CS3375: Computer Architecture
Spring 2020

Review #4 Solution

- Full name only: _____
- Release date: Mar 4th, 2020 (Wednesday)
- Total 5 points

1. Add two numbers in binary, 0.5_{10} and -0.4375_{10} based on the computer's point of view. Assume 4 digits of the significant and 2 digits of the exponent. Show all your work.

[3 pts]

① convert into binary

0.5 × 2 → 1.0 …. 1 → $0.1_{(2)} \times 2^{0}$ → normalize → 1.000×2^{-1}

-0.4375 × 2 → 0.875 …. 0 × 2 → 1.75 …. 1 × 2 → 1.5 …. 1 × 2 → 1.0 …. 1

$0.0111_{(2)} \times 2^{0}$ → normalize → -1.110×2^{-2}

② Find smaller number (adjust exponent)

$-1.110 \times 2^{-2} \rightarrow -0.111 \times 2^{-1}$

③ add significant

1.000 (+) -0.111 → 1.000 + 1.000 (using 2's complement) $\therefore 0.001 \times 2^{-1}$

④ normalize the sum

$0.001 \times 2^{-1} \rightarrow 1.000 \times 2^{-4}$

2. Multiply two numbers in binary, 0.5_{10} and -0.4375_{10} based on the computer's point of view. Assume 4 digits of the significant and 2 digits of the exponent. Show all your work.

[2 pts]

① convert into binary

$0.5_{(10)} \rightarrow 0.1_{(2)} \times 2^{0} \rightarrow 1.0 \times 2^{-1}$

$-0.4375_{(10)} \rightarrow -0.0111_{(2)} \times 2^{0} \rightarrow -1.110 \times 2^{-2}$

② add exponents

$-1 + (-2) = -3$

③ multiply significant

$$\begin{array}{r} 1.000 \\ \times\ 1.110 \\ \hline 0000 \\ 1000 \\ 1000 \\ 1000 \\ \hline 1.110000 \end{array}$$

$\therefore 1.110 \times 2^{-3}$

Sign (if the signs of two operands differ, make the sign of the product negative.)

$\boxed{-}\ 1.110 \times 2^{-3}$

④ Rounding?

↳ In this case, no need.