CS 6378: Advanced Operating Systems

Programming Assignment 2

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Total Ordering:

Total ordering assures that the messages are received by all processors in the same order and is a technique used to make sure that all delivered messages follow consistency. The main difference between complete ordering and causal ordering is that the former involves message randomization throughout all processors. Delivering messages in the desired order is ensured by total ordering.

To achieve Total Ordering

This is done using the Fixed Sequencer approach. Adding sequence numbers to received messages and broadcasting them to all other processors is the task of one processor in this method.

The steps used to achieve this algorithm are listed below:
Format for **Messages: *Id|SequenceNumber|MessageNumber***;

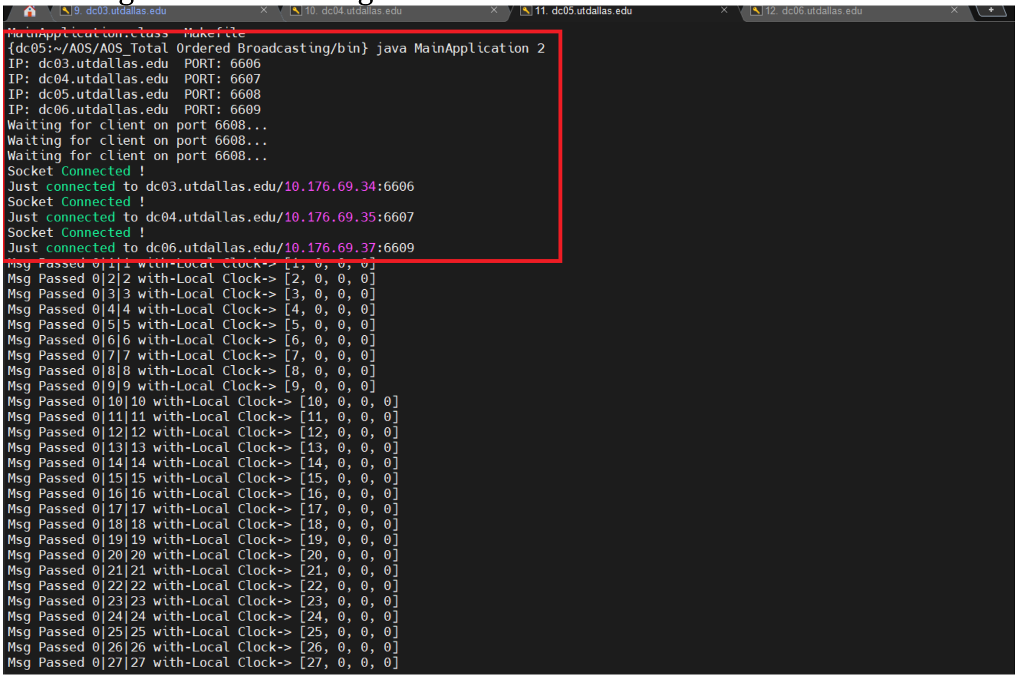
Example 1: *0|0|1* - Processor number 0 is responsible for generating this message. Because the sequencer checks the received message and adds the sequence number, the default sequence number is 0. Further transmit this message to the system's sequencer node, which is 0.

Example 2: *0|0|2* - Transmission of this message to the sequencer node comes from processor 0 with sequence number 0.

Message Broadcasting:
After allocating a sequence number, the sequencer simultaneously notifies all processors of the transmission of a certain sequenced message and broadcasts the message to them all.

For the Verification

As mentioned in Screenshot we can start an application and connect with 3 sockets then it's start broadcasting in Total Ordering.



