Midterm Study Guide

The midterm for the course will be on Oct 12th, 7:00pm till 8:30pm in 165 Everitt Lab. The exam will start at 7pm sharp, so please arrive early so that you don't waste time getting a seat.

Below is a list of topics covered on the midterm. Some of these are phrased as questions; most of these will *not* be asked directly on the midterm, but rather as a guide to what you must be able to understand in order to solve the midterm questions. In addition to these, you are expected to know how to solve all problems on homework sets 1-4. For study materials, you should be able to understand the lecture slides for lectures up to and including lecture 12, and read the Kurose & Ross chapters 1, 4.1-4.4, 5.1-5.6, 5.8, 6.3.

Networking Overview

- What is a network?
- What services must a network provide?
- What is addressing, routing?
- What are frequency, time-division, statistical multiplexing
- What is a channel abstraction?
- What is delay? Bandwidth? Which matters more when?
- Define and compute delay-bandwidth product
- What is the purpose of network layering? What are advantages and disadvantages of a layered architecture?
- What are the layers in the OSI architecture? What are examples of protocols at these layers used in the Internet?

Direct Link Networks

- What is encoding?
- Explain and apply NRZ, NRZI, Manchester, 4B/5B encodings
- Amplitude, Frequency, Phase modulation
- QAM encoding
- Bit vs. baud rates
- Limits on data rate (Nyquit's Theorem, Shannon's Law)
- What is framing?
- Explain advantages & disadvantages, calculate overhead for sentinel, length-based, and clock-based framing

Error Correction

- Define and compare error detection, correction
- Hamming distance and relationship to error checking
- Explain and calculate parity, 2D parity, Internet checksum, CRC

Multiple Access

- What problems do MAC protocols solve?
- What's an ideal MAC protocol?
- Slotted ALOHA, Pure ALOHA, CSMA, CSMA/CD, CSMA/CA protocols

- Ethernet: remember protocol; explain why the following features are there:
    - Minimum packet size
    - Jamming
    - Binary exponential backoff
- Explain backoff protocol and capture effect

802.11

- Why not use CSMA/CD?
- Hidden terminal problem, solution
- Backoff protocol, differences with Ethernet
- Why are there different inter-frame spacings?

Token Ring

- Why do we use token rings?
- Define Token Holding Time, Token Rotation Time, Ring Latency, delayed vs. early release
- Explain functions of ring monitor
- Explain behavior of target TRT and synchronous and asynchronous traffic

Bridges and Switches

- Explain purpose of bridges, switches, routers, difference between them
- Why would bridged networks have loops?
- Distributed spanning tree algorithm
- Switching tables: what are they, how are they used for forwarding, how are they built?
- Separate vs. single collision domains

Switch design

- Input, output ports
- Where does buffering occur? What is head-of-line blocking?
- What is back pressure? Why is it only used in short-RTT situations?
- Explain the design of a cross-bar switch
- Explain the purpose of knock-out switching, banyan networks, batcher networks (You do not need to remember the full design details of each.)

Datagram & Virtual circuits

- Difference between forwarding and routing
- Datagram forwarding: how it works, what are its advantages, disadvantages, why it's used in the Internet
- Virtual circuit forwarding: how it works, how are VCI's assigned, what are advantages/disadvantages of VCs, why are they used in telephony applications
- Source routing: how it works, advantages/disadvantages
- ATM
    - What are virtual paths (bundles); why are they used?
    - Why fixed-length cells? Why are they so short?

Internet Protocol

- Service model: what does IP provide, what doesn't it provide, why?
- IP addressing: networks, network classes, CIDR

- IP forwarding: routing tables, hierarchical networks, subnetting
- NAT: motivation, how does it work, advantages and disadvantages
- ARP: what does it accomplish? How does it work?
- IP header: do not need to remember what header looks like, but must be able to explain why each field is there
- IP fragmentation and reassembly: how does it work
- ICMP: what is it used for?
- DHCP: what is it used for? How does it work?

IPv6:

- What is the main motivation for switching to IPv6?
- What are some other improvements in IPv6 (should be able to name at least two)
- How big is the IPv6 address space?
- Why did IPv6 remove fragmentation, checksum from main header?
- What is incremental deployment? Why is it important?
- What is tunneling? How does it help incremental deployment of IPv6?

Assigned readings: Kurose & Ross Ch 1,