Question 1

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Which of the following parameters determine the value of TCP retransmission timer?

- a. Time used for transmitting TCP segment, along with the number of lost packets
- b. Measured round-trip delay between transmission and acknowledment, along with the variation of the measured delays
- c. Time used for transmitting TCP segment, along with the latest measured round-trip time
- d. Size of the TCP segment and the number of retransmitted packets
- e. Measured round-trip delay between transmission and acknowledment, along with the number of lost packets

Clear my choice

Question 2

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Which of the following statements related to **multiple access** protocols is true?

- a. There is delay in detecting a collision on a CSMA-based random access link
- b. Alternating protocol is reliable because it is based on the use of a token
- c. With channel partitioning (e.g., TDMA) one can achieve the maximal efficieny
- d. CSMA/CD makes wireless satellite link more efficient
- e. When there is a collision on a CSMA random access link, the node retransmits the frame immeditately

Question 3

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Which of the following is **not** true?

- a. An autonomous system can contain multiple routers
- b. Distance vector protocol can propagate the information about a deteriorated route slowly
- c. Routing table stores e.g. IP prefixes
- d. IP address of a router differs from other nodes' IP addresses
- e. BGP always chooses the shortest route between two nodes

Question 4

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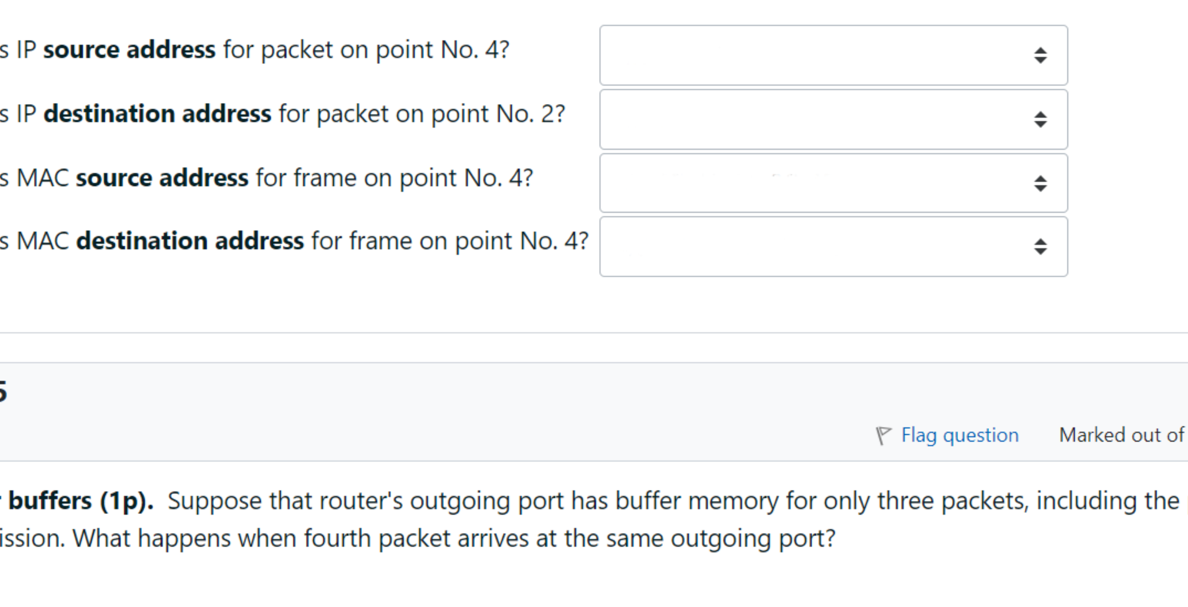
End-to-end addressing one network and link layer (1p). Investigate the network below. Hosts A, B and C have been assigned with IP and MAC addresses. Also the intermediate routers have been identified (note: the square boxes are *switches*). Let's assume that an IP packet/datagram that has been sent from node **A** to node **C**. Choose from below the correcy source and destination addresses on neywork and link layers. Let observe point (4).



What is IP **source address** for packet on point No. 4?

What is IP **destination address** for packet on point No. 2?

What is MAC **source address** for frame on point No. 4?

What is MAC **destination address** for frame on point No. 4?

Question 5

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Router buffers (1p). Suppose that router's outgoing port has buffer memory for only three packets, including the packet currently in transmission. What happens when fourth packet arrives at the same outgoing port?

