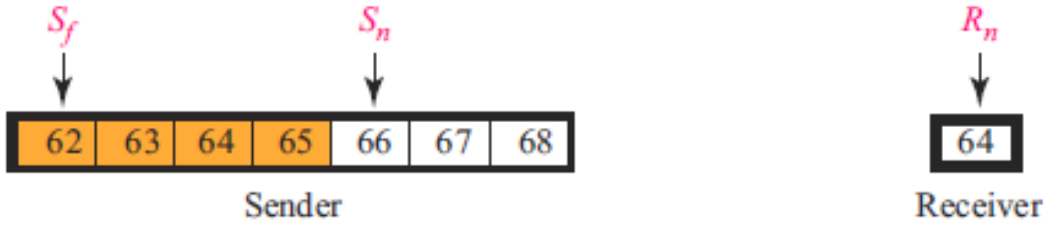
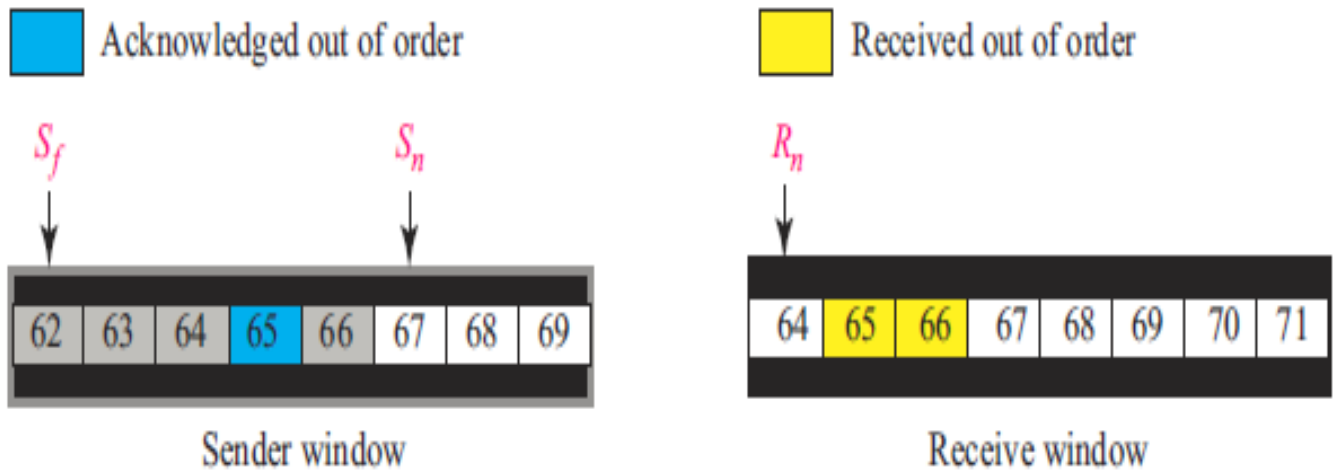
1.In a network using GO Back N with the sending window size of 7 the values of variable Sf=base or send-base=62 next-seqno=Sn=66 and rx-base= Rn= 64. Assume that network does not duplicate or reorder the packets.
a. What are the seq no of data packets in transit?
b. What are the ack numbers of ACK packets in transit?



a. If the receiver expects a packet with sequence number 64 and packets with sequence numbers 62 to 65 are already sent but not acknowledged, it means that two packets with sequence numbers 64 and 65 are in transit from the sender to the receiver.

b. If the sender expects the acknowledgment for packet 62, but the value of R_n = 64, it means that the ACK packets with acknowledgment numbers 62 and 63 are in transit from the receiver to the sender.

- 2. 1.In a network using Selective repeat with the sending window size of 7 the values of variable Sf=base or send-base=62 next-seqno=Sn=67 and rx-base= Rn= 64. Packet 65 has already acknowledged at the sender site , packets 65 & 66 are received out of order at receiver site. Assume that network does not duplicate or reorder the packets.
- a. What are the seq no of pending data packets(in transit, corrupted or lost)?
- b. What are the ack numbers of pending ACK packets in transit (in transit, corrupted or lost)?



a. The sender has sent packets 62 to 66; the receiver is expecting only packet 64 in this set (packets 62 and 63 have already been received and acknowledged). This means there is only one pending packet, packet 64.

b. The receiver has sent ACKs 62, 63, 65 and 66, but the sender has received only ACK 65. This means ACKs 62, 63, and 66 are pending.

- 3. Assume that we need to design a GO BACK N sliding window protocol for a network in which the bandwidth is 100 Mbps and average distance between sender and receiver is 10,000Km. Assume the average packet size is 10,000 bits and propagation speed in media is $2X10^8$ m/sec. Find the maximum size of send and receive windows, the no of seq number field (m) and the appropriate timeout value for the timer.

P3-24. We first calculate the average round-trip time (RTT) and the number of packets in the pipe before finding the sizes of the windows, the value of m, and the time-out value.

a. Average RTT $= 2 \times (10{,}000 \text{ Km}) / (2 \times 10^8) = 100$ ms.

b. The bandwidth-delay product = 100 Mbps × 100 ms = 10,000,000 bits.

c. The bandwidth-delay product = 10,000,000 bits /100,000 bits = 100 packets.

d. The maximum send window size should be 100 to allow not more than 100 packets in the pipe.

e. The maximum receive window size is 1 in Go-Back-N.

f. We know that the (send window size) $\leq (2^m - 1)$ or $100 \leq (2^m - 1)$. This means that we need to choose m to be at least 7. The sequence numbers are then 0 to 127.

g. The time-out value should be at least the average RTT = 100 ms to avoid early retransmission of the packets and to prevent congestion.