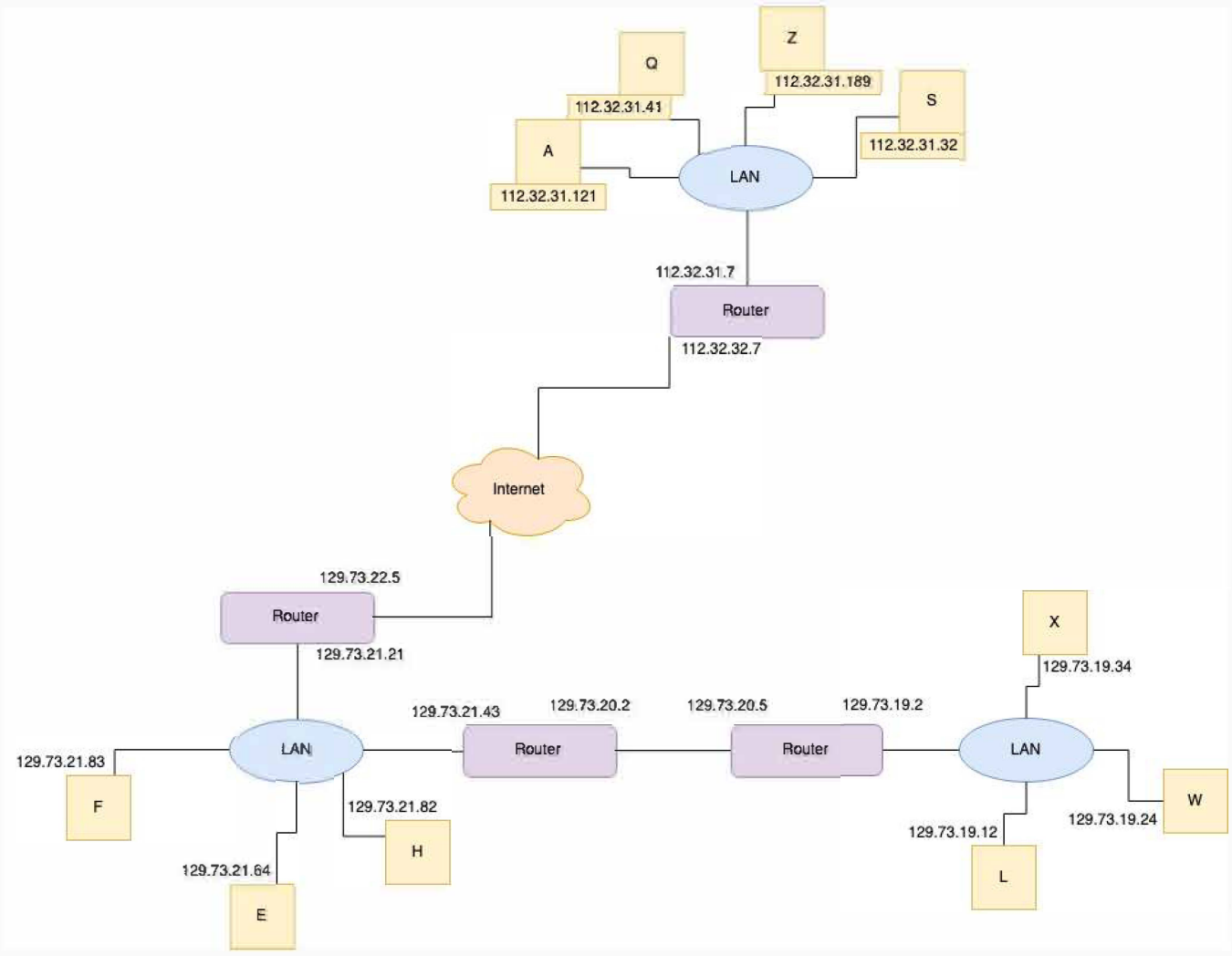
Homework 10 ● GRADED

Q1 IP Networks

18 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

4 Points

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

6

1.1 Network Count **4** / 4 pts

- ✔ − 0 pts Correct (4 or 6)
- − 0 pts Correct
- − 4 pts Incorrect

Q1.2 Grouping Hosts

9 Points

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

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

1.2 Grouping Hosts **9** / 9 pts

- ✔ − 0 pts Correct (F is accepted, but not required)
- − 3 pts Did not check E
- − 3 pts Did not check H
- − 3 pts Checked one other host
- − 3 pts Checked two other hosts
- − 9 pts Incorrect

Q1.3 Locating Network

4 Points

Which host would be in the same IP network as a new host with the address 112.32.31.45?

- F
- X
- A
- L

1.3 Locating Network **4** / 4 pts

- ✔ + 4 pts Correct
- + 0 pts Incorrect

Q1.4

1 Point

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

- 2
- 4
- 5
- 8

1.4 (no title) **0** / 1 pt

- + 1 pt Correct
- ✔ + 0 pts Incorrect

Q2 Network Calculation

24 Points

You are to send a 1000 byte message over a network with the following specification:

- Wire Bandwidth: 5 Mbps (5×10^6 bits per second)
- Time of Flight: 14 ms
- Processing Delay at the Sender: 1.0 ms
- Processing Delay at the Receiver: 1.0 ms

Q2.1 Transmission Time

12 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.

