

ARIANA OLSON

HWS

10/3/17

1) $91_{10} + \text{C6}_{16}$

convert 91_{10} to binary:

$91 \div 2 = 1$	$91/2 = 45$
$45 \div 2 = 1$	$45/2 = 22$
$22 \div 2 = 0$	$22/2 = 11$
$11 \div 2 = 1$	$11/2 = 5$
$5 \div 2 = 1$	$5/2 = 2$
$2 \div 2 = 0$	$2/2 = 1$
$1 \div 2 = 0$	$1/2 = 0$
$0 \div 2 = 0$	$0/2 = 0$

$91_{10} = 01011011$ I8Q0

convert C6_{16} to binary:

first convert to decimal...

$$\begin{aligned}\text{C6}_{16} &= \text{C} \times 16^1 + 6 \times 16^0 \\ &= (12)(16^1) + (6 \times 16^0) \\ &= 192 + 6 \\ &= 198_{10}\end{aligned}$$

then convert to binary...

$198 \div 2 = 0$	$198/2 = 99$
$99 \div 2 = 1$	$99/2 = 49$
$49 \div 2 = 1$	$49/2 = 24$
$24 \div 2 = 0$	$24/2 = 12$
$12 \div 2 = 0$	$12/2 = 6$
$6 \div 2 = 0$	$6/2 = 3$
$3 \div 2 = 1$	$3/2 = 1$
$1 \div 2 = 1$	$1/2 = 0$
$0 \div 2 = 0$	$0/2 = 0$

$\text{C6}_{16} = 198_{10} = 011000110$ I9Q0

$$91_{10} + C6_{16} = \begin{array}{r} 1111111 \\ 01011011 \\ 11000110 \\ \hline 100100001 \end{array} \quad \begin{array}{l} \cancel{U8Q0} \\ U8Q0 \\ U9Q0 \end{array}$$

check the result:

$$100100001_{10} = 2^8 + 2^5 + 2^0 = 289$$

$$91_{10} + 198_{10} = 289 \quad \checkmark$$

$$91_{10} + C6_{16} = 100100001_{10} = 289_{10}$$

$$2) 11_8 - 11_{10}$$

Convert 11_8 to binary

First convert to decimal ---

$$11_8 = 1 \times 8^1 + 1 \times 8^0 = 9$$

then convert to binary ---

$$\begin{array}{ll} 9 \div 2 = 1 & 9/2 = 4 \\ 4 \div 2 = 0 & 4/2 = 2 \\ 2 \div 2 = 0 & 2/2 = 1 \\ 1 \div 2 = 0 & 1/2 = 0 \\ 0 \div 2 = 0 & 0/2 = 0 \end{array}$$

$$11_8 = 01001 \text{ ISQO}$$

convert -11_{10} to binary

First convert $+11_{10}$ to binary...

$$\begin{array}{ll} 11 \div 2 = 1 & 11/2 = 5 \\ 5 \div 2 = 1 & 5/2 = 2 \\ 2 \div 2 = 0 & 2/2 = 1 \\ 1 \div 2 = 0 & 1/2 = 0 \\ 0 \div 2 = 0 & 0/2 = 0 \end{array}$$

$$+11_{10} = 01011 \text{ ISQO}$$

then negate ---

invert the bits.

$$01011 \rightarrow 10100 \text{ ISQO}$$

add 1 ---

$$\begin{array}{r} 10100 \\ + 1 \\ \hline \end{array}$$

$$10101 \text{ ISQO}$$

add the results

$$\begin{array}{r} 01001 \text{ ISQO } (9) \\ + 10101 \text{ ISQO } (11) \\ \hline 11110 \text{ ISQO} \end{array}$$

check ---

11110 is negative, so ~~negate~~ negate to check the value

invert bits: $11110 \rightarrow 00001$

add 1: 00001

$$\begin{array}{r} 00001 \\ + 1 \\ \hline 00010 = 2^1 = 2 \end{array}$$

$$\text{so } 11110 = -2$$

$$9_{10} - 11_{10} = -2 \quad \checkmark$$

$$\boxed{11_8 - 11_{10} = 11110 \text{ ISQO} = -2_{10}}$$

$$3) 12.3125_{10} + 0110_{12Q2}$$

convert 12.3125_{10} to binary:

convert the number to the left of the decimal point to binary...

