
# CS 342 - Operating Systems

# Project 4

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# 1. General Information

In the experiments, we decided that maximum cylinder amount has no effect on the results and we eliminated that parameter. The other parameters left are the time of requests' arrival and cylinder numbers. Rather than using parameters, we developed 5 different test scenarios that demonstrates different conditions. The data tables shows the test cases and the relevant information about wait times and total time. Figures also visualizes those tables.

# 2. Environment Setup

In the experiments we ran our codes on an Ubuntu 16.04.03 64-Bit virtual machine that is working on Oracle VirtualBox. The virtual machine has 2GB's of RAM and one CPU core. For the testing, we generated 5 different input.txt files.

# 3. Results of Experiments and Analysis

## 3.1 Test 1

In this test case, we bombard the disk with request in a certain time.

```
0 53
52 98
52 183
52 37
52 122
52 14
52 124
52 65
52 67
```

```
Request Index: 0, Wait Time0
Request Index: 1, Wait Time0
Request Index: 2, Wait Time45
Request Index: 3, Wait Time130
Request Index: 4, Wait Time276
Request Index: 5, Wait Time361
Request Index: 6, Wait Time469
Request Index: 7, Wait Time579
Request Index: 8, Wait Time638
FCFS : Total Time: 692 Mean: 277.56 Standart Deviation: 248.58
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Request Index: 0, Wait Time0
Request Index: 1, Wait Time67
Request Index: 2, Wait Time177
Request Index: 3, Wait Time14
Request Index: 4, Wait Time151
Request Index: 5, Wait Time44
Request Index: 6, Wait Time175
Request Index: 7, Wait Time0
Request Index: 8, Wait Time12
SSTF : Total Time: 288 Mean: 71.11 Standart Deviation: 75.84
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Request Index: 0, Wait Time0
Request Index: 1, Wait Time14
Request Index: 2, Wait Time71
Request Index: 3, Wait Time130
Request Index: 4, Wait Time45
Request Index: 5, Wait Time276
Request Index: 6, Wait Time69
Request Index: 7, Wait Time0
Request Index: 8, Wait Time12
LOOK : Total Time: 351 Mean: 68.56 Standart Deviation: 88.70
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Request Index: 0, Wait Time0
Request Index: 1, Wait Time14
Request Index: 2, Wait Time71
Request Index: 3, Wait Time299
Request Index: 4, Wait Time45
Request Index: 5, Wait Time130
Request Index: 6, Wait Time69
Request Index: 7, Wait Time0
Request Index: 8, Wait Time12
C-LOOK : Total Time: 374 Mean: 71.11 Standart Deviation: 95.50
```

**Figure 1: Input and Output for the test case 1**

| | Total Time | Mean | STD |
|---|---|---|---|
| FCFS | 692 | 277,56 | 248,58 |
| SSTF | 288 | 71,11 | 75,84 |
| LOOK | 351 | 68,56 | 88,7 |
| C-LOOK | 374 | 71,11 | 95,5 |