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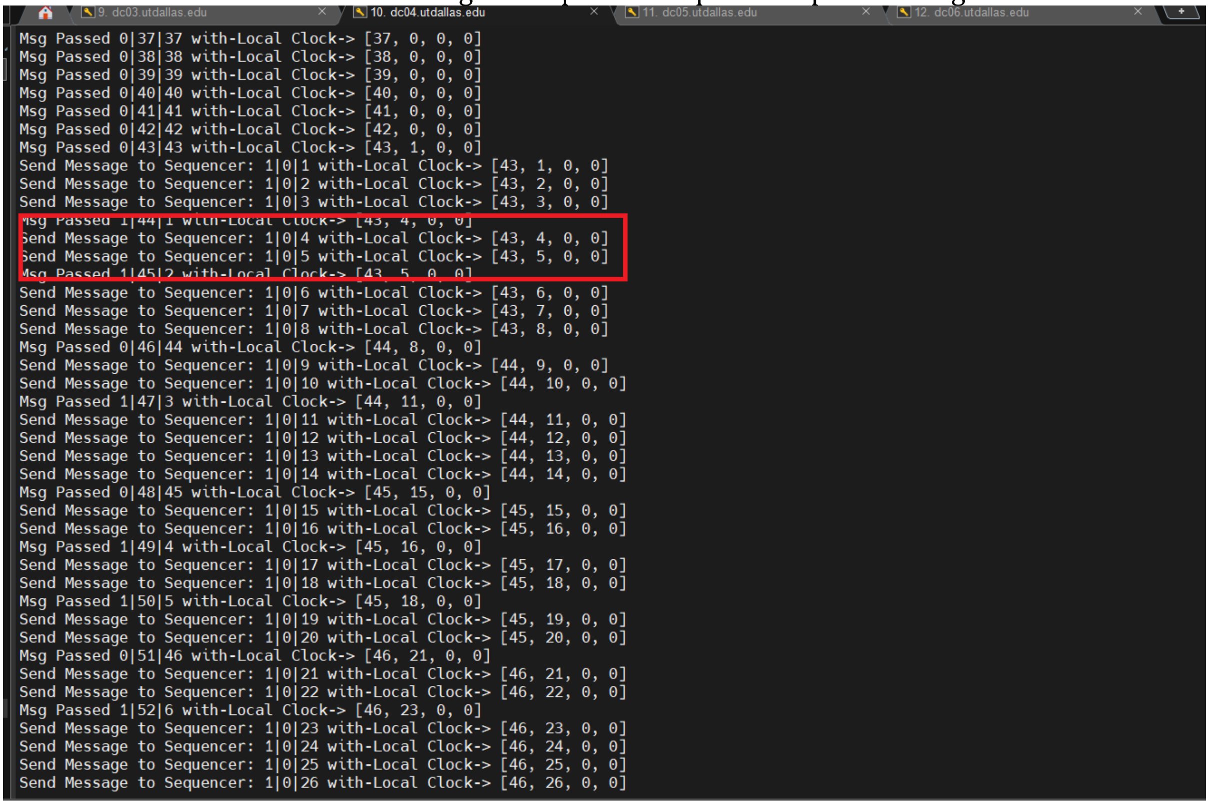
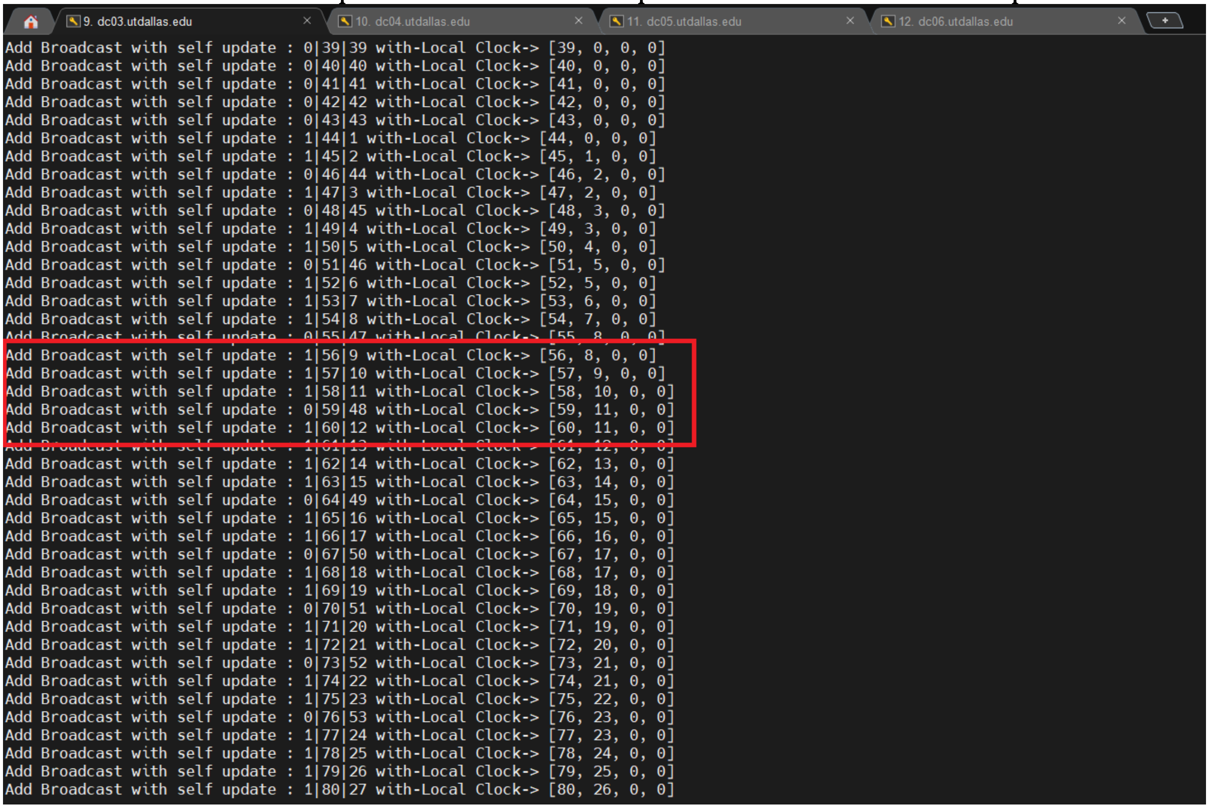
MainApplication.class  Makefile
{dc05:~/AOS/AOS_Total Ordered Broadcasting/bin} java MainApplication 2
IP: dc03.utdallas.edu  PORT: 6606
IP: dc04.utdallas.edu  PORT: 6607
IP: dc05.utdallas.edu  PORT: 6608
IP: dc06.utdallas.edu  PORT: 6609
Waiting for client on port 6608...
Waiting for client on port 6608...
Waiting for client on port 6608...
Socket Connected !
Just connected to dc03.utdallas.edu/10.176.69.34:6606
Socket Connected !
Just connected to dc04.utdallas.edu/10.176.69.35:6607
Socket Connected !
Just connected to dc06.utdallas.edu/10.176.69.37:6609
Msg Passed 0|1|1 with-Local Clock-> [1, 0, 0, 0]
Msg Passed 0|2|2 with-Local Clock-> [2, 0, 0, 0]
Msg Passed 0|3|3 with-Local Clock-> [3, 0, 0, 0]
Msg Passed 0|4|4 with-Local Clock-> [4, 0, 0, 0]
Msg Passed 0|5|5 with-Local Clock-> [5, 0, 0, 0]
Msg Passed 0|6|6 with-Local Clock-> [6, 0, 0, 0]
Msg Passed 0|7|7 with-Local Clock-> [7, 0, 0, 0]
Msg Passed 0|8|8 with-Local Clock-> [8, 0, 0, 0]
Msg Passed 0|9|9 with-Local Clock-> [9, 0, 0, 0]
Msg Passed 0|10|10 with-Local Clock-> [10, 0, 0, 0]
Msg Passed 0|11|11 with-Local Clock-> [11, 0, 0, 0]
Msg Passed 0|12|12 with-Local Clock-> [12, 0, 0, 0]
Msg Passed 0|13|13 with-Local Clock-> [13, 0, 0, 0]
Msg Passed 0|14|14 with-Local Clock-> [14, 0, 0, 0]
Msg Passed 0|15|15 with-Local Clock-> [15, 0, 0, 0]
Msg Passed 0|16|16 with-Local Clock-> [16, 0, 0, 0]
Msg Passed 0|17|17 with-Local Clock-> [17, 0, 0, 0]
Msg Passed 0|18|18 with-Local Clock-> [18, 0, 0, 0]
Msg Passed 0|19|19 with-Local Clock-> [19, 0, 0, 0]
