Homework 10

Graded

Student

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Total Points

98 / 100 pts

Question 1

IP Networks — **15** / 15 pts

1.1 **Network Count** — **3** / 3 pts

- ✔ **– 0 pts** Correct (6)
- **– 1 pt** Ignore networks between routers (4/5)
- **– 2 pts** Only count the ones around the LAN (3)
- **– 0 pts** Correct
- **– 3 pts** Incorrect

1.2 **Grouping Hosts** — **6** / 6 pts

- ✔ **– 0 pts** Correct (A, Q, Z)
- **– 0 pts** Correct
- **– 3 pts** Checked one other host
- **– 3 pts** Checked two other hosts
- **– 3 pts** Missed one host
- **– 6 pts** Missed two hosts
- **– 6 pts** Incorrect

1.3 **Locating Network** — **3** / 3 pts

- ✔ **+ 3 pts** Correct (F)
- **+ 3 pts** Correct
- **+ 0 pts** Incorrect

1.4 **(no title)** — **3** / 3 pts

- ✔ **+ 3 pts** Correct (5)
- **+ 3 pts** Correct
- **+ 0 pts** Incorrect

Question 2

Network Calculation **16** / 16 pts

2.1 **Transmission Time** **8** / 8 pts

✔ **– 0 pts** Correct (27.6)

– 0 pts Correct

– 2 pts Calculation/rounding error

– 4 pts Did not convert 5000 bytes to bits (answer was 23.2)

– 4 pts Did not properly convert from seconds to milliseconds

– 6 pts Incorrect transmission time formula

– 8 pts Incorrect

2.2 **Throughput** **8** / 8 pts

✔ **– 0 pts** Correct (1449275.4)

– 0 pts Correct

– 0 pts FOLLOW-THROUGH: Correct based on answer to Q2.1

– 2 pts Rounding error

– 3 pts Calculation/Unit error (right formula with right numbers, but wrong answer)

– 4 pts Did not properly convert from milliseconds to seconds.

– 4 pts Did not properly convert bytes into bits

– 6 pts Incorrect throughput formula

– 8 pts Incorrect

2.3 **Work (Optional)** **0** / 0 pts

✔ **+ 0 pts** Correct

Question 3

Transport Layer Protocols **15** / 15 pts

3.1 **Stop-and-Wait** **5** / 5 pts

✔ **– 0 pts** correct (54)

– 0 pts Correct

– 5 pts Incorrect

3.2 **No-ACK** **5** / 5 pts

✔ **– 0 pts** Correct: pipelined/sent all packets at the same time (3)

– 0 pts Correct

– 5 pts Incorrect

3.3 **Sliding Window** **5** / 5 pts

✔ **– 0 pts** Correct (15)

– 0 pts Correct

– 5 pts Incorrect

3.4 **Work (Optional)** **0** / 0 pts

✔ **+ 0 pts** Correct

Question 4

Packet Calculation **22** / 24 pts

4.1 **Number of Packets** **8** / 8 pts

- ✔ **– 0 pts** Correct (3643)
- **– 0 pts** Correct
- **– 2 pts** Correct formula, wrong answer
- **– 4 pts** Divided by payload size + header instead of just payload size
- **– 2 pts** Included ACK packets
- **– 8 pts** Incorrect

4.2 **Number of Bytes** **6** / 8 pts

- **– 0 pts** Correct (1005290)
- **– 0 pts** Correct
- **– 0 pts** FOLLOW-THROUGH: Correct calculation based on incorrect 4.1 answer (incorrect calculation marked below as appropriate)
- ✔ **– 2 pts** Transmitted full payload on partial empty packet (i.e. did 4.1 answer * sizeof(packet))
- **– 2 pts** Correct formula, but incorrect answer
- **– 8 pts** Incorrect

