I. Multiple Choice

3.1　A transport-layer protocol provides for logical communication between ＿＿.
　　A. Application processes
　　B. Hosts
　　C. Routers
　　D. End systems

3.2　Transport-layer protocols run in ＿＿.
　　A. Servers
　　B. Clients
　　C. Routers
　　D. End systems

3.3　In transport layer, the send side breaks application messages into ＿＿, passes to network layer.
　　A. Frames
　　B. Segments
　　C. Data-grams
　　D. bit streams

3.4　The receive side of transport layer reassembles segments into messages, passes to ＿＿layer.
　　A. Application
　　B. Networking
　　C. Physical
　　D. MAC

3.5　Services provided by transport layer include ＿＿.
　　A. HTTP and FTP
　　B. TCP and IP
　　C. TCP and UDP
　　D. SMTP

3.6　Which of the following services is not provided by TCP?
　　A. Delay guarantees and bandwidth guarantees
　　B. Reliable data transfers and flow controls
　　C. Congestion controls
　　D. In-order data transfers

3.7　These two minimal transport-layer services----＿＿ and ＿＿----are the only two services that UDP provides
　　A. process-to-process data delivery, error checking
　　B. congestion control, reliable data transfer
　　C. flow control, congestion control
　　D. In-order data transfer, error checking

3.8　UDP offers which of the following benefits relative to TCP?
　　A. UDP consumes fewer computer resources by not maintaining connection state
　　B. UDP supports a self-regulating "throttle" feature that prevents network saturation

C. UDP guarantees that Individual packets of a transmission will arrive "in order"

D. None of the above

3.9　Which of the following applications normally uses UDP services?

A. SMTP

B. Streaming multimedia

C. FTP

D. HTTP

3.10　The job of gathering data chunks, encapsulating each data chunk with header information to create segments and passing the segments to the network is called _____.

A. multiplexing

B. de-multiplexing

C. forwarding

D. routing

3.11　This job of delivering the data in a transport-layer segment to the correct socket is called _____.

A. multiplexing

B. de-multiplexing

C. forwarding

D. routing

3.12　The following four descriptions about multiplexing and de-multiplexing, which one is correct?

A. A UDP socket is identified by a two-tuples consisting of a source port number and a destination port number.

B. If two UDP segment have different source port number, they may be directed to the same destination process.

C. If two TCP segments with different source port number, they may be directed to the same destination process.

D. If two TCP segments with same destination IP address and destination port number, they must be the same TCP connection.

3.13　Port number's scope is _____ to _____.

A. 0, 1023

B. 0, 65535

C. 0, 127

D. 0,255

3.14　The port numbers ranging from _____to _____ are called well-known port number and are restricted.

A. 0, 1023

B. 0, 65535

C. 0, 127

D. 0,255

3.15　The UDP header has only four fields, they are_____.

A. Source port number, destination port number, length and checksum

B. Source port number, destination port number, source IP and destination IP

C. source IP, destination IP, source MAC address and destination MAC address

D. source IP, destination IP, sequence number and ACK sequence number

3.16　The field of Length in UDP segment specifies the length of ____.

A. the UDP segment, not including the header

B. the UDP segment, including the header

C. the UDP segment's header

D. the Length field

3.17　Which of the following about TCP connection is not correct?

A. It is a broadcast connection

B. It is a point-to-point connection

C. It is a pipelined connection

D. It is a full duplex connection

3.18　In the following four descriptions about MSS and MTU, which one is not correct?

A. The MSS is the maximum amount of application-layer data in the segment

B. The MSS is the maximum size of the TCP segment including headers

C. The MSS is typically set by MTU

D. The MTU means the largest link-layer frame

3.19　Which of the following field is not used for connection setup and teardown?

A. Sequence number

B. TST

C. SYN

D. FIN

3.20　____ is the byte stream number of first byte in the segment.

A. Sequence number

B. ACK number

C. Checksum

D. port number

3.21　____ is the byte sequence numbers of next byte expected from other side.

