CS305 Computer Networking

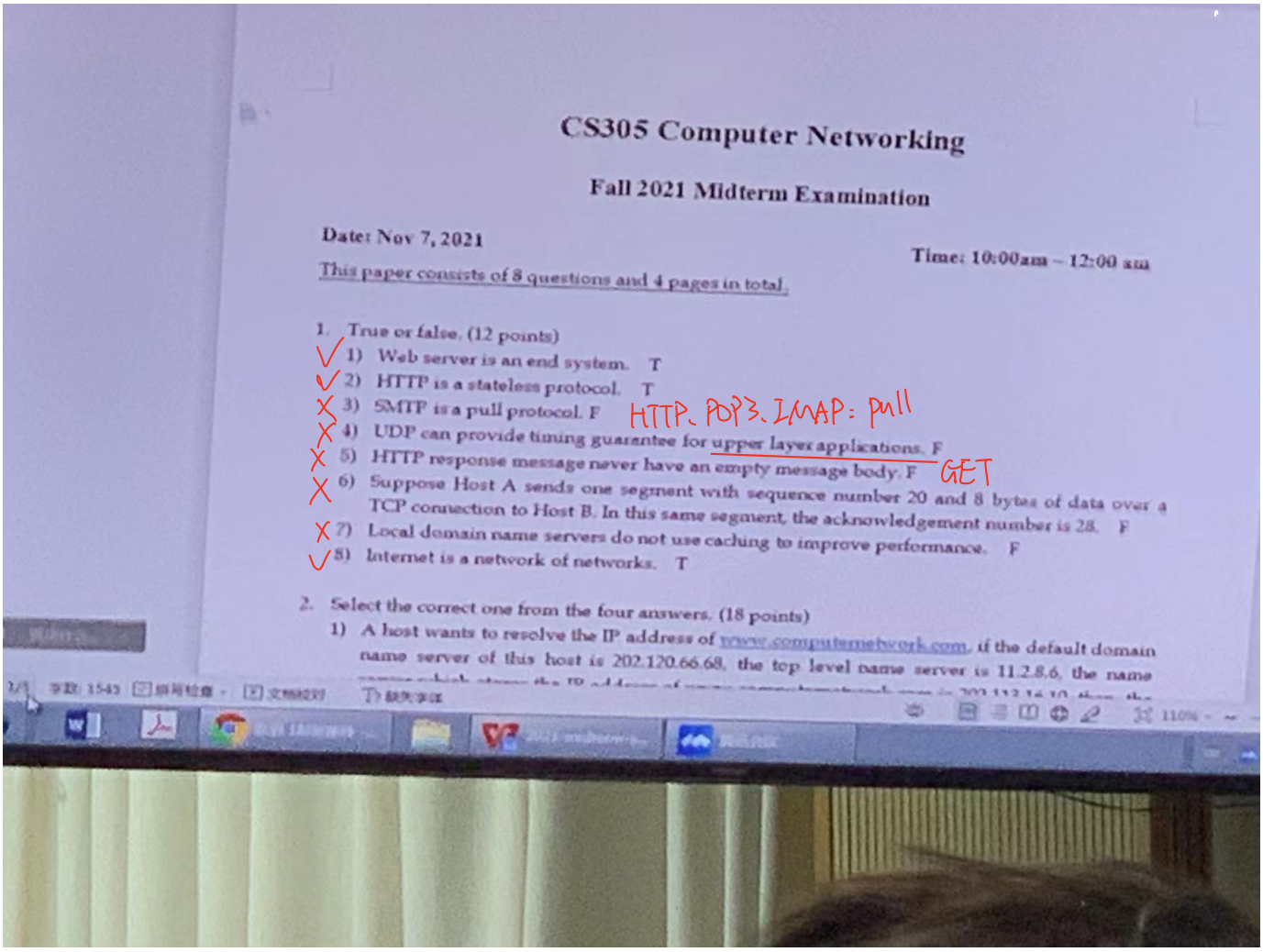
Fall 2021 Midterm Examination

Date: Nov 7, 2021 Time: 10:00am – 12:00 am

This paper consists of 8 questions and 4 pages in total.