Msg Passed 0|20|20 with-Local Clock-> [20, 0, 0, 0]
Msg Passed 0|21|21 with-Local Clock-> [21, 0, 0, 0]
Msg Passed 0|22|22 with-Local Clock-> [22, 0, 0, 0]
Msg Passed 0|23|23 with-Local Clock-> [23, 0, 0, 0]
Msg Passed 0|24|24 with-Local Clock-> [24, 0, 0, 0]
Msg Passed 0|25|25 with-Local Clock-> [25, 0, 0, 0]
Msg Passed 0|26|26 with-Local Clock-> [26, 0, 0, 0]
Msg Passed 0|27|27 with-Local Clock-> [27, 0, 0, 0]
```

Now the other Node can send the message to sequencer as per examples which given above.



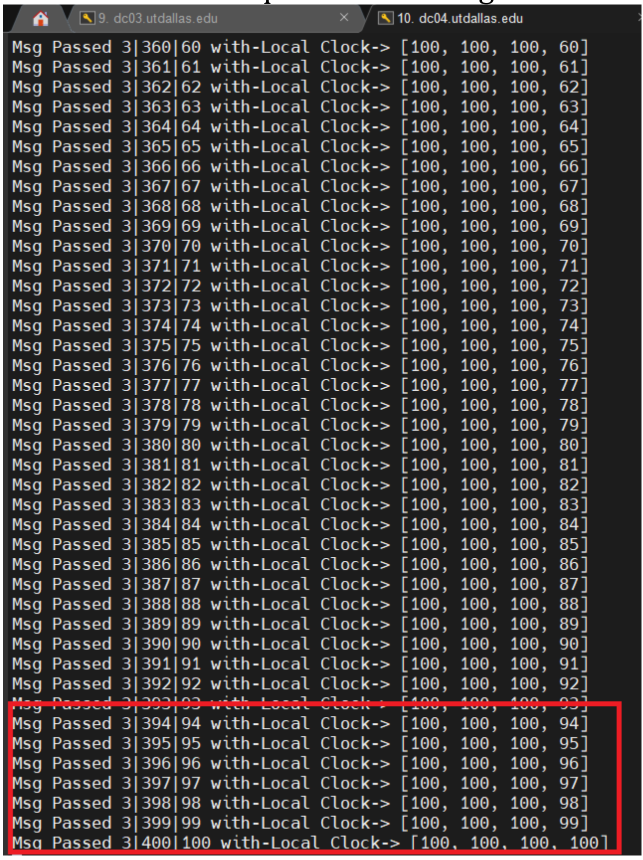
```
Msg Passed 0|37|37 with-Local Clock-> [37, 0, 0, 0]
Msg Passed 0|38|38 with-Local Clock-> [38, 0, 0, 0]
Msg Passed 0|39|39 with-Local Clock-> [39, 0, 0, 0]
Msg Passed 0|40|40 with-Local Clock-> [40, 0, 0, 0]
Msg Passed 0|41|41 with-Local Clock-> [41, 0, 0, 0]
Msg Passed 0|42|42 with-Local Clock-> [42, 0, 0, 0]
Msg Passed 0|43|43 with-Local Clock-> [43, 1, 0, 0]
Send Message to Sequencer: 1|0|1 with-Local Clock-> [43, 1, 0, 0]
Send Message to Sequencer: 1|0|2 with-Local Clock-> [43, 2, 0, 0]
Send Message to Sequencer: 1|0|3 with-Local Clock-> [43, 3, 0, 0]
Msg Passed 1|44|1 with-Local Clock-> [43, 4, 0, 0]
Send Message to Sequencer: 1|0|4 with-Local Clock-> [43, 4, 0, 0]
Send Message to Sequencer: 1|0|5 with-Local Clock-> [43, 5, 0, 0]
Msg Passed 1|45|2 with-Local Clock-> [43, 5, 0, 0]
Send Message to Sequencer: 1|0|6 with-Local Clock-> [43, 6, 0, 0]
Send Message to Sequencer: 1|0|7 with-Local Clock-> [43, 7, 0, 0]
Send Message to Sequencer: 1|0|8 with-Local Clock-> [43, 8, 0, 0]
Msg Passed 0|46|44 with-Local Clock-> [44, 8, 0, 0]
