Homework 5: Converting Fractions

CS 200 • 10 Points Total
Due Wednesday, March 8, 2017

Assignment

1. Perform the following conversions. All necessary steps to convert by hand should be shown - any conversion without accompanying work will be counted wrong. (2 pts each)

   a. Convert 43.46875_{10} into base 2.

Powers of 2:	32	16	8	4	2	1	.5	.25	.125	.0625	.03125
	1	0	1	0	1	1	. 0	1	1	1	1

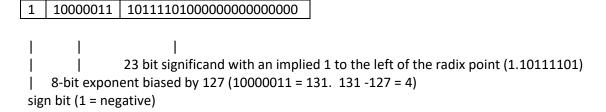   So 43.46875_{10} = 101011.01111_2

   b. Convert 11011011.010101_2 into base 10.

   $$1 \times 2^7 + 1 \times 2^6 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-2} + 1 \times 2^{-4} + 1 \times 2^{-6}$$
   $$= 128 + 64 + 16 + 8 + 2 + 1 + .25 + .0625 + .015625 = 219.328125$$

   c. Convert 241.35_7 into base 10.

   $$2 \times 7^2 + 4 \times 7^1 + 1 \times 7^0 + 3 \times 7^{-1} + 5 \times 7^{-2} = 98 + 28 + 1 + \frac{3}{7} + \frac{5}{49} = 127\frac{26}{49}$$

2. Write down the 32 bits that comprise the floating point representation of the number "-27.8125". Draw boxes around the three separate groups of bits and annotate them with explanations of what each group of bits means specifically, similar to the sample analysis printout shown on the Project 4 assignment. (4 pts)

   27.8125 = 11011.1101 X 2^0 (using powers of 2 from first problem) = 1.10111101 X 2^4 so we can now represent the three parts:

1	10000011	10111101000000000000000

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   |      |                |
   |      |         23 bit significand with an implied 1 to the left of the radix point (1.10111101)
   |  8-bit exponent biased by 127 (10000011 = 131.  131 -127 = 4)
   sign bit (1 = negative)
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3. Extra Credit: Convert 17.851_8 into base 10. (Note: if you attempt this and get it wrong, 2 points will be deducted from your score. If you don't attempt it, it can't count for your or against you.)

   Trick question! It can't be done because base 8 digits only run from 0-7, so the 8 is illegal.