**Figure 2: Results of test case 1**

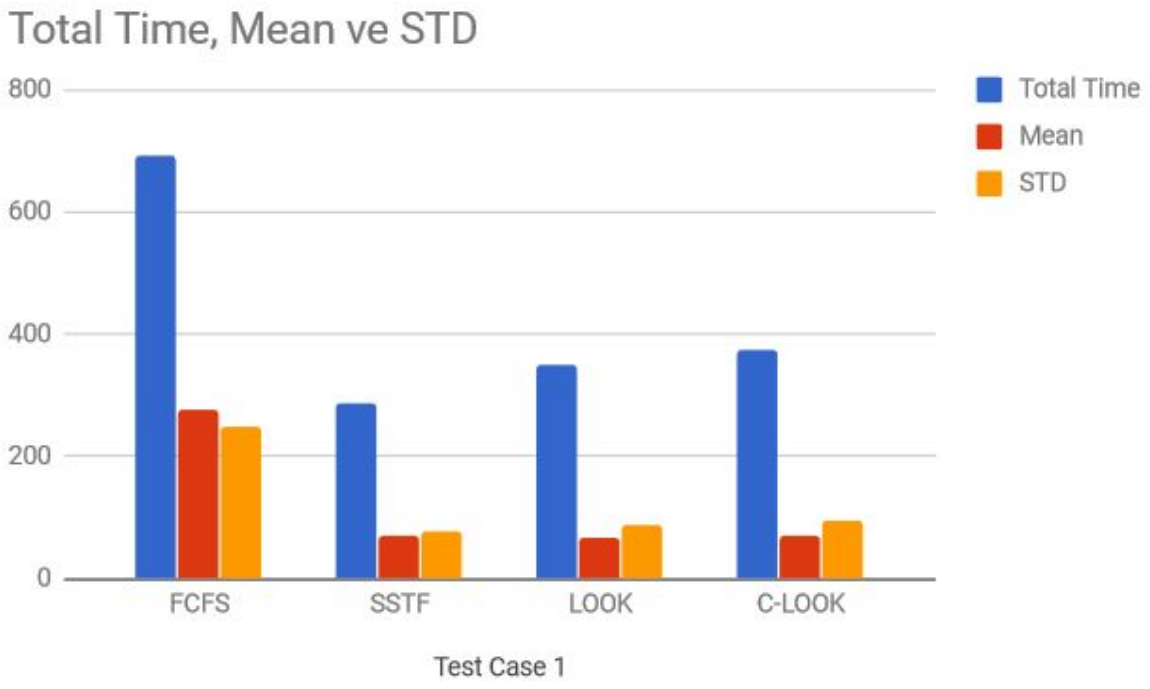


**Figure 3: Figure that visualizes output of test case 1**

## 3.2 Test 2

This test case shows a normal flow of disk requests.

