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CSE2120

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7 Feb 2024

Homework 2

Chapter 2

1. Exercises 16 (b, c), 20, 33, 44, 52, 55 (a, b) and 63 on pages 127-133.

Exercises

16. Represent the following decimal numbers in binary using 8-bit signed magnitude, one's comp, two's comp, and excess 127 bit representations

    a. 77
        i. 8-bit signed:
            1. $8_{10}=1000_2$
            2. Positive, so no leading 1
            3. 00001000_2
        ii. 1's comp:
            1. Flip each value
            2. 11110111_2
        iii. 2's comp:
            1. 1's comp + 1
            2. 11111000_2
        iv. Excess 127:
            1. Add M to original number:
            2. 77+127 = 204
            3. Now convert this number to binary
            4. 11001100_2
    b. -42
        i. 8-bit signed:
            1. $+42_{10} = 101010_2$
            2. Negative, so leading 1
            3. 10101010_2
        ii. 1's comp:

        1. Flip
        2. 01010101_2
    iii. 2’s comp:
        1. 1’s comp + 1
        2. 01010110_2
    iv. Excess 127:
        1. -42 + 127 = 85
        2. Convert to binary
        3. 01010101_2

20. What Decimal value does the 8-bit binary number 10011110 have if:
    a. It is interpreted as an unsigned number?
        i. Moving from right (LSB) to left(MSB):
        ii. 2+4+8+16+128 = 158
    b. It is on a computer using signed magnitude representation?
        i. From LSB to MSB:
        ii. 2+4+8+16 = 30
        iii. Leftmost bit is sign indicator: 1 = negative
        iv. -30
    c. It is on a computer using 1’s comp representation?
        i. 1’s comp: 01100001
        ii. To decimal:
        iii. 1+32+64 = 97
    d. It is on a computer using 2’s comp representation?
        i. 2’s comp = 1’s comp + 1
        ii. 01100001 + 1
        iii. 01100010
    e. It is on a computer using excess 127 representation?
        i. As unsigned number: 158
        ii. Now, -127:
        iii. 158-127 = 31

33. Add the following unsigned binary numbers as shown:
    a. 01110101+00111011
        i. 01110101
        ii. 00111011
        iii. 10110000
        iv. 10110000
        v.
        vi.

b. 00010101+00011011
    i. 00010101
    ii. 00011011
    iii. 110000
    iv. 110000
c. 01101111+00010001
    i. 01101111
    ii. 00010001
    iii. 10000000
    iv. 10000000

44. Using arithmetic shifting, perform the following:
    a. Double the value 00010101_2
        i. Shifting n times left multiplies by 2^n
        ii. 00101010
    b. Quadruple the value 01110111_2
        i. 111011100
    c. Divide the value 11001010_2 in half
        i. Opposite rule for dividing by 2
        ii. 01100101

52. Show how each of the following floating-point values would be stored using IEEE-754 double precision (be sure to indicate the sign bit, exponent, and significand fields)
    a. 12.5
        i. First convert to binary form using successive division

        Not Completely Sure how to do this

        ii. 1100.1
        iii.
    b. -1.5
        i. First to binary:
        ii. 1...1.1 where leftmost 1 is sign bit
        iii.
    c. 0.75
        i. To binary:
        ii. 0.11 because each further digit is worth half the previous digit (0.5 & 0.25)
        iii.
    d. 26.625
        i. To binary:

    ii. 11010.101 → same principle as before, each decimal digit is half the previous

55.

a. Given that the ASCII code for A is 1000001, what is the ASCII code for J?
    i. ASCII code for A is 1000001 = 65, J is 9 letters after A. We can add 9 to A to reach 74, and then translate it into binary
    ii. 1000001 + 1001 =
    iii. 1001010
b. Given that the EBCDIC code for A is 1100 0001, what is the EBCDIC code for J?
    i. Here, a similar process is used. By adding 9 to A (1100 0001), we can find the EBCDIC code for J:
    ii. 1101 0001

63. Compute the Hamming distance of the following code

0000000101111111 4
0000001010111111 4
0000010011011111
0000100011101111
0001000011110111
0010000011111011
0100000011111101
1000000011111110

Hamming Distance = 4

a. The hamming distance is 4 because throughout the code, only 4 bits change at a time.