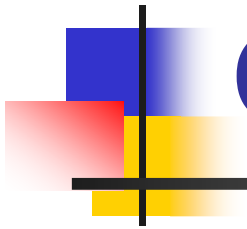

EC 553
Communication Networks

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Syllabus

- Tentatively

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Week 3	IP addressing and subnetting
Week 4	IP addressing and subnetting
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Week 10	Token ring networks
Week 11	VOIP
Week 12	WLAN
Week 13	TCP
Week 14	Congestion control
Week 15	QOS

Chapter 13

Multiple Access

Figure 13.1 Multiple-access protocols

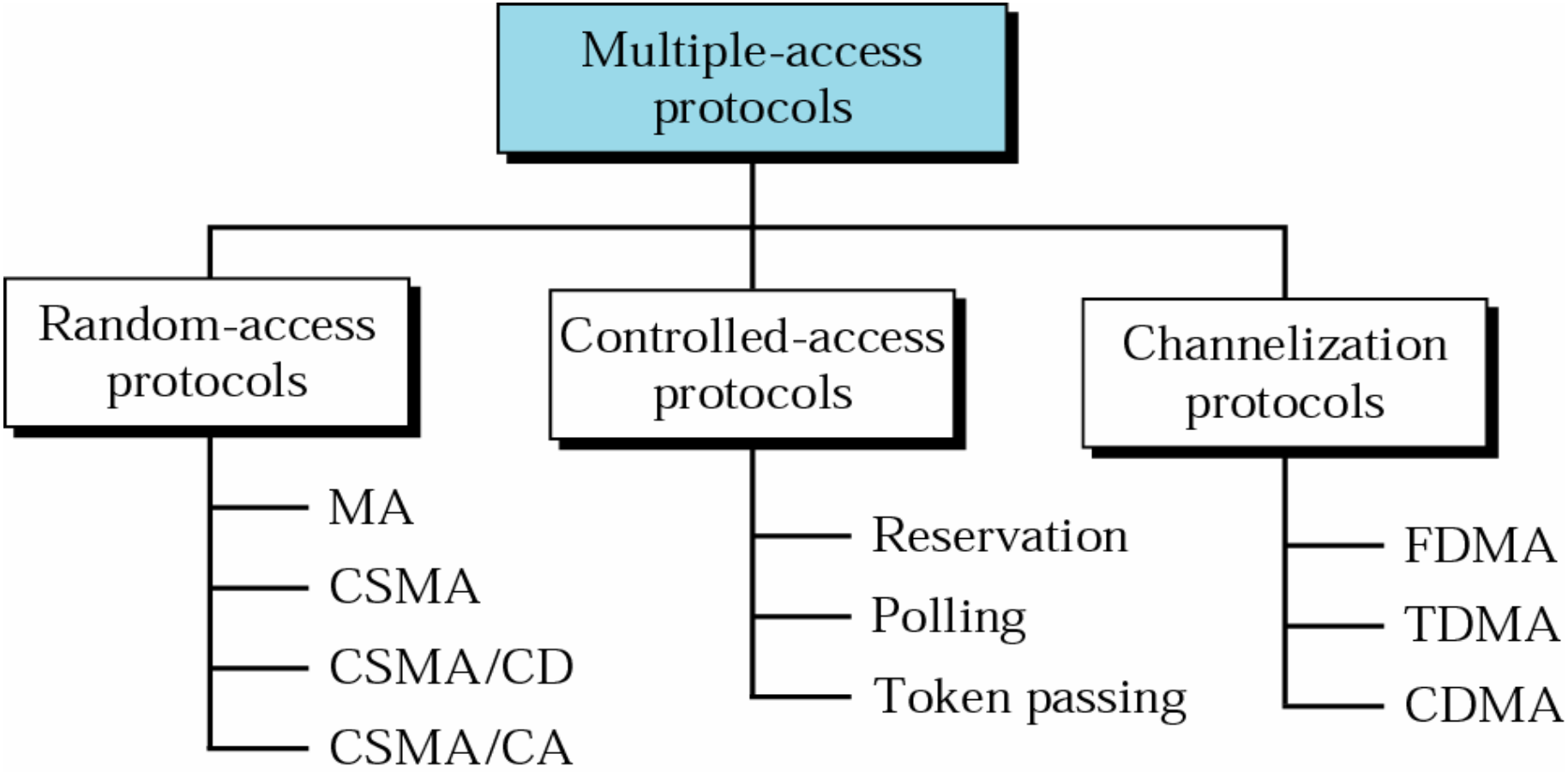


