# Homework 4: Converting Fractions

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### CS 200

#### 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)
   1. Convert 53.14062510 into base 2.

|  |  |
| --- | --- |
| Whole | Fraction |
| 53 % 2 = 26 R 1 | .140625 \* 2 = 0.28125 |
| 26 % 2 = 13 R 0 | .28125 \* 2 = 0.5625 |
| 13 % 2 = 6 R 1 | .5625 \* 2 = 1.125 |
| 6 % 2 = 3 R 0 | .125 \* 2 = 0.25 |
| 3 % 2 = 1 R 1 | .25 \* 2 = 0.5 |
|  | .5 \* 2 = 1.0 |
| = 1 1 0 1 0 1 | = .1 0 0 1 0 0 |
| **= 110101.1001002** | |

* 1. Convert 1101.10112 into base 10.

|  |  |
| --- | --- |
| Whole | Fraction |
| 1 \* 2^0 = 1 | 1 \* 1/(2^1) = .5 |
| 0 \* 2^1 = 0 | 0 \* 1/(2^2) = 0 |
| 1 \* 2^2 = 4 | 1 \* 1/(2^3) = .125 |
| 1 \* 2^3 = 8 | 1 \* 1/(2^4) = .0625 |
|  |  |
| 8 + 4 + 0 + 1 | .5 + 0 + .125 + .0625 |
| **= 13.687510** | |

* 1. Convert 24.435 into base 10.

|  |  |
| --- | --- |
| Whole | Fraction |
| 4 \* 5^0 = 4  2 \* 5^1 = 10 | 4 \* 1/(5^1) = .8  3 \* 1/(5^2) = .12 |
|  |  |
| 10 + 4 | .8 + .12 |
| **= 14.2010** | |

1. Write down the 32 bits that comprise the floating point representation of the number

"-0.28125". 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 2 assignment. (4 pts)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Sign |---------Exponent-----| |-----------------------Mantissa/Significand--------------------------------------|

Sign

Sign = 1 (negative) because “-0.28125” is a negative number

Finding Exponent

.28125 / 2^-1 = .5625

.28125 / 2^-2 = 1.125 <- exponent = -2

With bias 127

-2 + 127 = 12510, converted to base2 = 1111101

Exponent: 1111101 = 12510; w/ bias 127 -> (125 – 127) = -2

Finding Mantissa

.125 \* 2 = 0.25

.25 \* 2 = 0.5

.5 \* 2 = 1.0

= 0012

or

= 0010000000000000000000002

With implied 1:

= 1.0010000000000000000000002

[1 + 2^-3] \* 2^-2 = .2812510