1. Ethernet is considered to be both connectionless and reliable.
   1. True
   2. False
2. Assume that three routers, U, V and W, have link costs: c(U,V) = 4, c(U,W) = 50 and c(V,W) = 1. Using the Bellman-Ford algorithm, the common routing table for all

routers is:

|  |  |  |  |
| --- | --- | --- | --- |
|  | U | V | W |
| U | 1 | 4 | 5 |
| V | 4 | 1 | 1 |
| W | 5 | 1 | 1. |

* 1. True
  2. False

1. With non-persistent connections between browser and origin server, it is possible for a single TCP segment to carry two distinct HTTP request messages.
   1. True
   2. False
2. Consider an HTTP client that wants to retrieve a Web document at a given URL. The IP address of the HTTP server is initially unknown. What application layer protocols besides HTTP are needed in this scenario?
   1. DNS and HTTP
   2. TCP for DNS; TCP for HTTP
   3. UDP for DNS; TCP for HTTP
   4. None of the above are correct responses.

1. Consider an HTTP client that wants to retrieve a Web document at a given URL. The IP address of the HTTP server is initially unknown. What transport layer protocols besides HTTP are needed in this scenario?
   1. DNS and HTTP
   2. TCP for DNS; TCP for HTTP
   3. UDP for DNS; TCP for HTTP
   4. All of the above are correct responses.
2. In Ethernet networks, the Preamble consists of 7 bytes with pattern 10101010 followed by one byte with pattern \_\_\_\_\_\_\_\_\_\_\_\_\_ .
   1. 11101010
   2. 11111111
   3. 10101011
   4. None of the above responses are correct.
3. In Ethernet networks, the Preamble pattern is used to synchronize receiver and sender clock rates.
   1. True
   2. False
4. The term MAC refers to \_\_\_\_\_\_\_\_\_\_\_ .
   1. Machine Address Control
   2. Medium Access Control
   3. the first three characters of MAChine
   4. None of the above responses are correct.
5. Standard bus type Ethernet links are managed so that collisions are avoided.
   1. True
   2. False
6. The property that a network should provide services to several applications is called

\_\_\_\_\_\_\_\_\_ .

* 1. Scope
  2. Scalability
  3. Robustness
  4. Configurability

1. Most local area networks (LANs) use electrostatic network hardware.
   1. True
   2. False

1. Most fibre optic (photonic) networks are constructed based on the assumption that data transmission is completely reliable and also error free.
   1. True
   2. False
2. Amplitude modulation refers to rapid variations of signal strength to indicate bits or other tokens.
   1. True
   2. False
3. Suppose Client A initiates a Telnet session with Server S. At about the same time, Client B also initiates a Telnet session with Server S. If A and B are different hosts, it is possible that the source port number in the segments from A to S is the same as that from B to S.
   1. True
   2. False
4. Carrier signals are used to \_\_\_\_\_\_\_\_\_\_\_ .
   1. detect whether the network is currently in use by another host
   2. provide a stable reference above noise levels
   3. advise hosts that the network is active
   4. All of the above responses are correct.
5. A network‟s speed is expressed in terms of \_\_\_\_\_\_\_\_\_\_\_\_ .
   1. Routing protocol
   2. Round trip time
   3. Bit rate and latency
   4. I/O buffer response
6. Photonic networks utilize \_\_\_\_\_\_\_\_\_\_\_\_ switches.
   1. ABR
   2. IP
   3. CBR
   4. ATM
7. Transfer across TCP streams is full duplex.
   1. True
   2. False

1. Using TCP, three messages are exchanged before a connection exists.
   1. True
   2. False
2. In TCP, following a timeout, the server \_\_\_\_\_\_\_\_\_\_ .
   1. disconnects from the session
   2. retransmits the entire message
   3. retransmits the packet
   4. requests an acknowledgement from the client
3. Multiple TCP streams can distinguished on a given machine using \_\_\_\_\_\_\_\_\_\_ .
   1. Ports
   2. IP addresses
   3. network interface cards
   4. All of the above responses are correct.
4. A single program may have several open sockets at any time.
   1. True
   2. False
5. Both UDP and TCP require that the applications recognize their own data formats.
   1. True
   2. False
6. Which of the following is not a proper layer of the TCP stack?
   1. Link
   2. Network
   3. Transport
   4. All of the above responses are proper layers of the TCP stack.
7. All datagrams contain 2 ports.
   1. True
   2. False
8. Message encapsulation refers to \_\_\_\_\_\_\_\_\_\_ .
   1. designating message contents with descriptive data
   2. allowing for message content verification
   3. reliance upon IP for transmitting messages
   4. embedding payloads and protocol headers within logically layered packages

