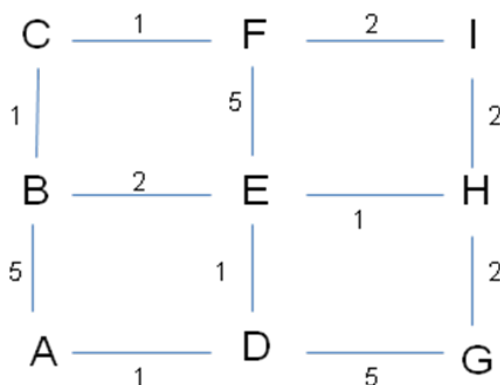
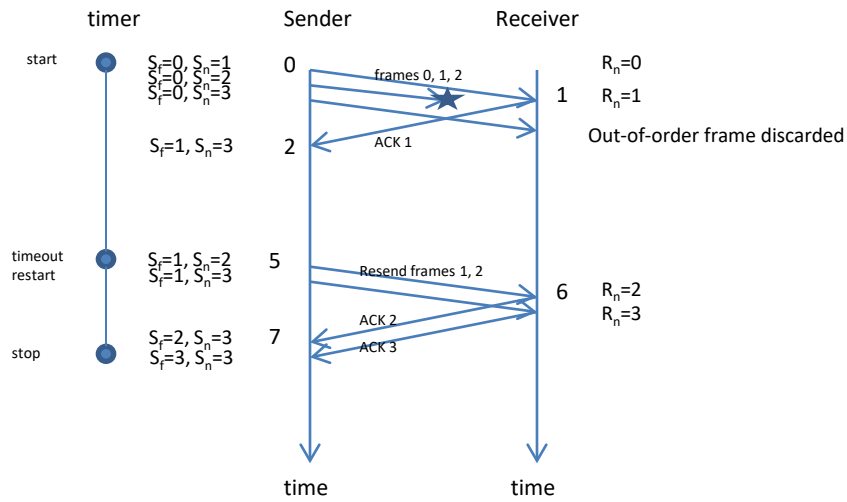


1. Consider a communication system using a Go-back-N ARQ protocol with  $m=3$  bits for sequence numbers. At the beginning, the sender accepts three requests from the upper layer, and transmits the three corresponding data frames (named frame 0, 1, and 2), one immediately after another, to the receiver. Frames 0 and 2 are received successfully, while frame 1 is lost during the transmission. Assume there is no further request from the upper layer, and all subsequent data frame transmissions, retransmissions, and ACK transmissions are successful. The propagation time is 1 second from the sender to the receiver, or from the receiver to the sender. Ignore all other time delay. The time-out value of a timer is 5 seconds. Please describe what will happen next at the receiver and the sender, until the transmission process for all frames is complete. Recall that in Go-back-N ARQ, ACK is issued at the receiver only when the expected data frame arrives.
2. There are three possible persistence methods for CSMA: 1-persistent, nonpersistent, and p-persistent. Among them, the 1-persistent method has the highest chance of collision. But the 1-persistent method is used in Ethernet Standard. Why?
3. Please describe the hidden station problem in CSMA protocols.
4. For the following network topology, please use the Dijkstra algorithm to find the shortest path tree for Station A, and based on the shortest path tree, give the routing table at Station A. Please show your steps. Please use a square to represent a station in the permanent list, and a circle to represent a station in the tentative list.



**You can find solution in the following pages.**

Question 1 solution:



2. In Ethernet, we use collision detection. If a collision happens, the involved stations can detect the collision quickly and abort. So the duration of the collision is short.
3. Consider Stations A, B, and C in a line. Stations A and C are far away from each other, and signals from one station cannot reach the other station. Thus, Stations A and C are hidden station to each other. When Station A is sending a message to Station B, if Station C also has a message to send, Station C will sense the channel first. Since Station C cannot hear anything from the channel, it considers that the channel is idle, and thus, it sends its message. Then, at Station B, the signals from Stations A and C collide.



y

T <sub>0</sub>	Cost	Next
A	0	—
B	4	D
C	5	D
D	1	—
E	2	D
F	6	D
G	5	D
H	3	D
I	5	D