CSCI 4311/5311 Midterm
Spring-2023

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Instructions:
- This exam is open book, notes, slides etc.
- The exam starts at 3.30 pm. Moodle will automatically close submission at 5.30pm.
- I do not accept email submission.
- You need to submit a PDF file. Make sure you convert your solutions to a PDF file.
- Do NOT attempt to cheat. If you get caught, you get F from the class and directly reported to the department and student affairs.
- If you cheat from your friend, I will assume that both of you are cheater and I will act accordingly.

Total Marks = 100   **Time: 120 minutes**

Good Luck!

(Q1) [2x8 = 16 points]

Write true or false in the box and shortly explain why you think it is true or false. You can use some examples to explain your reasoning. **Note that, without explanation, you will not get points.**

a-) (F) Client-Server architecture always works faster than Peer-to-Peer architecture.

with peer-to-peer, you are able to send information faster since peer can request service from other peers. where as client-server only sends information from host & back one by one.

example P2P

example sender

P1   P2   P3   P4
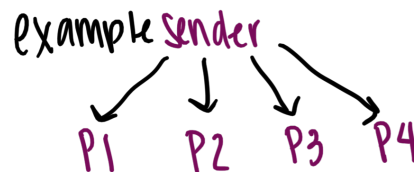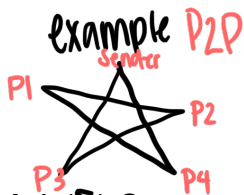
b-) (F) Suppose Host A sends one segment with sequence number 50 and 5 bytes of data over a TCP connection to Host B. In this same segment the acknowledgment number is necessarily 55.

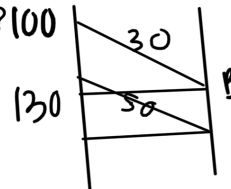The ack number indicates the next sequence number A is expecting from B
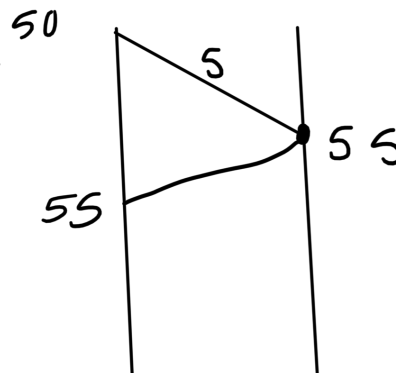
(Q2) [15 points]

Suppose Host A sends two TCP segments back-to-back to Host B over a TCP connection. The first segment has sequence number 100; the second has sequence number 130. Assume that the second segment size is 50 bytes.
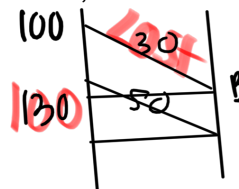
a-) [3 points] How much data is in the first segment?

30

b-) [3 points] Suppose that the first segment is lost but the second segment arrives at B. In the acknowledgment that Host B sends to Host A, what is the acknowledgment number?

100

c-) [3 points] If the second segment arrives before the first segment, in the ACK of the first arriving segment, what is the ACK number?

130

d-) [3 points] Suppose that both segments arrive at B in order. B sends acknowledgement packets but the first ack packet is lost, second packet arrived successfully. What will Host A do and why?
E.g., retransmit packets, retransmit a packet or, do not retransmit the packet.

does not retransmit the packet because   Host A doesn't recieve the ack packet for #1 but one for ack #2 then you would have to recieve #1 as well.

e-) [3 points] Suppose that both segments arrive at B in order. In the last acknowledgment that Host B sends to Host A, what is the acknowledgment number?

180
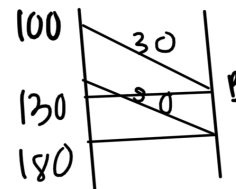
(Q3) [15 points]
Compare TCP and UDP protocols. What are the advantages and disadvantages of both protocols? Explain **briefly**.

