Chapter 1 Introduction (II)

Solved Problems (1/8)

- **Problem 1** Convert the following positive binary integers to decimal.

    a. 110100101

    b. 00010111

- **Answer 1**

    a. $110100101 = 1 + 4 + 32 + 128 + 256 = 421$

    b. $00010111 = 1 + 2 + 4 + 16 = 23$

Solved Problems (2/8)

- **Problem 2** Convert the following decimal integers to unsigned binary of 12 bits.

  a. 47

  b. 5000

- **Answer 2**

  a. $47 = 000000101111$

  b. 5000 cannot be represented in 12 bits because $5000 > (2^{12}-1)$

Solved Problems (3/8)

- **Problem 3** Convert the following to hexadecimal.

  a. 11010110111_2

  b. 611_{10}

- **Answer 3**

  a. $0110\ 1011\ 0111 = 6B7_{16}$

  b. $611/16 = 38$ rem   3   3

       $38/16 = 2$ rem   6   63

       $2/16 = 0$ rem   2   263

Solved Problems (4/8)

- **Problem** 4 Represent the following decimal numbers into a 6-bit two's complement format.

  a. +14

  b. -20

  c. +37

- **Answer 4**

  a. 001110

  b. 101100

  c. +37 cannot be represented into a 6-bit 2's complement format because it is out of the range $-32 \leqq n \leqq 31$.

Solved Problems (5/8)

- **Problem 5** Compute the sum of the following pairs of 2's complement into 6 bits of computer words.

    a. 111111+001011

    b. 001001+100100

    c. 001010+011000

- **Answer 5**

a.   1 1 1 1 1 1   −1

       0 0 1 0 1 1   +11   The carry out is ignored and will not

  (1) 0 0 1 0 1 0   +10   be shown in the remaining examples.

b.   0 0 1 0 0 1   +9

       1 0 0 1 0 0   −28

       1 0 1 1 0 1   −19

Solved Problems (6/8)

- **Answer 5 (Cont'd)**

c. $\quad 0\ 0\ 1\ 0\ 1\ 0 \qquad +10$

$\quad \underline{0\ 1\ 1\ 0\ 0\ 0} \qquad \underline{+24}$

$\quad 1\ 0\ 0\ 0\ 1\ 0 \qquad$ looks like -30; should be $+34$; overflow

$\qquad\qquad\qquad\qquad$ sum of two positive numbers looks negative

Solved Problems (7/8)

- **Problem 6** Subtract each of the following pairs of signed (two's complement) numbers.

  a. 110101-000011

  b. 110101-011000

- **Answer 6**

  a.

  $$
  \begin{array}{r}
  1\ 1\ 0\ 1\ 0\ 1 \\
  -0\ 0\ 0\ 0\ 1\ 1 \\
  \end{array}
  \qquad
  \begin{array}{r}
  1 \\
  1\ 1\ 0\ 1\ 0\ 1 \\
  \underline{1\ 1\ 1\ 1\ 0\ 0} \\
  (1)\ 1\ 1\ 0\ 0\ 1\ 0 \\
  \end{array}
  \qquad
  \begin{array}{r}
  -\ 11 \\
  \underline{-(+3)} \\
  -14 \\
  \end{array}
  $$

  b.

  $$
  \begin{array}{r}
  1\ 1\ 0\ 1\ 0\ 1 \\
  -0\ 1\ 1\ 0\ 0\ 0 \\
  \end{array}
  \qquad
  \begin{array}{r}
  1 \\
  1\ 1\ 0\ 1\ 0\ 1 \\
  \underline{1\ 0\ 0\ 1\ 1\ 1} \\
  (1)\ 0\ 1\ 1\ 1\ 0\ 1 \\
  \end{array}
  \qquad
  \begin{array}{l}
  -\ 11 \\
  \underline{-(+24)} \\
  \text{overflow, answer looks} \\
  \text{positive} \\
  \end{array}
  $$

8

Solved Problems (8/8)

- **Problem 7** Code the following into ASCII.

  i. HELLO

  ii. hello

- **Answer 7**

  i. 1001000 1000101 1001100 1001100 1001111
  ii. 1101000 1100101 1101100 1101100 1101111