

CE-1901-11 - Dr. Durant - Quiz 8
Winter 2016-'17, Week 10 Quiz

- (2 points) In binary, multiply $A=0101$ by $B=1011$, showing all 4 properly shifted intermediate products. Calculate the overall sum, showing the correct number of output bits needed to handle the largest possible product. In decimal, confirm whether your results agree with ~~$5 \times 12 = 60$~~ $5 \times 11 = 55$
- (3 points) **Express** $G = -7$ as a 6-bit number. Use this value of G as the starting point for each **calculation** below.
 - Arithmetic right shift by 2 bits (binary and decimal)
 - Logical right shift by 2 bits (binary and decimal)
 - Rotate left by 1 bit (binary and decimal)

①

$$\begin{array}{r}
 0101 \\
 \times 1011 \\
 \hline
 0101 \\
 0101 \\
 0000 \\
 + 0101 \\
 \hline
 0010111 \\
 \hline
 \underbrace{0010111}_{3 \times 16 = 48} \quad \underbrace{111}_7 \\
 \hline
 55 \checkmark
 \end{array}$$

② $7 = 111$
 Expand to 6b & Flip: 111000
 $+1: 111001 \leftarrow -7$

③ $\overset{\text{repeat}}{111}110 = -2$ ($-7/4$, round towards $-\infty$)

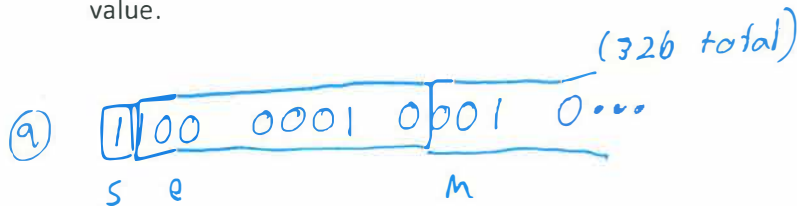
④ $001110 = 14$

⑤ $110011 = -13$

↑
note, moved 1 to L

3. (5 points) Interpret 0xC1100000 as a single-precision IEEE 754 floating point number...

- Write the value in binary and box in the sign, exponent, and mantissa
- Calculate 2^{exponent} after accounting for the bias.
- Write the complete binary fraction based on the mantissa and convert it to a decimal fraction.
- Multiply the contributions of the sign, exponent, and mantissa to arrive at the decimal value.



b) $e = (128 + 2) - 127 = \boxed{3}$

$$2^e = 8$$

leading 1

c) $1.001 = 1 + \frac{1}{8} = \boxed{1.125}$

\uparrow
 2^{-3}

d) $-1 \times 8 \times 1.125 = \boxed{-9}$

CE-1901-12 - Dr. Durant - Quiz 8
Winter 2016-'17, Week 10 Quiz

1. (2 points) In binary, multiply $A=1101$ by $B=0110$, showing all 4 properly shifted intermediate products. Calculate the overall sum, showing the correct number of output bits needed to handle the largest possible product. In decimal, confirm whether your results agree with $13 \times 6 = 78$
2. (3 points) **Express** $G = -9$ as a 6-bit number. Use this value of G as the starting point for each **calculation** below.
 - a. Arithmetic right shift by 2 bits (binary and decimal)
 - b. Logical right shift by 2 bits (binary and decimal)
 - c. Rotate right by 2 bits (binary and decimal)

①

$$\begin{array}{r}
 1101 \\
 \times 0110 \\
 \hline
 \dots 0000 \\
 1101 \\
 1101 \\
 + 0000 \\
 \hline
 01001110 \\
 \hline
 \underbrace{4 \times 16 = 64}_{14} \\
 \hline
 78 \checkmark
 \end{array}$$

② $9: 1001$
 extend to 6b & flip: 110110
 +1: $110111 \leftarrow -9$

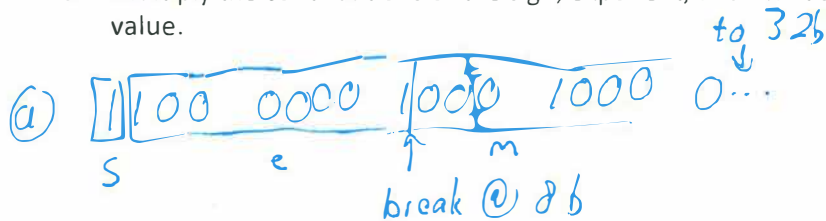
(a) $\downarrow \downarrow$
 $111101 = -3$ ($-9/4$, round towards $-\infty$)

(b) $001101 = 13$

(c) $111101 = -3$
 \uparrow
 0 moves 2 R

3. (5 points) Interpret 0xC0880000 as a single-precision IEEE 754 floating point number...

- Write the value in binary and box in the sign, exponent, and mantissa
- Calculate 2^{exponent} after accounting for the bias.
- Write the complete binary fraction based on the mantissa and convert it to a decimal fraction.
- Multiply the contributions of the sign, exponent, and mantissa to arrive at the decimal value.



(b) $e = (128 + 1) - 127 = 2$

$$2^e = \boxed{4}$$

(c) $1.0001 = 1 \frac{1}{16} = \boxed{1.0625}$

(d) $-1 \times 4 \times 1.0625$
 $= \boxed{-4.25}$