CHAPTER 13

Multiple Access

Review Questions

1. Only one station can send data at a time. Therefore there is no possibility of collision.
2. MA, CSMA, CSMA/CD, CSMA/CD.
3. Backoff in an ALOHA network is incremented when no ACK is received.
4. In a non-persistent strategy, the station waits a random period of time if the line is in use by another station. In a persistent strategy, the station either sends immediately if the line is idle or sends with probability p.
5. A jam signal is sent to inform other stations that a collision has occurred.
6. In CSMA/CA there is no collision. In CSMA/CD there can be a collision.
7. Reservation, polling, and token passing are three popular controlled-access methods.
8. There could be a slight loss in efficiency due to the large size of the reservation frame.
9. Polling is a procedure in which the primary station asks a secondary station if it has data to send. Selecting is a procedure in which the primary station asks a secondary to prepare to receive data.
10. In token passing only the station in possession of the token can send data.
11. FDMA, TDMA, and CDMA are the three channelization protocols.
12. In FDMA each station has an allocated band to send data. In TDMA there is just one band and each station is allocated a time slot. In CDMA there is only one band but all stations can send data simultaneously.
13. CDMA is superior to FDMA because the bandwidth is not divided into channels. CDMA is superior to TDMA because the channel is not divided into time slots.
14. When more than one station tries to send at the same time a collision is the result.
15. Multiply two sequences, element by element, and add the results.

Multiple-Choice Questions

16. a
17. c
18. a
19. d
20. c
21. a
22. c
23. a
24. a
25. d
26. b
27. b
28. c
29. b
30. a
31. c
32. a
33. a
34. c

Exercises

35. In the ALOHA protocol, the station accesses the medium whenever it has data to send.
36. In the ALOHA protocol, the station sends without knowing if the medium is busy or not.
37. In the ALOHA protocol, an ACK from the receiver means a successful transmission.
38. In the ALOHA protocol, if an ACK is not received within a specified time, a backoff strategy is implemented and then the data is sent again.
39. In the CSMA/CD protocol, a station listens to the line and sends data if the line is detected as idle.
40. In the CSMA/CD protocol, if the line is busy, the station sends after implementation of its backoff strategy.
41. In the CSMA/CD protocol, an ACK from the receiver means a successful transmission.
42. In the CSMA/CD protocol, if there is an access conflict before data is sent, a persistence strategy is implemented. If there is an access conflict after data is sent, a

jam signal is sent, the backoff is incremented, and the persistence strategy is again implemented.

43. In the CSMA/CA protocol, the station listens for an idle line. If the line is idle, the station waits an IFG amount of time and then waits a random amount of time. Data is then sent.

44. In the CSMA/CA protocol, if the medium is busy a persistence strategy is implemented before data is sent.

45. In the CSMA/CA protocol, an ACK from the receiver before the timer expires means a successful transmission.

46. In the CSMA/CA protocol, if there is an access conflict before data is sent, a persistence strategy is implemented. There should be no access conflict after data is sent.

47. In a token-passing protocol, a station accesses the medium if it is in possession of the token.

48. In a token-passing protocol, if the medium is busy, the stations that do not have the token cannot transmit data.

49. In a token-passing protocol, the receiver does not send an explicit ACK to the sender. However, the frame is returned to the sender. The sender checks a specific bit on the returned frame as a sign of a successful transmission.

50. In a token-passing protocol, there is no access conflict.

51. See Table 13.1.

Table 13.1   *Exercise 51*

Characteristic	*ALOHA*	*CSMA/ CD*	*CSMA/ CA*	*Token Passing*	*Channel- ization*
Multiple Access	yes	yes	yes	no	yes
Carrier Sense	no	yes	yes	no	no
Collision Checking	no	yes	no	no	no
Acknowledgement	yes	no	yes	no	NA

52.

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+1 +1 +1 +1 +1 +1 +1 +1 +1 +1 +1 +1 +1 +1 +1 +1
+1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1
+1 +1 -1 -1 +1 +1 -1 -1 +1 +1 -1 -1 +1 +1 -1 -1
+1 -1 -1 +1 +1 -1 -1 +1 +1 -1 -1 +1 +1 -1 -1 +1
+1 +1 +1 +1 -1 -1 -1 -1 +1 +1 +1 +1 -1 -1 -1 -1
+1 -1 +1 -1 -1 +1 -1 +1 +1 -1 +1 -1 -1 +1 -1 +1
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+1 -1 -1 +1 -1 +1 +1 -1 +1 -1 -1 +1 -1 +1 +1 -1
+1 +1 +1 +1 +1 +1 +1 +1 -1 -1 -1 -1 -1 -1 -1 -1
+1 -1 +1 -1 +1 -1 +1 -1 -1 +1 -1 +1 -1 +1 -1 +1
+1 +1 -1 -1 +1 +1 -1 -1 -1 -1 +1 +1 -1 -1 +1 +1
+1 -1 -1 +1 +1 -1 -1 +1 -1 +1 +1 -1 -1 +1 +1 -1
```

```
+1  +1  +1  +1  -1  -1  -1  -1  -1  -1  -1  -1  +1  +1  +1  +1
+1  -1  +1  -1  -1  +1  -1  +1  -1  +1  -1  +1  +1  -1  +1  -1
+1  +1  -1  -1  -1  -1  +1  +1  -1  -1  +1  +1  +1  +1  -1  -1
+1  -1  -1  +1  -1  +1  +1  -1  -1  +1  +1  -1  +1  -1  -1  +1
```

53. The inner product of the last row by itself.
    1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1 = 16

    The inner product of the last row by the next to last row.
    1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 = 0

54. The inner product of the last row by its complement.
    -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 = -16

    The inner product of the last row by the complement of the first row.
    -1 +1 +1 -1 +1 -1 -1 +1 +1 -1 -1 +1 -1 +1 +1 -1 = 0

55. +3, -1, -1, -1

56. See Figure 13.1.

Figure 13.1   *Exercise 56*