4.3 **Loss Rate** **8** / 8 pts

- ✔ **– 0 pts** Correct (4046)
- **– 0 pts** Correct
- **– 0 pts** FOLLOW-THROUGH: Correct calculation from incorrect number of packets in 4.1
- **– 2 pts** Different rounding, i.e. always round up or standard (4045 or 4046 or 4047)
- **– 2 pts** Only counted lost packets (did not include initial packets) (4007)
- **– 2 pts** Calculation Error
- **– 2 pts** Missing the Last Transmission
- **– 8 pts** Incorrect

4.4 **Work (Optional)** **0** / 0 pts

- ✔ **+ 0 pts** Correct

Question 5

Link Layer

14 / 14 pts

✔ **– 0 pts** Correct

– 3 pts Did not identify CSMA/CD as being used for Ethernet / wired protocols

– 1 pt Did not identify CSMA/CA as being used for IEEE 802.11 / Wi-Fi / wireless protocols

– 3 pts Partially incorrect or incomplete description of how CSMA/CD handles collisions

– 7 pts Did not identify how CSMA/CD handles collisions (listens to wire, transmits, listens for other transmissions, stops transmission if collision, etc.; look for general understanding for full points)

– 3 pts Partially incorrect or incomplete description of how CSMA/CA handles collisions

– 7 pts Did not identify how CSMA/CA handles collisions (listens to medium, can use Request-to-Send (RTS)/Clear-to-Send (CTS) packets, or mentions hidden node/terminal problem or its own transmission drowning out the medium as why CSMA/CD can't work, etc.; look for general understanding for full points)

– 14 pts Blank/no answer

Question 6

Network Stack Layers

16 / 16 pts

6.1 (no title)

4 / 4 pts

✔ **+ 4 pts** Correct

+ 0 pts Incorrect

6.2 (no title)

4 / 4 pts

✔ **+ 4 pts** Correct

+ 0 pts Incorrect

6.3 (no title)

4 / 4 pts

✔ **+ 4 pts** Correct

+ 0 pts Incorrect

6.4 (no title)