Figure 13.3 ALOHA network

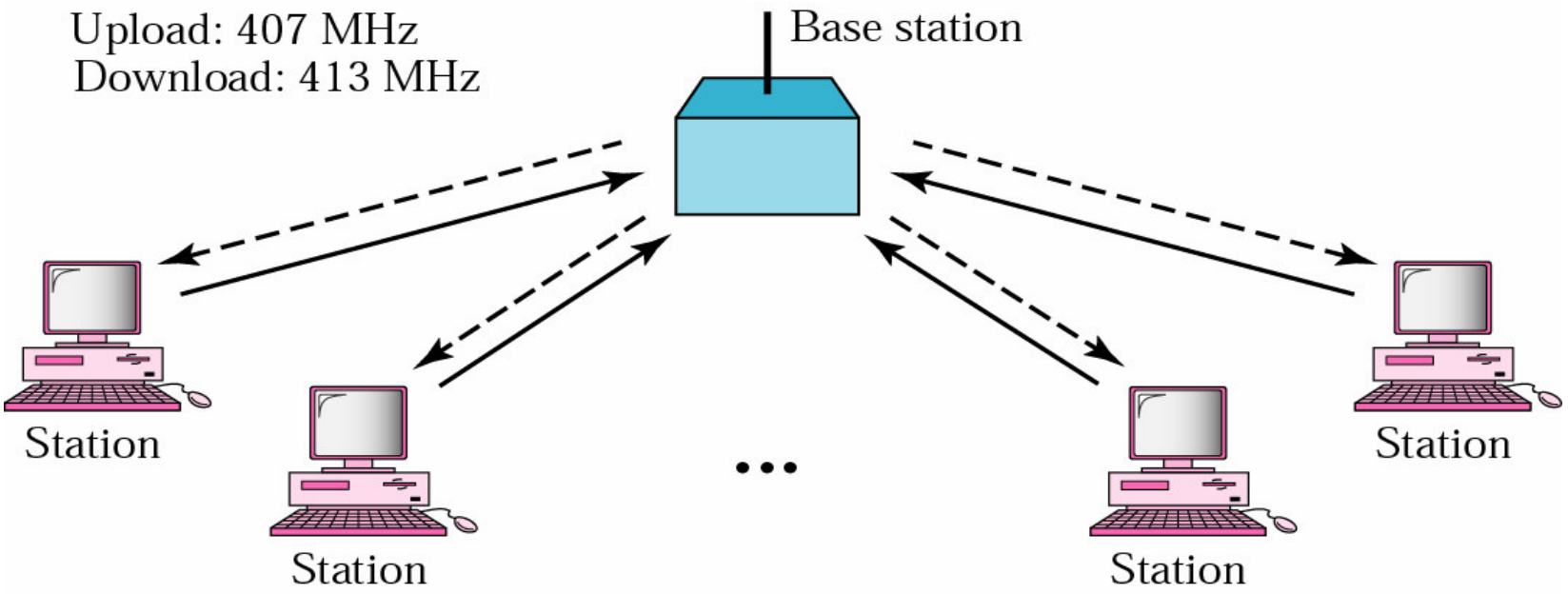


Figure 13.4 Procedure for ALOHA protocol

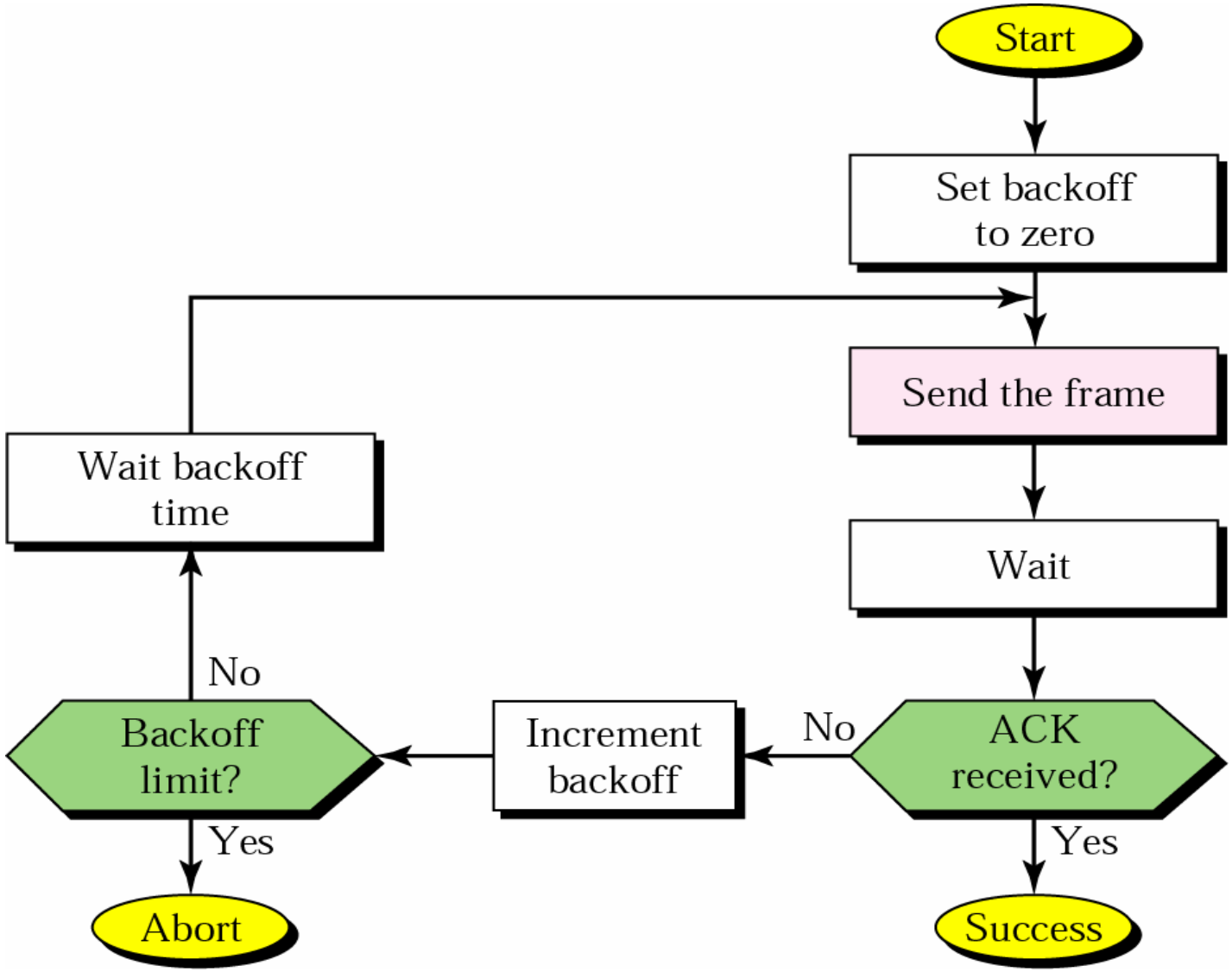


Figure 13.5 Collision in CSMA

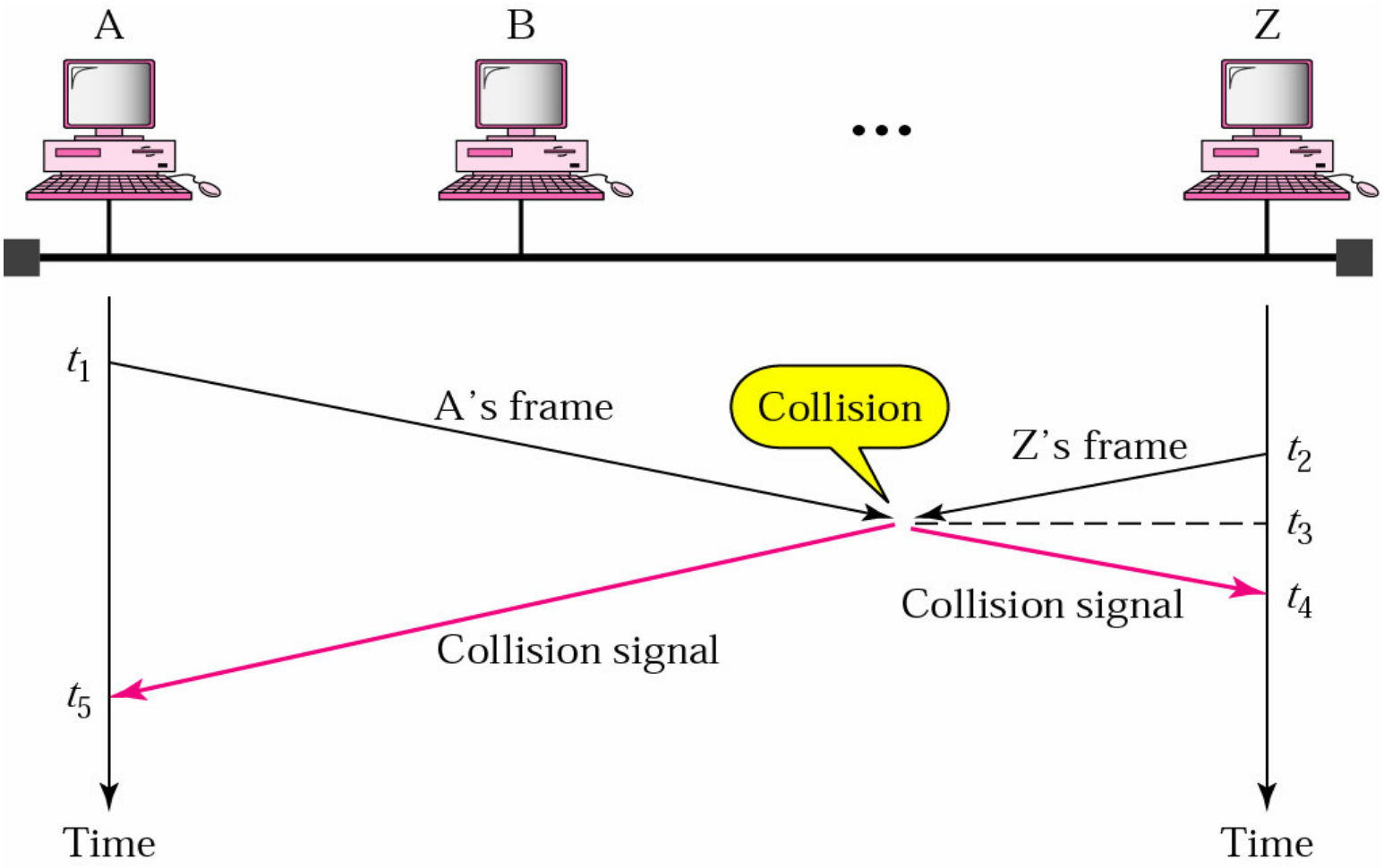
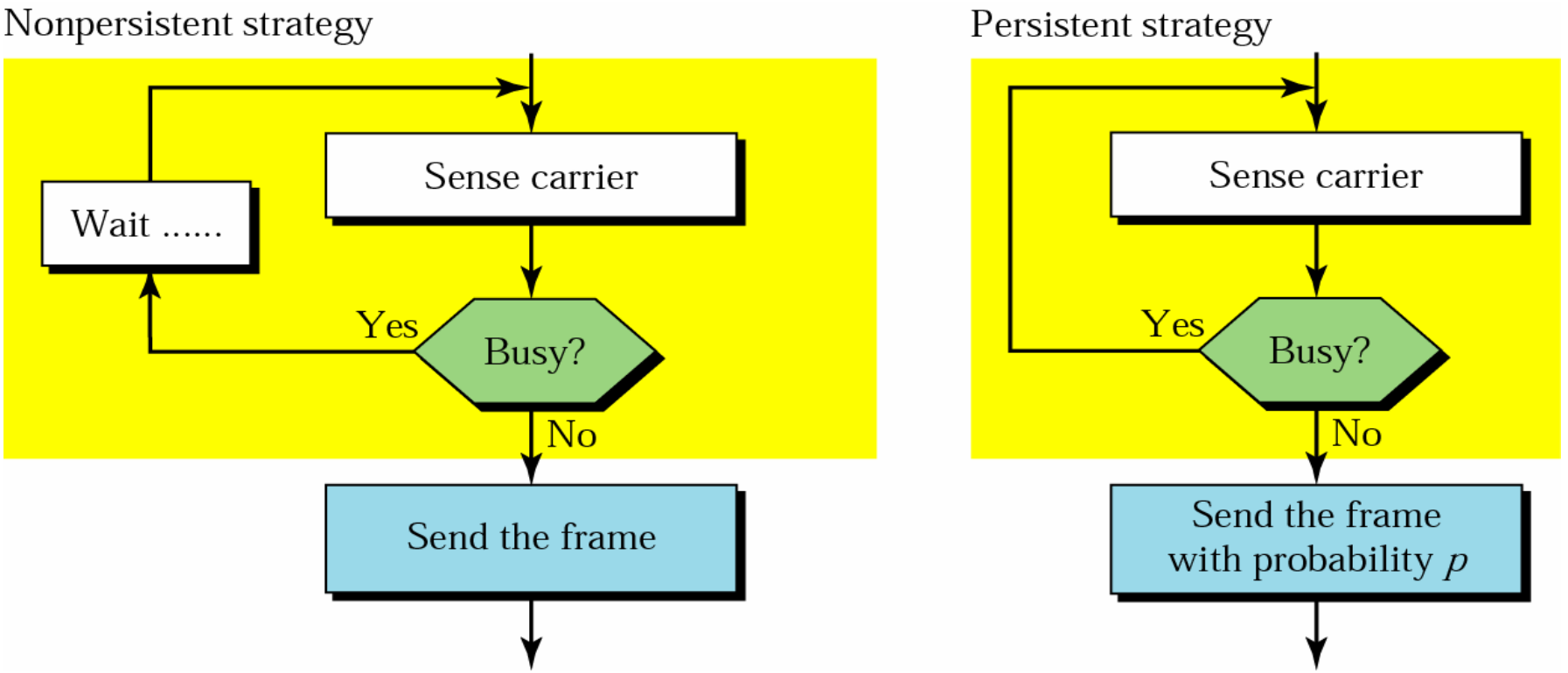


