CSA 283: Exam Two

Name: _____ Section: _____

Please write legibly. Ask questions if something is unclear. Write down any assumptions you make.

1. List the five protocol layers of the internet in order from highest to lowest. (5 points)

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   _____

   _____

   _____

   _____

2. List the four pieces of information used to identify a TCP socket connection. (4 points)

   _____ _____

   _____ _____

3. Below are four bytes of data and the 16 bit internet checksum received in a UDP datagram. Based on this checksum, has the data been corrupted? Indicate mathematically why or why not. (4 points)

Byte 1	Byte 2	Byte 3	Byte 4	Checksum
11100110	**01100110**	**11010101**	**01010101**	**0100010001000011**

4. Consider two packets.

   - The first packet has source IP address S1, destination IP address B, source port S2, and destination port D1.

   - The second packet has source IP address S2, destination IP address B, source port S2, and destination port D1.

   a. Assuming that both packets reach their final destination and are transmitted using UDP, will the two UDP packets be received by the same socket? Why or why not? (3 points)

   b. Assuming that both packets reach their final destination and are transmitted using TCP, will the two TCP packets be received by the same socket? Why or why not? (3 points)

5. Host A has calculated the congestion window to be 12,000 bytes. The receive window for Host B to which the host A is sending data is 14,000 bytes. Host A has transmitted 6,000 bytes of data. 2,000 of these bytes have been acknowledged. What is the maximum number of bytes Host A can transmit to Host B at this time? Explain/show your reasoning. (4 points)

6. TCP flow control uses the number of duplicate acks and timeouts to determine the transmission rate. Assume following events:

   - transmission of data begins at time 0 (RTT 0)
   - timeout event occurs between at RTT 3 and RTT 4.
   - three duplicates acks received between RTT 8 and RTT 9
   - positive ack received during all other RTT intervals

   Write the size of the congestion window and the Threshold at the following times. The CongWin should be adjusted at the end of each RTT interval based on what happens in the interval:

Time	**Size of congestion Window (CongWin) in Maximum Segment Sizes (MSS)**	**Threshold in MSS**
2 RTT		n/a
6 RTT		
7 RTT		
11 RTT		

   (7 points)

7. In relation to TCP congestion control, explain why are timeout events are handled differently from three duplicate acknowledgements. (4 points)

8. Consider the following parameters of a connection between two hosts:

   - End to end propagation delay 10 ms.
   - Single packet transmission delay of 10 microseconds (0.010 ms).
   - No packets are lost.

   (6 points)

   a. Ignoring all delays other than propagation delay, what is the round trip time (RTT)?

   b. Taking into account propagation and transmission delay, what is the bandwidth utilization for a stop and wait protocol during any given RTT interval? Explain/show your reasoning.

   c. Taking into account propagation and transmission delay, what is the bandwidth unitization for a pipelined protocol with a window size of eight? (Can send up to eight packets back to back before stopping to wait for an acknowledgement). Explain/show your reasoning.

9. Assume MTU = 600 bytes, break the following datagram (containing 1980 bytes of data) into as many fragments as necessary. For each fragment, give the length, fragmentation flag value, and the offset (both, length and offset should be in bytes). Assume the IP header is 20 bytes long. (8 points)

	Length = 2000	ID = 22	Fragflag = 0	Offset = 0		

	Length =	ID =	Fragflag =	Offset =		

	Length =	ID =	Fragflag =	Offset =		

	Length =	ID =	Fragflag =	Offset =		

	Length =	ID =	Fragflag =	Offset =		

	Length =	ID =	Fragflag =	Offset =		

10. Consider the following TCP scenario. Sender A is sending packets to Receiver B at a rate based on the congestion window calculated by A. The receive buffer at B overflows before the application layer can process all the packets B has received. Is this a flow control problem or a congestion control problem? Circle the correct answer. (3 points)

Flow control problem Congestion control problem

11. List two services that can be provided by a virtual circuit network that can not be provided by a datagram network. (4 points)

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_____

12. Below is a portion of a routing table.

Prefix	Link Interface
11001000 00010111 00010	0
11001000 00010111 00011000	1
11001000 00010111 00011	2
Otherwise	3

Using the destination IP addresses, determine which link interface each of the following packets should be sent to. (6 points)

Destination IP Address	Link Interface
11001000 00010111 00010110 10100001	
11001000 00010100 10100001 00011000	
11001000 00010111 00011000 10101010	

13. List the two primary manifestations of network congestion that can be observed by a sending host. (4 points)

_____

_____

14. A block of data for transmission using the TCP protocol has been broken up for transmission into three separate segments. The first segment contains 40 bytes, the second segment contains 30 bytes and the third segment contains 50 bytes. Sequence numbers for transmitting these three segments start at 200. Write the correct sequence number for each segment and the sequence number that would be used by the receiver to indicate in order receipt of each segment. (6 points)

	Segment Sequence Number	Acknowledgement Number
First Segment		
Second Segment		
Third Segment		

15. Using node **G** in Figure 1 as the source, use the link state (LV) algorithm to find the shortest path to all other nodes. Show the members of *N*, the predecessor of each destination, and the shortest known distance to each destination after the initialization phase of the algorithm and after each loop iteration. (7 points)

