

# **Project 2 - Report**

## **CS6378 - Advanced Operating Systems**

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## Introduction:

This report details the number of messages sent and received between the nodes (both server and client) until the completion message is sent (completion message not counted).

It also contains data about the number of messages exchanged and the elapsed time between making a request and being able to enter the critical section (latency) when the system is run with different values of time spent in the critical section and time spent waiting before entering the critical section, and how the times affect the system.

(CS in the report refers to the critical section)

## Detailed Analysis:

The system is re-run with the following pairs of time spent in CS and time spent waiting before entering the CS: (5, 10, 0.3), (5, 10, 3), (0.5, 1, 0.3), and (0.5, 1, 3).

### Scenario 1:

Range of time spent in the Critical Section (in seconds): 5, 10

Time spent before re-entering the Critical Section (in seconds): 0.3

Node	Messages Sent	Messages Received
Server 1	100	200
Server 2	100	200
Server 3	100	200
Server 4	100	200
Server 5	100	200
Server 6	100	200
Server 7	100	200
Client 1	280	140
Client 2	280	140
Client 3	280	140
Client 4	280	140

Client 5	280	140
<b>Total</b>	<b>2100</b>	<b>2100</b>

Stats for the clients:

Client 1:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 243
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 62
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 138
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 73
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 49
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 45
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 77
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 70
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 424
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 60
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 49
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 45
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 59
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 149
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 52
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 40
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 47
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 40
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 69
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 389
Average time: 109
```

Average latency: 109 ms

Client 2:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 388
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 338
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 122
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 50
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 58
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 52
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 38
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 48
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 41
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 63
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 758
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 46
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 38
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 54
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 34
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 47
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 52
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 44
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 39
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 40
Average time: 117
```

Average latency: 117 ms



### Client 5:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 175
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 267
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 32
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 40
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 33
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 26
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 141
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 23
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 32
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 67
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 28
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 190
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 78
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 35
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 205
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 32
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 26
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 20
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 27
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 35
Average time: 75
```

Average latency: 75 ms

### Scenario 2:

Range of time spent in the Critical Section (in seconds): 0.5, 1

Time spent before re-entering the Critical Section (in seconds): 0.3

Node	Messages Sent	Messages Received
Server 1	93	200
Server 2	100	200
Server 3	100	200
Server 4	100	200
Server 5	100	200
Server 6	100	200
Server 7	100	200
Client 1	280	126
Client 2	280	139
Client 3	280	122
Client 4	280	121

Client 5	280	140
<b>Total</b>	<b>2093</b>	<b>2048</b>

Stats for the clients:

#### Client 1:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 362
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 662
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 816
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 535
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 657
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 903
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 849
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 719
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 470
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 798
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 511
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 774
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 492
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 815
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 697
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 458
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 906
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 897
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 764
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 580
Average time: 683
```

Average latency: 683 ms

#### Client 2:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 1057
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 623
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 530
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 437
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 739
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 931
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 705
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 775
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 823
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 606
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 751
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 602
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 884
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 918
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 397
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 468
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 386
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 717
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 697
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 59
Average time: 655
```

Average latency: 655 ms



### Client 5:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 194
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 549
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 926
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 744
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 467
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 901
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 536
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 602
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 876
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 810
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 409
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 472
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 916
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 543
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 712
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 794
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 717
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 586
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 827
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 887
Average time: 673
```

Average latency: 673 ms

### Scenario 3:

Range of time spent in the Critical Section (in seconds): 5, 10

Time spent before re-entering the Critical Section (in seconds): 3

Node	Messages Sent	Messages Received
Server 1	100	200
Server 2	100	200
Server 3	100	200
Server 4	100	200
Server 5	100	200
Server 6	100	200
Server 7	100	200
Client 1	280	140
Client 2	280	140
Client 3	280	140
Client 4	280	140

Client 5	280	140
<b>Total</b>	<b>2100</b>	<b>2100</b>

Stats for Clients:

Client 1:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 2255
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 5210
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 5168
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7132
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 5135
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4099
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 5097
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 3066
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4078
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 7067
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 4060
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 5061
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 3049
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 3134
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 2141
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 7153
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 5145
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 2158
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 7136
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7070
Average time: 4720
```

Average latency: 4720 ms

Client 2:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7319
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 7169
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 3110
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4138
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 3132
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 6104
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 2077
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 6070
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 7070
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 6079
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 3060
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4059
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4055
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 3082
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4109
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 2138
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 3160
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4138
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 2158
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 2129
Average time: 4217
```

