

# **Project 2 - Report**

## **CS6378 - Advanced Operating Systems**

Aravind Menon Kadekuzhi  
axk210275

Introduction:	2
Detailed Analysis:	2
Scenario 1:	2
Stats for the clients:	3
Scenario 2:	5
Stats for the clients:	6
Scenario 3:	8
Stats for Clients:	9
Scenario 4:	11
Stats for the Clients:	12
Conclusion:	14
Regarding Deadlocks:	14
Regarding Time Spent Before Entering CS:	14
Regarding Time Spent in CS:	15

## 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, 0.3), (5, 3), (8, 0.3), and (8, 3).

### Scenario 1:

Time spent in the Critical Section (in seconds): 5

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	95	200
Server 6	100	200
Server 7	100	200
Client 1	280	139
Client 2	280	139
Client 3	280	139
Client 4	280	139

Client 5	280	120
<b>Total</b>	<b>2095</b>	<b>2076</b>

Stats for the clients:

#### Client 1:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 522
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 43
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 21
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 28
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 22
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 18
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 20
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 31
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 20
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 23
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 20
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 18
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 23
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 24
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 23
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 20
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 32
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 21
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 20
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 29
```

Average latency: 48.9 ms

#### Client 2:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 1163
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 89
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 58
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 24
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 21
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 42
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 35
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 : 6. Time elapsed : 24
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 22
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 30
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 36
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 32
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 21
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 21
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 21
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 20
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 24
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 19
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 15
```

Average latency: 87 ms



### Client 5:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 185
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 13
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 20
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 5
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 4
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 18
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 5
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 2
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 14
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 8
```

Average latency: 15.85

### Scenario 2:

Time spent in the Critical Section (in seconds): 8

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

Node	Messages Sent	Messages Received
Server 1	100	200
Server 2	95	200
Server 3	100	200
Server 4	100	200
Server 5	100	200
Server 6	100	200
Server 7	100	200
Client 1	280	139
Client 2	280	139
Client 3	280	139
Client 4	280	139

Client 5	280	121
<b>Total</b>	<b>2095</b>	<b>2077</b>

Stats for the clients:

#### Client 1:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 543
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 39
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 49
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 33
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 26
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 21
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 14
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 20
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 24
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 17
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 24
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 13
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 18
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 18
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 22
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 20
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 33
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 23
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 16
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 24
```

Average latency: 49.85 ms

#### Client 2:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 1524
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 76
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 84
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 21
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 35
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 23
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 32
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 21
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 16
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 19
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 20
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 20
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 15
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 40
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 23
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 21
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 27
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 19
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 16
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 36
```

Average latency: 104.4 ms

### Client 3:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 1190
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 81
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 54
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 20
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 26
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 20
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 32
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 24
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 20
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 22
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 23
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 21
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 22
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 31
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 14
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 20
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 16
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 14
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 34
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 25
```

Average latency: 85.45 ms

### Client 4:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 848
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 54
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 42
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 33
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 26
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 25
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 26
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 20
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 26
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 22
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 24
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 21
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 18
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 20
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 22
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 22
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 22
For attempt number : 18, Messages sent : 14. Messages receiv{dc11:~/pr
{dc11:~/project2} █
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 25
ed to enter CS : 5. Time elapsed : 24
```

Average latency: 67.25 ms

### Client 5:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 164
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 21
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 5
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 6
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 8
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 17
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 7
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 6
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 27
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 9
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 5
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 15
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 6
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 6
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 5
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 10
```

Average latency: 16.65 ms

### Scenario 3:

Time spent in the Critical Section (in seconds): 5

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:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 158
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7123
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7071
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 7073
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 7083
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7065
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 7071
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 7073
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7067
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 7088
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7069
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 7050
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 7052
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 7062
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7095
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 7058
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 7069
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7065
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 7066
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 7082
```

Average latency: 6727 ms

### Scenario 4:

Time spent in the Critical Section (in seconds): 8

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 the Clients:

Client 1:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 6238
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4126
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4071
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 4065
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 4060
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4057
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4075
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4059
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4055
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 4077
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 4076
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 : 6. Time elapsed : 4065
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 4067
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4071
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4056
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4066
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4070
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4072
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4085
```

Average latency: 4183 ms

Client 2:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 12294
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4095
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4068
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4061
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4058
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 4067
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4072
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4059
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4058
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 4082
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4070
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 4055
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 4070
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 4060
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4068
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4060
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 4065
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 4074
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4090
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 4063
```

Average latency: 4479.45 ms



### Client 5:

```
For attempt number : 1, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 176
For attempt number : 2, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 4170
For attempt number : 3, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4072
For attempt number : 4, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 4067
For attempt number : 5, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4061
For attempt number : 6, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4057
For attempt number : 7, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 4080
For attempt number : 8, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4060
For attempt number : 9, Messages sent : 14. Messages received to enter CS : 3. Time elapsed : 4056
For attempt number : 10, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 4067
For attempt number : 11, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4077
For attempt number : 12, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 4067
For attempt number : 13, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 4058
For attempt number : 14, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4069
For attempt number : 15, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 4062
For attempt number : 16, Messages sent : 14. Messages received to enter CS : 4. Time elapsed : 4064
For attempt number : 17, Messages sent : 14. Messages received to enter CS : 5. Time elapsed : 4062
For attempt number : 18, Messages sent : 14. Messages received to enter CS : 6. Time elapsed : 4069
For attempt number : 19, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 4074
For attempt number : 20, Messages sent : 14. Messages received to enter CS : 7. Time elapsed : 4091
```

Average latency: 3877.95 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. But the time for the overall system to complete the computation increases. The average latency when the time spent in CS was set to 3 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 time for the overall system to complete the computation and the latency also increases when increasing the time spent in CS. There was no significant change in the number of messages exchanged in the computation.