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CS 472 HW 2

(2.5) Calculations are to be performed to a precision of 0.001%. How many bits does this require?

- This precision requires 10 bits. 0.001 can be represented as $\frac{1}{1000}$. 2^{-9} is equal to $\frac{1}{512}$ and 2^{-10} is equal to $\frac{1}{1024}$. Since $\frac{1}{1000}$ is less than $\frac{1}{512}$, 9 bits is too few. However, since $\frac{1}{1000}$ is greater than $\frac{1}{1024}$, 10 bits is sufficient.

(2.13) Perform the following calculations in the stated bases:

a) include picture later

b) include picture later

(2.14) What is arithmetic overflow? When does it occur and how can it be detected?

- Arithmetic overflow is when the number of bits necessary to represent a binary number exceed the number of bits available to represent the number. It can be detected by the overflow flag of the status register being set.

(2.16) Convert 1234.125 into 32-bit IEEE floating-point format.

- The following
  - Whole number = 1234, decimal = .125
  - $1234_{10} = 10011010010_2$
  - $.125_{10} = .001_2$
  - Mantissa = 00100...0
  - Exponent = $10_{10} + 127_{10}$ (bias) = $137_{10} = 10001001_2$
  - Sign = 0 (positive)
  - Floating point format = ***0 10001001 00110100100010...0***

(2.17) What is the decimal equivalent of the 32-bit IEEE floating point value CC4C0000?

- The following are the components of this floating point value:
  - Sign = 1 (negative)
  - Exponent = 10011000 = 152 - 127 = ***25***
  - Significand = 1001100...0 = $\frac{1}{2} + \frac{1}{16} + \frac{1}{32} = \frac{19}{32} =$ ***0.59375***
  - Decimal number = $-1.59375 \times 2^{25} =$ ***-53477376***

(2.22) What is the difference between a *truncation* error and a *rounding* error?

- A truncation error is when bits are cut off of the end (which always results in a round-down). A rounding error is when a number is either rounded up or down based on whether the unwanted bits are greater than/equal to .5 or less than .5, respectively. Both errors happen due to significant figure requirements.

2.40 Draw a truth table for the circuit below and explain what it does:

- This circuit is logically equivalent to an XOR.

A	B	C
0	0	0
0	1	1
1	0	1
1	1	0

2.45 It is possible to have n-input AND, OR, NAND, and NOR gates, where n ¿ 2. Can you have an n-input XOR gate for n ¿ 2? Explain your answer with a truth table.

- No, XOR gates can only have 2 inputs. An XOR gate with more than 2 inputs can be representented with multiple 2 input XOR gates.