Figure 13.6 Persistence strategies



13.7 CSMA/CD procedure

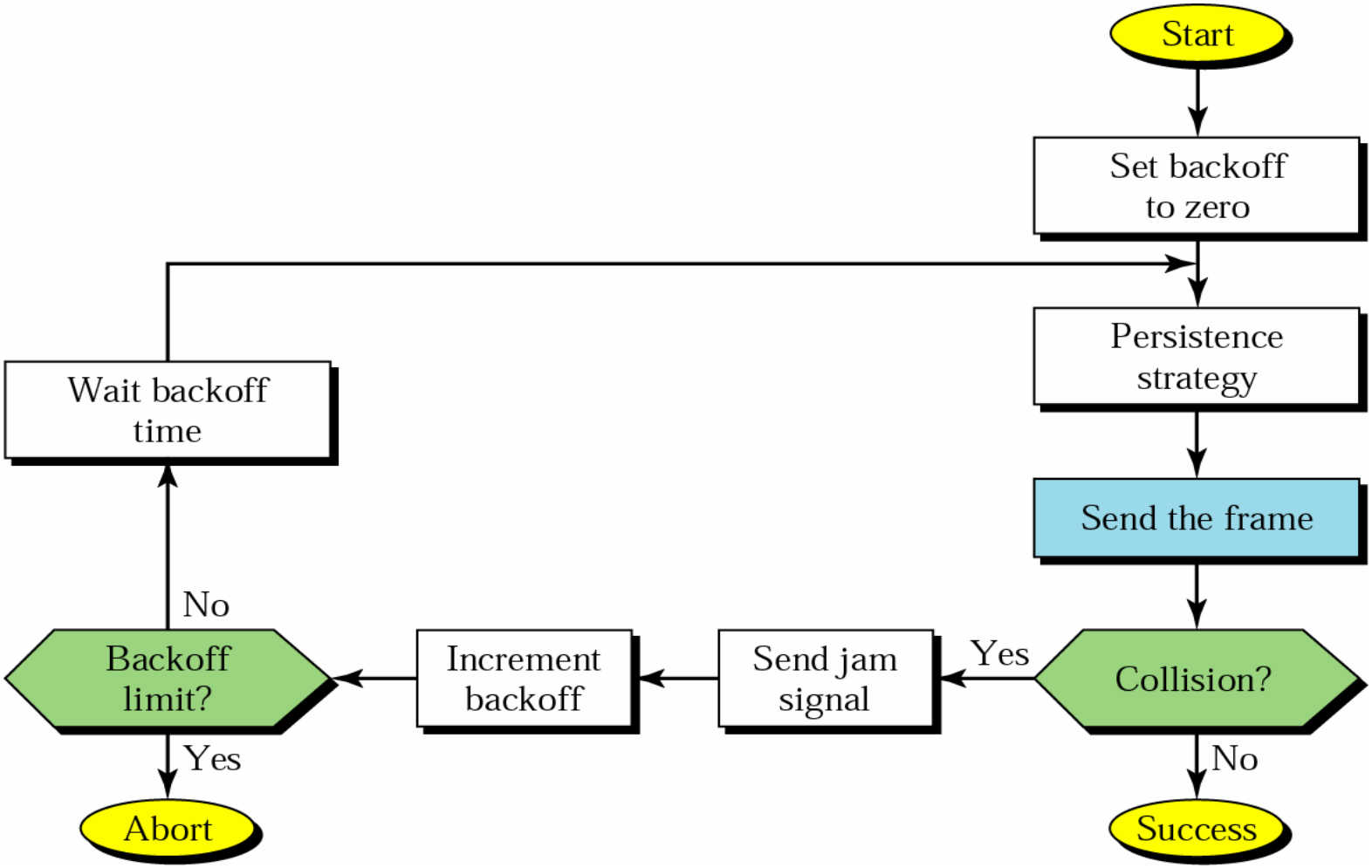
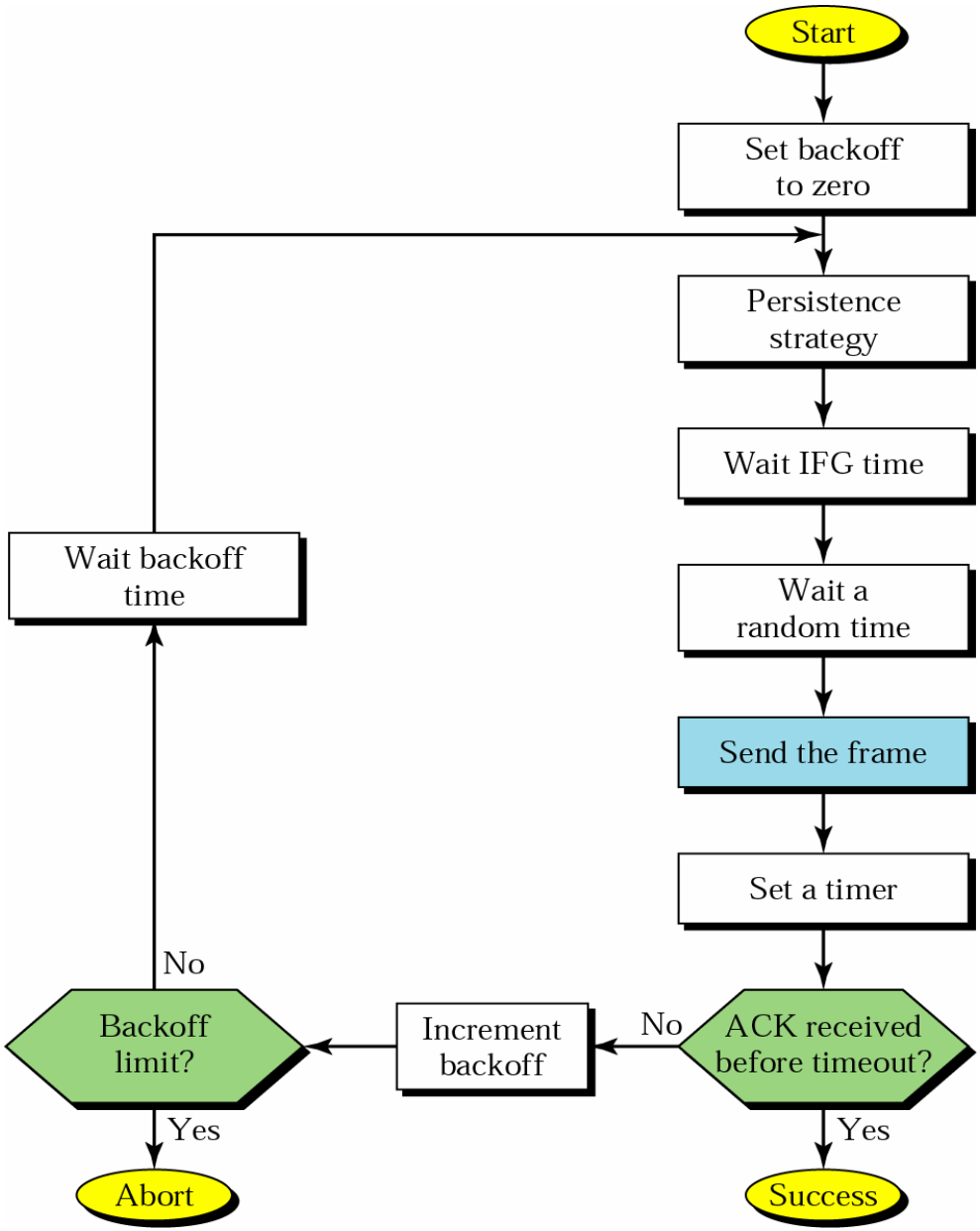