A. Sequence number

B. ACK number

C. Checksum

D. port number

3.22　In the following four options, which one is correct?

A. The variations in the SampleRTT are smoothed out in the computation of the EstimatedRTT

B. The timeout should be less than the connection's RTT

C. Suppose that the last SampleRTT in a TCP connection is equal to 1 sec. Then the current value of TimeoutInterval will necessarily be $\geqslant$ 1 sec

D. Suppose that the last SampleRTT in a TCP connection is equal to 1 sec. Then the current value of TimeoutInterval will necessarily be $\leqslant$ 1 sec

3.23　Provided α=0.125, current value of Estimated-RTT is 0.4s, Sample-RTT is 0.8s, then the new value of Estimated-RTT is ____s.

A. 0.45

B. 0.6

C. 0.7

D. 0.8

3.24   There are two 16-bit integers: 1110 0110 0110 0110, 1101 0101 0101 0101. Their checksum is____.

A. 0100010001000011

B. 1011101110111100

C. 1111111111111111

D. 1000000000000000

3.25   Suppose host A sends host B one TCP segment with sequence number 418, acknowledgement number 571, and 4 bytes of data. Then the sequence number in the acknowledgement to this segment is _____

A. 422   B. 418   C. 571   D. 575

3.26   Because TCP only acknowledges bytes up to the first missing byte in the stream, TCP is said to provide____.

A. Cumulative acknowledgements

B. Selective acknowledgements

C. 3 duplicate ACKs

D. positive ACKs

3.27   If we define N to be the window size, base to be the sequence number of the oldest unacknowledged packet, and next-seq-num to be the smallest unused sequence number, then the interval [nextseqnum,base+N-1] corresponds to packet that ____.

A. can be sent immediately

B. have already been transmitted and acknowledged

C. cannot be used

D. have been sent but not yet acknowledged

3.28   Which of the following is not a pipelining protocol.

A. Rdt1.0

B. Go-Back-N

C. Selective repeat

D. TCP

3.29   What is the main difference between stop-and-wait and pipelined reliable data transfer protocol?

A. The pipelined protocol uses the NAK packets, whereas in the stop-and-wait protocol senders always wait for ACK packets.

B With the pipelined protocol, the sender can send several packets in row, whereas in the stop-and-wait protocol the sender cannot send the packets in row.

C With the pipelined protocol, the receiver must send one ACK for several packets (cumulative ACK), whereas in the stop-and-wait protocol the receiver can not send the cumulative ACK.

D The pipelined protocol uses timeouts, whereas the stop-and-wait protocol does not use the timeout.

3.30   Fast retransmit means in the case that ____ duplicate ACK-s are received, the TCP sender resend segment before timer expires.

A. 3

B. 4

C. 5

D. 6

3.31 ____ is a speeding-matching service---matching the rate which the sender is sending against the rate at which the receiving application is reading.

A. congestion control

B. flow control

C. sliding-window control

D. variable control

3.32 TCP provides flow control by having the sender maintain a variable called the ____.

A. Receive window

B. Congestion window

C. Sliding window

D. buffer

3.33 In the following four descriptions about Rcv-Window, which one is correct?

A. The size of the TCP RcvWindow never changes throughout the duration of the connection

B. The size of the TCP RcvWindow will change with the size of the TCP RcvBuffer

C. The size of the TCP RcvWindow must be less than or equal to the size of the TCP RcvBuffer

D. Suppose host A sends a file to host B over a TCP connection, the number of unacknowledged bytes that A sends cannot exceed the size of the size of the RcvWindow.