1. True or false. (12 points)
   1) Web server is an end system. T
   2) HTTP is a stateless protocol. T
   3) SMTP is a pull protocol. F
   4) UDP can provide timing guarantee for upper layer applications. F
   5) HTTP response message never have an empty message body. F
   6) Suppose Host A sends one segment with sequence number 20 and 8 bytes of data over a TCP connection to Host B. In this same segment, the acknowledgement number is 28. F
   7) Local domain name servers do not use caching to improve performance. F
   8) Internet is a network of networks. T

2. Select the correct one from the four answers. (18 points)
   1) A host wants to resolve the IP address of www.computernetwork.com, if the default domain name server of this host is 202.120.66.68, the top level name server is 11.2.8.6, the name



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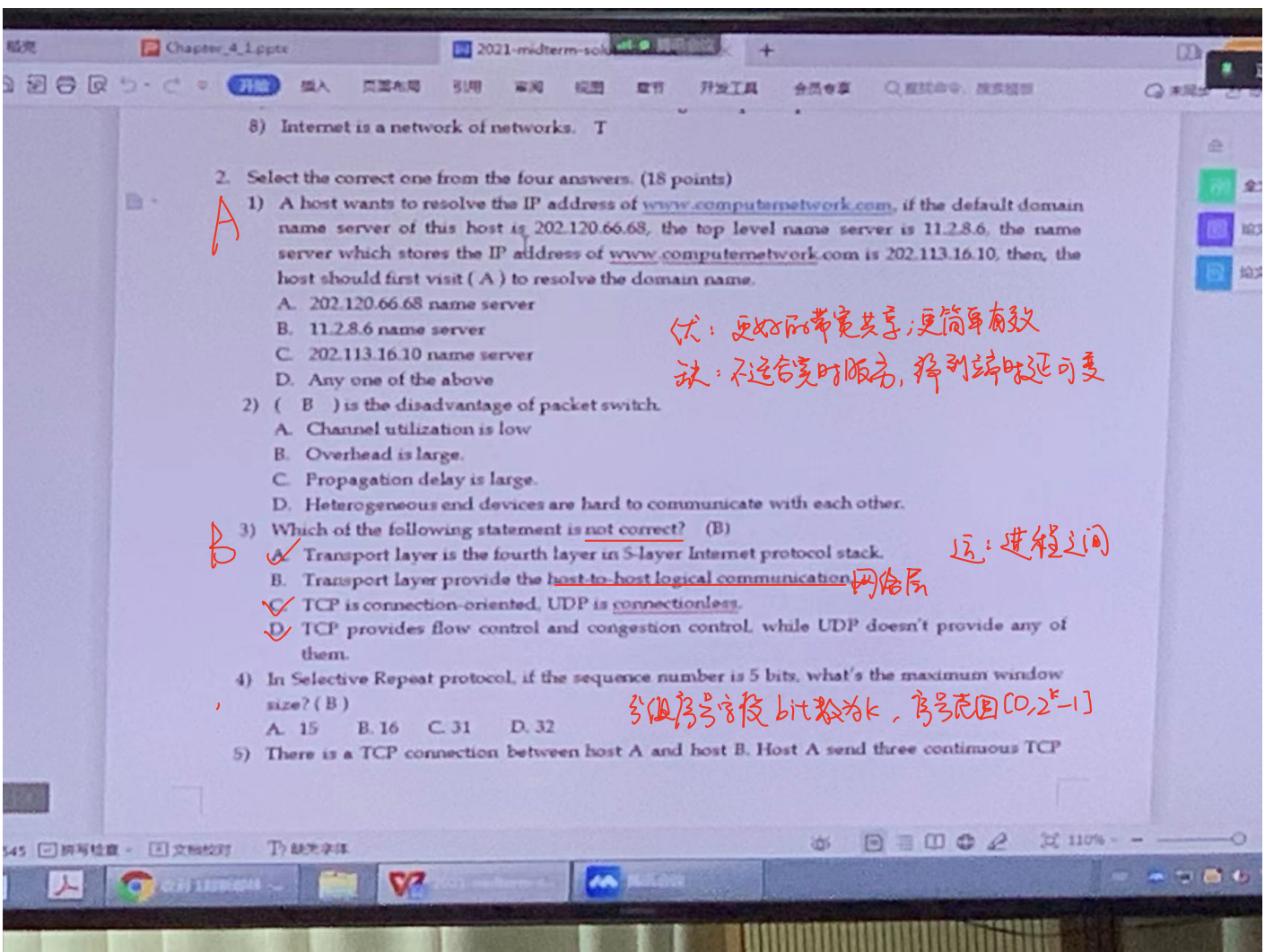
A 1) A host wants to resolve the IP address of www.computernetwork.com, if the default domain name server of this host is 202.120.66.68, the top level name server is 11.2.8.6, the name server which stores the IP address of www.computernetwork.com is 202.113.16.10, then, the host should first visit (A) to resolve the domain name.
   A. 202.120.66.68 name server
   B. 11.2.8.6 name server
   C. 202.113.16.10 name server
   D. Any one of the above

