

# Assignment 3

## Automated Tests Evidence

### testWithImmediateResponses

*ElectionManager output:*

```
testoutputs > election_1.txt
1  Acceptor M2 connected to server
2  Acceptor M8 connected to server
3  Acceptor M4 connected to server
4  Acceptor M1 connected to server
5  Acceptor M6 connected to server
6  Acceptor M5 connected to server
7  Acceptor M9 connected to server
8  Acceptor M3 connected to server
9  Acceptor M7 connected to server
10 PREPARE RESPONSE (M3, proposal 3): M1 responds OK
11 PREPARE RESPONSE (M3, proposal 3): M8 responds OK
12 PREPARE RESPONSE (M3, proposal 3): M7 responds OK
13 PREPARE RESPONSE (M1, proposal 1): M1 responds REJECTED
14 PREPARE RESPONSE (M3, proposal 3): M2 responds OK
15 PREPARE RESPONSE (M1, proposal 1): M8 responds REJECTED
16 PREPARE RESPONSE (M3, proposal 3): M6 responds OK
17 PREPARE RESPONSE (M1, proposal 1): M7 responds REJECTED
18 PREPARE RESPONSE (M2, proposal 2): M1 responds REJECTED
19 PREPARE RESPONSE (M1, proposal 1): M2 responds REJECTED
20 PREPARE RESPONSE (M2, proposal 2): M7 responds REJECTED
21 PREPARE RESPONSE (M2, proposal 2): M8 responds REJECTED
22 PREPARE RESPONSE (M2, proposal 2): M2 responds REJECTED
23 PREPARE RESPONSE (M3, proposal 3): M9 responds OK
24 PREPARE RESPONSE (M1, proposal 1): M6 responds REJECTED
25 PREPARE RESPONSE (M1, proposal 1): M9 responds REJECTED
26 PREPARE RESPONSE (M2, proposal 2): M6 responds REJECTED
27 PREPARE RESPONSE (M2, proposal 2): M9 responds REJECTED
28 M3's proposal got prepare majority for value 3
29 ACCEPT RESPONSE (M3, proposal 3, value 3): M6 responds OK
30 ACCEPT RESPONSE (M3, proposal 3, value 3): M3 responds OK
31 ACCEPT RESPONSE (M3, proposal 3, value 3): M7 responds OK
32 ACCEPT RESPONSE (M3, proposal 3, value 3): M4 responds OK
33 ACCEPT RESPONSE (M3, proposal 3, value 3): M5 responds OK
34 ACCEPT RESPONSE (M3, proposal 3, value 3): M2 responds OK
35 ACCEPT RESPONSE (M3, proposal 3, value 3): M1 responds OK
36 ACCEPT RESPONSE (M3, proposal 3, value 3): M8 responds OK
37 ACCEPT RESPONSE (M3, proposal 3, value 3): M9 responds OK
38 M1's proposal did not get accept majority, trying again.
39 PREPARE RESPONSE (M1, proposal 4): M1 responds OK, with previously accepted proposal 3, value 3
40 PREPARE RESPONSE (M1, proposal 4): M3 responds OK, with previously accepted proposal 3, value 3
41 PREPARE RESPONSE (M1, proposal 4): M4 responds OK, with previously accepted proposal 3, value 3
42 PREPARE RESPONSE (M1, proposal 4): M5 responds OK, with previously accepted proposal 3, value 3
43 PREPARE RESPONSE (M1, proposal 4): M6 responds OK, with previously accepted proposal 3, value 3
44 PREPARE RESPONSE (M1, proposal 4): M7 responds OK, with previously accepted proposal 3, value 3
45 PREPARE RESPONSE (M1, proposal 4): M8 responds OK, with previously accepted proposal 3, value 3
46 PREPARE RESPONSE (M1, proposal 4): M2 responds OK, with previously accepted proposal 3, value 3
47 PREPARE RESPONSE (M1, proposal 4): M9 responds OK, with previously accepted proposal 3, value 3
48 M2's proposal did not get accept majority, trying again.
49 PREPARE RESPONSE (M2, proposal 5): M1 responds OK, with previously accepted proposal 3, value 3
50 PREPARE RESPONSE (M2, proposal 5): M2 responds OK, with previously accepted proposal 3, value 3
51 PREPARE RESPONSE (M2, proposal 5): M3 responds OK, with previously accepted proposal 3, value 3
52 PREPARE RESPONSE (M2, proposal 5): M5 responds OK, with previously accepted proposal 3, value 3
53 PREPARE RESPONSE (M2, proposal 5): M6 responds OK, with previously accepted proposal 3, value 3
54 PREPARE RESPONSE (M2, proposal 5): M4 responds OK, with previously accepted proposal 3, value 3
55 PREPARE RESPONSE (M2, proposal 5): M8 responds OK, with previously accepted proposal 3, value 3
56 PREPARE RESPONSE (M2, proposal 5): M7 responds OK, with previously accepted proposal 3, value 3
57 PREPARE RESPONSE (M2, proposal 5): M9 responds OK, with previously accepted proposal 3, value 3
```

```
PREPARE RESPONSE (M2, proposal 5): M9 responds OK, with previously accepted proposal 3, value 3
M2's proposal did not get accept majority, trying again.
M3's proposal got accept majority for value 3
Member ID 3 succeeded on proposal with value 3
```