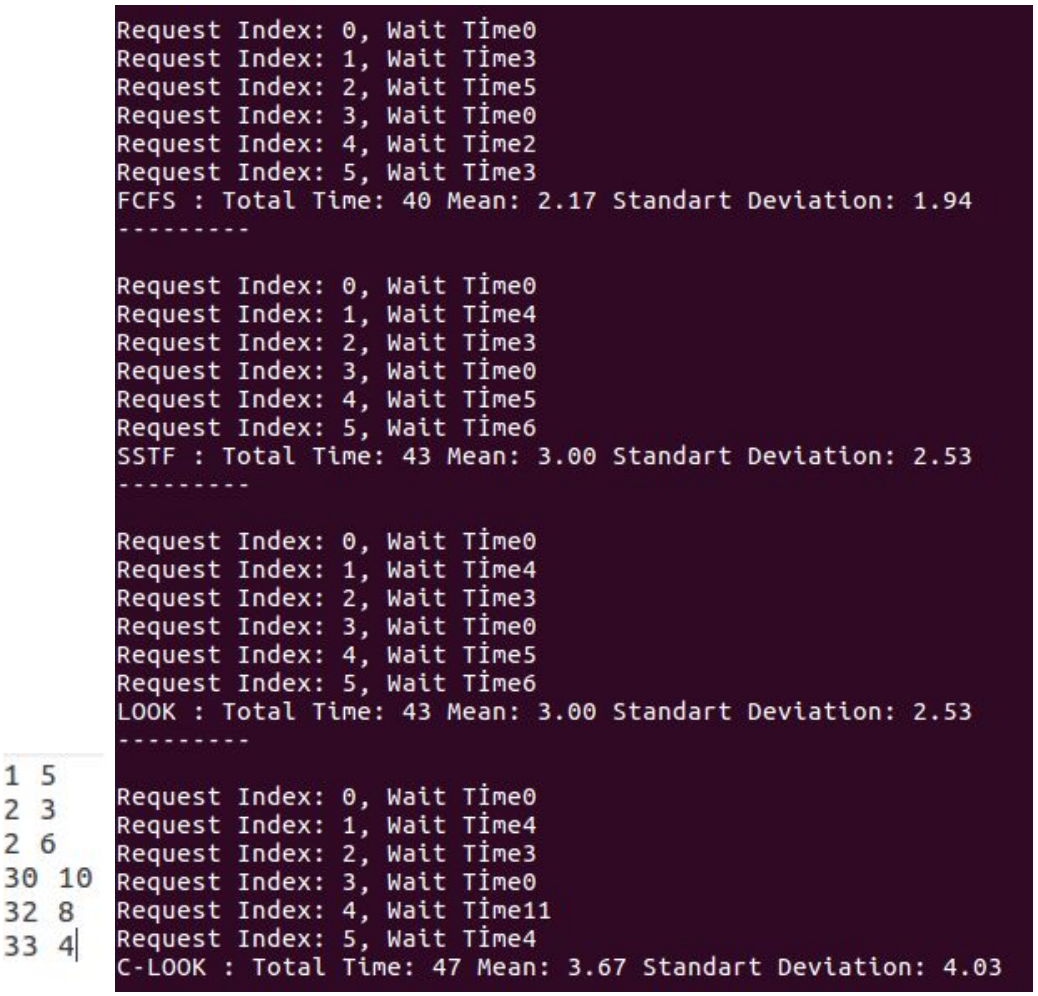


**Figure 4: Input and Output for the test case 2**

| | Total Time | Mean | STD |
|---|---|---|---|
| FCFS | 40 | 2,17 | 1,94 |
| SSTF | 43 | 3 | 2,53 |
| LOOK | 43 | 3 | 2,53 |
| C-LOOK | 47 | 3,67 | 4,03 |

**Figure 5: Results of test case 2**

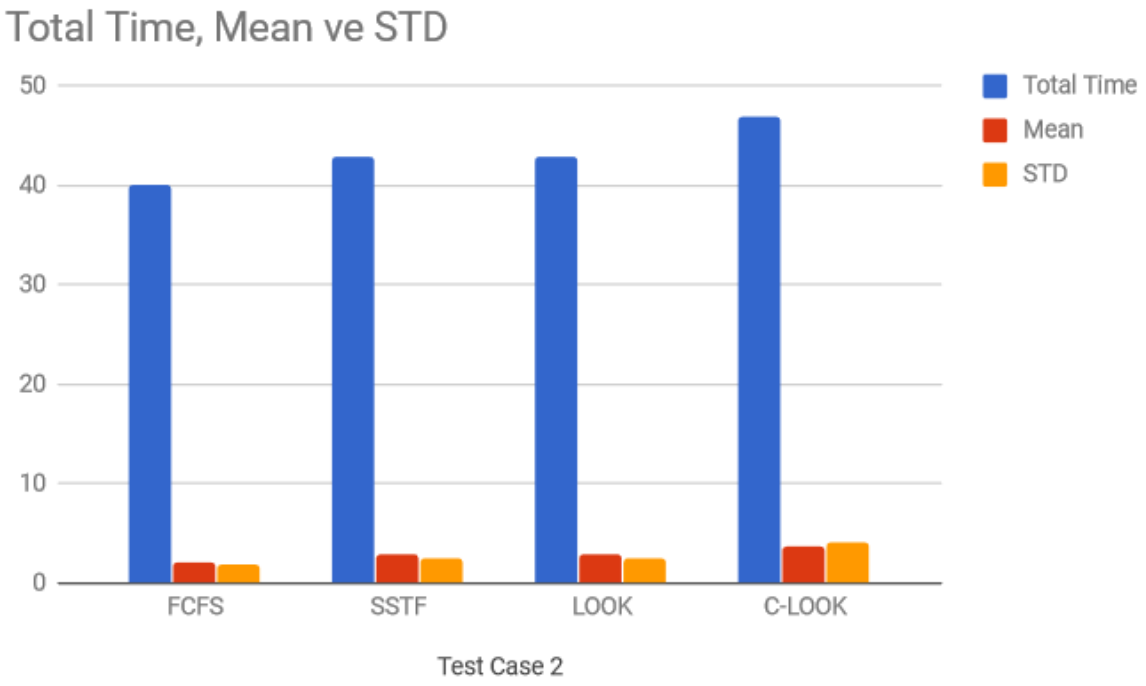


**Figure 6: Figure that visualizes output of test case 2**

## 3.3 Test 3

This case a normal flow of disk requests.

