

# CSE 550: *Systems for all*

Au 2022

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# What is consensus?

Everyone (who matters) agreeing on something

- Occurrence: Did it rain today?
- Ordering: Did the chicken come before the egg?
- Key-value: Is the dress blue/black or white/gold?

Not concerned with correctness  
of what is agreed upon



# Why do we want consensus?

Replication is a fundamental to fault tolerance

What if replicas disagree ... ?

# Why might replicas disagree?

## Faults

- Messages can get lost / delayed
- Messages can get corrupted
- Storage can get corrupted
- Nodes can fail .... and then come up
- Network may get partitioned
- ...

# The nature of faults

Fail stop	Byzantine
Working perfectly or not at all	Arbitrarily bad things can happen
Easier	Harder

# Top-level concerns for consensus algorithms (and fault tolerance algorithms in general)

<b>Types of failures tolerated</b>	Paxos is fail-stop, Bitcoin (next week) is byzantine
<b>Replicas needed for N failures</b>	2PC is $N+1$ , Paxos is $2N+1$ , Byzantine is $3N+1$
<b>Failover speed</b>	2PC is blocking, Paxos is not
<b>Message complexity</b>	2PC and Paxos is linear, Byzantine can be exponential

Trade-offs, trade-offs, trade-offs, ...

Over to Anjali and Elijah