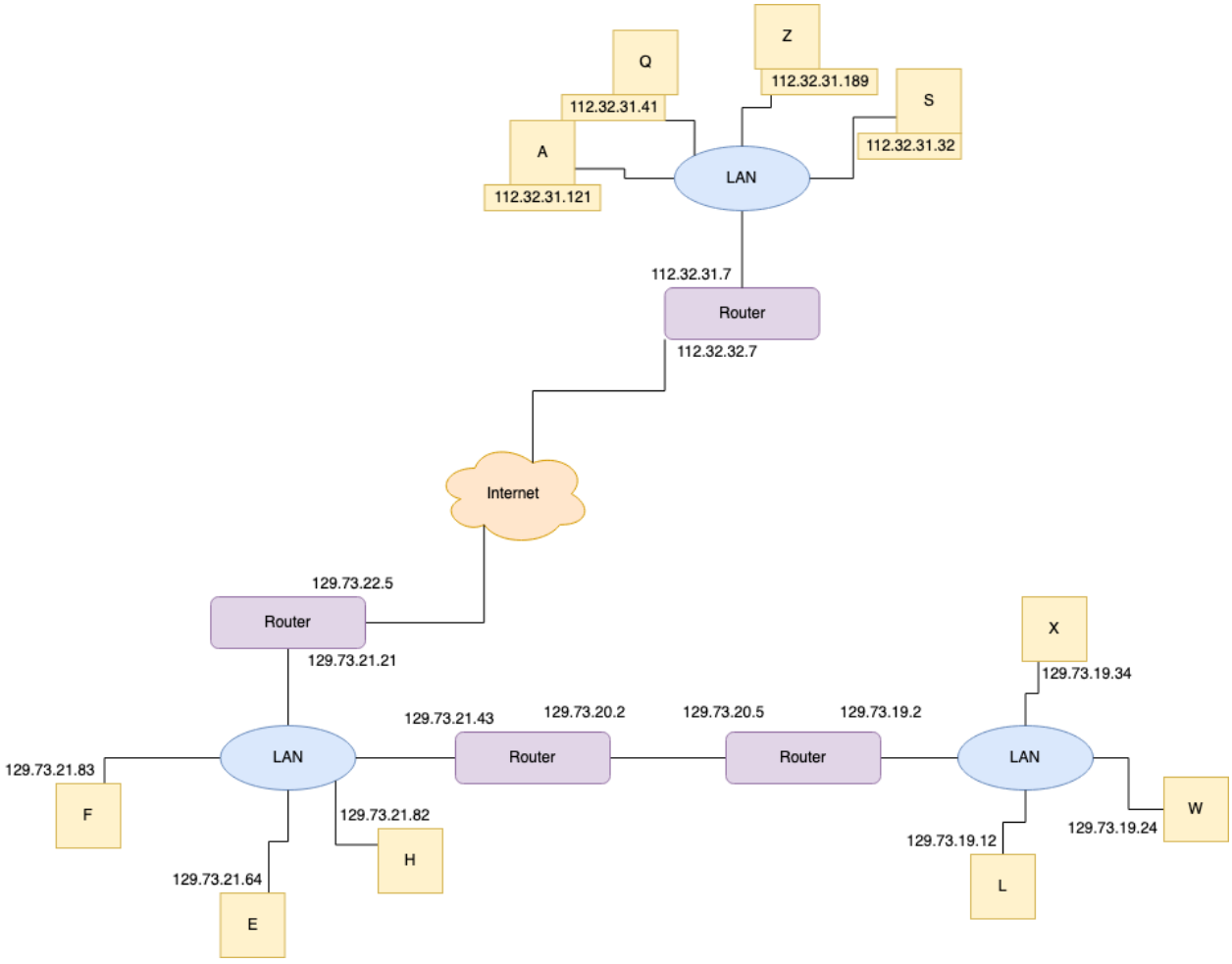
4 / 4 pts

✔ **+ 4 pts** Correct

+ 0 pts Incorrect

Q1 IP Networks
15 Points

Use the diagram to answer the following questions. Assume that the top 24 bits of the 32-bit address name an IP network.



Q1.1 Network Count
3 Points

How many IP networks are contained in the diagram? (Ignoring the Internet bubble)

6

Q1.2 Grouping Hosts
6 Points

Which hosts are on the same IP network as host S?

- [x] A
- [ ] E
- [ ] F
- [ ] H
- [ ] L
- [x] Q
- [ ] W
- [ ] X
- [x] Z

Q1.3 Locating Network
3 Points

Which host would be in the same IP network as a new host with the address 129.73.21.44?

- (•) F
- ( ) X
- ( ) A
- ( ) L

Q1.4
3 Points

In order for packets to flow from X to Z, How many intermediate network hops will it use? (Skip the internet bubble)

- ○ 2
- ○ 4
- ◉ 5
- ○ 6

Q2 Network Calculation

16 Points

You are to send a 5000 byte message over a network with the following specification:

- Wire Bandwidth: 8 Mbps (8×10^6 bits per second)
- Time of Flight: 20 ms
- Processing Delay at the Sender: 1.5 ms
- Processing Delay at the Receiver: 1.1 ms

Q2.1 Transmission Time

8 Points

Calculate the total time for message transmission in milliseconds. Do not include the units when you enter your answer. Round your answer to 1 decimal place.

Use the rounded value to answer the next question.

27.6

Q2.2 Throughput

8 Points

Calculate the throughput for the message in units of bits/sec. Do not include the units when you enter your answer. Round your answer to 1 decimal place.

1449275.4

Q2.3 Work (Optional)
0 Points

If you would like partial credit in case of an incorrect answer on the previous parts, show your work in the field below or attach it as a file:

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2.1: S + Tw + Tf + R = 1.5 ms + (5000 * 8 * 1000 / 8×10^6) ms + 20 ms + 1.1 ms = 27.6 ms

2.2: 5000 * 8 * 1000 / 27.6 = 1449275.4 bit/s

Q3 Transport Layer Protocols
15 Points

Different transport-layer protocols perform differently; this question will show the difference in propagation time between different protocols.

For each question, we will send a message that contains **9 packets**. Additionally, assume that the time to send or receive the packet and the ACK (if present) are negligible compared to the propagation time on the medium, and that there is no packet loss in the medium.

