

CS 425 / ECE 428

Distributed Systems

Fall 2026

Aishwarya Ganesan w/ Ram Kesavan

Lecture 19: Raft – questions

Raft Review

- State machine safety
- Leader-driven replication
 - log consistency check
- Committing a command
- Electing a leader



Respond at

pe.app/[aishwaryaganesa](#) 



Client sends command X to a Raft cluster with 5 servers.
The leader appends X to its log.
Two followers acknowledge successfully. Remaining two followers are unreachable.
What can the leader do?



Question. Valid log states?

1.

1	2	3	4	5
1	1	3	2	2
a	b	c	d	e

Is this a valid log?

2. Can two servers have these logs?

S1

1	1	2
a	b	c

S2

1	1	2
a	b	d

Question. Valid log states (contd)?

3. Can two servers have these logs?

S1

1	1	3
a	b	c

S2

1	1	2
a	b	c

4. Can two servers have these logs?

S1

1	2	4
a	c	d

S2

1	3	4
a	b	d

Question. Valid log states (contd)?

Consider following log states. S3's current term is 2. Can S3 become a leader?

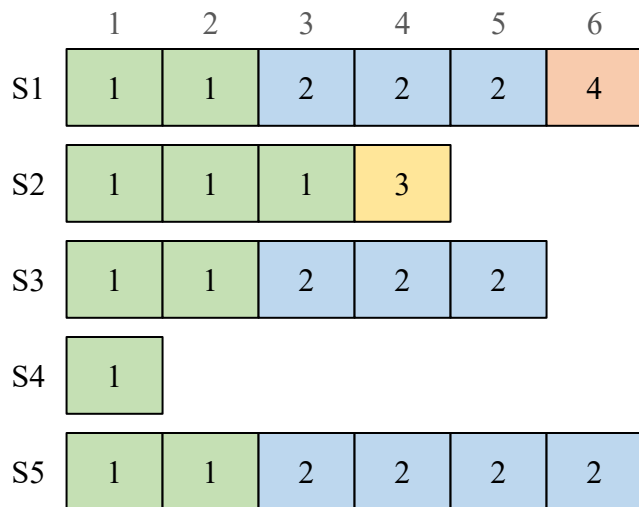
S1	<table><tr><td>1 a</td><td>1 b</td><td>3 c</td></tr></table>	1 a	1 b	3 c
1 a	1 b	3 c		
S2	<table><tr><td>1 a</td><td>1 b</td></tr></table>	1 a	1 b	
1 a	1 b			
S3	<table><tr><td>1 a</td><td>1 b</td></tr></table>	1 a	1 b	
1 a	1 b			

Log Properties

- Log entries have terms that are monotonically increasing
- If entries on different servers have the same index and term:
 - they store the same command
 - the logs are identical in all preceding entries
- If a given entry is committed, all preceding entries are also committed.

Question: Which entries are safe to apply?

Current term is 4 and S1 is the leader. Which entries can S1 safely apply to its state machine?



Hint: think about which nodes could become leader if S1 fails right now.

For each of S2–S5: whose votes can it get?

Restrictions on Commitment

For a leader to decide an entry is committed:

- It must be stored on a majority of servers
- At least one new entry from the leader's current term must also be stored on a majority of servers

Question: Deposed leader

In a 5-server Raft cluster, S1 is the leader in term 2. S1 becomes partitioned from the other three servers, which elect S3 as the new leader in term 3. S1 is still alive and believes it is the leader. S2 is in term 2. Can this violate safety?

Question: Deposed leader (variant 2)

In a 5-server Raft cluster, S1 is the leader in term 2. S1 becomes partitioned from the other three servers, which elect S3 as the new leader in term 3. S1 is still alive and believes it is the leader. S2 is in term 2. After this, can commit an old log entry that was received before the election started?

Question: Reads

Do reads have to go through consensus? Can you just read from leader state machine?

Question: Follower corrupt disk

Suppose a follower crashes, and when it restarts, its most recent vote has been lost. Is it safe for the follower to rejoin the cluster ?