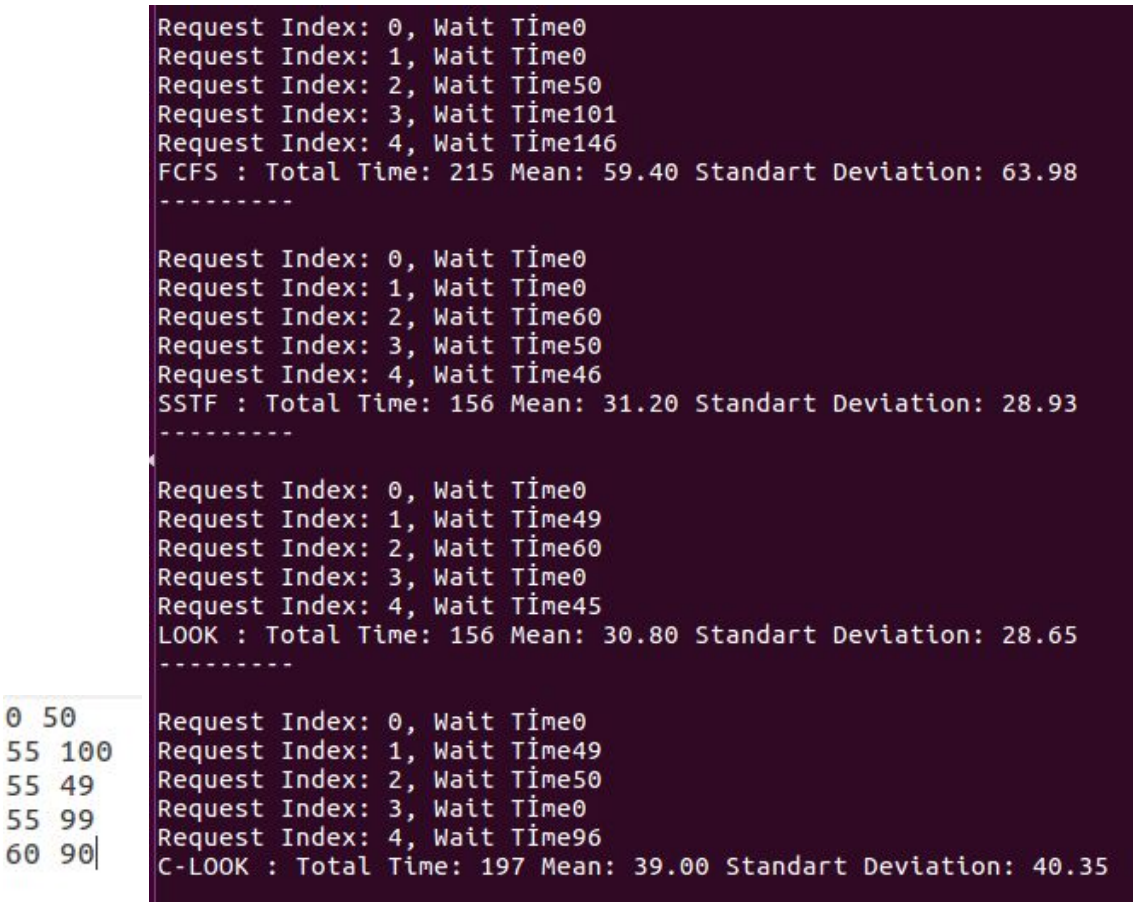


**Figure 7: Input and Output for the test case 3**

| | Total Time | Mean | STD |
|---|---|---|---|
| FCFS | 215 | 59,4 | 63,98 |
| SSTF | 156 | 31,2 | 28,93 |
| LOOK | 156 | 30,8 | 28,65 |
| C-LOOK | 197 | 39 | 40,35 |

