Test cases:

Test case 1: only one process (Process 10) is trying to get elected,

Log:

Process 10[8, 7, 9, 1, 2, 4, 5, 6, 3]

10 send to 8

8 receive (0, 10) from 10

Process 8 set 10 as parent and ack

10 receive (0, 10) from 8

10 send to 7

7 receive (1, 10) from 10

Process 7 set 10 as parent and ack

10 receive (1, 10) from 7

10 send to 9

9 receive (2, 10) from 10

Process 9 set 10 as parent and ack

10 receive (2, 10) from 9

10 send to 1

1 receive (3, 10) from 10

Process 1 set 10 as parent and ack

10 receive (3, 10) from 1

10 send to 2

2 receive (4, 10) from 10

Process 2 set 10 as parent and ack

10 receive (4, 10) from 2

10 send to 4

4 receive (5, 10) from 10

Process 4 set 10 as parent and ack

10 receive (5, 10) from 4

10 send to 5

5 receive (6, 10) from 10

Process 5 set 10 as parent and ack

10 receive (6, 10) from 5

10 send to 6

6 receive (7, 10) from 10

Process 6 set 10 as parent and ack

10 receive (7, 10) from 6

10 send to 3

3 receive (8, 10) from 10

Process 3 set 10 as parent and ack

10 receive (8, 10) from 3

Process 10 ELECTED

Result:

Process id	capture msg	kill msg	ack msg	maximum level	captured time
1 to 9	Receive 1	0	Send 1	0	1
10	Send 9	0	Receive 9	9	0

For processes whose id from 1 to 9, the results are the same. For Process 10, it will capture every other node in a random order.

Test case 2: two processes (Process 9, 10) start the election simultaneously,
Log:
Process 10[7, 9, 8, 2, 5, 3, 4, 6, 1]
10 send to 7
7 receive (0, 10) from 10
Process 7 set 10 as parent and ack
10 receive (0, 10) from 7
10 send to 9
Process 9[10, 4, 1, 5, 2, 8, 3, 7, 6]
9 send to 10
9 receive (1, 10) from 10
Process 9 RESIGNED
10 receive (1, 10) from 9
10 send to 8
10 receive (0, 9) from 9
8 receive (2, 10) from 10
Process 8 set 10 as parent and ack
10 receive (2, 10) from 8
10 send to 2
2 receive (3, 10) from 10
Process 2 set 10 as parent and ack
10 receive (3, 10) from 2
10 send to 5
5 receive (4, 10) from 10
Process 5 set 10 as parent and ack
10 receive (4, 10) from 5
10 send to 3
3 receive (5, 10) from 10
Process 3 set 10 as parent and ack
10 receive (5, 10) from 3
10 send to 4
4 receive (6, 10) from 10
Process 4 set 10 as parent and ack
10 receive (6, 10) from 4
10 send to 6
6 receive (7, 10) from 10
Process 6 set 10 as parent and ack

10 receive (7, 10) from 6

10 send to 1

1 receive (8, 10) from 10

Process 1 set 10 as parent and ack

10 receive (8, 10) from 1

Process 10 ELECTED

Result:

Process id	capture msg	kill msg	ack msg	maximum level	captured time
1 to 8	Receive 1	0	0	0	1
9	Receive 1	0	0	0	1
10	Send 9	0	Receive 9	9	0

If Process 9 captures Process 10 first, then the row of Process 9 and Process 10 will exchange.

Test case 3: several processes (Process 7, 8, 9, 10) start the election consecutively, with a delay interval of 100 ms,

Log:

Process 7[10, 6, 5, 1, 2, 3, 8, 4, 9]

7 send to 10

10 receive (0, 7) from 7

Process 8[6, 5, 10, 2, 7, 4, 1, 9, 3]

8 send to 6

6 receive (0, 8) from 8

Process 6 set 8 as parent and ack

8 receive (0, 8) from 6

8 send to 5

Process 9[10, 1, 5, 2, 3, 8, 7, 6, 4]

9 send to 10

5 receive (1, 8) from 8

Process 5 set 8 as parent and ack

8 receive (1, 8) from 5

8 send to 10

Process 10[3, 5, 2, 1, 8, 6, 9, 4, 7]

10 send to 3

10 receive (0, 9) from 9

10 receive (2, 8) from 8

Process 10 RESIGNED

8 receive (2, 8) from 10

8 send to 2

2 receive (3, 8) from 8

Process 2 set 8 as parent and ack

8 receive (3, 8) from 2

8 send to 7

3 receive (0, 10) from 10

Process 3 set 10 as parent and ack

10 receive (0, 10) from 3

Process 10 attempt to kill 8

8 receive (0, 10) from 10

7 receive (4, 8) from 8

Process 7 RESIGNED

8 receive (4, 8) from 7

8 send to 4

4 receive (5, 8) from 8

Process 4 set 8 as parent and ack

8 receive (5, 8) from 4

8 send to 1

1 receive (6, 8) from 8

Process 1 set 8 as parent and ack

8 receive (6, 8) from 1

8 send to 9

9 receive (7, 8) from 8

Process 9 RESIGNED

8 receive (7, 8) from 9

8 send to 3

3 receive (8, 8) from 8

Process 3 attempt to kill 10

10 receive (8, 8) from 3

Process 10 attempt to kill 8

8 receive (8, 8) from 10

Process 8 ELECTED

Result:

Process id	capture msg	kill msg	ack msg	maximum level	captured time
1 to 6	Receive 1 or 2	0 or 1	0	0	1 or 2
7	Receive 1	0	0	0	1
8	Send 9	0	Receive 9	9	0
9	Receive 1	0	0	0	1
10	Receive 1, Send 1	2	Receive 1	1	1

There are many other possible cases, the result only shows the case because Process 8 first captures all the other candidate processes.

Test case 4: all five processes start the election simultaneously,

Log:

Process 2[3, 1, 4, 5]

2 send to 3

Process 5[4, 3, 1, 2]

5 send to 4

3 receive (0, 2) from 2

Process 4[1, 2, 3, 5]

4 send to 1

Process 3[5, 1, 2, 4]

3 send to 5

Process 1[2, 4, 5, 3]

1 send to 2

4 receive (0, 5) from 5

Process 4 RESIGNED

5 receive (0, 5) from 4

5 send to 3

3 receive (1, 5) from 5

Process 3 RESIGNED

5 receive (1, 5) from 3

5 send to 1

5 receive (0, 3) from 3

1 receive (0, 4) from 4

Process 1 RESIGNED

4 receive (0, 4) from 1

Process 4 attempt to kill 5

5 receive (0, 4) from 4

1 receive (2, 5) from 5

Process 1 attempt to kill 4

4 receive (2, 5) from 1

Process 4 attempt to kill 5

5 receive (2, 5) from 4

5 send to 2

2 receive (0, 1) from 1

2 receive (3, 5) from 5

Process 2 RESIGNED

5 receive (3, 5) from 2

Process 5 ELECTED

Result:

Process id	capture msg	kill msg	ack msg	maximum level	captured time
1	Receive 1	1	0	0	1
2	Receive 1	0	0	0	1
3	Receive 1	0	0	0	1
4	Receive 1	2	0	0	1
5	Send 4	0	Receive 4	4	0