#HW, cec32x_HW_26_HW4_data_representations, 110 points total.

HW 4. Data representations and operations

Prob 4-1 (30 points total, 5 points each) Convert the following signed integers to the THREE signed binary representations: (i) sign-and-magnitude, (ii) one's complement (OC), and (iii) two's complement (TC) expressions, respectively, using a 6-bit system:

- − 8
- + 18

Prob 4-1.

a) 8 = 0b00_1000
(i) -8 = 0b10_1000; (ii) -8 = 0b11_0111; (iii) -8 = 0b11_1000.

b) 18 = 0b01_0010
(i) 18 = 0b01_0010; (ii) 18 = 0b01_0010; (iii) 18 = 0b01_0010.

Prob 4-2 (20 points total, 5 points each) Consider the TC expression of the two number of the previous problem. Determine the results (in both binary and decimal forms) of the following shift operations of each of these two numbers: (i) shift to left by ONE bit and (ii) shift to the right by TWO bits.

Prob 4-3 (40 points total, 10 points each) We have learned before that we can express real numbers using the fixed-point expression. Convert the following real numbers into Q3.4 representation:

- A1 = 0.5
- A2 = 2.25
- A3 = 6.725
- A4 = -4.5

A1 = 0.5 ⇒ 0b0000_1000
A2 = 2.25 ⇒ 0b0010_0100
A3 = 6.725 ⇒ 0b0110_1100
A4 = -4.5 ⇒ -4.5 + 16.0 = 11.5 ⇒ 0b1011_1000

or 0b0110_0111. Note that there is a rounding problem here, so either one is good.

Prob 4-4 (20 points total, 10 points each) Convert the following Q3.4 representations back to real numbers:

- 0b0111_0111
- 0b1010_1010

7.4375
10.625 (UQ4.4 UM4.4) ⇒ 10.625 - 16.0 = -5.375

Prob 4-2.

① 0b11_1000 <<1 ⇒ 0b11_0000
0b01_0010<<1 ⇒ 0b10_0100
② 0b11_1000 >>2 ⇒ 0b11_1110
0b01_0010 >>2 ⇒ 0b00_0100