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## CHAPTER 11

# *Data Link Protocol*

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### 11.1 REVIEW QUESTIONS

1. Data transparency is the ability to send any combination of bits as data without their being confused with control information.
3. The information field of an HDLC I-frame contains user data, while the same field of a U-frame has information concerning network management.
5. Data link protocols are divided into two classes: synchronous and asynchronous. In an asynchronous protocol, there are start and stop bits and possible gaps between characters. In a synchronous protocol, the sender and receiver should be synchronized; time is involved.
7. Asynchronous protocols are losing their popularity due to their low data rate and the need for overhead such as start and stop bits.
9. In character-oriented protocols, control information is inserted into the data stream in the form of code words taken from existing character sets such as ASCII or EBCDIC.
11. There are two types of BSC frames: control and data frames. Control frames exchange information between devices to establish an initial connection, provide flow and error control, and disconnect the devices when the session is over. A data frame is used to carry user data.
13. In a multiframe BSC transmission an ETB (end of transmission block) shows the end of each frame except the last one which is marked with the ETX (end of text) character.
15. There are three types of stations in HDLC: primary, secondary, and combined. A primary station sends commands. A secondary station sends responses. A combined station sends both commands and responses.

17. I-frames are used to transport user data and related control information. S-frames carry control information (data link flow and error control). U-frames are used to transport system management information.
19. The first one or two bits identify the frame. The N(S) bits define the sequence number of the frame. The N(R) bits define the acknowledgment number. One field in the S-frame and two fields of the U-frame define the type of the corresponding frames. In all of types of frames a P/F bit defines the direction of the frame.
21. RR, RNR, REJ, SREJ.
23. LAPB is used only in balanced configurations of two devices of the combined type. LAPD is used for out-of-band signaling in Integrated Services Digital Network. LAPM does asynchronous-synchronous conversion, error detection and retransmission for modems.

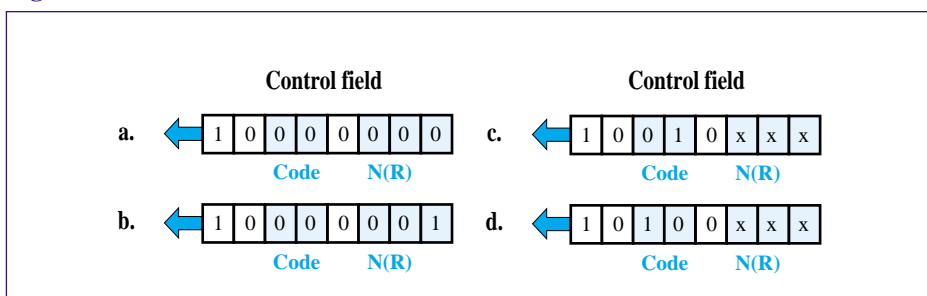
## 11.2 MULTIPLE CHOICE QUESTIONS

25. b    27. b    29. b    31. c    33. b    35. b    37. a    39. b    41. b

## 11.3 EXERCISES

43. SYN-SYN-EOT-SYN-H-E-L-L-O (The hyphens separate bytes).
45. Only the control field is shown in Figure 11.1

**Figure 11.1** Exercise 45



47.  $\Leftarrow 0001111101111101111101111101111101111100111110001$

49.
  - a. 0000111 (7)
  - b. S-frame
  - c. N/A
  - d. 3
  - e. no
  - f. no

- g. It is a negative response to poll or positive response to select (depends on the previous packet).

51.

- a. 0000011 (3)
- b. S-frame
- c. N/A
- d. 3
- e. no
- f. no
- g. Negative response to select

53.

- a. 0000011 (3)
- b. I-frame
- c. 2
- d. 3
- e. 001111101011110010100001011
- f. no

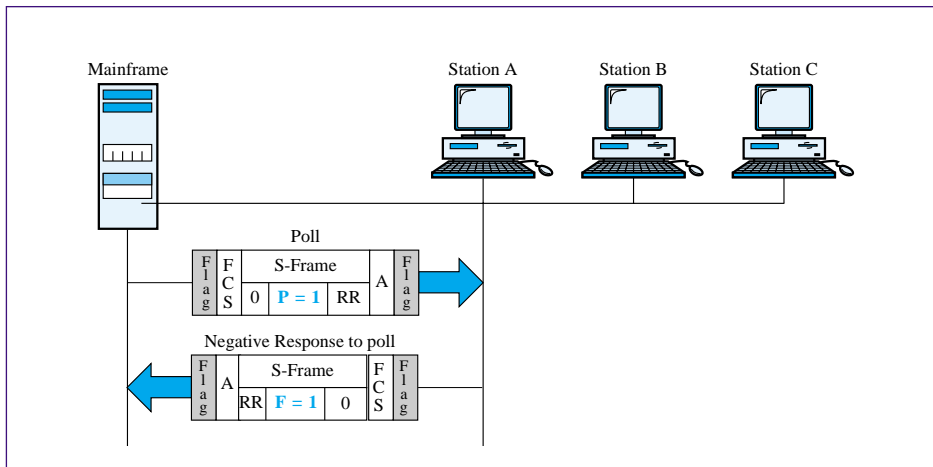
55.

- a. SYN-SYN-ENQ
- b. SYN SYN ACK0
- c. SYN SYN STX 100bytes ITB BCC STX 100bytes ITB BCC STX 100bytes  
ITB BCC STX 100bytes ETB BCC  
SYN SYN STX 100bytes ITB BCC STX 100bytes ITB BCC STX 100bytes  
ITB BCC STX 100bytes ETB BCC  
SYN SYN STX 100bytes ITB BCC STX 100bytes ITB BCC STX 100bytes  
ITB BCC STX 100bytes ETX BCC
- d. SYN SYN ACK1

57. See Figure 11.2

59. See Figure 11.3

**Figure 11.2** Exercise 57



**Figure 11.3** Exercise 59