1. UDP and TCP are examples of \_\_\_\_\_\_\_\_ layer protocols.
   1. Application
   2. Link
   3. Transport
   4. Network
2. Closing a TCP socket requires \_\_\_\_\_\_ Acknowledgements.
   1. 0
   2. 1
   3. 2
   4. 3
3. The property that a network should operate efficiently when deployed on a small-scale as well as on a large-scale is called \_\_\_\_\_\_\_\_\_ .
   1. Migration
   2. Determinism
   3. Scalability
   4. Autoconfigurability
4. TCP abstracts data communication to appear as an apparent stream of flowing data.
   1. True
   2. False
5. The socket that represents a „passive open‟ is a(n) \_\_\_\_\_\_\_\_ socket.
   1. Server
   2. Client
   3. TCP
   4. Application
6. In order to deal with the situation where, too many sources send too much data too fast for a network to handle, it is necessary to use a technique called \_\_\_\_\_\_\_\_\_\_\_\_\_\_ .
   1. Flow control
   2. Congestion control
   3. Routing control
   4. Dynamic packet management
7. The term ARP refers to \_\_\_\_\_\_\_\_\_\_\_ Protocol.
   1. Address Resolution
   2. Address Reservation
   3. Asynchronous Routing
   4. None of the above responses are correct.

1. Within LANs, link layer addressing is accomplished by using \_\_\_\_\_\_\_\_\_\_\_ .
   1. IP addresses
   2. MAC addresses
   3. IP and MAC addresses
   4. All of the above responses are correct.
2. HTTP is referred to as a stateless protocol because \_\_\_\_\_\_\_\_\_\_\_\_\_ .
   1. clients do not maintain historic information about transactions with servers
   2. servers and clients do not maintain open connections
   3. server maintains no information about past client requests
   4. All of the above responses are correct
3. Consider a packet of length 1024 bytes. Assuming the packet must travel over a link of distance 2500 kilometers with propagation speed 2.5 x 108 m/s and transmission rate 2 Mbps, what is the propagation delay?
   1. 1 msec
   2. 10 msec
   3. 21 msec
   4. 100 microsec
4. Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links, of rates R1 = 800 Kbps, R2 = 2 Mbps and R3 = 1 Mbps. Assuming no other traffic in the network, what is the throughput for the file transfer?
   1. 800 Kbps
   2. 2 Mbps
   3. 1 Mbps
   4. 3.5 Mbps
5. By using Web caching \_\_\_\_\_\_\_\_\_\_\_\_\_\_ .
   1. it is possible to reduce response time for client request
   2. it is possible to reduce traffic on an institution‟s access link
   3. the cache acts as both client and server
   4. All of the above responses is correct
6. TCP congestion control uses a congestion window to implement \_\_\_\_\_\_\_\_\_\_.
   1. Timeout acknowledgment
   2. Congestion avoidance
   3. Message traffic scheduling
   4. None of the above responses is correct

1. Applications require which of the following transport services.
   1. Data loss and Security
   2. Timing
   3. Throughput
   4. All of the above responses are correct
2. Delivery and storage of email messages to a server is achieved using \_\_\_\_\_\_\_\_\_\_\_ .
   1. Post Office Protocol (POP)
   2. Internet Mail Access Protocol (IMAP)
   3. Simple Mail Transfer Protocol (SMTP)
   4. Hypertext Transfer Protocol (HTTP)
3. General Peer-to-Peer systems must not use “always on” servers.
   1. True
   2. False
4. Peer-to-Peer networks are used \_\_\_\_\_\_\_\_\_\_\_\_ .
   1. for content sharing
   2. for Instant Messaging
   3. for IP based telephony
   4. All of the above responses are correct.
5. Host A is sending Host B a large file over a TCP connection. Assume Host B has no data to send Host A. Host B will not send acknowledgments to host A, because Host B cannot piggyback the acknowledgments on data.
   1. True
   2. False
6. The size of the TCP receive window (**RcvWindow**) may change throughout the duration of the connection.
   1. True
   2. False
7. Suppose Host A is sending Host B a large file over a TCP connection. The number of unacknowledged bytes that A sends cannot exceed the size of the receive buffer.
   1. True
   2. False

