CSE 461 Midterm
Winter 2018

Your Name: _____

UW Net ID: _____

General Information

This is a closed book/laptop examination. You have **50 minutes** to answer as many questions as possible. The number in parentheses at the end of each question indicates the number of points given to the question. There are **5 questions** on this exam (check to make sure you have all of them), and there are a total of **50 points.** Write all of your answers directly on this paper. Make your answers as concise as possible. If there is something in the question that you believe is open to interpretation, then please go ahead and interpret, but state your assumptions in your answer. Remember to **READ THE ENTIRE QUESTION** before answering, as later questions will build on earlier answers.

Problem 1: Basics (10 points)

a) How are hosts with two different link layers (e.g., WiFi and Ethernet) able to communicate? (3 points)

Layering, de-layering and layering through different network.

Alternative: The network layer (IP) does that. It decapsulates the data from one link layer and encapsulates in another.

b) What is a simplex link? (1 point)

One way channel: one is the sender, one is the receiver

c) What is a half-duplex link? (1 point)

Two way channel: can both send to each other but not at the same time

d) What is the primary approach used to divide network functionality in the Internet? (2 points)

Layering (yes)

e) Consider a protocol stack composed of WiFi, IP, TCP, and HTTP. Illustrate what the packet on the wire look like for this stack? (3 points)
WIFI - IP - TCP - HTTP .

a drawing of HTTP encapsulated by TCP then by IP then by WIFI

Problem 2: Modern transport protocols (10 points)

a) Describe MPTCP (multipath TCP) and how it differs from TCP. (5 points)

MPTCP uses multiple paths simultaneously when they are available. A common use case is when the host has two network interfaces. TCP will only use one.

b) Describe QUIC and how it differs from TCP. (5 points)

QUIC is Google's implementation of TCP + TLS based on UDP

https://blog.cloudflare.com/the-road-to-quic/

QUIC is implemented on top of UDP. It combines the functionality of a transport protocol and TLS. It caches keys such that connection establishment is fast.

Problem 3: IP primitives (10 points)

a) What is ICMP used for? (2 points)

Sending back error messages (reports)

b) Describe two advantages and two disadvantages of NAT (4 points)

Advantages: 1. Counter the shortage of IP address
2. We can add firewall and filter malicious packets or ... (security)

Disadvantages: 1. Cannot let outside connect to inside host if the inside host is not showing in the table(did not connect to outside)

2. can only send incoming packets after an outgoing connection is set up
3. Cannot do peer-to-peer app easily
4. Breaks some protocols that embed IP address information in payload (e.g., FTP)

c) What was the primary motivation for developing IPv6? (1 point)

Shortage of IPv4 addresses (we got larger population)

d) How can IPv6 traffic be carried over a network that does not support IPv6? (3 points)

1. Tunneling

Problem 4: Routing and forwarding (10 points)

a) What is difference between routing and forwarding (3 points)

1. Routing: needs to figure out where to send the packets
2. Forwarding: knows where to go, just needs to send it

b) What is longest matching prefix? (1 point)

1. A forwarding strategy where the router uses the longest prefix that matches the packet's destination IP address.

c) Consider a host with IP address 10.10.10.10, prefix 10.10.10.0/24, and gateway 10.10.10.1. How will this host forward packet to following destinations? (3 points)

i) 10.10.10.11
Send on the local network.

ii) 10.10.11.10
Send to gateway

iii) 10.11.10.10
Send to gateway

d) Describe three ideas that help routing in the Internet scale? (3 points)

Subnetting
Hierarchical routing
Aggregation

Problem 5: Distance vector and link state (10 points)

a) Describe how distance vector and link state routing algorithms differ? (6 points)

Distance vector exchanges shortest path information with neighbors. Link state exchanges topology information.

Distance vector converges slower.

Distance vector is computationally simpler.

b) Which of the two algorithms converges faster? (1 point)
Link state routing
What is converging faster? -- Computes new shortest paths after changes faster.

c) Which of the two algorithms requires more computation (1 point)
Link State Algorithm

d) Give an example of a routing protocol that uses distance vector algorithm (1 point)

RIP

e) Given an example of a routing protocol that uses link state algorithm. (1 points)

OSPF, IS-IS