10.6

2.1 Transmission Time **10** / 12 pts

- − 0 pts Correct (17.6)
- − 0 pts Correct
- − 2 pts Rounding error
- − 4 pts Did not convert 1000 bytes to bits (answer was 16.2)
- − 4 pts Did not properly convert from seconds to milliseconds
- − 6 pts Incorrect transmission time formula
- − 12 pts Incorrect
- 💬 − 2 pts You don't need to divide by 2 for time of flight since it is the time for a one-way trip. Don't get confused with RTT

Q2.2 Throughput

12 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.

754717.0

2.2 Throughput **12** / 12 pts

- − 0 pts Correct (454545.5)
- − 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)
- − 6 pts Incorrect throughput formula
- − 12 pts Incorrect

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.) Total time of Transmission Time $= S + t_w + t_f + R$

S: Processing Delay of sender = 1 ms

t_w: Transmission Delay $= \frac{\text{size of message}}{\text{Bandwidth}}$

$= \frac{1000 \text{ bytes} \left(\frac{8 \text{ bits}}{\text{byte}}\right)}{5 \cdot 10^6 \frac{\text{bit}}{\text{sec}}}$

$= \frac{1}{625} \text{ s} = 0.0016 \text{ sec} = 1.6 \text{ ms}$

t_f: Time of flight = 7 ms

R: Processing delay of Receiver = 1 ms

Transmission Time = 1 + 1.6 + 7 + 1 = **10.6 ms**

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2.2.) Throughput $= \frac{\text{Message size}}{\text{Transmission Time}}$

$= \frac{1000 \text{ bytes} \left(\frac{8 \text{ bits}}{\text{byte}}\right)}{10.6 \text{ ms}} = \frac{40{,}000{,}000}{53} \frac{\text{bits}}{\text{s}}$

$\simeq 754{,}717.0 \text{ bits/s}$

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 **6 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 3 ms. How much time is required to complete the transmission?

18 ms

3.1 Stop-and-Wait R 5 / 5 pts

- 0 pts Correct (18)
- 5 pts Incorrect
- 0 pts Correct

Regrade Request Submitted on: May 07

Gradescope rubric seems to say "-0 pts correct (18)" and I put "18 ms"

Resolved, points returned

Reviewed on: May 07

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 2 ms? Assume the source knows this time, and the time does not change.

2 ms

3.2 — No-ACK — **5** / 5 pts

- ✔ − 0 pts — Correct: pipelined/sent all packets at the same time (2)
- − 0 pts — Correct
- − 0 pts — Correct: stop-and-wait protocol (12)
- − 5 pts — Incorrect

Q3.3 Sliding Window

5 Points

Assume we are using a sliding window protocol with a window size of 3 and a RTT of 4 ms. How much time is required to complete the transmission?

8 ms

3.3 — Sliding Window — R **5** / 5 pts

- ✔ − 0 pts — Correct (8)
- − 5 pts — Incorrect

Regrade Request — Submitted on: **May 07**

> Gradescope rubric seems to say "-0 pts Correct (8)" and I put "8 ms"

Regraded!

Reviewed on: **May 07**

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:

No files uploaded

3.1.) t = num_packets * RRT = 6 * 3 ms = 18 ms
3.2.) Since we don't wait for acknowledgments we just keep firing off messages every 2 ms.
3.3.) t = (packet_size / window size) * RRT = (6/3) * 4 ms = 8 ms

Q4 Packet Calculation

24 Points

Assume that a computer wants to send a message 100,000 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 30 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).

391

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

- ✔ − 0 pts — Correct (391)
- − 0 pts — Correct
- − 2 pts — Correct formula, wrong answer
- − 2 pts — Rounded down/forgot the last packet (390)
- − 4 pts — Divided by payload size + header instead of just payload size
- − 2 pts — Included ACK packets
- − 8 pts — Incorrect

Q4.2 Number of Bytes

8 Points

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

111826

4.2 — Number of Bytes — **6** / 8 pts

- − 0 pts — Correct (111730)
- − 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

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 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.

433

4.3 — Loss Rate — **8** / 8 pts

- ✔ − 0 pts — Correct (433)

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.) Packet Loss

4.1) Number of Packets needed (no packet loss)

$$\text{Number of Packets needed} = \frac{\text{Total message size}}{\text{Payload size}}$$

$$= \frac{100\,000}{256} \approx 390.625 \text{ packets}$$

(391 packets needed)

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4.2)

Size of Packet = Header size + Payload size

= 30 bytes + 256 bytes = 286 bytes

Total bytes sent = (Number of packets)(Size of Packet)

= (391)(286 bytes)

= 111,826 bytes

▾ 53E00BBD-851B-40F8-924F-19153C6413BE.jpeg Download

4.3)

10 % Packet loss rate

question said to round down number of packets lost

	Packets sent		Lost	Delivered
original number of packets sent →	391	/10 =	39	352
	39		3	36
	3		0	3
Totals:	433		42	391

Q5 Link Layer

20 Points

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

CSMA/CD and CSMA/CA are random access protocols for devices that want to transmit data over broadcast mediums such as Ethernet or WiFi.