Finishing election and cleaning up threads

```
PREPARE RESPONSE (M2, proposal 8): M2 responds OK, with previously accepted proposal 3, value 3
PREPARE RESPONSE (M2, proposal 8): M5 responds OK, with previously accepted proposal 3, value 3
PREPARE RESPONSE (M2, proposal 8): M6 responds OK, with previously accepted proposal 3, value 3
PREPARE RESPONSE (M2, proposal 8): M7 responds OK, with previously accepted proposal 3, value 3
PREPARE RESPONSE (M2, proposal 8): M8 responds OK, with previously accepted proposal 3, value 3
PREPARE RESPONSE (M2, proposal 8): M9 responds OK, with previously accepted proposal 3, value 3
```

Acceptor M1 closing socket

```
PREPARE RESPONSE (M2, proposal 8): M4 responds OK, with previously accepted proposal 3, value 3
```

```
PREPARE RESPONSE (M2, proposal 8): M3 responds OK, with previously accepted proposal 3, value 3
```

```
PREPARE RESPONSE (M2, proposal 8): M1 responds OK, with previously accepted proposal 3, value 3
```

Acceptor M2 closing socket

Acceptor M3 closing socket

Acceptor M4 closing socket

Acceptor M5 closing socket

Acceptor M6 closing socket

Acceptor M7 closing socket

Acceptor M8 closing socket

Acceptor M9 closing socket

Thread member1 joined

Thread member2 joined

Thread member3 joined

Thread member4 joined

Thread member5 joined

Thread member6 joined

Thread member7 joined

Thread member8 joined

Thread member9 joined

Member 3 won the election!

You can now exit the Paxos server.

### *PaxosServer output:*

```
testoutputs > ≡ server_1.txt
1 Paxos server started on port 4567
2
3 PREPARE REQUEST: Member M3, proposal 3
4
5
6 PREPARE REQUEST: Member M2, proposal 2
7
8
9 PREPARE REQUEST: Member M1, proposal 1
10
11 Member M3 response count: 1
12 Member M3 response count: 2
13 Member M3 response count: 3
14 Member M3 response count: 4
15 Member M3 response count: 5
16 Member 3 received responses from majority of acceptors
17
18 PREPARE REQUEST: Member M3, proposal 3, value 3
19
20 Member M1 response count: 1
21 Member M2 response count: 1
22 Member M1 response count: 2
23 Member M2 response count: 2
24 Member M3 response count: 1
25 Member M1 response count: 3
26 Member M1 response count: 4
27 Member M2 response count: 3
28 Member M1 response count: 5
29 Member 1 received responses from majority of acceptors
30 Member M2 response count: 4
31 Member M3 response count: 2
32 Member M3 response count: 3
33
34 PREPARE REQUEST: Member M1, proposal 4
35
36 Member M2 response count: 5
```

```
Member M2 response count: 5
Member 2 received responses from majority of acceptors
Member M3 response count: 4
Member M3 response count: 5
Member M3 response count: 6

PREPARE REQUEST: Member M2, proposal 5

Member M3 response count: 7
Member M3 response count: 8
Member 2 received responses from majority of acceptors
Member 3 received responses from majority of acceptors

PREPARE REQUEST: Member M2, proposal 8

Member M2 response count: 1
Member M2 response count: 2
Member M2 response count: 3
Member M2 response count: 4
Member M2 response count: 5
Member 2 received responses from majority of acceptors
Member 1 received responses from majority of acceptors

Server has been informed that the current election is finished.
Clearing connected sockets and response counts.
Messages that appear below this line as threads resolve may be ignored.
```