**Figure 8: Results of test case 3**

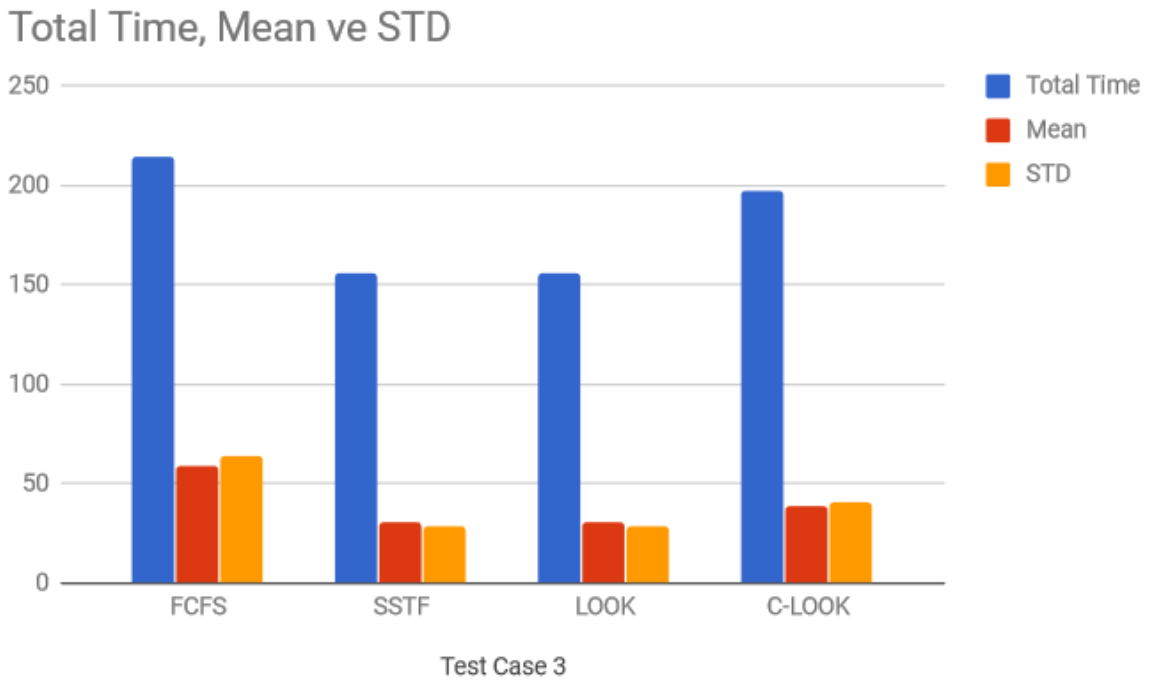


**Figure 9: Figure that visualizes output of test case 3**

## 3.4 Test 4

In this test case, the disk head jumps from left to right rapidly.

```
10 478
18 256
18 389
27 132
45 90
50 410
```

```
Request Index: 0, Wait Time0
Request Index: 1, Wait Time469
Request Index: 2, Wait Time691
Request Index: 3, Wait Time815
Request Index: 4, Wait Time1054
Request Index: 5, Wait Time1091
FCFS : Total Time: 1461 Mean: 686.67 Standart Deviation: 408.36
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Request Index: 0, Wait Time0
Request Index: 1, Wait Time558
Request Index: 2, Wait Time537
Request Index: 3, Wait Time682
Request Index: 4, Wait Time788
Request Index: 5, Wait Time437
SSTF : Total Time: 875 Mean: 500.33 Standart Deviation: 273.78
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Request Index: 0, Wait Time0
Request Index: 1, Wait Time558
Request Index: 2, Wait Time537
Request Index: 3, Wait Time682
Request Index: 4, Wait Time788
Request Index: 5, Wait Time437
LOOK : Total Time: 875 Mean: 500.33 Standart Deviation: 273.78
---------

Request Index: 0, Wait Time0
Request Index: 1, Wait Time899
Request Index: 2, Wait Time1023
Request Index: 3, Wait Time848
Request Index: 4, Wait Time442
Request Index: 5, Wait Time1124
C-LOOK : Total Time: 1195 Mean: 722.67 Standart Deviation: 424.05
```

**Figure 10: Input and Output for the test case 4**

| | Total Time | Mean | STD |
|---|---|---|---|
| FCFS | 1461 | 686,67 | 408,36 |
| SSTF | 875 | 500,33 | 273,78 |
| LOOK | 875 | 500,33 | 273,78 |
| C-LOOK | 1195 | 722,67 | 424,05 |