Send Message to Sequencer: 1|0|9 with-Local Clock-> [44, 9, 0, 0]
Send Message to Sequencer: 1|0|10 with-Local Clock-> [44, 10, 0, 0]
Msg Passed 1|47|3 with-Local Clock-> [44, 11, 0, 0]
Send Message to Sequencer: 1|0|11 with-Local Clock-> [44, 11, 0, 0]
Send Message to Sequencer: 1|0|12 with-Local Clock-> [44, 12, 0, 0]
Send Message to Sequencer: 1|0|13 with-Local Clock-> [44, 13, 0, 0]
Send Message to Sequencer: 1|0|14 with-Local Clock-> [44, 14, 0, 0]
Msg Passed 0|48|45 with-Local Clock-> [45, 15, 0, 0]
Send Message to Sequencer: 1|0|15 with-Local Clock-> [45, 15, 0, 0]
Send Message to Sequencer: 1|0|16 with-Local Clock-> [45, 16, 0, 0]
Msg Passed 1|49|4 with-Local Clock-> [45, 16, 0, 0]
Send Message to Sequencer: 1|0|17 with-Local Clock-> [45, 17, 0, 0]
Send Message to Sequencer: 1|0|18 with-Local Clock-> [45, 18, 0, 0]
Msg Passed 1|50|5 with-Local Clock-> [45, 18, 0, 0]
Send Message to Sequencer: 1|0|19 with-Local Clock-> [45, 19, 0, 0]
Send Message to Sequencer: 1|0|20 with-Local Clock-> [45, 20, 0, 0]
Msg Passed 0|51|46 with-Local Clock-> [46, 21, 0, 0]
Send Message to Sequencer: 1|0|21 with-Local Clock-> [46, 21, 0, 0]
Send Message to Sequencer: 1|0|22 with-Local Clock-> [46, 22, 0, 0]
Msg Passed 1|52|6 with-Local Clock-> [46, 23, 0, 0]
Send Message to Sequencer: 1|0|23 with-Local Clock-> [46, 23, 0, 0]
Send Message to Sequencer: 1|0|24 with-Local Clock-> [46, 24, 0, 0]
Send Message to Sequencer: 1|0|25 with-Local Clock-> [46, 25, 0, 0]
Send Message to Sequencer: 1|0|26 with-Local Clock-> [46, 26, 0, 0]
```

Here ***dc03.utdallas.edu*** is sequencer. It will add sequence and broadcast and update self.

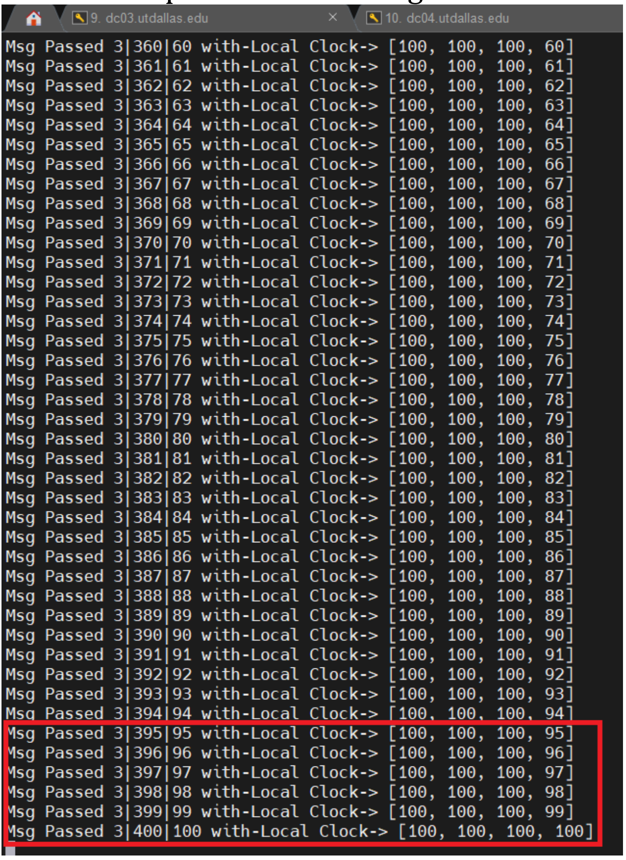