1. Routers provide feedback to end systems to assist \_\_\_\_\_\_\_\_\_\_\_\_\_\_ .
   1. network-assisted congestion control
   2. network-assisted flow control
   3. end-end congestion control
   4. end-end flow control
2. In pipelining protocols, the selective repeat approach requires \_\_\_\_\_\_\_\_\_\_\_\_\_ .
   1. Receiver only sends cumulative **acks**
   2. Sender maintains timer for cumulative **unacked** packets
   3. Receiver **acks** individual packets
   4. Both B and C responses are correct
3. Assume that three routers, U, V and W, have link costs: c(U,V) = 4, c(U,W) = 50 and c(V,W) = 1. Using the Bellman-Ford algorithm, the common routing table for all

routers is:

|  |  |  |  |
| --- | --- | --- | --- |
|  | U | V | W |
| U | 0 | 4 | 50 |
| V | 4 | 0 | 1 |
| W | 50 | 1 | 0. |

* 1. True
  2. False

1. When the link cost increases suddenly between two routers in a network, poisoned reverse is used to \_\_\_\_\_\_\_\_\_\_\_\_\_ .
   1. accelerate the convergence to a stable routing table
   2. replace all update link costs initially to infinity for all routes through the affected routers
   3. guarantee unique routing solutions in the final routing tables
   4. Both A and B responses are correct.
2. Which layer has the responsibility of transferring datagrams from one node to adjacent node(s) over a link?
   1. Application layer
   2. Transport layer
   3. Link layer
   4. Network layer

1. The property that it should be possible to add new features to a network without disruption of network service is called \_\_\_\_\_\_\_\_\_ .
   1. Migration
   2. Safety
   3. Robustness
   4. Self-Stabilization
2. Transport services and protocols provide logical communication between hosts.
   1. True
   2. False
3. Round-trip time (RTT) is estimated based on \_\_\_\_\_\_\_\_\_\_ .
   1. a weighted average RTT that is fixed after several samples
   2. a weighted average RTT that is continuously updated
   3. sampling of routes to determine minimum cost paths
   4. None of these responses is correct.
4. Routing algorithms may be classified based on \_\_\_\_\_\_\_\_\_\_\_\_ .
   1. availability of global information
   2. availability of local information
   3. rate of change of network paths
   4. All of the above responses are correct.
5. A subnet may be defined as any interconnected set of computers and routers (or switches) that can operate in isolation from other subnets, or in cooperation with other subnets.
   1. True
   2. False
6. The need for IP tunneling depends primarily on the type of routers along the message path.
   1. True
   2. False
7. Network Address Translation is used because it expands the available device address space through use of port numbers and thereby satisfies the end-end argument at the network layer.
   1. True
   2. False

1. Network layer protocols must be defined in every host and router.
   1. True
   2. False
2. TCP flow control is provided by \_\_\_\_\_\_\_\_\_\_\_\_ .
   1. including value of the receiver buffer available size in acknowledgements
   2. keeping out-of-order segments in the receiver buffer
   3. keeping the send rate always less than the receive rate
   4. All of these responses are correct.
3. Channel partitioning MAC protocols are inefficient at low network loads because active nodes cannot utilize un-owned allocated channels.
   1. True
   2. False
4. In “ring” networks, using the “taking turns” MAC protocol, a \_\_\_\_\_\_\_\_\_\_\_ is passed from one node to the next node sequentially.
   1. link allocation schedule
   2. “network ready” polling signal
   3. network synchronization signal
   4. control token
5. Connectionless demultiplexing may be performed using \_\_\_\_\_\_\_\_\_ .
   1. TCP
   2. UDP
   3. ICMP
   4. All of the above are correct responses.
6. Internet transport-layer protocols provide delay and bandwidth guarantees.
   1. True
   2. False
7. The TCP “Slow Start” approach to congestion control \_\_\_\_\_\_\_\_\_\_\_\_ .
   1. doubles the size of the message bundle until failure occurs
   2. increases the size of the message bundle linearly until failure occurs
   3. sends a message and waits to obtain the receiver buffer size before increasing the number of messages sent as a bundle
   4. None of the above responses is correct

