Problem #1

1. It is true. If the transmission time is long and the sender times out waiting for the ACK’s, then the sender will send the same packets twice. Thus, the sender will receive duplicate ACK’s from the receiver if all the packets arrived. After the first ACK received, the sender will send the following packets, but it will receive the second ACK for the first set of packets after sending the second set of packets. Thus, the sender will receive an ACK’s for a packet that falls outside of its current window.
2. It is true because the same situation can occur with both SR protocol and GBN.
3. True, it is the same in terms of ACKs.
4. True, with window size 1 it is the same as the alternating-bit protocol. Cumulative ACK becomes ordinary ACK.

Problem #2

1. The TCP slow start operates at the time intervals are from 1 to 6 and 23 to 26.
2. The TCP congestion avoidance operates at the time intervals from 6 to 23.
3. After the 16th transmission round, the segment loss is detected by a triple duplicate ACK.
4. After the 22nd transmission round, the segment loss is detected by a timeout.

Problem #3

Forwarding is an action taken in a local router for transferring the packet from an input link interface to the correct output link interface. It forwards the packet based on routing information. In the case of routing, it refers to the network-wide process, which defines the end-to-end paths. Packets take these paths from their source to their destination.

Problem #4

Destination-base routing sends messages containing the address of the destination. The router forwards the datagram based on the destination IP address. The generalized forwarding is the router forwarding the datagram based on header field values, TCP/UDP source and destination port numbers, and other information. The Software-Defined Networking on Section 4.4 adopted the destination-based forwarding approach.

Problem #5

1. Maximum delay for a packet for the memory is (n-1) \* D.
2. Maximum delay for a packet for the bus is (n-1) \* D.
3. Maximum delay for a packet for the crossbar switching fabrics is zero (0).

Problem #6

a)

|  |  |
| --- | --- |
| Prefix Match | Link Interface |
| 11100000 00 | 0 |
| 11100000 01000000 | 1 |
| 11100000 | 2 |
| 11100001 0 | 2 |
| otherwise | 3 |

b)

* The prefix for the first address is link interface 3.
* The prefix for the second address is link interface 2.
* The prefix for the third address is link interface 2.