CSE 452

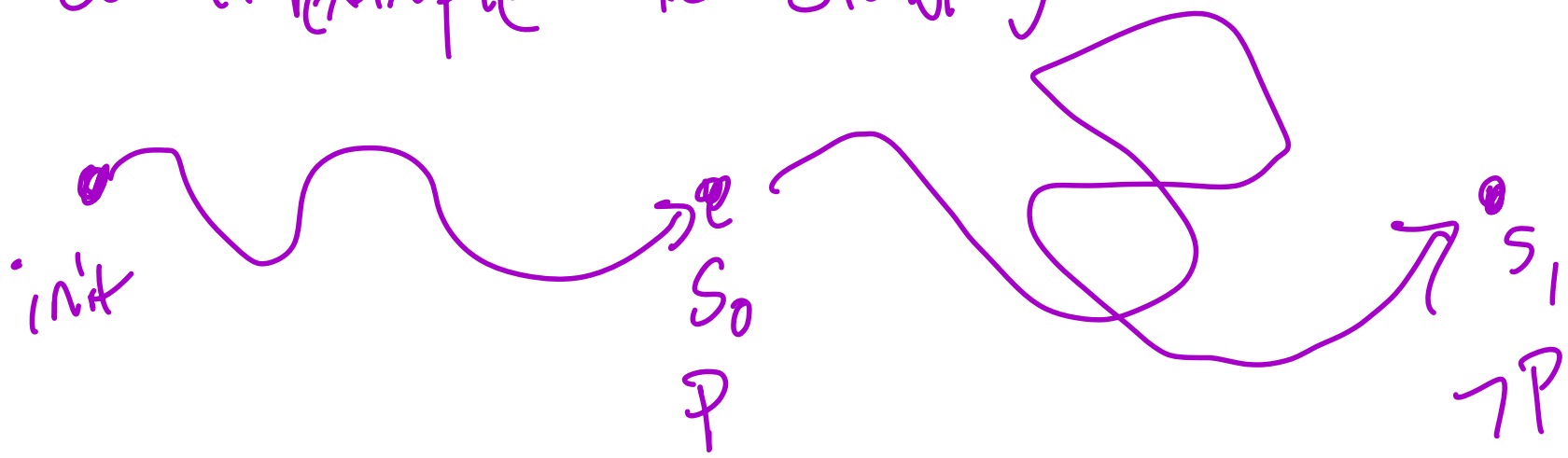
Distributed Systems

Time

- when things are true
- happens before relation
- Lamport clocks (virtual clocks)

When things are true

- invariant - always true
- stable - once true, true for rest of execution
- unstable - not stable
  - counterexample to stability



Examples: Invariants

- running instructions means computer on
- client has ≤ 1 outstanding request
  req sent, but reply not recv.
  (using client/seqnum as key)
- seq num saved by server for each client
  is mon. increasing (per client)
- backup has all the state the primary has
  ~~(in every view)~~ after state transfer in that view
  (in the highest view)

Example Stable Properties

- once a client id is in the server's AMO it's always there
  - client C is in server's AMO App
- there is a primary in VS's highest view
- once a server dies, it doesn't come back
  - "server S is dead"
- if view server is in view n+1
  then primary of view n completed start
  (invariant) after view n

Unstable

- the current view has a backup
- View U has a backup
  (depends on def of "has a backup")

"False" Stable

Simultaneity

e_1 happens before e_2

- they happen on one machine, and e_1 is first
- e_2 recvs a msg that e_1 sent
- or any transitive combination

e_1 is concurrent w/ e_2

if e_1 did not HB e_2

and e_2 —— e_1