# CS 221 Numbers Evaluation Assignment

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# 1.

Click here

## 2.

Click here

## 3.

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## 4.

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**5.**

**a.**

$$\text{min} : 0$$
$$\text{max} : 2^{43} - 1$$

**b.**

$$\text{min} : -2^{42}$$
$$\text{max} : 2^{42} - 1$$

**c.**

$$\text{min} : 0$$
$$\text{max} : 2^{11} - 1$$

**d.**

$$\text{min} : -2^{10}$$
$$\text{max} : 2^{10} - 1$$

## 6.

### a.

The largest tiny floating point would have a sign of $0$, an exponent of $7$ (or $1110_2 - 7$) and a mantissa of $1.875$ (or $1.111_2$), and so would equal $(-1)^0 \cdot 1.875 \cdot 2^7 = 240$. The second-largest tiny floating point would have the same sign and exponent and a mantissa of $1.75$ (or $1.111_2$) which would equal $(-1)^0 \cdot 1.75 \cdot 2^7 = 224$. So, the difference between the largest non-infinite number representable with tiny floating points and the second largest would be $240 - 224 = 16$.

### b.

The smallest positive tiny floating point would have a sign of $0$, an exponent of $-6$ (or $0000_2$) and a mantissa of $0.125$ (or $0.001_2$ due to denormalized encoding), and so would equal $(-1)^0 \cdot 0.125 \cdot 2^{-6} \approx 0.001953125 = 0.000000001_2$. The second smallest would have the same sign and exponent and a mantissa of $0.25$ (or $0.010_2$) which would equal $(-1)^0 \cdot 0.25 \cdot 2^{-6} \approx 0.00390625$ or exactly $0.00000001_2$. So the difference between the two would approximately be $0.00390625 - 0.001953125 \approx 0.001953125 = 0.000000001_2$.