## testWithDelayedAndAbsentResponses

*ElectionManager output:*

```
testoutputs > election_2.txt
1 | Acceptor M8 connected to server
2 | Acceptor M4 connected to server
3 | Acceptor M7 connected to server
4 | Acceptor M9 connected to server
5 | Acceptor M1 connected to server
6 | Acceptor M6 connected to server
7 | Acceptor M5 connected to server
8 | Acceptor M3 connected to server
9 | Acceptor M2 connected to server
10 | PREPARE RESPONSE (M2, proposal 2): M2 does not respond
11 | PREPARE RESPONSE (M2, proposal 2): M7 does not respond
12 | PREPARE RESPONSE (M2, proposal 2): M8 responds OK
13 | PREPARE RESPONSE (M2, proposal 2): M4 responds OK
14 | PREPARE RESPONSE (M2, proposal 2): M9 responds OK
15 | PREPARE RESPONSE (M2, proposal 2): M3 responds OK
16 | PREPARE RESPONSE (M2, proposal 2): M1 responds OK
17 | PREPARE RESPONSE (M2, proposal 2): M5 responds OK
18 | PREPARE RESPONSE (M2, proposal 2): M6 responds OK
19 | PREPARE RESPONSE (M1, proposal 1): M9 responds REJECTED
20 | PREPARE RESPONSE (M1, proposal 1): M3 responds REJECTED
21 | PREPARE RESPONSE (M1, proposal 1): M6 does not respond
22 | PREPARE RESPONSE (M1, proposal 1): M8 does not respond
23 | PREPARE RESPONSE (M1, proposal 1): M5 responds REJECTED
24 | PREPARE RESPONSE (M1, proposal 1): M1 responds REJECTED
25 | PREPARE RESPONSE (M1, proposal 1): M7 responds OK
26 | PREPARE RESPONSE (M3, proposal 3): M6 responds OK
27 | PREPARE RESPONSE (M3, proposal 3): M1 responds OK
28 | PREPARE RESPONSE (M3, proposal 3): M7 responds OK
29 | PREPARE RESPONSE (M3, proposal 3): M3 responds OK
30 | PREPARE RESPONSE (M1, proposal 1): M4 responds REJECTED
31 | PREPARE RESPONSE (M3, proposal 3): M9 responds OK
32 | PREPARE RESPONSE (M3, proposal 3): M8 does not respond
33 | PREPARE RESPONSE (M3, proposal 3): M5 responds OK
34 | PREPARE RESPONSE (M3, proposal 3): M4 does not respond
35 | M2's proposal got prepare majority for value 2
36 | ACCEPT RESPONSE (M2, proposal 2, value 2): M1 responds REJECTED
37 | ACCEPT RESPONSE (M2, proposal 2, value 2): M3 responds REJECTED
38 | ACCEPT RESPONSE (M2, proposal 2, value 2): M4 responds OK
39 | ACCEPT RESPONSE (M2, proposal 2, value 2): M5 responds REJECTED
40 | ACCEPT RESPONSE (M2, proposal 2, value 2): M6 responds REJECTED
41 | M1's proposal did not get accept majority, trying again.
42 | ACCEPT RESPONSE (M2, proposal 2, value 2): M7 responds REJECTED
43 | ACCEPT RESPONSE (M2, proposal 2, value 2): M9 responds REJECTED
44 | M3's proposal got prepare majority for value 3
45 | ACCEPT RESPONSE (M3, proposal 3, value 3): M1 responds OK
46 | ACCEPT RESPONSE (M3, proposal 3, value 3): M3 responds OK
47 | ACCEPT RESPONSE (M3, proposal 3, value 3): M5 responds OK
48 | ACCEPT RESPONSE (M3, proposal 3, value 3): M6 responds OK
49 | ACCEPT RESPONSE (M3, proposal 3, value 3): M7 responds OK
50 | ACCEPT RESPONSE (M3, proposal 3, value 3): M4 responds OK
51 | ACCEPT RESPONSE (M3, proposal 3, value 3): M9 responds OK
52 | PREPARE RESPONSE (M1, proposal 4): M1 responds OK, with previously accepted proposal 3, value 3
53 | PREPARE RESPONSE (M1, proposal 4): M3 does not respond
54 | PREPARE RESPONSE (M1, proposal 4): M4 does not respond
55 | PREPARE RESPONSE (M1, proposal 4): M5 responds OK, with previously accepted proposal 3, value 3
56 | PREPARE RESPONSE (M1, proposal 4): M6 responds OK, with previously accepted proposal 3, value 3
```

```
56 PREPARE RESPONSE (M1, proposal 4): M6 responds OK, with previously accepted proposal 3, value 3
57 PREPARE RESPONSE (M1, proposal 4): M7 does not respond
58 PREPARE RESPONSE (M1, proposal 4): M9 does not respond
59 M2's proposal did not get accept majority, trying again.
60 M3's proposal got accept majority for value 3
61 Member ID 3 succeeded on proposal with value 3
62
63 Finishing election and cleaning up threads
64
65 PREPARE RESPONSE (M2, proposal 5): M1 responds OK, with previously accepted proposal 3, value 3
66 PREPARE RESPONSE (M2, proposal 5): M3 responds OK, with previously accepted proposal 3, value 3
67 PREPARE RESPONSE (M2, proposal 5): M4 responds OK, with previously accepted proposal 3, value 3
68 PREPARE RESPONSE (M2, proposal 5): M5 responds OK, with previously accepted proposal 3, value 3
69 PREPARE RESPONSE (M2, proposal 5): M6 responds OK, with previously accepted proposal 3, value 3
70 PREPARE RESPONSE (M2, proposal 5): M7 responds OK, with previously accepted proposal 3, value 3
71 PREPARE RESPONSE (M2, proposal 5): M9 responds OK, with previously accepted proposal 3, value 3
72 Acceptor M1 closing socket
73 Acceptor M2 closing socket
74 ACCEPT RESPONSE (M2, proposal 2, value 2): M8 responds OK
75 ACCEPT RESPONSE (M3, proposal 3, value 3): M8 responds OK
76 PREPARE RESPONSE (M1, proposal 4): M8 does not respond
77 PREPARE RESPONSE (M2, proposal 5): M8 responds OK, with previously accepted proposal 3, value 3
78 PREPARE RESPONSE (M1, proposal 1): M2 responds OK
79 Acceptor M3 closing socket
80 Acceptor M4 closing socket
81 Acceptor M5 closing socket
82 Acceptor M6 closing socket
83 Acceptor M7 closing socket
84 Acceptor M8 closing socket
85 Acceptor M9 closing socket
86 Thread member1 joined
87 Thread member2 joined
88 Thread member3 joined
89 Thread member4 joined
90 Thread member5 joined
91 Thread member6 joined
92 Thread member7 joined
93 Thread member8 joined
94 Thread member9 joined
95
96 Member 3 won the election!
97 You can now exit the Paxos server.
98
```

