

**CS3375: Computer Architecture
Spring 2020**

Review #3 Solution

- Full name only: _____
- Release date: Mar 2nd, 2020 (Monday)
- Total 5 points

I. Show the IEEE 754 binary representation of the number -0.75 (decimal) in single and double precision. Show ALL your work.

[3 pts]

① converting into binary

$$\begin{array}{r} -0.75 \\ \times 2 \\ \hline 1.5 \quad \dots 1 \\ \times 2 \\ \hline 1.0 \quad \dots 1 \end{array} \downarrow$$

$$= -0.11_{(2)} \times 2^0$$

$$= -1.1 \times 2^{-1}$$

② general representation for a single / ~~double~~ precision.

$$(-1)^S \times (1 + \text{Fraction}) \times 2^{E - \text{bias}}$$

$$\rightarrow (-1)^1 \times (1 + 0.1) \times 2^{E - 127}$$

$$E - 127 = -1 \quad \underline{\underline{E = 126}}$$

sign	exp	fraction
1	01111110	10.....0

③ double precision

$$(-1)^S \times (1 + \text{Fraction}) \times 2^{E - \text{bias}}$$

$$\rightarrow (-1)^1 \times (1 + 0.1) \times 2^{E - 1023}$$

$$E - 1023 = -1 \quad \underline{\underline{E = 1022}}$$

11 bit	
sign	fraction
1	01111111111010.....0
ϕ	ϕ

2. What decimal number is represented by this word (32 bits)? Show All your work.

[2 pts]

1	1 0 0 0 0 0 0 1	0 1 0 0 0 0 0 0 0 0 0 0 ... 0 0 0
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Sign bit = 1 $E = 128 + 1 = 129$ $F = 0 \times 2^{-1} + 1 \times 2^{-2} = 0.25$

$$(-1)^S \times (1 + F) \times 2^{E - \text{bias}}$$

$$= (-1)^1 \times (1 + 0.25) \times 2^{129 - 127}$$

$$= -1.25 \times 2^2$$

$$= -5$$