TCP → reliable, in-order delivery
  → connection-oriented protocol
  → slower
  → retransmission of lost data is only w/ tcp

UDP → unreliable, unordered delivery
  → connectionless protocol
  → faster & simpler

(Q4) [24 points]
A router has only two links; incoming link has bandwidth 4 Mbps and outgoing link has bandwidth 16 Mbps. The next hop router in the outgoing link is 100 km away. A packet of 8000 bytes arrives at the incoming link. Calculate the time interval between the time when the first bit of the packet enters the router incoming interface and the time when the first bit of the packet enters the next hop router incoming interface. Initially all the queues are empty.
Speed of light in fiber is 200,000 km/s. $d_{nodal} = d_{proc} + d_{queue} + d_{trans} + d_{prop}$
Note1: Mbps (Megabit per second), 1 byte = 8 bits, don't forget to convert units.
Note2: Giga = 10^9, Mega = 10^6, kilo = 10^3, milli = 10^{-3}, micro 10^{-6}, nano 10^{-9}

$$d_{nodal} = d_{proc} + d_{queue} + \frac{L}{R} + \frac{d}{S}$$

$$\frac{64,000}{4 \times 10^6} + \frac{100 \, km}{200,000}$$

$$\downarrow$$

$$0.016 + 0.0005$$

$$= 0.0165 \, s$$

(Q5) [30 points]
We are trying to transfer a large file over this connection. Initial ssthresh is 8 MSS. MSS= 1KB. A timeout occurs at RTT 4. A triple double ACK arrives after having just transmitted 33KB **after the timeout**. Assume that you successfully transfer all the data at RTT 14.
- Draw the Congestion Window (cwin) value against time (RTT).
- Identify slow start and congestion avoidance intervals.
- Find the ssthresh values for all intervals.

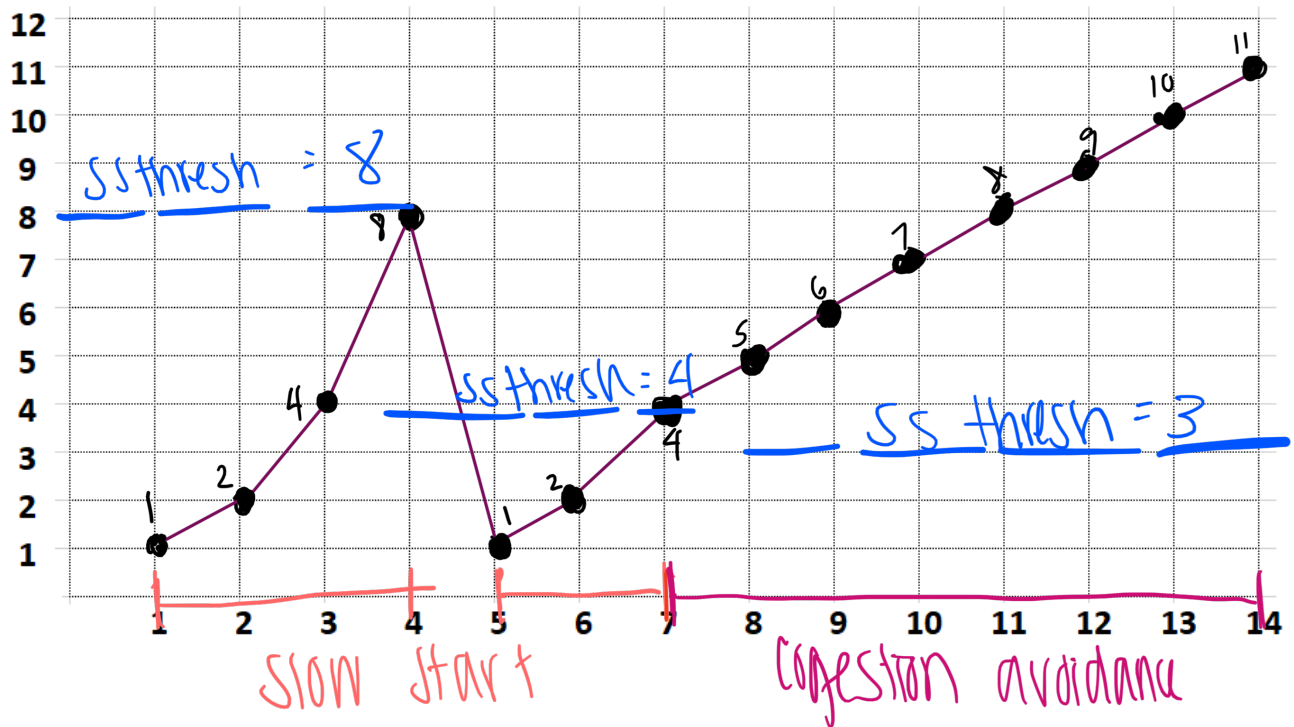**Hint**: Be careful about "triple double ACK **after having 33 KB AFTER the timeout**."

