Electrical and Computer Engineering
COMPREHENSIVE/BREADTH EXAM

Question 2/3/4	Communications, Controls, and Signal Processing	ECGR-4187: Data Communications

(15 points) Select the **single** choice of correct answer or fill out blanks:

(1) The address class (Class A, B, or C) of the IP address,
10000011 10000011 00011011 11111111, is _____

(2) For IP address 129.14.6.8, the network ID is _____, host ID is _____.

(3) In IPv4, what is the length of the data given the value of the *Internet Header Length (IHL)* field is 12 and the value of the *Total Length* field is 40,000 in the header?

_____

(4) In the header of an IPv4 datagram, the *more* bit is set to 1 and the offset field has a value of 0. This means:
(A) The datagram has not been fragmented
(B) This datagram is the last fragment
(C) This datagram is the first fragment
(D) None of the above

(5) In an IPv4 datagram, the total length is 1200 bytes, 1176 of which is data from the upper layer. The value of the *Fragmentation Offset* field in the header is 120. What is the byte number of the last byte in this datagram?

_____

(6) In IPv6, options are inserted between the _____ and the _____ in a datagram.

(A) base header; extension header

(B) base header; upper-layer data

(C) base header; frame header

(D) None of the above

(7) In a least-cost routing algorithm, which of the following is a reasonable definition for the *cost* associated with a link?

(A) The cost could be inversely proportional to the data rate of the link

(B) The cost could be inversely proportional to the queue length on the link

(C) The cost could be inversely proportional to the traffic load of the link

(D) None of the above

(8) A transport protocol can be either connection-oriented, such as UDP, or connectionless, such as TCP.

(A) TRUE

(B) FALSE

(9) Which field in the TCP header contains the sequence number of the next data byte that the TCP entity expects to receive?

(A) Acknowledgement Number

(B) Sequence Number

(C) WINDOW

(D) None of the above

(10) A TCP sender is sending a file of 5000 data bytes. Suppose each TCP segment carries 1000 data bytes. The first segment has a sequence number 10,001. The sequence number of the 5th segment is

_____.

(11) Following the above scenario, suppose all the five segments are successfully received by the TCP receiver. What is the value of the acknowledge number field in the header of the ACK segment sent from the TCP receiver after receiving the 5th segment?

(A) 5,000

(B) 15,001

(C) 14,000

(D) None of the above

(12) What is the value of the WINDOW field in the header of the segments sent by a TCP host if this host has a buffer size of 5000 bytes and 1000 bytes of received and unprocessed data?

(A) 1000

(B) 2000

(C) 3000

(D) None of the above

(13) TCP protocol is a _____ and _____ transport protocol.

(A) connection-oriented; reliable

(B) connection-oriented; unreliable

(C) connectionless; reliable

(D) connectionless; unreliable

(14) UDP header has a length of _____ bytes

(A) 8 (B) 16 (C) 32 (D) None of the above

(15) Connection establishment in TCP is called _____ handshaking.

(A) two-way

(B) four-way

(C) one-way

(D) None of the above

(16) **(5 points)** Given an IP address "65.51.240.1":

a) What is the address class (Class A, B, or C)?

b) What is the network/domain address?

c) What is the host address of this host? Assume sub-networking is not used.

d) Now assume there are 15 sub-networks in this network domain. What is the sub-network address? What is the host address?

(17) **(5 points)** Consider a TCP connection between Host A and Host B. Suppose that the TCP segments traveling from Host A to Host B have a source port number *x* and destination port number *y*.

a) The TCP segments traveling from Host B to Host A over the above TCP connection have source port numbers _____ and destination port number _____

b) Is it possible for there to be two or more TCP connections between these two ports (*x* and *y*) at the same time? If yes, how? If not, why?

c) If the sequence number field in the header of a segment sent from Host A to Host B over this TCP connection is *m*, then the sequence number field in the header of the **subsequent** segment sent from Host A to Host B over this TCP connection **must be** *m+1*. (**TRUE** or **FALSE**, circle one)

d) The combination of the IP address of Host A and port number x is referred to as a _____.

(18) **(5 points)** Consider the TCP congestion control protocol. Assume that the maximum segment size is **2 KB**. Suppose that the TCP congestion window was initially **20KB**, and a timeout occurred at time 0. Then if all the next 12 transmissions are successful except that the 5th one has a timeout event. Please draw the size of TCP congestion window for the next 12 transmissions in the following figure.