1. The action of a sender involving the gathering of data from multiple sockets and enveloping the data with a header is called \_\_\_\_\_\_\_\_\_\_ .
   1. Multiplexing
   2. Packet creation
   3. Data integration
   4. Demultiplexing
2. Transport services and protocols \_\_\_\_\_\_\_\_\_\_\_\_\_\_ .
   1. provide communication between system processes running on different hosts
   2. are provided in hosts and routers
   3. make more than one transport protocol available to applications
   4. All of the above responses are correct
3. In TCP, flow control is maintained by \_\_\_\_\_\_\_\_\_\_\_\_\_ .
   1. Having senders keep a message buffer with varying size
   2. Having receivers return the speed of clearing their buffers
   3. Having senders modify their propagation speed
   4. Both A and B responses above are correct
4. Network services and protocols provide logical communication between hosts.
   1. True
   2. False
5. A datagram contains the payload bit pattern <1100111, xxxx > where the first (left) field is the 7-bit data payload D and the second (right) field is the 4-bit Cyclic Redundancy Check code R. The receiver knows that the CRC generator G is the 5-bit pattern 01101. In order that the receiver determine that the datagram passes the CRC test as correct, the value of R received must be equal to \_\_\_\_\_\_\_\_\_\_ .
   1. 1010
   2. 1100
   3. 0101
   4. None of the above responses are correct.
6. One role of a NIC is to accept a datagram from the next higher layer and encapsulate the datagram into a frame, along with frame header and trailer bit fields, such as rdt and CRC.
   1. True
   2. False
7. Reverse Path Forwarding relies on a router‟s knowledge of the unicast based shortest path from it to the sender.
   1. True
   2. False
8. Demultiplexing \_\_\_\_\_\_\_\_\_\_\_ .
   1. involves gathering data from multiple sockets
   2. involves enveloping data with header
   3. involves delivering received segments to correct socket
   4. Both A and B are correct responses.
9. In TCP based demultiplexing, TCP sockets are identified by \_\_\_\_\_\_\_\_\_\_\_ .
   1. both sender and receiver port numbers
   2. sender IP address and port numbers
   3. receiver IP address and port number
   4. both sender and receiver IP addresses and port numbers
10. In pipelining protocols, the Go-back-N approach requires \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .
    1. Sender can have up to N **unacked** packets in pipeline
    2. Receiver **acks** individual packets
    3. If sender timer expires, retransmit all N packets
    4. Sender has timer for each **unacked** packet
11. In order to establish a virtual connection (also called a virtual circuit) that permits datagrams to flow between communicating end hosts, it is necessary to \_\_\_\_\_\_\_\_\_\_\_ .
    1. involve both the end hosts and all intervening routers
    2. initiate the connection using specialized datagrams that carry historical information about the end-end route
    3. complete the connection using receiver and sender acknowledgements
    4. All of these responses are correct.
12. The motivation(s) for utilizing Network Address Translation include(s) \_\_\_\_\_\_\_\_\_\_\_ .
    1. making available a range of unique IP addresses for all devices in every subnet
    2. ability to change addresses of devices in local network without notifying outside world
    3. ability to change ISP without changing addresses of devices in global network
    4. establishing direct addressability to local devices inside subnet

1. IP datagrams may be fragmented into several smaller IP datagrams \_\_\_\_\_\_\_\_\_\_\_\_\_\_ .
   1. that are reassembled at the next router link
   2. in order to adapt to the largest link layer frame
   3. that are reassembled only at the final destination
   4. Both B and C are correct responses.
2. The IPv6 datagram header has length 40 bytes.
   1. True
   2. False
3. RIP, OSPF and BGP are examples of \_\_\_\_\_\_\_\_\_ .
   1. application layer routing protocols
   2. transport layer routing protocols
   3. network layer routing protocols
   4. Both B and C responses are correct.
4. In TCP “slow start”, after establishing the connection, the message flow rate is

\_\_\_\_\_\_\_\_\_\_\_ .