**Figure 11: Results of test case 4**

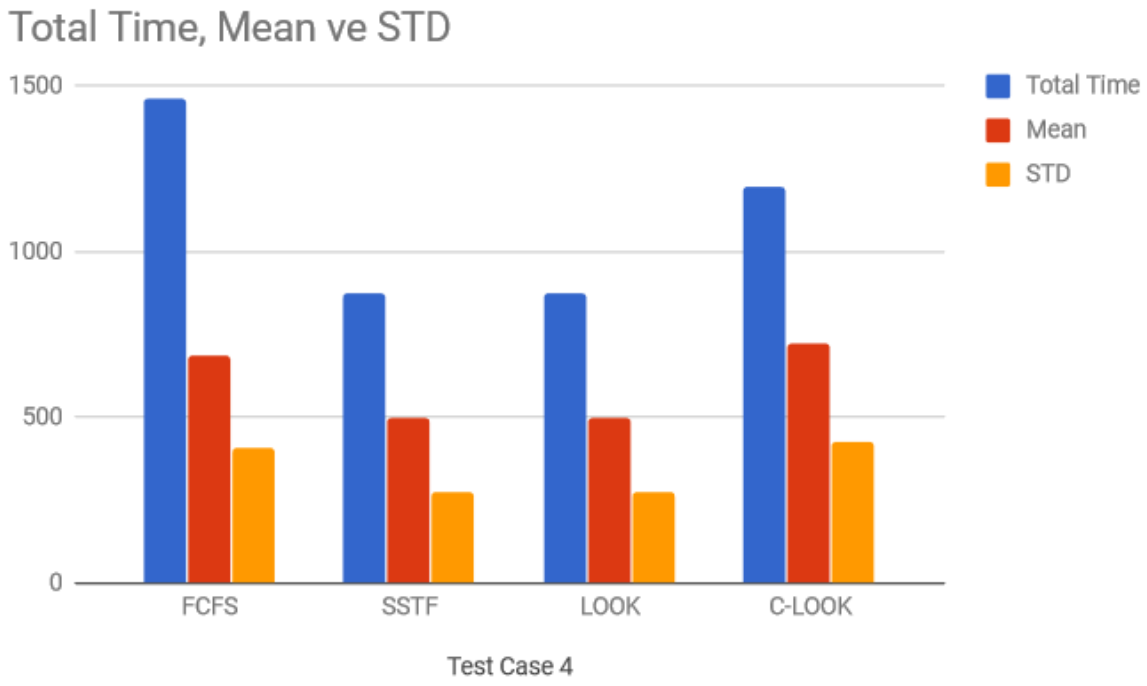


**Figure 12: Figure that visualizes output of test case 4**

## 3.5 Test 5

This test case also shows the rapid left to right jumping of disk head.

```
0 478
10 250
20 380
30 120
40 80
50 20
```

```
Request Index: 0, Wait Time0
Request Index: 1, Wait Time467
Request Index: 2, Wait Time685
Request Index: 3, Wait Time805
Request Index: 4, Wait Time1055
Request Index: 5, Wait Time1085
FCFS : Total Time: 1195 Mean: 682.83 Standart Deviation: 406.94
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Request Index: 0, Wait Time0
Request Index: 1, Wait Time565
Request Index: 2, Wait Time457
Request Index: 3, Wait Time675
Request Index: 4, Wait Time795
Request Index: 5, Wait Time825
SSTF : Total Time: 935 Mean: 552.83 Standart Deviation: 304.17
---------

Request Index: 0, Wait Time0
Request Index: 1, Wait Time565
Request Index: 2, Wait Time457
Request Index: 3, Wait Time675
Request Index: 4, Wait Time795
Request Index: 5, Wait Time825
LOOK : Total Time: 935 Mean: 552.83 Standart Deviation: 304.17
---------

Request Index: 0, Wait Time0
Request Index: 1, Wait Time1025
Request Index: 2, Wait Time1145
Request Index: 3, Wait Time965
Request Index: 4, Wait Time895
Request Index: 5, Wait Time427
C-LOOK : Total Time: 1295 Mean: 742.83 Standart Deviation: 439.41
```