```
Add Broadcast with self update : 0|39|39 with-Local Clock-> [39, 0, 0, 0]
Add Broadcast with self update : 0|40|40 with-Local Clock-> [40, 0, 0, 0]
Add Broadcast with self update : 0|41|41 with-Local Clock-> [41, 0, 0, 0]
Add Broadcast with self update : 0|42|42 with-Local Clock-> [42, 0, 0, 0]
Add Broadcast with self update : 0|43|43 with-Local Clock-> [43, 0, 0, 0]
Add Broadcast with self update : 1|44|1 with-Local Clock-> [44, 0, 0, 0]
Add Broadcast with self update : 1|45|2 with-Local Clock-> [45, 1, 0, 0]
Add Broadcast with self update : 0|46|44 with-Local Clock-> [46, 2, 0, 0]
Add Broadcast with self update : 1|47|3 with-Local Clock-> [47, 2, 0, 0]
Add Broadcast with self update : 0|48|45 with-Local Clock-> [48, 3, 0, 0]
Add Broadcast with self update : 1|49|4 with-Local Clock-> [49, 3, 0, 0]
Add Broadcast with self update : 1|50|5 with-Local Clock-> [50, 4, 0, 0]
Add Broadcast with self update : 0|51|46 with-Local Clock-> [51, 5, 0, 0]
Add Broadcast with self update : 1|52|6 with-Local Clock-> [52, 5, 0, 0]
Add Broadcast with self update : 1|53|7 with-Local Clock-> [53, 6, 0, 0]
Add Broadcast with self update : 1|54|8 with-Local Clock-> [54, 7, 0, 0]
Add Broadcast with self update : 0|55|47 with-Local Clock-> [55, 8, 0, 0]
Add Broadcast with self update : 1|56|9 with-Local Clock-> [56, 8, 0, 0]
Add Broadcast with self update : 1|57|10 with-Local Clock-> [57, 9, 0, 0]
Add Broadcast with self update : 1|58|11 with-Local Clock-> [58, 10, 0, 0]
Add Broadcast with self update : 0|59|48 with-Local Clock-> [59, 11, 0, 0]
Add Broadcast with self update : 1|60|12 with-Local Clock-> [60, 11, 0, 0]
Add Broadcast with self update : 1|61|13 with-Local Clock-> [61, 12, 0, 0]
Add Broadcast with self update : 1|62|14 with-Local Clock-> [62, 13, 0, 0]
Add Broadcast with self update : 1|63|15 with-Local Clock-> [63, 14, 0, 0]
Add Broadcast with self update : 0|64|49 with-Local Clock-> [64, 15, 0, 0]
Add Broadcast with self update : 1|65|16 with-Local Clock-> [65, 15, 0, 0]
Add Broadcast with self update : 1|66|17 with-Local Clock-> [66, 16, 0, 0]
Add Broadcast with self update : 0|67|50 with-Local Clock-> [67, 17, 0, 0]
Add Broadcast with self update : 1|68|18 with-Local Clock-> [68, 17, 0, 0]
Add Broadcast with self update : 1|69|19 with-Local Clock-> [69, 18, 0, 0]
Add Broadcast with self update : 0|70|51 with-Local Clock-> [70, 19, 0, 0]
Add Broadcast with self update : 1|71|20 with-Local Clock-> [71, 19, 0, 0]
Add Broadcast with self update : 1|72|21 with-Local Clock-> [72, 20, 0, 0]
Add Broadcast with self update : 0|73|52 with-Local Clock-> [73, 21, 0, 0]
Add Broadcast with self update : 1|74|22 with-Local Clock-> [74, 21, 0, 0]
Add Broadcast with self update : 1|75|23 with-Local Clock-> [75, 22, 0, 0]
Add Broadcast with self update : 0|76|53 with-Local Clock-> [76, 23, 0, 0]
Add Broadcast with self update : 1|77|24 with-Local Clock-> [77, 23, 0, 0]