Figure 13.8 CSMA/CA procedure



13.2 Control Access

Reservation

Polling

Token Passing

Figure 13.9 Reservation access method

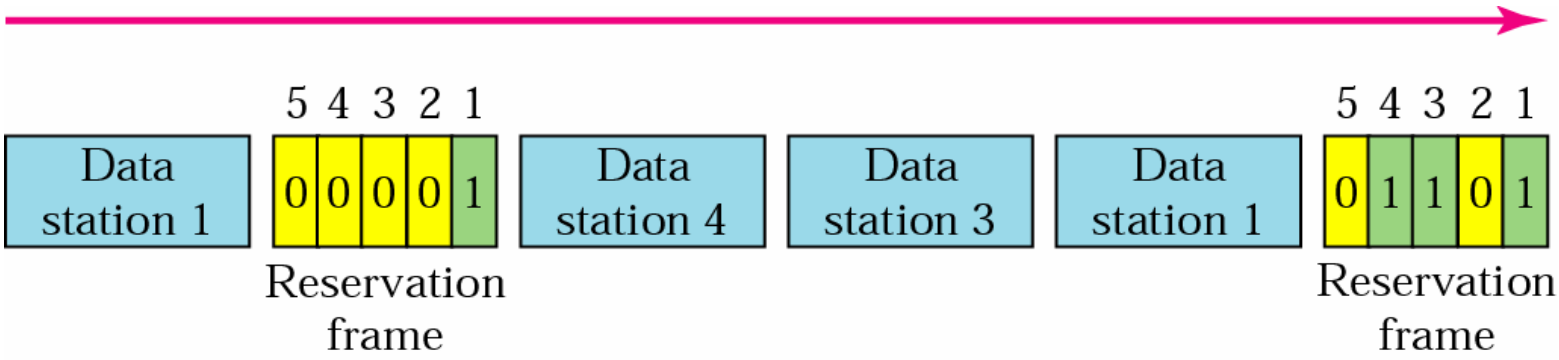


Figure 13.10 Select