Q3.1 Stop-and-Wait
5 Points

Assume we are using a stop-and-wait protocol with a RTT for a packet is 6 ms. How much time is required to complete the transmission?

54

Q3.2 No-ACK
5 Points

If the protocol does not send acknowledgements, how much time is required to complete the transmission if the time to send a packet from source to destination is 3 ms? Assume the source knows this time, and the time does not change.

3

Q3.3 Sliding Window
5 Points

Assume we are using a sliding window protocol with a window size of 4 and a RTT of 5 ms. How much time is required to complete the transmission?

15

Q3.4 Work (Optional)
0 Points

If you would like partial credit in case of an incorrect answer on the previous parts, show your work in the field below or attach it as a file:

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3.1: 9 * 6 =54

3.3: ceiling(9/4) * 5 = 3 * 5 = 15

Q4 Packet Calculation

24 Points

Assume that a computer wants to send a message 932,430 bytes long. The computer sends the message packet by packet across a reliable connection using the stop-and-wait protocol.
Each packet has a header that is 20 bytes long and a payload of 256 bytes.

Q4.1 Number of Packets

8 Points

Calculate the minimum number of packets that need to be sent to transmit the entire message (assuming no packet loss).

3643

Q4.2 Number of Bytes

8 Points

How many bytes does the sender transmit in total using the packets above?

1005468

Q4.3 Loss Rate

8 Points

Now assume 1 out of every 10 packets is lost. How many packets will need to be sent to the receiver to transmit all the packets?

Note: assume no acknowledgments are lost. If you lose a non-whole number of packets, **round down** to determine the number of packets lost.

4046

Q4.4 Work (Optional)
0 Points

If you would like partial credit in case of an incorrect answer on the previous parts, show your work in the field below or attach it as a file:

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4.1:
932430 / 256 = 3643

4.2:
256 + 20 = 276
276 * 3643 = 1005468

4.3:
3643 + 364 + 36 + 3 = 4046

Q5 Link Layer

14 Points

Compare and contrast how CSMA/CD and CSMA/CA handle the problem of collisions, including when each method is used.

CSMA/CD is used in traditional Ethernet networks. A device listens to the network to check if it is idle before transmitting. If two devices transmit at the same time, a collision is detected, and each device stops and waits for a random time before trying again, utilizing exponential backoff. CSMA/CD can afford this because it is capable of detecting collisions due to the electrical properties of the medium, which is typically a wired network.

CSMA/CA is used in wireless networks such as Wi-Fi. Because it's not possible to listen while sending (due to the nature of radio communications), collision detection is not feasible. Instead, devices try to avoid collisions by waiting for a random period of time when the medium is idle before they attempt to transmit. They may also use an acknowledgment system to ensure the packet was received; if no acknowledgment is received, the device assumes a collision occurred and tries to retransmit after another random waiting period.

CSMA/CD directly deals with collisions after they occur and tries to resolve them by stopping and resending, while CSMA/CA tries to prevent collisions by waiting before sending. CSMA/CD is typically used in wired networks, while CSMA/CA is used in wireless networks.

Q6 Network Stack Layers

16 Points

Q6.1

4 Points

Which layer of the network stack has the role of navigating a packet from the source to the destination?

- ○ Application
- ○ Transport
- ◉ Network
- ○ Link
- ○ Physical

Q6.2

4 Points

Which layer of network stack would be responsible for acquiring physical medium for transmission, and sending the packet to the destination host?

- ○ Application
- ○ Transport
- ○ Network
- ◉ Link
- ○ Physical

Q6.3
4 Points

Which layer of the network stack would protocols such as TCP and UDP be considered part of?

- ○ Application
- ◉ Transport
- ○ Network
- ○ Link
- ○ Physical

Q6.4
4 Points

Which layer of the network stack would protocols such as SMTP and HTTP be considered part of?

- ◉ Application
- ○ Transport
- ○ Network
- ○ Link
- ○ Physical