PaxosServer output:

```
testoutputs > ≡ server_2.txt
1 Paxos server started on port 4568
2
3 PREPARE REQUEST: Member M2, proposal 2
4
5
6 PREPARE REQUEST: Member M3, proposal 3
7
8
9 PREPARE REQUEST: Member M1, proposal 1
10
11 Member M1 response count: 1
12 Member M2 response count: 1
13 Member M2 response count: 2
14 Member M2 response count: 3
15 Member M2 response count: 4
16 Member M2 response count: 5
17 Member M2 response count: 6
18 Member M2 response count: 7
19 Member M1 response count: 2
20 Member 2 received responses from majority of acceptors
21 Member M3 response count: 1
22
23 PREPARE REQUEST: Member M2, proposal 2, value 2
24
25 Member M1 response count: 3
26 Member M1 response count: 4
27 Member M3 response count: 2
28 Member M3 response count: 3
29 Member M1 response count: 5
30 Member M1 response count: 6
31 Member 1 received responses from majority of acceptors
32 Member M3 response count: 4
33 Member M3 response count: 5
34 Member M2 response count: 1
35 Member 3 received responses from majority of acceptors
36
37 PREPARE REQUEST: Member M3, proposal 3, value 3
38
39 Member M2 response count: 2
40
41 PREPARE REQUEST: Member M1, proposal 4
42
43 Member M2 response count: 3
44 Member M2 response count: 4
45 Member M3 response count: 1
46 Member M2 response count: 5
47 Member M3 response count: 2
48 Member M1 response count: 1
49 Member M3 response count: 3
50 Member M3 response count: 4
51 Member M3 response count: 5
52 Member 2 received responses from majority of acceptors
53 Member 3 received responses from majority of acceptors
54
55 PREPARE REQUEST: Member M2, proposal 5
56
```

PREPARE REQUEST: Member M2, proposal 5

Member M2 response count: 1

Member M1 response count: 2

Member M1 response count: 3

Member M2 response count: 2

Member M2 response count: 3

Member M2 response count: 4

Member M2 response count: 5

Member 2 received responses from majority of acceptors

Server has been informed that the current election is finished.

Clearing connected sockets and response counts.

Messages that appear below this line as threads resolve may be ignored.

Member 1 received responses from majority of acceptors