$$\begin{array}{ll} 12 \div 2 = 0 & 12/2 = 6 \\ 6 \div 2 = 0 & 6/2 = 3 \\ 3 \div 2 = 1 & 3/2 = 1 \\ 1 \div 2 = 1 & 1/2 = 0 \\ 0 \div 2 = 0 & 0/2 = 0 \end{array}$$

$$12_{10} = 01100_{15Q0}$$

convert the ~~number~~ fractional part of the number to binary (right of decimal point)...

$$\begin{array}{ll} (0.3125)(2) = 0.625 & 0 \\ (0.625)(2) = 1.25 & 1 \\ (0.25)(2) = 0.5 & 0 \\ (0.5)(2) = 1.0 & 1 \end{array}$$

$$0.3125_{10} = 0101_{15Q4}$$

$$12.3125_{10} = 011000101_{15Q4}$$

~~convert~~

Sign extend 0110_{12Q2} :

$$00001.1000$$

$$\begin{array}{r} \text{Add: } 011000101 \\ + 000011000 \\ \hline 01101.1101 \quad 15Q4 \end{array}$$

check:

convert 01101202 to base 10...

$$2^0 + 2^{-1} = 1.5_{10}$$

~~12.3125₁₀ + 1.5₁₀ =~~

$$12.3125_{10} + 1.5_{10} = 13.8125_{10}$$

convert answer to base 10...

01101.1101 I5Q4

$$2^3 + 2^2 + 2^0 + 2^{-1} + 2^{-2} + 2^{-4} = 13.8125_{10} \quad \checkmark$$

$$12.3125_{10} + 01101202 = \text{01101101 I5Q4} \\ = 13.8125_{10}$$

$$4) 5.75_{10} - 7.125_{10}$$

Convert 5.75_{10} to binary:

$5 \div 2 = 1$	$5/2 = 2$	$(0.75)(2) = 1.5$	1
$2 \div 2 = 0$	$2/2 = 1$	$(0.5)(2) = 1.0$	1
$1 \div 2 = 0$	$1/2 = 0$	$(0.0)(2) = 0.0$	0
$0 \div 2 = 0$	$0/2 = 0$		

$$5.75_{10} \rightarrow 01011100 \text{ I4Q4}$$

Convert -7.125_{10} to binary:

first convert $+7.125_{10}$...

$7 \div 2 = 1$	$7/2 = 3$	$(0.125)(2) = 0.25$	0
$3 \div 2 = 1$	$3/2 = 1$	$(0.25)(2) = 0.5$	0
$1 \div 2 = 0$	$1/2 = 0$	$(0.5)(2) = 1.0$	1
$0 \div 2 = 0$	$0/2 = 0$	$(0.0)(2) = 0.0$	0

$$+7.125_{10} \rightarrow 01110010 \text{ I4Q4}$$

negate...

$$01110010 \rightarrow 10001101 \text{ I4Q4}$$

$$10001101$$

+ 1

$$10001110 \text{ I4Q4}$$

$$-7.125_{10} \rightarrow 10001110 \text{ I4Q4}$$

	1	1						
0	1	0	1	1	1	0	0	I4Q4
+	1	0	0	0	1	1	1	I4Q4
	1	1	1	0	1	0	1	

Convert back to decimal...

regate...

11101010 I4Q4 \rightarrow 00010101 I4Q4

00010101
+ 1

00010110 I4Q4

~~11101010~~ $2^0 + 2^{-2} + 2^{-3} = 1.375_{10}$

So 11101010 I4Q4 is -1.375_{10}

$$5.75_{10} - 7.125_{10} = -1.375_{10} \quad \checkmark$$

$$5) 9_{10} \cdot 3_{10}$$

convert 9_{10} to binary:

$$\begin{array}{ll} 9 \div 2 = 1 & 9/2 = 4 \\ 4 \div 2 = 0 & 4/2 = 2 \\ 2 \div 2 = 0 & 2/2 = 1 \\ 1 \div 2 = 1 & 1/2 = 0 \\ 0 \div 2 = 0 & 0/2 = 0 \end{array}$$