Add Broadcast with self update : 1|78|25 with-Local Clock-> [78, 24, 0, 0]
Add Broadcast with self update : 1|79|26 with-Local Clock-> [79, 25, 0, 0]
Add Broadcast with self update : 1|80|27 with-Local Clock-> [80, 26, 0, 0]
```

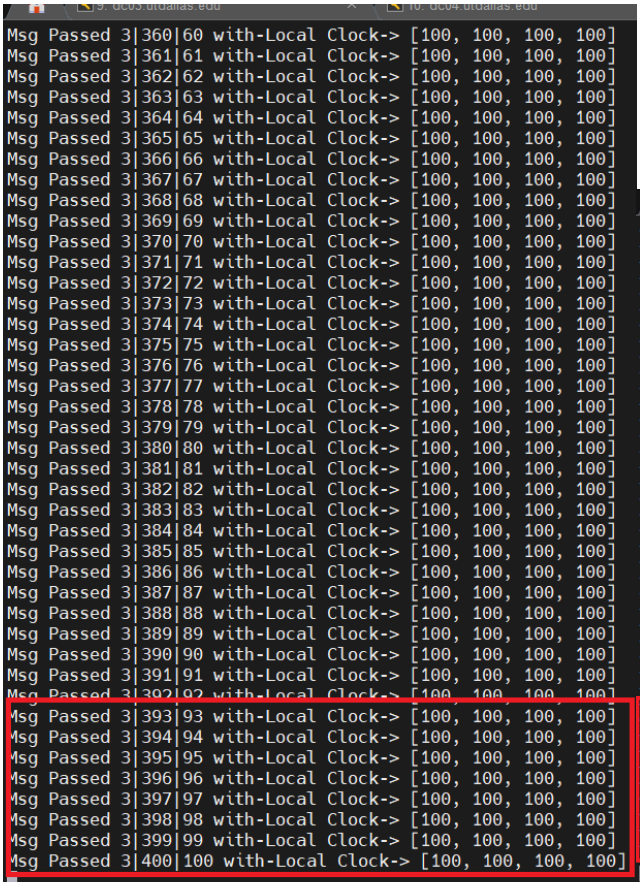
We can check the sequence of messages it is same and its stop after 400 messages.



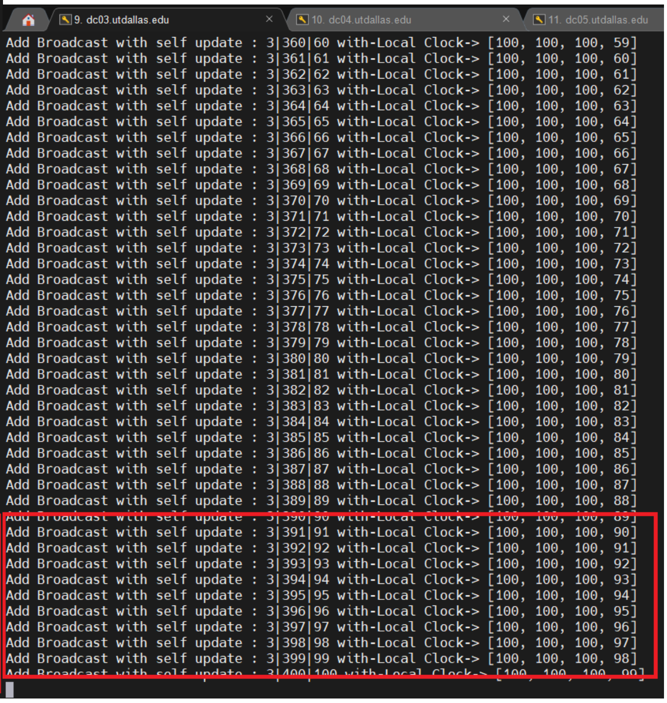
```
Msg Passed 3|360|60 with-Local Clock-> [100, 100, 100, 60]
Msg Passed 3|361|61 with-Local Clock-> [100, 100, 100, 61]
Msg Passed 3|362|62 with-Local Clock-> [100, 100, 100, 62]
Msg Passed 3|363|63 with-Local Clock-> [100, 100, 100, 63]
Msg Passed 3|364|64 with-Local Clock-> [100, 100, 100, 64]
Msg Passed 3|365|65 with-Local Clock-> [100, 100, 100, 65]
Msg Passed 3|366|66 with-Local Clock-> [100, 100, 100, 66]
Msg Passed 3|367|67 with-Local Clock-> [100, 100, 100, 67]
Msg Passed 3|368|68 with-Local Clock-> [100, 100, 100, 68]
Msg Passed 3|369|69 with-Local Clock-> [100, 100, 100, 69]
Msg Passed 3|370|70 with-Local Clock-> [100, 100, 100, 70]
Msg Passed 3|371|71 with-Local Clock-> [100, 100, 100, 71]
Msg Passed 3|372|72 with-Local Clock-> [100, 100, 100, 72]
Msg Passed 3|373|73 with-Local Clock-> [100, 100, 100, 73]
Msg Passed 3|374|74 with-Local Clock-> [100, 100, 100, 74]
Msg Passed 3|375|75 with-Local Clock-> [100, 100, 100, 75]
Msg Passed 3|376|76 with-Local Clock-> [100, 100, 100, 76]
Msg Passed 3|377|77 with-Local Clock-> [100, 100, 100, 77]
Msg Passed 3|378|78 with-Local Clock-> [100, 100, 100, 78]
Msg Passed 3|379|79 with-Local Clock-> [100, 100, 100, 79]
Msg Passed 3|380|80 with-Local Clock-> [100, 100, 100, 80]
Msg Passed 3|381|81 with-Local Clock-> [100, 100, 100, 81]
Msg Passed 3|382|82 with-Local Clock-> [100, 100, 100, 82]
Msg Passed 3|383|83 with-Local Clock-> [100, 100, 100, 83]
Msg Passed 3|384|84 with-Local Clock-> [100, 100, 100, 84]
Msg Passed 3|385|85 with-Local Clock-> [100, 100, 100, 85]
Msg Passed 3|386|86 with-Local Clock-> [100, 100, 100, 86]
Msg Passed 3|387|87 with-Local Clock-> [100, 100, 100, 87]
Msg Passed 3|388|88 with-Local Clock-> [100, 100, 100, 88]
Msg Passed 3|389|89 with-Local Clock-> [100, 100, 100, 89]
Msg Passed 3|390|90 with-Local Clock-> [100, 100, 100, 90]
Msg Passed 3|391|91 with-Local Clock-> [100, 100, 100, 91]
Msg Passed 3|392|92 with-Local Clock-> [100, 100, 100, 92]
Msg Passed 3|393|93 with-Local Clock-> [100, 100, 100, 93]
Msg Passed 3|394|94 with-Local Clock-> [100, 100, 100, 94]
Msg Passed 3|395|95 with-Local Clock-> [100, 100, 100, 95]
Msg Passed 3|396|96 with-Local Clock-> [100, 100, 100, 96]
Msg Passed 3|397|97 with-Local Clock-> [100, 100, 100, 97]
Msg Passed 3|398|98 with-Local Clock-> [100, 100, 100, 98]
Msg Passed 3|399|99 with-Local Clock-> [100, 100, 100, 99]
Msg Passed 3|400|100 with-Local Clock-> [100, 100, 100, 100]
```