The Carrier Sense Multiple Access/Collision Detection protocol (CSMA/CD) is a protocol for WIRED networks (in the modern world this is pretty much obsolete, however). CSMA/CD requires allows only one device to access the shared medium a time by making each device sense if the shared medium is idle. If it is, then the device can transmit data; if the medium is already transmitting another devices request, then the current device must wait until it is idle. If, however, two devices see that the network is idle at nearly the same time and begin transmitting data on the network, a collision will occur. When this collision occurs both devices will terminate their data transmission, send out a jamming signal across the medium to all other devices, and then the two devices that caused the collision will separately calculate a random amount of time to wait before checking if the medium is idle again. If more collisions happen between the same two networks, the random amount of time the devices will wait before attempting to retransmit will increase exponentially.

The Carrier Sense Multiple Access/Collision Avoidance protocol (CSMA/CA) is a protocol for WIRELESS networks. CSMA/CA has devices first check if there is another transmission occurring on the network. If there is a transmission occurring, then the device must wait, otherwise it may transmit the message. CSMA/CA may employ the “Ready to Send-Clear to Send” (RTS/CTS) protocol where a device on the network may ask the network access point to allow it to transmit data solely by sending an RTS signal. If the access point grants this request, a CTS signal is sent and all other activity on the network ceases and the device that sent out the RTS signal will start transmitting data once it receives the CTS signal.

Similarities:
- Both protocols require devices to wait if there is currently activity on the network.

Differences:

When each method is used: CSMA/CD is used for wired networks whilst CSMA/CA is used for wireless networks.

QUESTION 5
Link Layer **20** / 20 pts

✔ − 0 pts	Correct
− 3 pts	Did not identify CSMA/CD as being used for Ethernet / wired protocols
− 1 pts	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)
− 20 pts	Blank/no answer

Q6 Network Stack Layers
4 Points

Q6.1
1 Point

Which layer of the network stack would the Internet Protocol be considered part of?

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

QUESTION 6
Network Stack Layers **4** / 4 pts

6.1 (no title) **1** / 1 pt

✔ + 1 pt	Correct
+ 0 pts	Incorrect

Q6.2
1 Point

Which layer of network stack would protocols such as Ethernet and IEEE 802.11 be considered part of?

- Application
- Transport
- Network
- Link
- Physical

6.2 (no title) **1** / 1 pt

✔ + 1 pt Correct

+ 0 pts Incorrect

Q6.3

1 Point

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

- Application
- Transport
- Network
- Link
- Physical

6.3 (no title) **1** / 1 pt

✔ + 1 pt Correct

+ 0 pts Incorrect

Q6.4

1 Point

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

- Application
- Transport
- Network
- Link
- Physical

6.4 (no title) **1** / 1 pt

✔ + 1 pt Correct

+ 0 pts Incorrect

Homework 10

GRADED

STUDENT

Eric Anders Gustafson

TOTAL POINTS

100 / 105 pts

QUESTION 1

IP Networks **17** / 18 pts

1.1 Network Count **4** / 4 pts

1.2 Grouping Hosts **9** / 9 pts

1.3 Locating Network **4** / 4 pts

1.4 (no title) **0** / 1 pt

QUESTION 2

Network Calculation **22** / 24 pts

2.1 Transmission Time — **10** / 12 pts

- **– 0 pts** Correct (17.6)
- **– 0 pts** Correct
- **– 2 pts** Rounding error
- **– 4 pts** Did not convert 1000 bytes to bits (answer was 16.2)
- **– 4 pts** Did not properly convert from seconds to milliseconds
- **– 6 pts** Incorrect transmission time formula
- **– 12 pts** Incorrect

> **– 2 pts** You don't need to divide by 2 for time of flight since it is the time for a one-way trip. Don't get confused with RTT

2.2 Throughput — **12** / 12 pts

2.3 Work (Optional) — **0** / 0 pts

QUESTION 3

Transport Layer Protocols — **15** / 15 pts

3.1 Stop-and-Wait — R **5** / 5 pts

3.2 No-ACK — **5** / 5 pts

3.3 Sliding Window — R **5** / 5 pts

3.4 Work (Optional) — **0** / 0 pts

QUESTION 4

Packet Calculation — **22** / 24 pts

4.1 Number of Packets — **8** / 8 pts

4.2 Number of Bytes — **6** / 8 pts

4.3 Loss Rate — **8** / 8 pts

4.4 Work (Optional) — **0** / 0 pts

QUESTION 5

Link Layer — **20** / 20 pts

QUESTION 6

Network Stack Layers — **4** / 4 pts

6.1 (no title) — **1** / 1 pt

6.2 (no title) — **1** / 1 pt

6.3 (no title) — **1** / 1 pt

6.4 (no title) — **1** / 1 pt