3.34 Provided RcvBuffer = 20, LastByteRcvd = 20, LastByteRead = 15, then RcvWindow=____.

A. 14

B. 15

C. 16

D. 10

3.35 In the following four descriptions about TCP connection management, which one is not correct?

A. Either of the two processes participating in a TCP connection can end the connection

B. If the FIN bit is set to 1, it means that it wants to close the connection

C. In the first two step of the three-way handshake, the client and server randomly choose an initial sequence number

D. In the three segments of the three-way handshake, the SYN bit must be set to 1

3.36 How does TCP sender perceive congestion?

A. Through a timeout event

B. Through a receiving duplicate ACK-s event

C. Both A and B

D. Either A or B

3.37　There are two states in TCP congestion control, which are ____.

　　A. slow start and congestion avoidance

　　B. safe start and congestion avoidance

　　C. slow start and congestion abandon

　　D. safe start and congestion abandon

3.38　In TCP, the timeout interval is a function of:

　　A. estimated RTT at the sender　　　　　　B. MSS and the overhead of a segment

　　C. the size of buffer at the receiver　　　　D. the size of sending window

3.39　In a TCP connection , there is timeout event when the value of threshold is 32 and the size of congestion window is 16. According to the TCP congestion control policy, the new value of threshold and the new size of congestion window should be _____, respectively.

　　A. 16, 8　　　　　B. 24, 8　　　　　C. 8, 1　　　　　D. 16, 1

3.40　Flow control and congestion control are same at that they all limit the rate of the sender, but differ in that ____.

　　A. flow control limits its rate by the size of RcvWindow, but congestion control by the traffic on the link

　　B. congestion control limits its rate by the size of RcvWindow, but flow control by the traffic on the link

　　C. flow control mainly is accomplished by the sender, but congestion control by the receiver.

　　D. flow control mainly is accomplished by the receiver, but congestion control by the link.

II. True or False

3.41　The Slow-Start algorithm increases a source's rate of transmission faster than "additive increase"

3.42　A source's retransmission timeout value is always set equal to the measured RTT.

3.43　Congestion control reduces the transmission rate at the sender when the receiver is overloaded

3.44　Suppose that host A wants to send data over TCP to host B, and host B wants to send data to host A over TCP. Two separate TCP connections - one for each direction - are needed.

3.45　The stop-and-wait protocol is highly inefficient when there is a large distance between source and destination and the transmission rate is high.

3.46　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.

3.47　The size of the TCP rwnd never changes throughout the duration of the connection.

3.48   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.

3.49   Suppose Host A is sending a large file to Host B over a TCP connection. If the sequence number for a segment of this connection is m, then the sequence number for the subsequent segment will necessarily be m + 1.

3.50   The TCP segment has a field in its header for rwnd.

3.51   Suppose that the last SampleRTT in a TCP connection is equal to 1 sec. The current value of TimeoutInterval for the connection will necessarily be $\geq$ 1 sec.

3.52   Suppose Host A sends one segment with sequence number 38 and 4 bytes of data over a TCP connection to Host B. In this same segment the acknowledgment number is necessarily 42.

III. Answer Briefly

3.53   What is the principal difference between connectionless communication and connection-oriented communication?

3.54   Why does UDP exist? Would it not have been enough to just let user processes send raw IP packets?

3.55   Both UDP and TCP use port numbers to identify the destination entity when delivering a message. Give two reasons for why these protocols invented a new abstract ID (port numbers), instead of using process IDs, which already existed when these protocols were designed.

3.56   Two networks each provide reliable connection-oriented service. One of them offers a reliable byte stream and the other offers a reliable message stream. Are these identical? If so, why is the distinction made? If not, give an example of how they differ

3.57   When a file is transferred between two computers, two acknowledgement strategies are possible. In the first one, the file is chopped up into packets, which are individually acknowledged by the receiver, but the file transfer as a whole is not acknowledged. In the second one, the packets are not acknowledged individually, but the entire file is acknowledged when it arrives. Discuss these two approaches.

3.58   Fill in the value of the congestion window size (number of segments) for each

transmission round.   Assume the threshold starts at 30 MSS and the following events occur: (10 points)

- triple duplicate ACK during round 5
- timeout during round 9
- triple duplicate ACK during round 12
- triple duplicate ACK during round 16

Round	Congestion Window Size(MSS)	Round	Congestion Window Size(MSS)
1	1	11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	