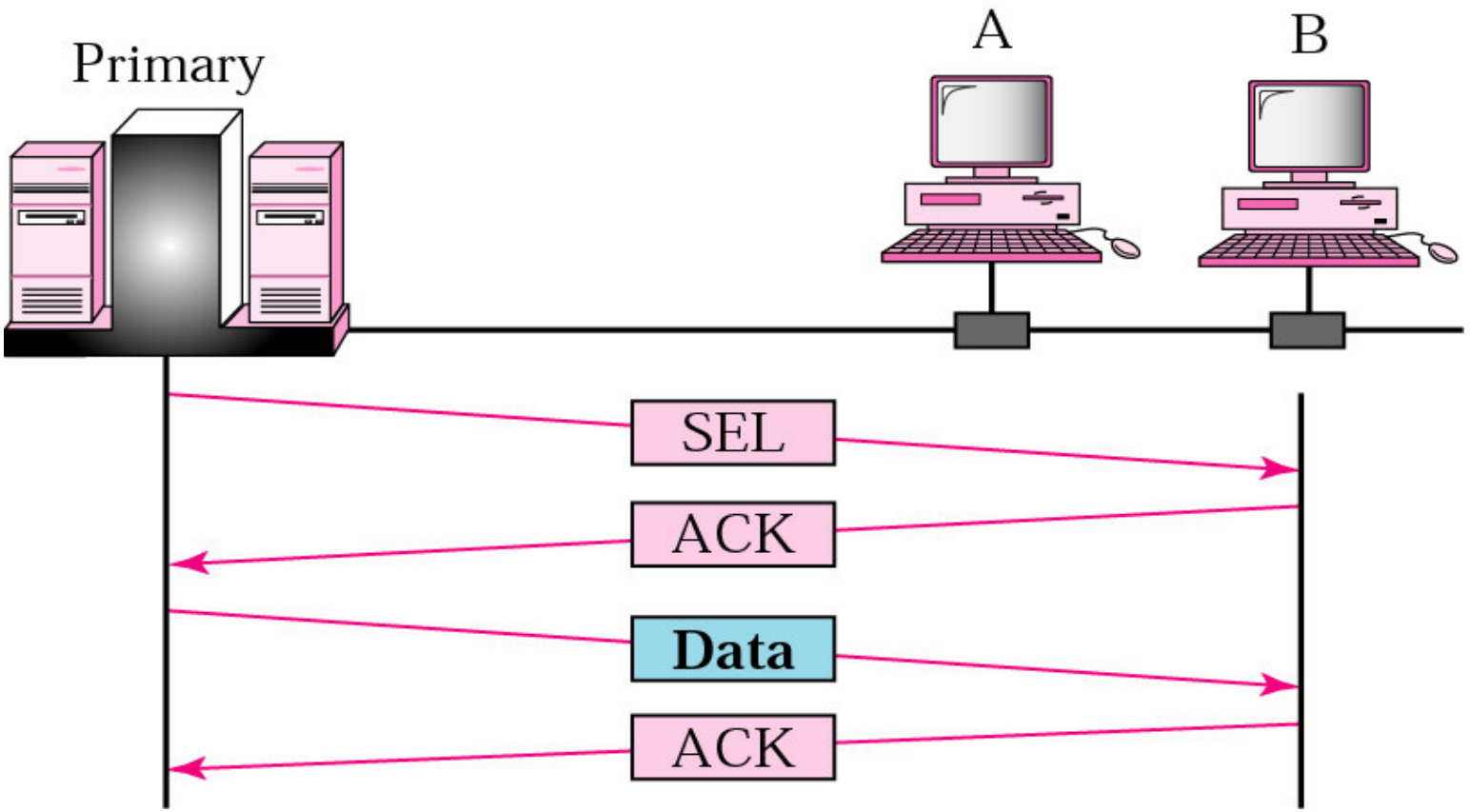


Figure 13.11 Poll

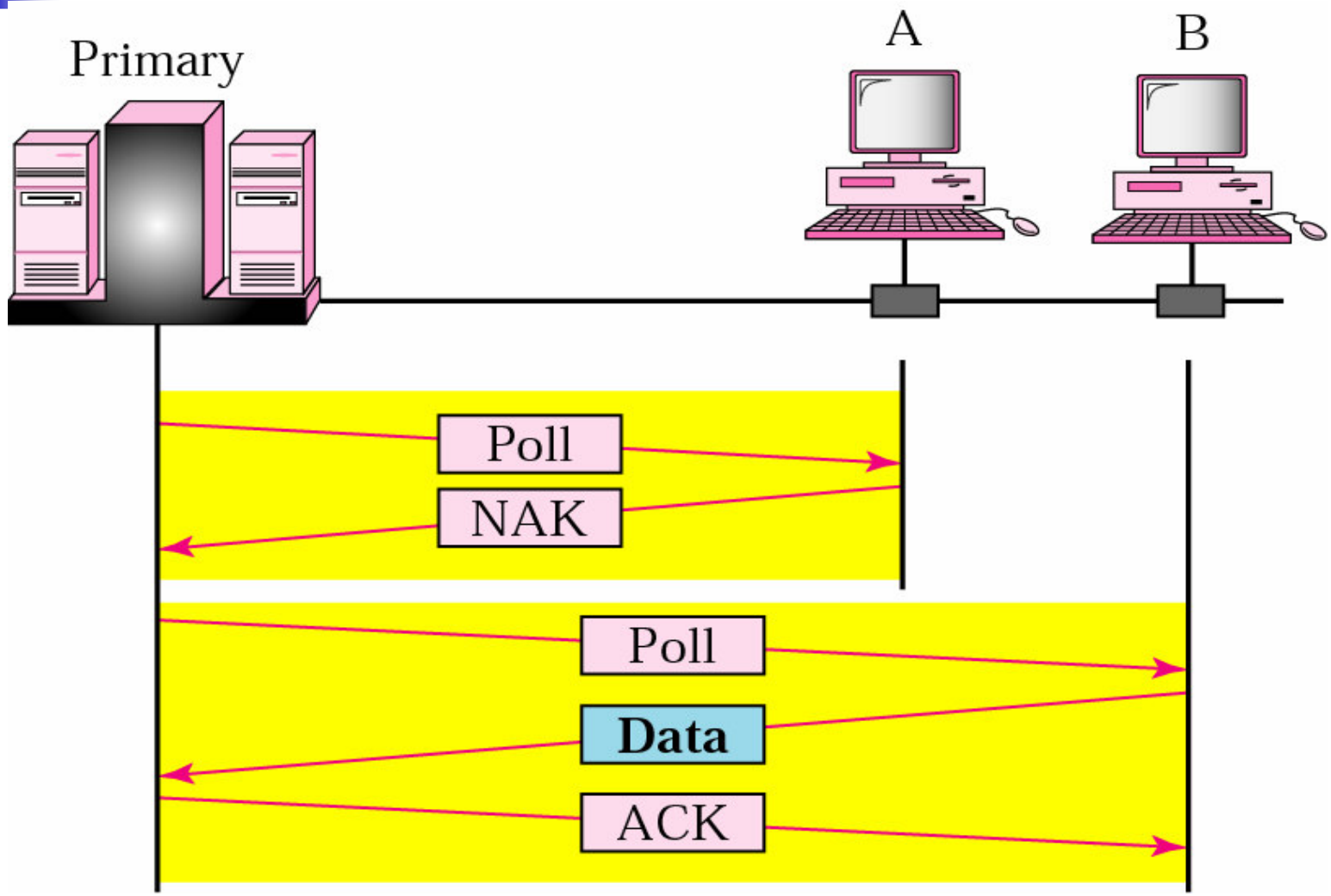


Figure 13.12 Token-passing network

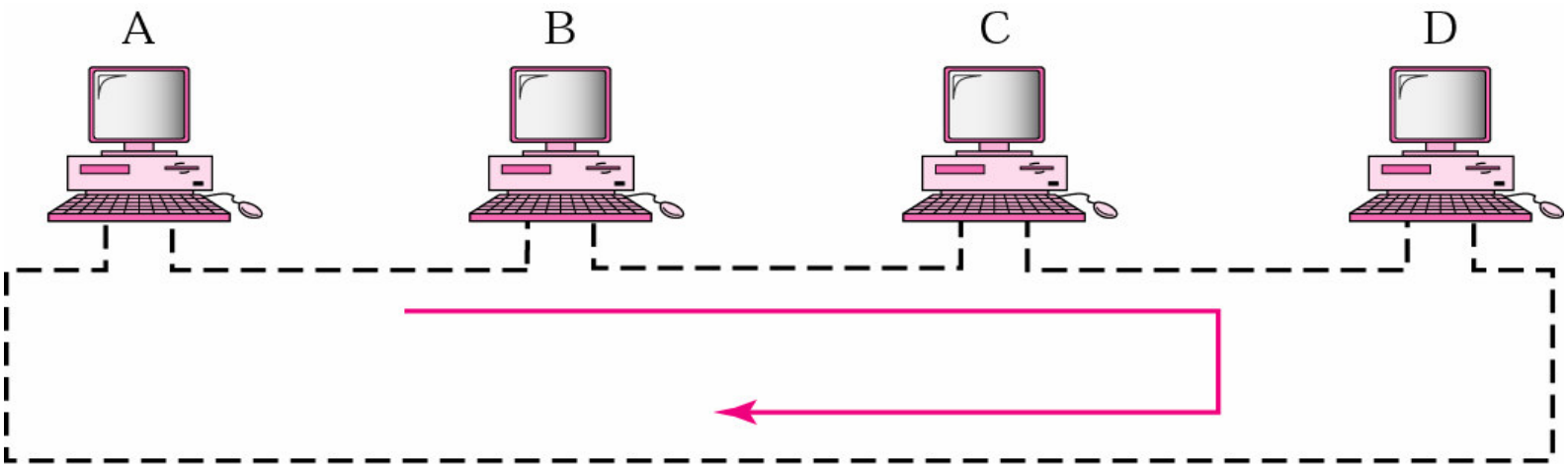
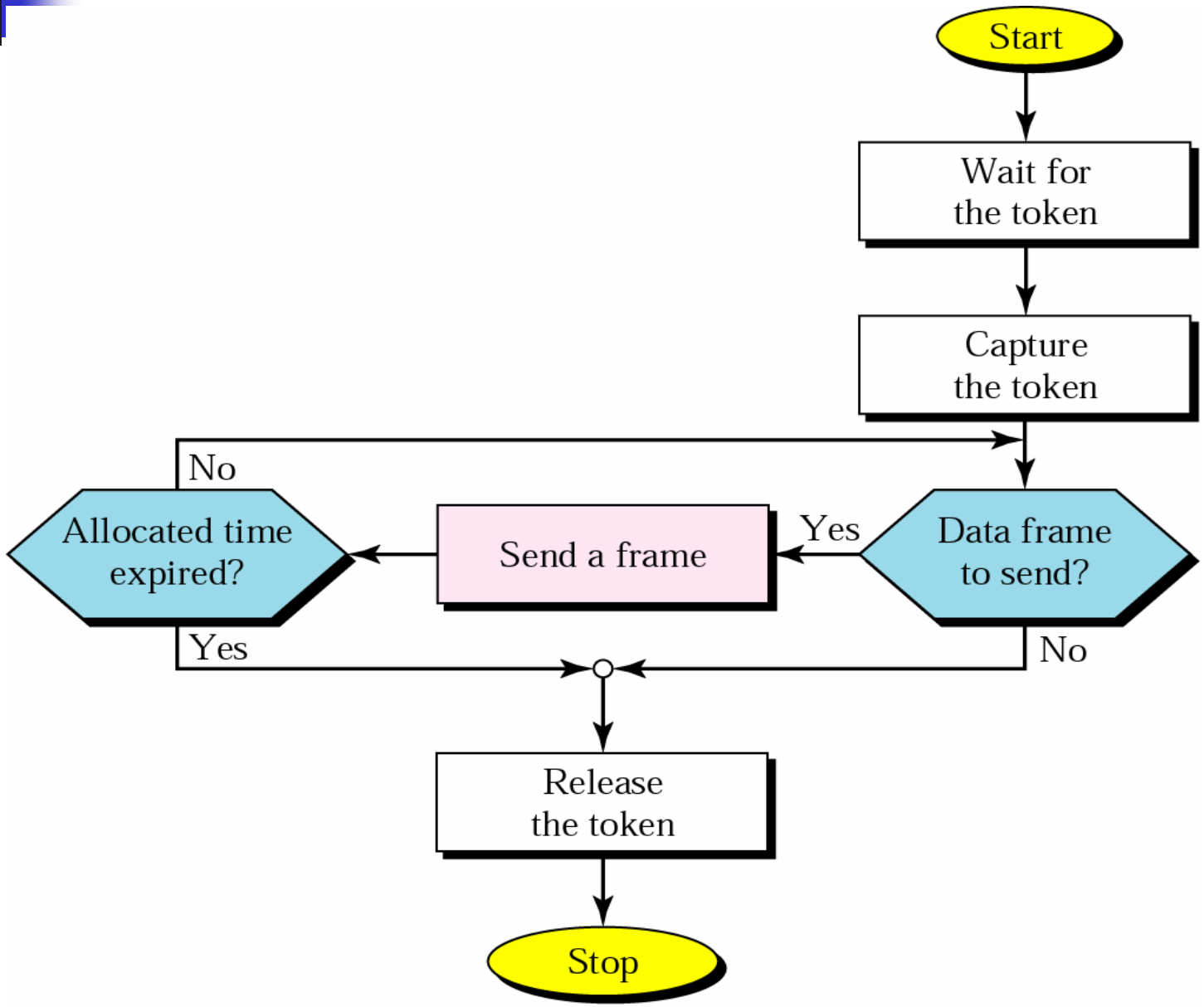


