CMSC 417: Computer Networks
Spring 2024

Final Exam
Date: May 15th, 2024
Time and Location: 10:30am, In-class (CSI 2117)
Duration: 1 hour 45 minutes

Instructions:
1. Write your name and UID on this question/answer sheet.
2. This is an in-class exam. The duration of this exam is 1:45 hours.
3. There are total 60 points to score.
4. Be neat and precise. Write your answer within the box provided after each question.
5. This is a closed book/note exam. You may NOT discuss with others in the class.
6. A handwritten cheat-sheet on a U.S. letter size (8.5" x 11") paper (both sides) is allowed.

Question paper format:
Section 1: Multiple choice questions. (10 marks)
Section 2: Short answer type questions (20 points)
Section 3: Problem solving type question-1 (10 points)
Section 4: Problem solving type question-2 (20 marks)

Exam Syllabus:

(A) Topics covered before third-term exam #1
1. Networks Overview (Chapter 1)
    a) Basic components of a computer network (Section: 1.2.2)
    b) Interconnection, internet, the Internet (Section: 1.2.2)
    c) Importance and challenges of computer networks (Refer to class slides and notes)
    d) Network architecture, abstractions, and protocol stacks/layers (Section: 1.3)
    e) Resource sharing, Circuit switching and packet switching (Section: 1.2.3)
    f) Network edge and network core (Refer to class slides and notes)
    g) Access networks (Refer to class slides and notes)
    h) Failures, delay, throughput, bandwidth, delay x bandwidth (Section: 1.2.4, 1.5)
2. Routing Protocols (Chapter:3, Section: 3.3)
    a) Network as a graph (Section: 3.3.1)
    b) Distance Vector Routing (Section: 3.3.2)
    c) Link State Routing (Section: 3.3.3)
3. Internet Protocol (IP) (Chapter:3, Section: 3.2)
    a) Data plane and control plane (Refer to class slides and notes)
    b) IP datagram format (Section: 3.2.2)
    c) Fragmentation and reassembly (Section: 3.2.2)
    d) IPv4 address (Section: 3.2.3)
    e) IP datagram forwarding (Section: 3.2.4)
    f) Subnetting (Section: 3.2.5)

Discussions of "problem solving" on:
a) Network delay, throughput, bandwidth
b) IP addresses and Subnetting
c) IP fragmentation and reassembly
d) Routing protocols

(B) Topics covered after third-term exam #1 and before third-term exam #2
1. Internet Protocol (IP) (Chapter:3, Section: 3.2) (Continued.)
   a) Classless addressing and CIDR (Section: 3.2.5)
   b) ARP protocol (Section: 3.2.6)
   c) DHCP protocol (Section: 3.2.7)
   d) Private address spaces and NAT protocol (Refer to class slides and notes)
   e) ICMP protocol (Section: 3.2.8, for Ping and Traceroute refer to class slides)
   f) Virtual networks and tunnels (Section: 3.2.9)
   g) Basics of IPv6 (Class slides)

2. Transport layer multiplexing and demultiplexing (Class slides, Section: 5.1)
3. UDP protocol (Section: 5.1)
4. TCP protocol (Chapter 5)
   3.1 Reliable byte stream (Section: 5.2)
   3.2 Packet format, flags, sequence number (Section: 5.2.2, 5.2.3)
   3.3 ARQ protocols: Stop-&-Wait, Sliding window (Class slides, Section: 5.2.4)
   3.4 Cumulative ACK (Class slide, Section: 6.3.2, 6.3.3)
   3.5 TCP flow control (Section: 5.2.4)
   3.6 Silly-window syndrome, Nagle's algo (Section: 5.2.5)
   3.7 Karn-Partridge algo (Section: 5.2.6)
   3.8 Congestion control (Chapter: 6)
       3.8.1 AIMD protocol (Section: 6.3.1)
       3.8.2 Drop-tail FIFO queue (Section: 6.2.1)
       3.8.3 Slow start (Section: 6.3.2)
       3.8.4 Fast retransmit, Fast recovery (Section: 6.3.3)
       3.8.5 TCP variants and Router assisted congestion control (Chapters 5 & 6)
       3.8.6 Vulnerabilities of TCP (Mentioned research paper and class slides)

Expect "problem solving" type questions on:
a) CIDR, ICMP, Traceroute protocol
b) 3-Way handshake for TCP
c) Calculating header fields for TCP segments/packets and ACKs.
d) Throughput calculation for ARQ protocols
e) Calculating Advertised_window
f) Observing Congestion-window behavior

(C) Topics covered after the third-term exam #2
Transport layer, link layer, BGP, and application layer protocols (Class slides and text book chapters 5, 6, 2, 3, 4, & 9)
1. TCP variants and Router assisted congestion control (Chapters 5 & 6)
2.   3.8.4 Fast retransmit, Fast recovery (Section: 6.3.3)
3.   3.8.5 TCP variants and Router assisted congestion control (Chapters 5 & 6)
   3.8.6 Vulnerabilities of TCP (Mentioned research paper and class slides)
4. Link layer protocols (Chapters 2, 3, & 4)
   2.1 Types of links (Class slides)
   2.2 Link layer address, address resolution protocol (Section 3.2.6)

2.3 Medium access protocols, CSMA (Class slides)
2.4 Ethernet: Architecture, medium access (CSMS/CD) (Section 2.6)
2.5 Repeater, hub, switch, bridge, router (Class slides)
2.6 Wireless LANs, WiFi protocol (Section 2.7)
2.7 Mobility in wireless networks (Section 4.4)
3. Intra-AS routing and Inter-AS routing, BGP protocols (Section 4.1.2 and class slides)
4. Security issues in BGP networks (class slides)
5. Application layer protocols (Chapter 9)
5.1 Architecture (Class slides)
5.2 DNS (Section 9.3)
5.3 Web and HTTP (Section 9.1)
5.4 Email (Section 9.1)

Expect "problem solving" type questions on:
a) Ethernet, CSMA/CD
b) Wireless channel sharing
c) Learning bridge, repeater, hub, switch, and router
d) BGP protocol and attacks
e) DNS

Please note that the final exam syllabus includes all topics covered in class. The questions will include topics discussed in response to various questions asked in the class.