Study Guide for the Final Exam

CS118
Spring 2019
Rules for Final Exam

• Closed book, closed notes
• No calculators/laptops/desktops & Internet access would be allowed

• You can bring in 2 pages of “cheat sheets” to the final exam
  – Page size: 8x11; can be double-sided
  – Whatever font size you’d like
Major Breakdowns

• Materials covered after the midterm: 80%
  – Chapters 4-8
  – 7th edition (Chapter 4, Chapter 5.1-5.4, Chapter 5.6, Chapter 6.1, 6.2.3, 6.3.1~5.3.3, 6.4, 6.5, 6.6, 6.7, Chapter 7.1~7.2, 7.3.1~7.3.4, 7.5, 7.6, Chapter 8.1~8.4 (excluding crypto algorithms), 8.9)
  – Lecture slides, posted RFC on course webpage

• Materials covered in the midterm: 20%
  – Reliable data transfer
  – TCP retransmission timeout, TCP congestion control, TCP connection management
  – (possibly) also a couple of short Q&A
Materials to Be Covered

• Lecture notes as the focus
  – (also check for the referred textbook chapters in the previous slide)
  – The followup slides can serve as study guide when you review such materials

• 2 Programming Projects
• Homeworks
• Posted RFC
Reliable Data Transfer

• Can you enumerate all the basic mechanisms needed to ensure reliable data transfer?

• How to handle the following scenarios (if any exists) using Stop-and-Wait, Go-back-N, or selective repeat?
  – Packet loss
  – Packet corruption
  – Corrupted ACK
  – Lost ACK
  – duplicate packets
  – Out-of-order packet delivery
TCP Protocol

• TCP round-trip estimation and timeout
  – Is the SampleRTT computed for a segment that has been retransmitted? Why?

• What is the negative effect if the timeout value is set too small, or too big?

• Why does sampleRTT fluctuate?

• how does TCP readjust its timer? (see lecture slides)
  – When receiving a new ACK
  – When receiving a duplicate ACK?
  – When the current timer expires for N times?
TCP Connection Management

• What is 3-way handshake?
  – How are the initial seq, ACK #, etc. decided?

• Are the TCP connection setup and teardown identical?
  – Why are they different?
  – Why do you need so many states in the FSM model for TCP connection?
TCP Congestion Control (slides & RFC)

• how many components are there in TCP congestion control?
• how does each work? slow start, congestion avoidance, fast retransmit/fast recovery.
• how are cwnd and ssthresh adjusted in each phase?
Chapters 4&5  Network Layer

• What is the Internet service model?
• Comparing VC and datagram networks
• How does a router decide which next hop to forward when a packet arrives?
• What is the rationale for each field in the IP packet header?
• IP fragmentation & reassembly
• What is subset? What is CIDR?
• How does NAT work? What about DHCP?
• What fields exist in IPv4 but not in IPv6? What exist in IPv6 but not in IPv4? What exist in both?
Chapters 4&5

• How does the tunneling technique work?
  – When you plan to deploy a new network technology on the global Internet, how do you address the issue of incremental deployment?

• Compare link state routing and distance vector routing

• Given a network topology, apply link-state routing or distance vector routing algorithm to compute the minimum-cost path

• What kind of info is propagated/collected in link state routing or distance vector routing? How many messages are propagated in each?

• What is a potential problem with distance vector routing? How to address it?
Chapters 4&5

• Why does RIP limit the maximum hop count as 16? Can it fully address the count-to-inf problem?
• Can OSPF compute multiple same-cost paths?
• Why intra-AS and inter-AS routing protocols are different?
  – Can BGP always compute the shortest path route?
  – Does the path vector in BGP include any router’s IP address? Why?
• What is the difference between hierarchical OSPF and BGP inter-domain routing?
• What is longest prefix matching rule?
• Compare SDN routing and the current Internet routing
• Compare SDN and router-based data forwarding
Chapters 4&5

• How do iBGP and eBGP work?
• How is the path vector computed?
• Given a topology, how does the BGP advertise the path vector?
  – Look at the example in the lecture notes
• Can BGP lead to routing loop? Why?
• How does BGP work with intra-AS routing?
  – How is the BGP reachability info propagated within an AS and across Ases?
• What is hot potato routing? How does it play in the Internet routing in reality?
Chapter 6  Link Layer

• Why do you need a new link-layer header (frame header) in addition to IP header?
  – Can you merge IP header with the frame header?

• Can an error-detection algorithm detect packet errors with 100% accuracy?

• Comparing the cons and pros of channel partitioning MAC, random access MAC, and taking-turns MAC

• Given a few scenarios, choose the best possible MACs (channel-partitioning, random access, or token-based) and justify your answer
Chapter 6

• The detailed operations of CSMA and CSMA/CD
• Can CSMA/CD completely avoid collisions?
  – Identify two cases when collision still occurs
• How does the binary exponential backoff work?
• How does ARP work? Is it using soft-state (i.e., maintaining timers for its state information)?
• Compare the efficiency of CSMA/CD, ALOHA and slotted ALOHA?
  – Where does the saving come from in CSMA/CD?
Chapter 6

- Given a network scenario, explain how the packet is delivered from the sending host to the receiving host (that is located on a different subnet) step-by-step. (see lecture nodes)
  - How many protocols are used in the delivery process?
  - What are the IP header and frame header as the IP data packet is being delivered at each step?
  - How is the next hop found out?

- Is DHCP a soft-state protocol? Why?

- Can ARP work in point-to-point link, rather than broadcast medium?
Chapter 6

- What is the difference between a switch and a router?
- Which device can isolate collision domains?
- Given a scenario, use the appropriate devices (hub, switch, and router) to interconnect hosts to form a large network.
- How does the self-learning algorithm work?
- What protocols are used in web browsing, file transfer or email checking?
  - Which service is accessed first, DNS or DHCP?
  - How do you find out the DNS server via DHCP?
  - For the UDP/TCP segments, can arbitrary source/destination ports be selected?
  - How many times is ARP used? Can ARP messages propagate to different subnets across routers?
Chapter 7 Wireless & Mobile Networks

• Which category of MAC does CDMA belong to?
• The detailed operations of CSMA/CA.
  – What components are the same, or different between CSMA/CA and CSMA/CD?
• Why does not 802.11 MAC implement collision detection but uses collision avoidance?
• What is the purpose to use link-layer acknowledgment in 802.11 MAC?
  – Can TCP ACK replace it? Can MAC ACK replace TCP ACK?
• What is the mechanism to handle hidden terminals?
Chapter 7

• How to handle mobility in the same IP subnet?
• How to do routing to a mobile host?
• How is mobility supported across different subnets?
  – Operations of home agent, foreign agent,
• How to avoid triangle routing (i.e., indirect routing where packets are forwarded to the home network, then the visited network of the mobile host) in mobility support?
• How can you know a mobile host’s current location?
• How does a mobile host update its location?
Chapter 8

• Compare public key based encryption and symmetric key based encryption
  – You do NOT need to study the crypto algorithms (but only the basic concepts)

• Using the public key/private key of users as the initial building blocks, how can you offer the following security functions:
  – Encryption
  – Authentication
  – Digital signature
  – Message integrity
Chapter 8

• What are the security mechanisms to defend against the following network attacks? How do they work?
  – Data sniffing & interception
  – IP address spoofing
  – Replay attack
  – Man in the middle attack
  – Email spam
  – Illegal access to UCLA campus network