CHAPTER 9

Error Detection and Correction

9.1   REVIEW QUESTIONS

1. In a single bit error only one bit of a data unit is corrupted, i.e. changed from 1 to 0 or from 0 to 1, whereas the term burst error means more than one corrupted bit.

3. Vertical redundancy check, longitudinal redundancy check, cyclical redundancy check, and checksum.

5. In even parity the number of 1s should be even; in odd parity the number of 1s should be odd.

7. Like VRC, LRC also uses the parity bit technique for error detection. The difference is in the way the parity bits are calculated. The original data bits are organized in a table of rows and columns. The parity bit is then calculated for each column.

9. The CRC remainder is added to the data unit.

11. The CRC checker divides the received data by the predetermined divisor and accepts the data if the remainder is zero.

13. CRC can detect all burst errors that affect an odd number of bits, all errors of length less than or equal to the degree of the polynomial, and most burst errors of length greater than the degree of the polynomial.

15. One's complement arithmetic.

17. The checker divides the received data into the same number of segments. The segments are added using one's complement to get the sum. The checker then complements the sum. If the result is 0 the data are accepted, otherwise the data are discarded.

19. $2^r \geq m + r + 1$, where r is the number of redundancy bits, and m is the number of data bits.

9.2   MULTIPLE CHOICE QUESTIONS

21. b   23. d   25. c   27. c   29. d   31. b   33. b   35. d   37. c   39. d
41. b   43. d

9.3   EXERCISES

45.
   a. $1{,}500 \times 2 \times 0.001 = 3$ bits /data unit
   b. $12{,}000 \times 2 \times 0.001 = 24$ bits/data unit
   c. $96{,}000 \times 2 \times 0.001 = 192$ bits/data unit

47. Yes, because the number of 1s is odd.

49. 001

51. 1101010000011110

53. No error

55. $r_1 = 1$
    $r_2 = 1$
    $r_4 = 1$
    $r_8 = 0$
    The code is 100101101111

57. The error cannot be detected because the number of corrupted bits is even.

59. 8 bits (not considering VRC bits). The ratio is 8 to 9

61. 100001011

63. The 5th bit is in error. The correct code is 11001110111.

65. Four redundancy bits, six data bits.