Average latency: 4217 ms

### Client 3:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 10349
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 3159
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7134
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 5138
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4118
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4107
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 3047
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 3068
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 5074
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 4069
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4069
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 5058
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 3052
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 4105
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7146
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4140
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 3157
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4124
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 4128
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 5110
Average time: 4667
```

Average latency: 4667 ms

### Client 4:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 226
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 2174
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 5160
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 5139
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4136
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 7117
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 5096
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7071
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4066
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 2080
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 7062
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 4056
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 2055
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 3068
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 5169
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 5138
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 6155
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7137
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 6186
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 6098
Average time: 4719
```

Average latency: 4719 ms

### Client 5:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4308
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 3136
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4145
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 6139
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4134
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4111
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 2089
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 7071
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 6072
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 3074
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 5081
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 5058
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 3056
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 3093
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7142
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7138
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4163
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 6168
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 5140
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 7098
Average time: 4870
```

Average latency: 4870 ms

### Scenario 4:

Time spent in the Critical Section (in seconds): 0.5, 1

Time spent before re-entering the Critical Section (in seconds): 3

Node	Messages Sent	Messages Received
Server 1	100	200
Server 2	100	200
Server 3	100	200
Server 4	100	200
Server 5	100	200
Server 6	100	200
Server 7	100	200
Client 1	280	140
Client 2	280	140
Client 3	280	140

<b>Client 4</b>	<b>280</b>	<b>140</b>
<b>Client 5</b>	<b>280</b>	<b>140</b>
<b>Total</b>	<b>2100</b>	<b>2100</b>

Stats for the Clients:

Client 1:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11671
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11489
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11728
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11748
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 11535
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11621
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11520
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11596
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11338
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11767
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11930
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11292
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11524
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11911
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11616
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11582
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11374
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11279
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11404
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11635
Average time: 11578
```

Average latency: 11578 ms

Client 2:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 6203
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11376
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11182
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 11664
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 11661
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11620
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11220
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11699
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11525
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 11638
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11576
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11650
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11295
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 11760
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11780
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11438
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 11332
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11339
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11497
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11280
Average time: 11236
```

Average latency: 11236 ms

Client 3:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 9204
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11590
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 11484
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11593
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11740
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11725
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 11311
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11510
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11516
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11363
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 11889
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11525
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11603
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 11691
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11747
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11404
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11351
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11502
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11377
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11739
Average time: 11443
```

Average latency: 11443 ms

Client 4:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 3164
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11205
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11655
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 11658
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11649
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11726
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 11619
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 11429
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11605
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11735
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11581
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11844
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11699
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11671
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 11369
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11230
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11317
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11754
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11591
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11504
Average time: 11150
```

Average latency: 11150 ms

### Client 5:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 134
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11711
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11172
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11744
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11568
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 11428
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11314
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11724
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 11314
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11233
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11481
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11545
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 11797
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11572
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11579
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11541
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 11286
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 11475
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 11284
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 11390
Average time: 10914
```

Average latency: 10914 ms

### Conclusion:

#### Regarding Deadlocks:

Deadlocks could be found in the system. There were multiple instances where it occurred. One such scenario was

1. Client 1 received the GRANT from Server 2, Server 4, and Server 6.
2. Client 2 received the GRANT from Server 1, Server 3, and Server 5.
3. Client 4 received the GRANT from Server 7.

In this case, a deadlock can be seen since none of the clients can enter their respective critical sections and hence can't send a release message.

#### Regarding Time Spent Before Entering CS:

Increasing the time it takes before re-entering the critical section reduces the chance of there being deadlocks. This is because the number of concurrent requests reduces when the time before re-entering the critical section is increased. A decrease in the number of concurrent requests leads to a lower chance of deadlocks. The average latency when the time spent in CS decreased when increasing the time spent before entering CS. There was no significant change in the number of messages exchanged in the computation.

Regarding Time Spent in CS:

Increasing the time spent in CS lead to an increase in the chance of there being deadlocks. This is because the number of concurrent requests increases when the time spent in the critical section is increased. An increase in the number of concurrent requests leads to an increased chance of deadlocks. The latency increases when increasing the time spent in CS. There was no significant change in the number of messages exchanged in the computation.