```
Msg Passed 3|360|60 with-Local Clock-> [100, 100, 100, 60]
Msg Passed 3|361|61 with-Local Clock-> [100, 100, 100, 61]
Msg Passed 3|362|62 with-Local Clock-> [100, 100, 100, 62]
Msg Passed 3|363|63 with-Local Clock-> [100, 100, 100, 63]
Msg Passed 3|364|64 with-Local Clock-> [100, 100, 100, 64]
Msg Passed 3|365|65 with-Local Clock-> [100, 100, 100, 65]
Msg Passed 3|366|66 with-Local Clock-> [100, 100, 100, 66]
Msg Passed 3|367|67 with-Local Clock-> [100, 100, 100, 67]
Msg Passed 3|368|68 with-Local Clock-> [100, 100, 100, 68]
Msg Passed 3|369|69 with-Local Clock-> [100, 100, 100, 69]
Msg Passed 3|370|70 with-Local Clock-> [100, 100, 100, 70]
Msg Passed 3|371|71 with-Local Clock-> [100, 100, 100, 71]
Msg Passed 3|372|72 with-Local Clock-> [100, 100, 100, 72]
Msg Passed 3|373|73 with-Local Clock-> [100, 100, 100, 73]
Msg Passed 3|374|74 with-Local Clock-> [100, 100, 100, 74]
Msg Passed 3|375|75 with-Local Clock-> [100, 100, 100, 75]
Msg Passed 3|376|76 with-Local Clock-> [100, 100, 100, 76]
Msg Passed 3|377|77 with-Local Clock-> [100, 100, 100, 77]
Msg Passed 3|378|78 with-Local Clock-> [100, 100, 100, 78]
Msg Passed 3|379|79 with-Local Clock-> [100, 100, 100, 79]
Msg Passed 3|380|80 with-Local Clock-> [100, 100, 100, 80]
Msg Passed 3|381|81 with-Local Clock-> [100, 100, 100, 81]
Msg Passed 3|382|82 with-Local Clock-> [100, 100, 100, 82]
Msg Passed 3|383|83 with-Local Clock-> [100, 100, 100, 83]
Msg Passed 3|384|84 with-Local Clock-> [100, 100, 100, 84]
Msg Passed 3|385|85 with-Local Clock-> [100, 100, 100, 85]
Msg Passed 3|386|86 with-Local Clock-> [100, 100, 100, 86]
Msg Passed 3|387|87 with-Local Clock-> [100, 100, 100, 87]
Msg Passed 3|388|88 with-Local Clock-> [100, 100, 100, 88]
Msg Passed 3|389|89 with-Local Clock-> [100, 100, 100, 89]
Msg Passed 3|390|90 with-Local Clock-> [100, 100, 100, 90]
Msg Passed 3|391|91 with-Local Clock-> [100, 100, 100, 91]
Msg Passed 3|392|92 with-Local Clock-> [100, 100, 100, 92]
Msg Passed 3|393|93 with-Local Clock-> [100, 100, 100, 93]
Msg Passed 3|394|94 with-Local Clock-> [100, 100, 100, 94]
Msg Passed 3|395|95 with-Local Clock-> [100, 100, 100, 95]
Msg Passed 3|396|96 with-Local Clock-> [100, 100, 100, 96]
Msg Passed 3|397|97 with-Local Clock-> [100, 100, 100, 97]
Msg Passed 3|398|98 with-Local Clock-> [100, 100, 100, 98]
Msg Passed 3|399|99 with-Local Clock-> [100, 100, 100, 99]
Msg Passed 3|400|100 with-Local Clock-> [100, 100, 100, 100]
```