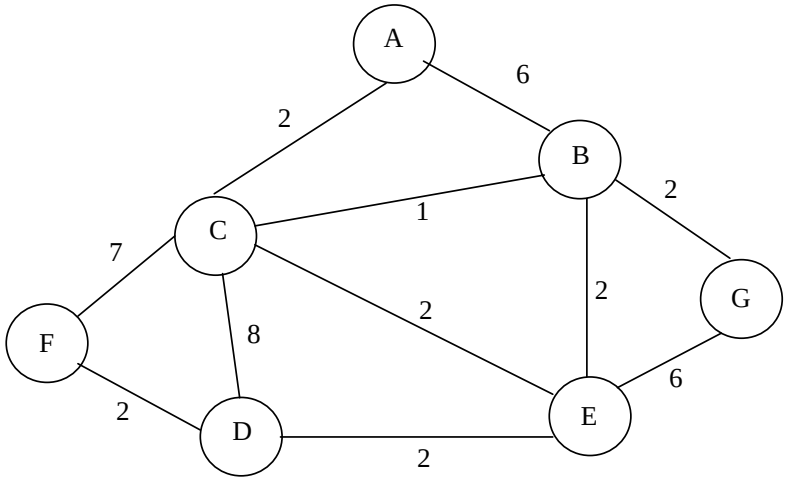

Figure 1: Network Graph

16. Write down the shortest path to all destinations in Figure 1 using the predecessor data in the table you created in the previous question. (6 points)

17. Write the initial distance vector table that would be created by the DV algorithm for node D in Figure 1. (4 points)

18. Below is a RIP protocol forwarding table for router "D".

Destination Network	Next Router	Hops to Destination
W	A	2
X	C	3
Y	B	2
Z	B	7
…	…	…

Each of the neighbors of router D is one hop away. Assume router D receives the following *advertisement* from a neighbor, router A.

Destination Network	Next Router	Hops to Destination
V	C	5
W	F	4
X	B	3
Z	C	4
…	…	…

Update the routing table of D based on the advertisement from A. Circle any changes that will require updates to the neighbors of D. (10 points)

Destination Network	Next Router	Hops to Destination

19. Figure 2 is a simple network diagram. The network includes three hosts (A, B, and C) and one router. The router is performing Network Address Translation (NAT) using the NAT table below the figure. An application on host B (port 4505) sends a datagram containing an HTTP request to an application running on a host, Z, in the internet with an IP address of 137.76.29.5 and a port number of 80.

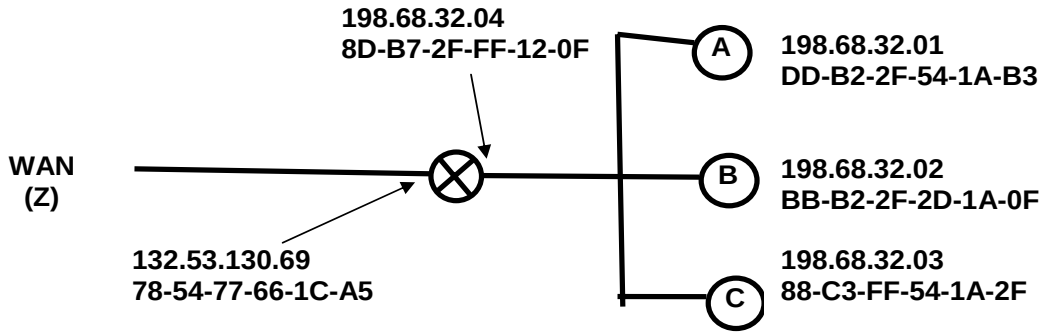

Figure 2: Simple Network with a Router Using the NAT Protocol

NAT Translation Table	
WAN side address	LAN side address
132.53.130.69, 5006	198.68.32.01, 3345
132.53.130.69, 3200	198.68.32.02, 4505
132.53.130.69, 1200	198.68.32.03, 7000
…	…

Fill in the source and destination IP addresses and port numbers that will be carried in datagrams at the following four points in the network. (8 points)

	Outgoing		**Incoming**	
	From B to router	**From router to Z**	**From Z to router**	**From router to B**
Source IP				
Source Port				
Dest. IP				
Dest. Port				

20. Sequence numbers are used by the UDP protocol to detect corrupt packets. (2 points)

TRUE FALSE

21. Fast retransmit occurs after a timeout occurs in order to avoid an extended delay before resending a lost packet. (2 points)

    TRUE FALSE

22. A Go-Back-N protocol is simpler to implement than the selective repeat (SR) protocol. (2 points)

    TRUE FALSE

23. TCP uses a network assisted approach to congestion control. (2 points)

    TRUE FALSE

24. A pipelined protocol is more efficient than a stop-and-wait protocol because it utilizes a lower percentage of the network bandwidth. (2 points)

    TRUE FALSE

25. The timeout interval is recalculated about once every round trip time (RTT). (2 points)

    TRUE FALSE

26. The TCP protocol uses a three way handshake to set up a connection. (2 points)

    TRUE FALSE

27. Intra-AS routing algorithms are executed by gateway routers connecting together autonomous systems. (2 points)

    TRUE FALSE

28. Information used to build the forwarding table of an interior router is supplied by both inter AS and intra AS routing algorithms. (2 points)

    TRUE FALSE

29. Name two commonly used intra-AS. (2 points)

    _____

    _____

30. Host A is sending data to host B. The reliable data transfer protocol uses **Go-Back-N** algorithm. Host A sends 3 segments (sequence numbers 0 through 2). Window size is 2 (window is grey).

    Segment number 1 is lost. **Complete the graph below and show how the sender window is modified**. Show how segment 2 is acknowledged and the retransmission and acknowledgement of segment 1. Assume that a timeout value is about 1.5 * RTT from A to B. (6 points)