: 1616952745282.514893 ms, Waiting Time: 0.040039 ms

Burst Number: 20, Thread Index: 4, Burst Index: 7, Burst Length: 129.173462 ms, Arrival Time: 1616952745710.016113 ms, Waiting Time: 0.055908 ms

Burst Number: 21, Thread Index: 2, Burst Index: 4, Burst Length: 148.035431 ms, Arrival Time: 1616952746628.845947 ms, Waiting Time: 0.058105 ms

Burst Number: 22, Thread Index: 3, Burst Index: 5, Burst Length: 721.416382 ms, Arrival Time: 1616952746990.268066 ms, Waiting Time: 0.045898 ms

Burst Number: 23, Thread Index: 4, Burst Index: 8, Burst Length: 122.771324 ms, Arrival Time: 1616952748069.294922 ms, Waiting Time: 0.056152 ms

Burst Number: 24, Thread Index: 2, Burst Index: 5, Burst Length: 186.908768 ms, Arrival Time: 1616952748282.889893 ms, Waiting Time: 0.071045 ms

Burst Number: 25, Thread Index: 2, Burst Index: 6, Burst Length: 151.755890 ms, Arrival Time: 1616952749336.882080 ms, Waiting Time: 0.055908 ms

Burst Number: 26, Thread Index: 3, Burst Index: 6, Burst Length: 154.241196 ms, Arrival Time: 1616952749650.204102 ms, Waiting Time: 0.059814 ms

Burst Number: 27, Thread Index: 4, Burst Index: 9, Burst Length: 215.167526 ms, Arrival Time: 1616952750564.618896 ms, Waiting Time: 0.057129 ms

Burst Number: 28, Thread Index: 2, Burst Index: 7, Burst Length: 686.408508 ms, Arrival Time: 1616952750658.076904 ms, Waiting Time: 121.904053 ms

Burst Number: 29, Thread Index: 1, Burst Index: 7, Burst Length: 285.599335 ms, Arrival Time: 1616952751398.156006 ms, Waiting Time: 68.352051 ms

Burst Number: 30, Thread Index: 2, Burst Index: 8, Burst Length: 179.140640 ms, Arrival Time: 1616952751675.429932 ms, Waiting Time: 76.833984 ms

Burst Number: 31, Thread Index: 3, Burst Index: 7, Burst Length: 264.161469 ms, Arrival Time: 1616952751437.447021 ms, Waiting Time: 494.082031 ms

Burst Number: 32, Thread Index: 3, Burst Index: 8, Burst Length: 130.460403 ms, Arrival Time: 1616952752680.324951 ms, Waiting Time: 0.047119 ms

Burst Number: 33, Thread Index: 4, Burst Index: 10, Burst Length: 211.270981 ms, Arrival Time: 1616952752982.031006 ms, Waiting Time: 0.072021 ms

Burst Number: 34, Thread Index: 2, Burst Index: 9, Burst Length: 189.005554 ms, Arrival Time: 1616952753344.206055 ms, Waiting Time: 0.052002 ms

Burst Number: 35, Thread Index: 3, Burst Index: 9, Burst Length: 323.360046 ms, Arrival Time: 1616952754648.211914 ms, Waiting Time: 0.046143 ms

Burst Number: 36, Thread Index: 1, Burst Index: 8, Burst Length: 329.910492 ms, Arrival Time: 1616952754663.928955 ms, Waiting Time: 307.804932 ms

Burst Number: 37, Thread Index: 3, Burst Index: 10, Burst Length: 481.947662 ms, Arrival Time: 1616952756433.647949 ms, Waiting Time: 0.047119 ms

Burst Number: 38, Thread Index: 1, Burst Index: 9, Burst Length: 418.895721 ms, Arrival Time: 1616952758569.634033 ms, Waiting Time: 0.045898 ms

Burst Number: 39, Thread Index: 1, Burst Index: 10, Burst Length: 1080.747437 ms, Arrival Time: 1616952762857.733887 ms, Waiting Time: 0.047119 ms

Burst Number: 40, Thread Index: 2, Burst Index: 10, Burst Length: 372.279419 ms, Arrival Time: 1616952765214.482910 ms, Waiting Time: 0.056152 ms