- a. Packet 4 is kept in the switching fabric, and when the buffer on outgoing port has room, the packet will be placed there.
- b. Packet 4 is sent back to the incoming port and added to its queue.
- c. Packet 4 is deleted ("dropped"), or some other packet in the queue is dropped, so that there is room for packet 4.

Clear my choice

Question 6

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Assume that there are multiple transport-layer flows on that are arrive at a overload link (you can think that several connections arrive at router with an overloaded link). Let's assume that all *but one* of the transport-layer flows use TCP with a modern congestion control. There is *one* flow, however, that does not reduce its sending rate in response to congestion, i.e., it does not apply TCP's congestion control.

What happens to this one flow on this link, in the above-described case?

- a. The packets of this one different connection will be preferentially dropped at a higher likelihood.
- b. Nothing special compared to other connections. It will be treated in the same way.
- c. The router starts to randomly drop 50% of the packets that are part of this special flow.
- d. The router signals the TCP sender of the flow that it must reduce its transmission rate by 50%
- e. The router signals the TCP sender of the flow that it must reduce its transmission rate by 25%

Question 7

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ARQ (2p): Assume we have a link with length with $d = 1500$ m and signal propagation speed is $v = 2.5\times10^8$ m/s. Transmission rate on the link is $R = 25$ Mbps. The frame length is $N_F = 1500$ bytes, and the acknowledgments (N_{ACK}) are 46 bytes. Assume also that the processing delays at sender and receiver are 0.25ms.

(a) Assume now that the link is error-free. What is the efficiency of Stop-and-Wait ARQ protocol in percents on this link?

(b) Assume now that there are errors on the link and its bit error rate (BER) is 10^{-4} (you can assume that the bit errors are idependent of each other, i.i.d). What is the Stop-and-Wait ARQ efficiency in this case?

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Question 8

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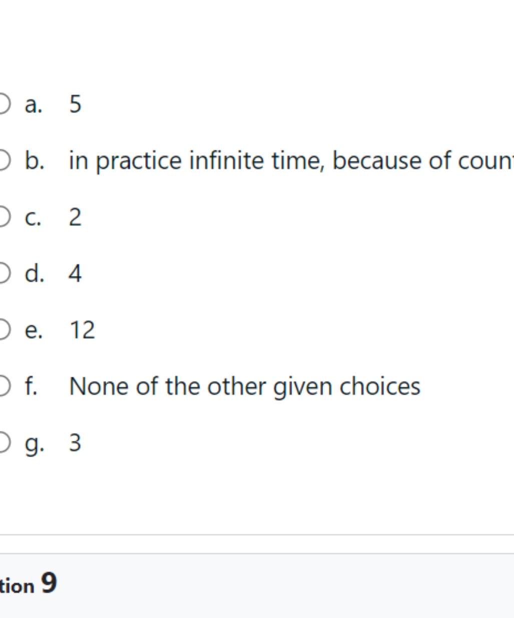
Bellman Ford Algorithm - change in link weight in distance vector algorithm (1p). Investigate the network below. Assume that at discrete time t=0, the link between node **b** and node **c** goes down and we lose this connection. At the same time (t=0) node b detects this change and recomputes the distance vector (DV). At time t=1 a new distance vector arrives at b's neighbours and they will pass their updated distance vectors forward (*if needed*). These DVs arrive at neighbours at time t=2, and so on. What is the latest time when DV computation takes place (assuming that there are no other changes to link weights than what happened at t=0).



- a. 5
- b. in practice infinite time, because of count-to-infinity problem
- c. 2
- d. 4
- e. 12
- f. None of the other given choices
- g. 3

Question 9

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For the network shown below, use Dijkstra's algorithm to generate least-cost routes form node A to all other nodes in the network. Show your working in detail (in a tabular format as in excercises) and write down explicitly the resulting routing (forwarding) table for Node A.

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Question 10

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Consider the below plot of TCP Reno congestion window size as a function of transmission rounds. The initial slow start threshold has been set to 32 MSS (maximum segment size). Please answer the following questions, and make sure to include a brief justification for each of your answers.

(a) Identify the intervals when TCP slow start is operating. (1p)

(b) Identify the intervals when TCP congestion avoidance is operating. (1p)

(c) What happened at the round before to cause the decrease in the congestion window size at the (i) 7th transmission round?; (ii) 16th transmission round? (1p)

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