Chapter 1 Numericals.

3-1. Convert the following binary numbers to decimal: 101110; 1110101; and 110110100.

3-3. Convert the following decimal numbers to binary: 1231; 673; and 1998.

3-4. Convert the following decimal numbers to the bases indicated.

a. 7562 to octal
b. 1938 to hexadecimal
c. 175 to binary

3-5. Convert the hexadecimal number F3A7C2 to binary and octal.

3-7. Show the value of all bits of a 12-bit register that hold the number equivalent to decimal 215 in (a) binary; (b) binary-coded octal; (c) binary-coded hexadecimal; (d) binary-coded decimal (BCD).

3-7 $(215)_{10} = 128 + 64 + 16 + 7 = (11010111)_2$

(a) 000011010111 Binary

(b) 000 011 010 111 Binary coded octal
0 3 2 7

(c) 0000 1101 0111 Binary coded hexadecimal
0 D 7

(d) 0010 0001 0101 Binary coded decimal
2 1 5

3-11. Obtain the 9's complement of the following eight-digit decimal numbers: 12349876; 00980100; 90009951; and 00000000.

3-12. Obtain the 10's complement of the following six-digit decimal numbers: 123900; 090657; 100000; and 000000.

3-13. Obtain the 1's and 2's complements of the following eight-digit binary numbers: 10101110; 10000001; 10000000; 00000001; and 00000000.

3-14. Perform the subtraction with the following unsigned decimal numbers by taking the 10's complement of the subtrahend.

a. 5250 − 1321 b. 1753 − 8640
c. 20 − 100 d. 1200 − 250

3-15. Perform the subtraction with the following unsigned binary numbers by taking the 2's complement of the subtrahend.

a. 11010 − 10000 b. 11010 − 1101
c. 100 − 110000 d. 1010100 − 1010100

3-16. Perform the arithmetic operations $(+42) + (-13)$ and $(-42) - (-13)$ in binary using signed-2's complement representation for negative numbers.

3-17. Perform the arithmetic operations $(+70) + (+80)$ and $(-70) + (-80)$ with binary numbers in signed-2's complement representation. Use eight bits to accommodate each number together with its sign. Show that overflow occurs in both cases, that the last two carries are unequal, and that there is a sign reversal.

3-18. Perform the following arithmetic operations with the decimal numbers using signed-10's complement representation for negative numbers.

a. $(-638) + (+785)$
b. $(-638) - (+185)$

$+42 = 0101010$ $+13 = 0001101$
$-42 = 1010110$ $-13 = 1110011$

$$\begin{array}{rr} (+42) & 0101010 \\ (-13) & 1110011 \\ \hline (+29) & 0011101 \end{array} \qquad \begin{array}{rr} (-42) & 1010110 \\ (+13) & 0001101 \\ \hline (-29) & 1100011 \end{array}$$

3-17

$$\begin{array}{lll} & 0\ 1 \leftarrow \text{last two carries} \rightarrow & 1\ 0 \\ +70 & 01000110 & -70 \quad 10111010 \\ +80 & 01010000 & -80 \quad 10110000 \\ \hline +150 & 10010110 & -150 \quad 01101010 \end{array}$$

+150: greater than +127; 10010110: negative

−150: less than −128; 01101010: positive

3-18

(a)

$$\begin{array}{rr} (-638) & 9362 \\ (+785) & +0785 \\ \hline (+147) & 0147 \end{array}$$

(b)

$$\begin{array}{rr} (-638) & 9362 \\ (-185) & +9815 \\ \hline (-823) & 9177 \end{array}$$

3-20. Represent the number $(+46.5)_{10}$ as a floating-point binary number with 24 bits. The normalized fraction mantissa has 16 bits and the exponent has 8 bits.

3-20

$$46.5 = 32 + 8 + 4 + 2 + 0.5 = (101110.1)_2$$

Sign

$$\underbrace{0\ 101110100000000}_{\text{24-bit mantissa}} \quad \underbrace{00000110}_{\text{8-bit exponent } (+6)}$$

3-22. Represent decimal number 8620 in (a) BCD; (b) excess-3 code; (c) 2421 code; (d) as a binary number.

3-22 8620

(a) BCD 1000 0110 0010 0000

(b) XS-3 1011 1001 0101 0011

(c) 2421 1110 1100 0010 0000

(d) Binary 10000110101100 (8192+256+128+32+8+4)

3-26. Derive the circuits for a 3-bit parity generator and 4-bit parity checker using an even-parity bit. (The circuits of Fig. 3-3 use odd parity.)

3-26

Same as in Fig. 3-3 but without the complemented circles in the outputs of the gates.

$P = x \oplus y \oplus z$

$\text{Error} = x \oplus y \oplus z \oplus P$