* 1. increased linearly until first loss event
  2. increased linearly after the first loss event
  3. increased exponentially until first loss event
  4. Both B and C are correct responses.

1. Forwarding refers to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .
   1. the manner by which datagrams are routed from source to destination ports of end hosts
   2. the manner by which datagrams are routed from input to output ports of individual routers
   3. the set of algorithms required to ensure near-optimal path selection of datagrams
   4. the manner by which datagrams are routed from source to destination between adjacent routers
2. The main goal of Bellman-Ford‟s algorithm is to ensure that all network nodes have the same information to provide shortest path service for message routing.
   1. True
   2. False
3. Internet Control Message Protocol (ICMP) is used by hosts and routers to communicate network-level information.
   1. True
   2. False

1. If a router malfunctions, the link state algorithm is affected because \_\_\_\_\_\_\_\_\_\_ .
   1. a node can advertise incorrect path cost
   2. a node can advertise incorrect link cost
   3. errors are contained locally within the network
   4. each node recomputes its table and forwards it to other nodes
2. ICMP (Internet Control Message Protocol) messages are carried in IP datagrams.
   1. True
   2. False
3. Assuming that W is the maximum window size established by TCP “slow start”, and the round-trip time is RTT, what is the average throughout of TCP as a function of W and RTT?
   1. W/RTT
   2. 0.5 x W/RTT
   3. 1.25 x W/RTT
   4. None of the above responses is correct.
4. Datagram networks do not require call setup at the network layer.
   1. True
   2. False
5. Router buffer sizes should be selected based on \_\_\_\_\_\_\_\_\_\_\_\_\_ .
   1. message round-trip time (eg. as determined by acknowledgements)
   2. link capacity
   3. tolerance for data loss due to overflow
   4. All of these responses are correct.
6. The first item in an IP datagram is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .
   1. header length (in bytes)
   2. total datagram length (in bytes)
   3. protocol version number
   4. type of service
7. In datagram networks \_\_\_\_\_\_\_\_\_\_\_\_ .
   1. routers maintain state about end-to-end connections
   2. packets are forwarded using destination host address and virtual circuit number
   3. packets between same source-destination pair may take different paths
   4. None of these responses is correct.
8. The purpose of a network interface card is to implement the link and physical layer interface.
   1. True
   2. False
9. Link layer services provide \_\_\_\_\_\_\_\_\_\_ .
   1. Framing and flow control
   2. Reliable delivery between adjacent nodes
   3. Error detection and correction
   4. All of the above responses are correct.
10. The MAC address is \_\_\_\_\_\_\_\_\_\_\_\_ .
    1. Burned into the NIC ROM
    2. Set locally on the host using software
    3. Both A and B are correct responses
    4. None of these responses are correct.
11. In order to provide multiple access to networks it is necessary to \_\_\_\_\_\_\_\_\_\_\_\_ .
    1. use a reserved channel to obtain communication information about channel sharing
    2. specify a distributed algorithm that determines how nodes share channel
    3. use only devices for which collisions do not occur
    4. Both A and B responses are correct.
12. Suppose Client A initiates a Telnet session with Server S. At about the same time, Client B also initiates a Telnet session with Server S. If A and B are the same host, it is possible that the source port number in the segments from A to S is the same as that from B to S.
    1. True
    2. False
13. Assume that four (4) datagrams are received in sequence and are then checked for parity errors. The first datagram bit string contains the 7-bit pattern 1011010, followed by the second datagram pattern 0000111, third datagram pattern 1111110, and fourth

datagram pattern 0110011. Each of the bit patterns consists of a leading (leftmost) 6-bit pattern that is the data payload followed by the rightmost parity bit (parity is defined as 0/1 if the number of 1-bits in the data payload is even/odd). The fourth datagram pattern bits are the parity values of the first three datagram bits in the corresponding positions. The error checking scheme is the two-dimensional parity bit check. Which of the following statements is most correct?