a- [12 points] A TCP connection uses the Tahoe version.
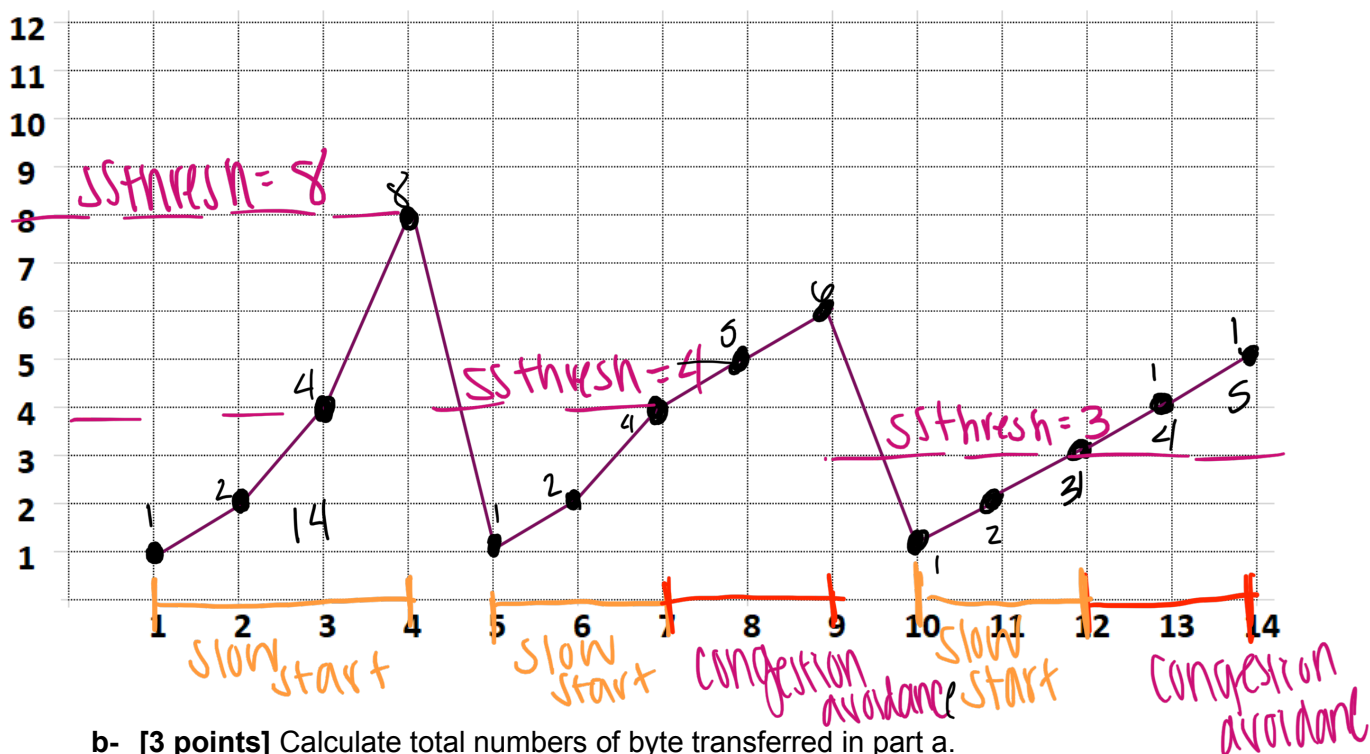
b- [3 points] Calculate total numbers of byte transferred in part a.

$$15 + 18 + 15 = 48$$

c- [12 points] A TCP connection uses the Reno version.

ssthresh = 8

ssthresh = 4

ss thresh = 3

Slow start

Congestion avoidance

d- [3 points] Calculate total numbers of byte transferred in part c.

$15 + 63 = 78$