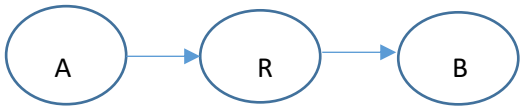
1. A channel has a bit rate of 4Kbps and a propagation delay of 20m/sec. For what range of frame sizes does stop and wait give an efficiency of at least 50 percent?
2. Consider a MAN with average source and destination 20KM apart and one way delay of 100µs. At what rate does the round trip delay equal the transmission delay for a 1KB packet?
3. Suppose you are designing a sliding window protocol for a 1Mbps point to point link to the moon, which has a one way latency (delay) of 1.25 seconds. Assuming that each frame carries 1KB of data, what is the min. number of bits you need for sequence number?
4. A 3000km long trunk operates at 1.536 Mbps is used to transmit 64 byte frames and uses SWP. If the propagation speed is 6 µsec/km, how many bits should the sequence number be?
5. Compute the approximate optimal window size when packet size is 53 bytes, the RTT is 60ms and bottleneck bandwidth is 155 Mbps.
6. Compute the fraction of the bandwidth that is wasted on overhead (headers and retransmissions) on a heavily loaded 50 kbps satellite channel with data frames consisting of 40 header and 3960 data bits. ACK frames never occur. NAK frames are 40 bits. The error rate for data frames is 1 percent, and the error rate for NAK frames is negligible. The sequence numbers are 8 bits.
7. Suppose A is connected to B via an intermediate Router R.



The A-R link is instantaneous, but the R-B link transmits only one packet each second, one at a time. Assume A sends to B using SWP with Ws = 4. For time T=2 state what packets arrive at R and in queue.