* 1. All datagram data payloads are correct with highest probability
  2. It is impossible to be fully certain about the data correctness in this case
  3. There is certainly an error in the second datagram
  4. There is certainly an error in the third datagram

1. With half duplex at the link layer, nodes at both ends of the link can transmit, but not at same time.
   1. True
   2. False
2. Hosts A and B are directly connected with a 200 Mbps link. There is one TCP connection between the two hosts, and Host A is sending to Host B an enormous file over this connection. Host A can send application data into the link at 100 Mbps, but Host B can read out of its TCP receive buffer at a maximum rate of 50 Mbps. The long term average rate at which Host A sends data is approximately \_\_\_\_\_\_\_\_\_\_\_\_ .
   1. 50 Mbps
   2. 75 Mbps
   3. 100 Mbps
   4. 200 Mbps
3. RIP advertisements typically announce the number of hops to various destinations. BGP updates, on the other hand, announce the \_\_\_\_\_\_\_\_\_\_\_ to the various destinations.
   1. link costs
   2. adjacent link nodes
   3. “I‟m alive” message
   4. previous link path table
4. Consider a virtual-circuit network. Suppose the VC number is a 16-bit field. What is the maximum number of virtual-circuits that can be carried over a link?
   1. 2 16
   2. 2 15
   3. 2 16 – 1
   4. 2 12
5. BGP messages are exchanged using \_\_\_\_\_\_\_\_\_\_ .
   1. UDP
   2. TCP
   3. ICMP
   4. Proprietary Cisco protocols
6. The reasons for handling routing differently in Inter-AS and Intra-AS routing are based on \_\_\_\_\_\_\_\_\_\_\_\_ .
   1. differences in router capabilities
   2. distance vector versus link state information
   3. policy, scale and performance
   4. imposed standards for packaging messages

1. Consider a datagram network using 8-bit host addresses. Suppose a router uses longest prefix matching to determine whether message traffic is to be routed through one of only four forwarding ports. The range of addresses to be routed through Port 2 is

\_\_\_\_\_\_\_\_\_\_\_ .

* 1. 00000000 through 00111111
  2. 00000000 through 11111100
  3. 10000000 through 10111111
  4. 01000000 through 10000000

1. Consider sending a 3000 byte datagram into a link that has a maximum transfer size (MTU) of 500 bytes. How many fragments are generated?
   1. 8
   2. 7
   3. 6
   4. 5
2. Banded frequency modulation permits \_\_\_\_\_\_\_\_\_\_ .
   1. multiple message signals to overlap on links
   2. standard oscillators to be deployed on network devices
   3. redundancy checking of messages
   4. Frequency banding is only used for FM radio.
3. If Bob and Alice are two peers and each is located behind a Network Address Translation (NAT) server across a wide-area network (WAN). In the absence of application-specific NAT configuration \_\_\_\_\_\_\_\_\_\_\_ .
   1. they can establish a reliable UDP connection
   2. they cannot establish a SMTP connection
   3. they can establish a TCP connection
   4. they cannot establish a TCP connection
4. At the network layer, a spanning tree is used to ensure that no redundant packets are received by any node.
   1. True
   2. False

Use the following Table for Questions **109 and 110**. The table contains the link costs (in arbitrary units) between routers S, T, U, V, W, X, Y and Z. A dash (hyphen) entry indicates that there is no connection between these pairs of routers.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | S | T | U | V | W | X | Y | Z |
| S | 0 | 1 | 4 | - | - | - | - | - |
| T | 1 | 0 | 2 | 4 | - | - | 7 | 5 |
| U | 4 | 2 | 0 | 3 | 3 | - | - | - |
| V | - | 4 | 3 | 0 | 4 | 3 | 1 | - |
| W | - | - | 3 | 4 | 0 | 6 | - | - |
| X | - | - | - | 3 | 6 | 0 | 6 | - |
| Y | - | 7 | - | 1 | - | 6 | 0 | 12 |
| Z | - | 5 | - | - | - | - | 12 | 0 |

1. Based on the pairwise link costs in the Table above, and using Dijkstra‟s algorithm, determine the shortest path route from X to S.
   1. Infinity
   2. 10
   3. 8
   4. 9
2. Based on the pairwise link costs in the Table above, and using Dijkstra‟s algorithm, determine the shortest path route from X to Z.
   1. Infinity
   2. 12
   3. 16
   4. 18