HOMEWORK #4

1. Assuming a stop-and-wait protocol, describe a scenario to show the need for sequence numbers.
2. A finite-state machine is an important tool in modeling protocols. For the stop-and-wait protocol, define the status of the system as SRC, where S is the sender [S = 1 when the sender sends frame I and S = 0 when the sender sends frame 0]. Similarly, R is the receiver [R = 1 when the receiver expects to receive frame 1 and R = 0 when the receiver expects to receive frame 0]. C is the channel, which can be in one of the four states, frame 1 is on the channel (C = 1), frame 0 is on the channel (C = 0), the acknowledgement is on the reverse channel (C = A), or the channel is empty (C = - ). Assume a half-duplex communications link connecting two stations (A and B) with A only sending traffic to B and B only sending back acknowledgement traffic.
   1. Draw the finite state diagram; assume an error-free link.
   2. Repeat (a) assuming that the communications link may have errors.
3. The following events occur between the primary station A and the two secondary stations B and C on a multidrop error-free half-duplex line using HDLC protocol: *Events e1,e2,e3,e4,* where

*e1* = A activates the link with B and C using a normal response mode

*e2* = A polls B for traffic, B responds by sending four I frames, then A only acknowledges B without granting B additional further transmission rights

*e3* = A polls C for traffic and C only acknowledges A

*e4* = A sends three frames to B and grants B the right to transmit. B responds by sending five additional frames and A acknowledges.

1. Show the frames exchanges between the primary station A and the two secondary stations (B and C).
2. Now assume that the noise corrupted the transmission of the first frame out of the five frames send out by B to A in event *e4*. Show two possible procedures for error recovery. Also, assume that the window size is seven.

Note: Use abbreviations A, YN(s)N(R),P/F to describe a frame where A is the address field, Y is the type of the frame, P/F is the poll/final bit, N(s) is the sending sequence number, and N(R) is the receiving sequence number.

HOMEWORK #5

1. For the network shown in Figure below:
   1. Use Dijkstra’s algorithm to obtain the shortest paths from node A to all other nodes.
   2. Use the shortest backward path tree algorithm to obtain the shortest paths from all nodes to node A.

7

10

16

3

1

1

10

5

5

4

12

10

1. Assume that the network in problem 1 above has been using the intermodal distance exchange distributed routing procedure for a long time and that the costs have not changed during that time.
   1. Show the distance-routing table entries at all nodes (except A) that indicate paths to destination A.
   2. Assume that the A to B and the B to A links fail simultaneously. Show the operation of the algorithm including all the messages transmitted.

HOMEWORK #6

1. In section 6.1, we assume the so-called retransmission model. That is, packets discarded because of buffer overflow are retransmitted by the source. Another possible model is the loss model, in which discarded packets are totally lost. Discuss the behavior of an uncontrolled network using the four scenarios in Section 6.1 and using the loss model.
2. A switch with finite buffer capacity has input and output links as shown in figure. Traffic coming in on link X is at a constant rate of 0.8 packets per unit time. 50% of this traffic leaves over link A and the other 50% leaves over link B. traffic coming in over link Y is at a variable rate L and is divided 25% and 75% for output links B and C. assume that buffers in the switch are strictly split into two partitions; one for outgoing link B and another partition shared between outgoing links A and C.
   1. Using the loss model, sketch the following (i.e., show the general shape of the curve and parameter values):
      1. The total throughput and X’s throughput on link B as a function of L.
      2. The total throughput as a function of L on links A and C.
   2. What are the problems with these throughput curves? Devise a solution (by further partitioning the buffers) to alleviate the problems.

X

Max = 1

0.8

Max = 1

Max = 1

Max = 10

Y

Max = 1

0.5

0.5

0.25

0.75

B

C

A

L