100/100

1)

A. Receivers use sequence numbers to determine whether a packet contains new data or is a retransmission, to support packet reordering, and to report dropped packets.

B. Detecting lost packets was made possible by introducing timers. In the absence of an ACK (or on its own ACK or NACK) for a transmitted packet, it is assumed that the packet (or its ACK or NACK) has been lost. As a result, the packet is retransmitted.

20/20

2)

11010001 10001100

01001110 10110000

100100000 00111100

20/20

1

Sum of two numbers = 00100000 00111101 (16-bit sum)

The checksum is 1's complement of the sum = 11011111 11000010

3)

Sockets are different for every hosts. Each host has uniquely destination address, destination port and source address, source port. By these values each host will be assigned with new socket. And we are accessing web server

20/20 which runs on port 80. As ports are used to identify the running process. So, both the sockets have same port number.

4)

Sequence number = 118, Segment size = 646 bytes

Next sequence number = sequence num + segment size.

20/20

A. Sequence numbers for each 4 segments are: 118, 764, 1410, 2056
B. Acknowledgement ACK numbers are: 764, 1410, 2056, X

5)

Packet size = 1500 bytes

Link speed = 1Gbps

Propagation delay = 15ms

Round trip time (RTT) = 15 + 15 = 30ms

Channel utilization = 98%

Transmission delay (TD) = L/R = 1500 bytes / 1 Gbps = 12ms

Channel utilization = N * (TD/ RTT + TD)

20/20

98/100 = N * (0.012/30+0.012) => 0.98 * 30.012 = N * 0.012 => 29.4 = N * 0.012

N = 29.4/0.012 = 2450.98

Approximately, we can have 2451 packets per Window size.

So the size would be around 2451 (no on packets)* 1500 (packet size) = 3676500 bytes.