convert 3_{10} to binary:

$$\begin{array}{ll} 3 \div 2 = 1 & 3/2 = 1 \\ 1 \div 2 = 0 & 1/2 = 0 \\ 0 \div 2 = 0 & 0/2 = 0 \end{array}$$

$$\begin{aligned} 9_{10} &\rightarrow 01001 \text{ U5Q0} \\ &\rightarrow 1001 \text{ U4Q0} \end{aligned}$$

$$3_{10} \rightarrow 0011 \text{ U4Q0}$$

multiply:

$$\begin{array}{r} 1001 \text{ U4Q0} \\ \times 0011 \text{ U4Q0} \\ \hline 0001001 \\ 001001X \\ 00000XX \\ + 0000XXX \\ \hline 0011011 \\ = 11011 \text{ U5Q0} \end{array}$$

check:

convert to decimal...

$$\begin{aligned} 11011 \text{ U5Q0} \\ 2^4 + 2^3 + 2^1 + 2^0 = 27_{10} \end{aligned}$$

$$9_{10} \cdot 3_{10} = 27_{10} \quad \checkmark$$

$$6) (-5)_{10} \cdot (-6)_{16}$$

convert -5_{10} to binary:

$$\begin{array}{ll} 5 \div 2 = 1 & 5/2 = 2 \\ 2 \div 2 = 0 & 2/2 = 1 \\ 1 \div 2 = 0 & 1/2 = 0 \\ 0 \div 2 = 0 & 0/2 = 0 \end{array}$$

$$-(0101 \text{ I4Q0}) \rightarrow \begin{array}{r} 1010 \\ +1 \\ \hline 1011 \text{ I4Q0} \end{array}$$

$$-5_{10} \rightarrow 1011$$

convert -6_{16} to binary:

$$6 \times 16^0 = 6_{10} \xrightarrow{\text{negate}} -6_{10}$$

$$\begin{array}{ll} 6 \div 2 = 0 & 6/2 = 3 \\ 3 \div 2 = 1 & 3/2 = 1 \\ 1 \div 2 = 0 & 1/2 = 0 \\ 0 \div 2 = 0 & 0/2 = 0 \end{array}$$

$$-(0110 \text{ I4Q0}) \rightarrow \begin{array}{r} 1001 \\ \hline 1010 \text{ I4Q4} \end{array}$$

I 460
I 460

Check :

0	1	1	1	1	0	7600
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$$(-5_{10}) \cdot (-6_{10}) = 30_{10} \quad \checkmark$$

7) $9.5_{10} \cdot 2.625_{10}$

Convert 9.5_{10} to binary:

$$9002 = 1$$

$$(0.5)(2) = 1.0 \quad 1$$

$$40\% Z = 6$$

$$(0.0)(2) = 0.0 \quad \Delta$$

$$20102 = 0$$

$$1062 = 1$$

$$0.102 = 0$$

100110461

Q2 convert 2.025_{10} to binary.

$$2 \circ 2 = 0$$

$$(0.625)(2) = 1.25$$

$$100\% \cdot 2 = 1$$

$$(0.25)(2) = 0.5 \quad 0$$

$$0\% \quad z = 0$$

$$(0.5)(2) = 1.0 \quad 1$$

$$(0.0)(2) = 0.0 \quad 0$$

1 0 1 0 1 0 2 3

Sign extend and multiply:

1001 . 6100 0403

10. 101 U2Q3

0 0 0 0 1 6 0 1 1 6 0

O	O	O	G	O	O	O	G		O	O	X
---	---	---	---	---	---	---	---	--	---	---	---

00 166 110 0xx

0 0 0 0 0 0 0 0 x x x

1 0 0 1 1 0 0 X X X X

11006.111100 USQ6

$$= 11000.1111 \text{ USQ4}$$

Check:

convert to decimal:...

110001111 U5Q4

$$2^4 + 2^3 + 2^1 + 2^{-2} + 2^{-3} + 2^{-4} = 24.9375_{10}$$

$$9.5_{10} \cdot 2.625_{10} = 24.9375_{10} \quad \checkmark$$