   2) (B) is the disadvantage of packet switch.
   A. Channel utilization is low
   B. Overhead is large.
   C. Propagation delay is large.
   D. Heterogeneous end devices are hard to communicate with each other.

B 3) Which of the following statement is not correct? (B)
   A. Transport layer is the fourth layer in 5-layer Internet protocol stack.
   B. Transport layer provide the host-to-host logical communication
   C. TCP is connection-oriented, UDP is connectionless.
   D. TCP provides flow control and congestion control, while UDP doesn't provide any of them.

   4) In Selective Repeat protocol, if the sequence number is 5 bits, what's the maximum window size? (B)
   A. 15 B. 16 C. 31 D. 32

   5) There is a TCP connection between host A and host B. Host A send three continuous TCP



3. Fill in the blanks. (25 points)

1) Write down the two defining elements of a protocol. A protocol defines _message_____ and ___action____.

2) Packets in different layers have different names. A packet in application layer is called a _message_____, a packet in transport layer is called a ___segment____, a packet in network layer is called a _datagram_____, a packet in link layer is called a __frame_____.

3) DNS runs on top of ___UDP____ (TCP/UDP), SMTP runs on top of __TCP_____(TCP/UDP).

4) What application layer protocols are used to send email in the following scenarios? List all possible protocols. _SMTP, HTTP_____ protocols are used to send email between sender's mail agent and sender's mail server. _POP3 IMAP HTTP_____ protocols are used to send email between receiver's mail agent and receiver's mail server.

5) In reliable data transfer, __checksum_____ technique is used to check whether a packet is corrupted. ___ACK_____ technique is used for the receiver to give feedback to the sender. ___timeout_____ technique is used to handle packet loss.

6) To enable clients with different Internet access rates to download video streaming at different encoding rates, __DASH_____ protocol is used in Internet.

7) CDN adopt two different server placement strategies: __bring home_____ and _enter deep_____.

8) If a UDP server needs to support n simultaneous connections, each from a different client host, __1_____ number of sockets are needed for the UDP server. If the server is TCP server, __n+1_____ number of sockets are needed.

9) Congestion control is to control ___sender_____'s rate to avoid __router's buffer overflow_____, flow control is to control ___sender_____'s rate to avoid __receiver's buffer overflow_____.

4. (8 points) Suppose Host A wants to send a file of 6 Kbyte to Host B. The file is divided into several 1.5Kbyte-length packets to transmit. The path from Host A to Host B has three links, of

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rates R_1 = 500Kbps, R_2 = 1Mbps, R_3 = 2Mbps. The propagation delay for each link is 2ms.

1) Ignore the nodel processing delay. What's the end-to-end delay for transmitting the file?

2) Assume the packet switch processing delay is 3ms, and R_2 is reduced to 250Kbps, what's the total end-to-end delay?