**Figure 13: Input and Output for the test case 5**

| | Total Time | Mean | STD |
|---|---|---|---|
| FCFS | 1195 | 682,83 | 406,94 |
| SSTF | 935 | 552,83 | 304,17 |
| LOOK | 935 | 552,83 | 304,17 |
| C-LOOK | 1295 | 742,83 | 439,41 |

**Figure 14: Results of test case 5**

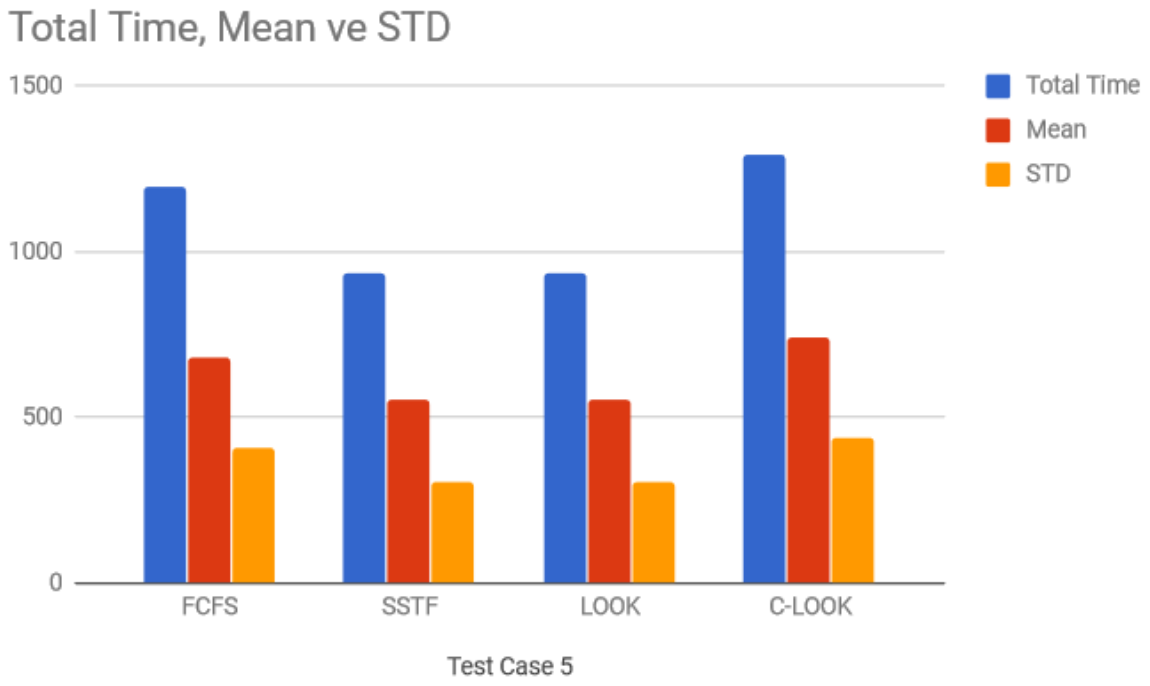


**Figure 15: Figure that visualizes output of test case 5**

# 4. Discussion and Conclusion

## FCFS:

Whatever happens, FCFS serves the requests depending on their arrival time. As it can be seen from the results, in most of the cases, because this algorithm has no optimization, it performs the worst. Because of its simplicity, it can be implemented with minimum amount of requirements.

## SSTF:

SSTF uses algorithms to optimize the disk head movement and performs best with LOOK algorithm head to head in most cases. It performs best when a request bombardment occurs in a certain time.

## LOOK:

LOOK algorithm performs head to head with SSTF in the top position. The difference is that, since it fixes on a direction and can move both directions, it has a slight advantage when requests come to the same side of the disk head direction.

## C-LOOK:

C-LOOK operates just like LOOK, but in only one direction. This operation style gives it a disadvantage since it can only move on a direction and has to trace back to starting position after every iteration. This can be seen from the results.