Topics to date

So far, we have covered:

- Internet architecture
- Android development (will not directly appear on exam)
- Failure detectors
- Time
  - Physical clocks, logical clocks, causal ordering
- Global states (snapshots)
- Reliable multicast
- Gossiping
- Peer-to-Peer architectures
  - Napster, Gnutella, KaZaA, BitTorrent
The Big Picture

In addition to individual topics, you should know:

- “It depends on the application.”
  - What protocol?
  - How should it be configured?
  - etc.

- The Internet is indifferent to your suffering.
  - Messages can be lost, arbitrarily delayed, duplicated, reordered, …
  - Many of the big problems in DS come from asking: What happens if this message is lost? Delayed? Reordered?
I’m not going to ask you (directly) about your PAs.

Your PAs evaluate your understanding of specific implementation details.

I *might* ask you about concepts used in your PAs.
Internet Architecture

You should understand:

- The model of the Internet as we have discussed it
- Roughly where the various responsibilities lie
  - (Naming, routing, reliability, etc.)
- The Internet design goals
- The Internet protocols’ approach to reliability
Failure Detectors

You should understand:

- Our model *(crash-stop)* of failures
- The advantages and disadvantages of:
  - Heartbeating detectors
  - Ping detectors
  - Gossip detectors
- The limitations of *asynchronous systems*
Physical Time

You should understand:

- What we mean by physical clocks
- The notion of an ideal time, approximated by UTC
- Time synchronization protocols
- Clock skew vs. drift
Logical Time

You should understand:

- Logical clocks (Lamport and vector, etc.)
- Causal ordering
- Advantages and disadvantages over physical clocks
Global States

Closely related to logical time.

You should understand:

- The snapshot algorithm
- **Consistent** states/cuts/snapshots
- The implications of FIFO ordering
You should understand:

- B-multicast
- R-multicast
- The distinction between receive and deliver
- Ordered multicast (causal, FIFO, total)
- ISIS
Gossiping

You should understand:

- The advantages and disadvantages of:
  - Gossiping vs. B-multicast
  - Gossiping vs. R-multicast
- The cost/latency/reliability tradeoff of $b$ and $c$
- Gossiping as a failure detector
Peer-to-Peer Architectures

You should understand:

- The spectrum of architectures from centralized to fully distributed
- Where the protocols that we discussed fit in
- What each protocol does and does not solve
  - In particular, the differences between BitTorrent and the others
- The free-rider problem
Procedures

The midterm is **closed book**.

You **may not** consult notes during the exam.

Use blue or black ink.

**Do not bring:**

- Cell phones
- Laptops
- Wearables

(If you have a phone/laptop in your bag, that’s fine … but I don’t want to see or hear it!)