proprep

Workbook

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Machine level representation of data

Numeric data and number bases

Questions

1) Convert the following numbers from binary to decimal:
a. $(1011001)_2$
b. $(110110101)_2$

2) Convert the following numbers from decimal to binary:
a. $(237)_{10}$
b. $(359)_{10}$
c. $(1857)_{10}$
d. $(44100)_{10}$

3) Convert the following numbers from hexadecimal to binary:
a. $(42)_{16}$
b. $(D9)_{16}$
c. $(1FA)_{16}$
d. $(CDDB)_{16}$

4) Convert the following from decimal to hexadecimal:
a. $(240)_{10}$
b. $(251)_{10}$
c. $(1100)_{10}$
d. $(25432)_{10}$
e. $(112000)_{10}$

5) In what situation might:
a. binary representation be useful to a programmer?
b. hexadecimal representation be useful to a programmer?

6) Of the numbers $(55)_{10}$, $(37)_{16}$ and $(67)_8$ which is the largest?

Answer Key

1) a. $(89)_{10}$ b. $(437)_{10}$

2) a. $(11101101)_2$ b. $(101100111)_2$ c. $(11101000001)_2$ d. $(10101100010000100)_2$

3) a. $(01000010)_2$ b. $(11011001)_2$ c. $(00111111010)_2$ d. $(1100110111011011)_2$

4) a. $(FO)_{16}$ b. $(FB)_{16}$ c. $(044C)_{16}$ d. $(6358)_{16}$ e. $(1B580)_{16}$

5) a. When dealing with a bit or group of bits.
b. For lengthy numbers that would be inconvenient to write out as binary, and that could be grouped as nibbles.

6) All the same.

Signed and twos complement

Questions

1) Given the binary number $(1010110)_2$, state the value in decimal for:
a. an unsigned number
b. a signed number using sign and magnitude
c. a signed number using two's complement

2) Given the binary number $(101100110110)_2$, state the value in decimal for:
a. an unsigned number
b. a signed number using sign and magnitude
c. a signed number using two's complement

3) Convert the decimal number -256 into a binary representation using:
a. sign and magnitude
b. two's complement

4) Convert the decimal number -1394 into a binary representation using:
a. two's complement
b. sign and magnitude

5) State the range of a 12 bit number, using:
a. two's complement
b. sign and magnitude

6) How many bits would be required to store the decimal number -32000 in two's complement representation?

7) Assume the following operations are carried out using 12 bits.
Add the two unsigned binary numbers, showing your working in each case:
a. $(10101100)_2$, $(01010010)_2$
b. $(11010101)_2$, $(11011011)_2$
c. $(1100111011)_2$, $(1000101010)_2$

8) Assume the following operations are carried out using 8 bits. Using binary addition subtract the second number from the first, showing your working in each case:
a. $(1010111)_2$, $(11011)_2$
b. $(11101111)_2$, $(1101001)_2$
c. $(0111)_2$, $(110101)_2$

Answer Key

1) a. $(86)_{10}$ b. $(-22)_{10}$ c. $(-42)_{10}$

2) a. $(2870)_{10}$ b. $(-822)_{10}$ c. $(-1226)_{10}$

3) a. $(1100000000)_2$ b. $(100000000)_2$

4) a. $(101010001110)_2$ b. $(110101110010)_2$

5) a. -2048…2047 b. -2047…2047

6) 16

7) a. $(000011111110)_2$ b. $(000110110000)_2$ c. $(010101100101)_2$

8) a. 00111100 b. 10000110 c. 11010010

Fixed and floating point

Questions

1) Using 8 bit fixed point fractional representation, with 3 bits for the fractional part, convert the following decimal numbers to binary:
   a. 27.5
   b. 30.25
   c. 15.75
   d. 9.375

2) Assuming you have 12 bits available, encode the following decimal numbers in fixed point binary representations:
   a. 17.5
   b. -37.75
   c. 253.0625

3) Assuming a 5 bit mantissa, and 3 bit exponent in two's complement, convert the following binary encodings into denary:
   a. 01011 001
   b. 10101 010

4) Assuming two's complement encoding, and given an 8 bit mantissa and 4 bit exponent, convert the following into denary:
   a. 00100000 1011
   b. 11101101 0110
   c. 10110000 1100

5) Using sign and magnitude for the mantissa and two's complement for the exponent, express the following as binary with a sign bit as the MSB, followed by 4 bits for the exponent, and 11 bits for the mantissa (SEEEEMMMMMMMMMMM):
   a. 13.375
   b. -31.25
   c. -92.9375

6) Normalize the following binary representations, all of which use a two's complement 16 bit encoding with the least significant 4 bits representing the mantissa:
   a. 0001010101110101
   b. 1111010110000100
   c. 1110111000001110

Answer Key

1)	a. $(11011100)_2$	b. $(11110010)_2$	c. $(01111110)_2$	d. $(01001011)_2$
2)	a. $(000010001100)_2$	b. $(111011010010)_2$	c.$(111111010001)_2$	
3)	a. $(1.375)_{10}$	b. $(-2.75)_{10}$		
4)	a. $(0.0078125)_{10}$	b. $(-9.5)_{10}$	c. $(-0.0390625)_{10}$	
5)	a. $(0001111010110000)_2$	b. $(1010011111010000)_2$		c. $(1011010111001110)_2$
6)	a. $(0101010111000011)_2$	b. $(1010110000000001)_2$		c. $(1011100000001100)_2$