(1) 6K*8/0.5M + 2 + 1.5K*8/1M + 2 + 1.5K*8/2M + 2 ms= 96 + 2 + 12 + 2 + 6 + 2ms = 120ms

(2) 1.5K*8/0.5M + 2 + 3 + 6K*8/0.25M + 2 + 3 + 1.5K*8/2M + 2 ms = 24 + 2 + 3 + 192 + 2 + 3 + 6 + 2ms = 234ms

5. (8 points) Consider distributing a file of F = 30 Gbits to N = 1000 peers. The server has an upload rate of u_s = 30 Mbps, and each peer has a download rate of d_i = 2 Mbps and an upload rate of u = 300Kbps. Calculate the minimum distribution time of the file for both client-server distribution and P2P distribution.

(1) 30G/30M * 1000 = 1000000 s

(2) max(30G/30M, 30G/2M, 30G*1000/(30M+300K*1000)) = 90909.1s = 10/11 * 100000

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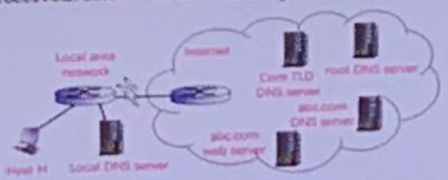
6. (6 points) Consider a network as shown in the figure below, the local DNS server provides recursive query, the other DNS server provide iterative query; The round-trip time for the host H or the server in the local area network to visit any server in the Internet is 10ms, ignore all other delays. The host H want to visit the webpage index.html via the URL http://www.abc.com/index.html, calculate the time delay from it clicks the link until the index.html page is well received. Show the calculation procedure.



20ms, 50ms

7. (8 points) Assuming TCP Reno is the protocol experiencing the behavior shown in the figure below.
   1) Identify the intervals of time when TCP slow start is operating. 1-6 23-26
   2) Identify the intervals of time when TCP congestion avoidance is operating. 6-16 17-22
   3) What happens for the 16th transmission round? 3 duplicate ACK
   4) What is the value of ssthresh at the 18th transmission round? 21

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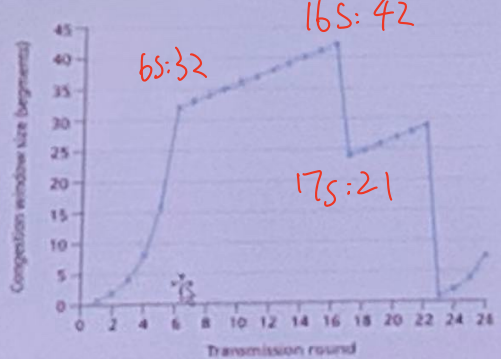
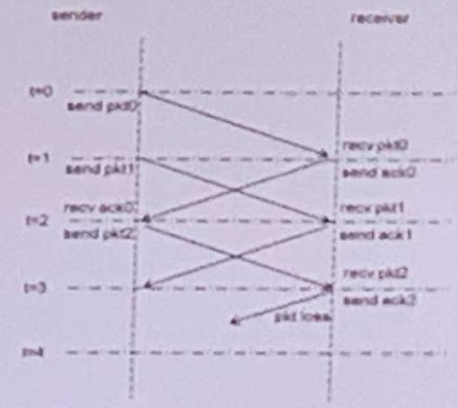


8. GBN and Selective Repeat (15 points)
In this problem you will be drawing examples of the application of the GBN and Selective Repeat protocols. We start with the setup:
   - Machine A is a sender; machine B is a receiver.
   - Window size N=4

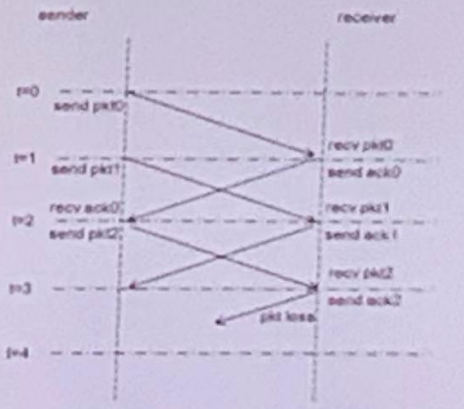
packets sent at time t=1,2,4,5,7,8... are all delivered successfully. Run all actions performed by A and B under the GBN protocol until A is sure that packets 0,1,2,3,4,5,6 have all been successfully received.

2) Redo the problem in part 1) but selective repeat is used.



Sender receiver

(1)



sender receiver

(2)