

# CMSC 417: Computer Networks

## Spring 2024

### **List of topics:**

Following is the list of topics intended to be covered during this course. There may be minor changes to this list. Exam syllabi are based on topics discussed in class.

#### **(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

#### **(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)
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 (Section: 6.3.3)

Discussions of "problem solving" on:

- a) IP addresses, Subnetting, and CIDR
- b) Throughput calculation for ARQ protocols
- c) Calculating Advertised\_window
- d) 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. Link layer protocols (Chapters 2, 3, & 4)
  - 2.1 Types of links (Class slides)
  - 2.2 Link layer address, address resolution protocol (Section 3.6)
  - 2.3 Medium access protocols, CSMA (Class slides)
  - 2.4 Ethernet: Architecture, medium access (CSMA/CD) (Section 2.6)
  - 2.5 Repeater, hub, switch, bridge, router (Class slides)
  - 2.6 Wireless LANs, WiFi protocol (Section 2.7)
  - 2.7 Bluetooth, WiMax, Cellular Networks (Section 2.7 and class slides)
  - 2.8 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 Web and HTTP (Section 9.1)
  - 5.3 Email (Section 9.1)
  - 5.4 DNS (Section 9.3)

Discussions of "problem solving" on:

- a) Ethernet, CSMA/CD
- b) Wireless channel sharing
- c) Repeater, hub, switch, bridge, router
- d) BGP protocol and attacks
- e) DNS