Figure 13.13 Token-passing procedure



13.3 Channelization

FDMA

TDMA

CDMA

Note:

In FDMA, the bandwidth is divided into channels.

Note:

In TDMA, the bandwidth is just one channel that is timeshared.

Note:

In CDMA, one channel carries all transmissions simultaneously.

Figure 13.14 Chip sequences

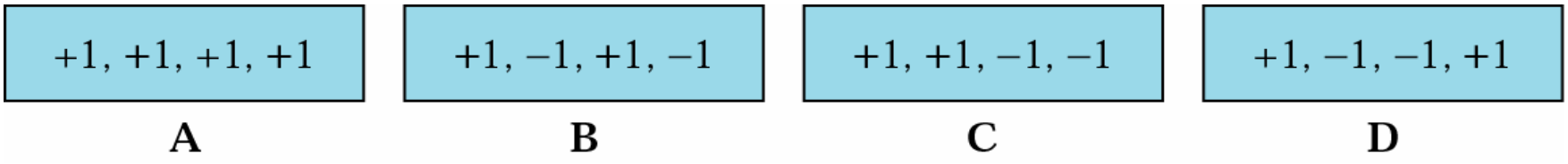


Figure 13.15 Encoding rules

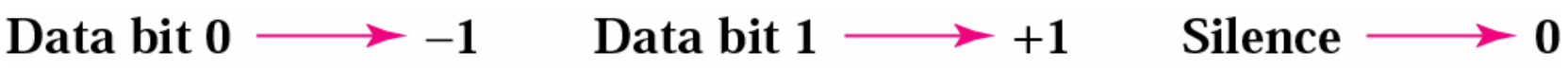


Figure 13.16 CDMA multiplexer

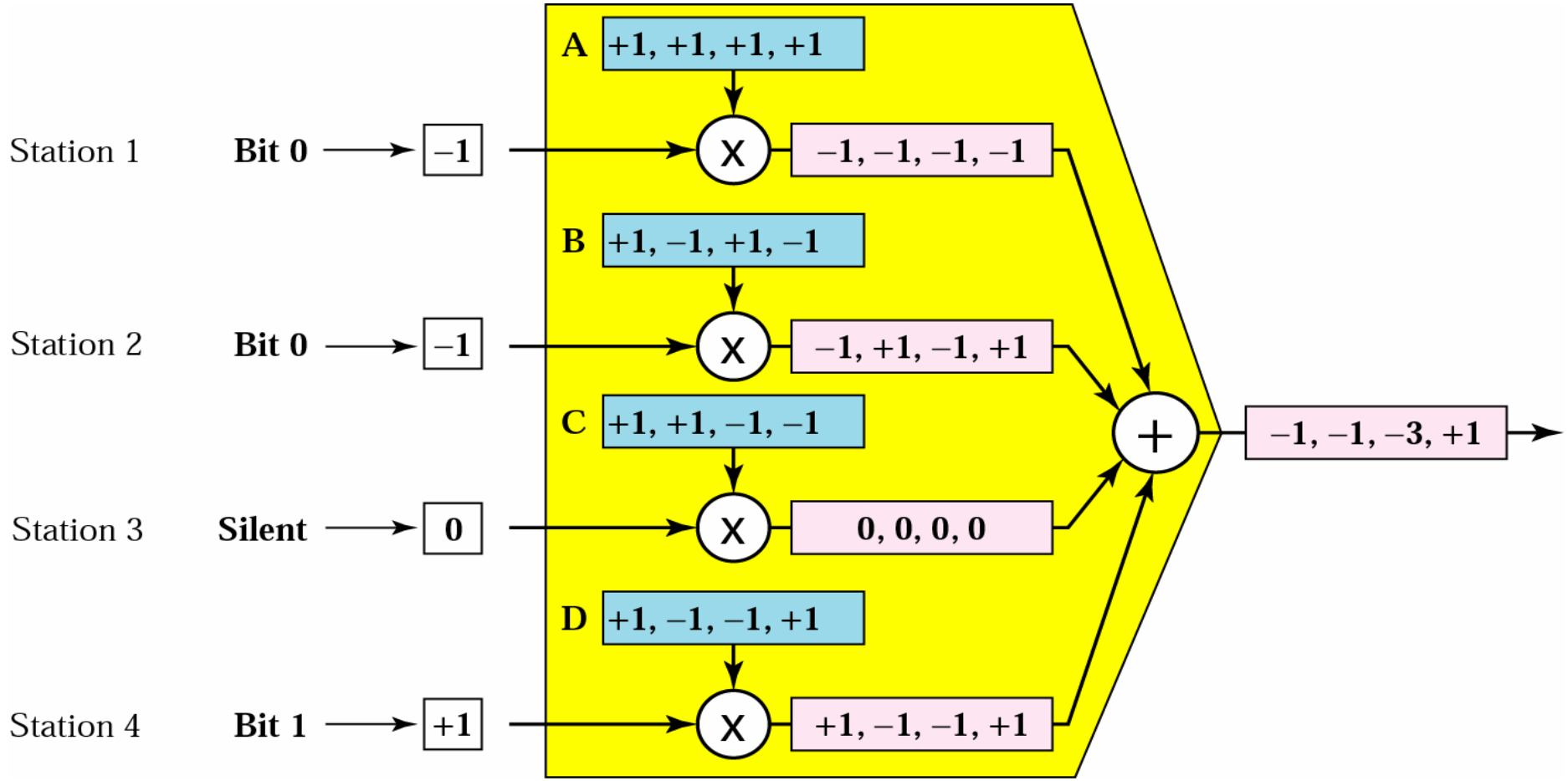


Figure 13.17 CDMA demultiplexer

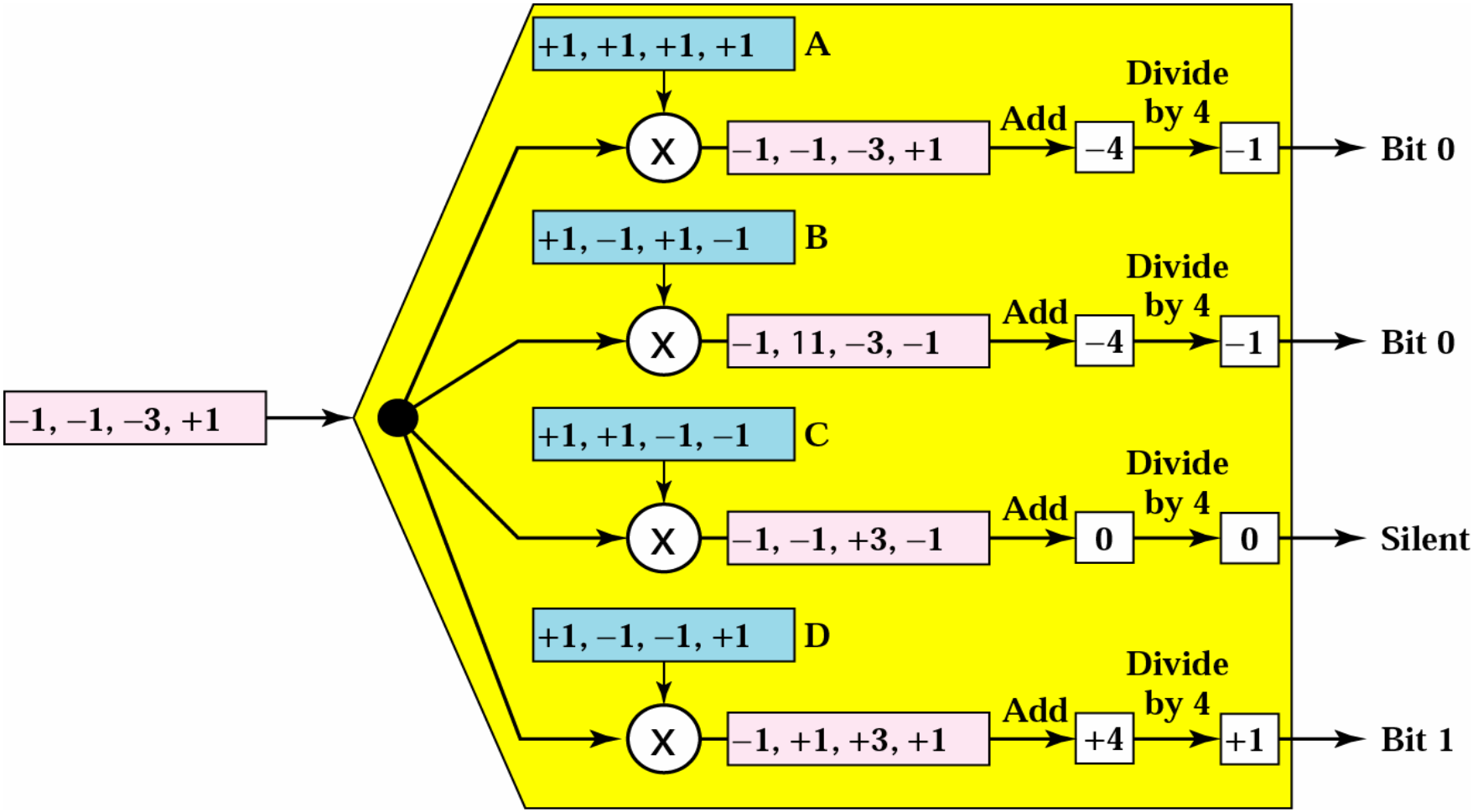


Figure 13.18 W1 and W2N

$$W_1 = \begin{bmatrix} +1 \end{bmatrix} \qquad W_{2N} = \begin{bmatrix} W_N & W_N \\ W_N & \overline{W_N} \end{bmatrix}$$

Figure 13.19 Sequence generation

$$W_1 = \begin{bmatrix} +1 \end{bmatrix}$$

$$W_2 = \begin{bmatrix} +1 & +1 \\ +1 & -1 \end{bmatrix}$$

$$W_4 = \begin{bmatrix} +1 & +1 & +1 & +1 \\ +1 & -1 & +1 & -1 \\ +1 & +1 & -1 & -1 \\ +1 & -1 & -1 & +1 \end{bmatrix}$$

Example 1

Check to see if the second property about orthogonal codes holds for our CDMA example.

Solution

The inner product of each code by itself is N. This is shown for code C; you can prove for yourself that it holds true for the other codes.

$$\mathbf{C} \cdot \mathbf{C} = [+1, +1, -1, -1] \cdot [+1, +1, -1, -1] = 1 + 1 + 1 + 1 = 4$$

If two sequences are different, the inner product is 0.

$$\mathbf{B} \cdot \mathbf{C} = [+1, -1, +1, -1] \cdot [+1, +1, -1, -1] = 1 - 1 - 1 + 1 = 0$$

Example 2

Check to see if the third property about orthogonal codes holds for our CDMA example.

Solution

The inner product of each code by its complement is –N. This is shown for code C; you can prove for yourself that it holds true for the other codes.

$$\mathbf{C} \cdot (-\mathbf{C}) = [+1, +1, -1, -1] \cdot [-1, -1, +1, +1] = -1 - 1 - 1 - 1 = -4$$

The inner product of a code with the complement of another code is 0.

$$\mathbf{B} \cdot (-\mathbf{C}) = [+1, -1, +1, -1] \cdot [-1, -1, +1, +1] = -1 + 1 + 1 - 1 = 0$$

Example of DS multiple access waveforms