```
Msg Passed 3|360|60 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|361|61 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|362|62 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|363|63 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|364|64 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|365|65 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|366|66 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|367|67 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|368|68 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|369|69 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|370|70 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|371|71 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|372|72 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|373|73 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|374|74 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|375|75 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|376|76 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|377|77 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|378|78 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|379|79 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|380|80 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|381|81 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|382|82 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|383|83 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|384|84 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|385|85 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|386|86 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|387|87 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|388|88 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|389|89 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|390|90 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|391|91 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|392|92 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|393|93 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|394|94 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|395|95 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|396|96 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|397|97 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|398|98 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|399|99 with-Local Clock-> [100, 100, 100, 100]
Msg Passed 3|400|100 with-Local Clock-> [100, 100, 100, 100]
```



```
Add Broadcast with self update : 3|360|60 with-Local Clock-> [100, 100, 100, 59]
Add Broadcast with self update : 3|361|61 with-Local Clock-> [100, 100, 100, 60]
Add Broadcast with self update : 3|362|62 with-Local Clock-> [100, 100, 100, 61]
Add Broadcast with self update : 3|363|63 with-Local Clock-> [100, 100, 100, 62]
Add Broadcast with self update : 3|364|64 with-Local Clock-> [100, 100, 100, 63]
Add Broadcast with self update : 3|365|65 with-Local Clock-> [100, 100, 100, 64]
Add Broadcast with self update : 3|366|66 with-Local Clock-> [100, 100, 100, 65]
Add Broadcast with self update : 3|367|67 with-Local Clock-> [100, 100, 100, 66]
Add Broadcast with self update : 3|368|68 with-Local Clock-> [100, 100, 100, 67]
Add Broadcast with self update : 3|369|69 with-Local Clock-> [100, 100, 100, 68]
Add Broadcast with self update : 3|370|70 with-Local Clock-> [100, 100, 100, 69]
Add Broadcast with self update : 3|371|71 with-Local Clock-> [100, 100, 100, 70]
Add Broadcast with self update : 3|372|72 with-Local Clock-> [100, 100, 100, 71]
Add Broadcast with self update : 3|373|73 with-Local Clock-> [100, 100, 100, 72]
Add Broadcast with self update : 3|374|74 with-Local Clock-> [100, 100, 100, 73]
Add Broadcast with self update : 3|375|75 with-Local Clock-> [100, 100, 100, 74]
Add Broadcast with self update : 3|376|76 with-Local Clock-> [100, 100, 100, 75]
Add Broadcast with self update : 3|377|77 with-Local Clock-> [100, 100, 100, 76]
Add Broadcast with self update : 3|378|78 with-Local Clock-> [100, 100, 100, 77]
Add Broadcast with self update : 3|379|79 with-Local Clock-> [100, 100, 100, 78]
Add Broadcast with self update : 3|380|80 with-Local Clock-> [100, 100, 100, 79]
Add Broadcast with self update : 3|381|81 with-Local Clock-> [100, 100, 100, 80]
Add Broadcast with self update : 3|382|82 with-Local Clock-> [100, 100, 100, 81]
Add Broadcast with self update : 3|383|83 with-Local Clock-> [100, 100, 100, 82]
Add Broadcast with self update : 3|384|84 with-Local Clock-> [100, 100, 100, 83]
Add Broadcast with self update : 3|385|85 with-Local Clock-> [100, 100, 100, 84]
Add Broadcast with self update : 3|386|86 with-Local Clock-> [100, 100, 100, 85]
Add Broadcast with self update : 3|387|87 with-Local Clock-> [100, 100, 100, 86]
Add Broadcast with self update : 3|388|88 with-Local Clock-> [100, 100, 100, 87]
Add Broadcast with self update : 3|389|89 with-Local Clock-> [100, 100, 100, 88]
Add Broadcast with self update : 3|390|90 with-Local Clock-> [100, 100, 100, 89]
Add Broadcast with self update : 3|391|91 with-Local Clock-> [100, 100, 100, 90]
Add Broadcast with self update : 3|392|92 with-Local Clock-> [100, 100, 100, 91]
Add Broadcast with self update : 3|393|93 with-Local Clock-> [100, 100, 100, 92]
Add Broadcast with self update : 3|394|94 with-Local Clock-> [100, 100, 100, 93]
Add Broadcast with self update : 3|395|95 with-Local Clock-> [100, 100, 100, 94]
Add Broadcast with self update : 3|396|96 with-Local Clock-> [100, 100, 100, 95]
Add Broadcast with self update : 3|397|97 with-Local Clock-> [100, 100, 100, 96]
Add Broadcast with self update : 3|398|98 with-Local Clock-> [100, 100, 100, 97]
Add Broadcast with self update : 3|399|99 with-Local Clock-> [100, 100, 100, 98]
Add Broadcast with self update : 3|400|100 with-Local Clock-> [100, 100, 100, 99]
```

Reference:

1. Lamport, Leslie. “Time, clocks, and the ordering of events in a distributed system.” Commun. ACM 21 (1978): 558-565.

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