EECS 112 & CSE 132, FALL 2017

Homework 1

Due date: October, 16, 2017

Student ID:	7	2	7	9	7	0	3	8	Name: Michael Choi

256.

1) Represent the given numbers in the requested bases:

a) $(011010011001)_2$ = (031121)$_4$ = (1531)$_8$ = (359)$_{16}$

b) $(7501)_8$ = (F41)$_{16}$

$7\cdot8^3+5\cdot8^2+1\cdot8^0 \rightarrow 15\cdot16^2+4\cdot16^1+1\cdot16^0$

$7\cdot512+5\cdot64+1\cdot1$

$3584+320+1$

3905

c) $(11212)_3$ = (203)$_4$

$1\cdot3^4+1\cdot3^3+2\cdot3^2+1\cdot3^1+2\cdot3^0 \rightarrow 2\cdot4^3+3\cdot4^0$

$81+27+18+3+2$

131

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2) Find the binary representation of the following numbers in the correspondent system.

n = 8 bits

$-37 \rightarrow 37 = (00100101)_2$

$-16 \rightarrow 16 = (00010000)_2$

Number	Sign Magnitude	1'S Complement	2's Complement
-37	10100101	11011010	11011011
-16	10010000	11101111	11110000

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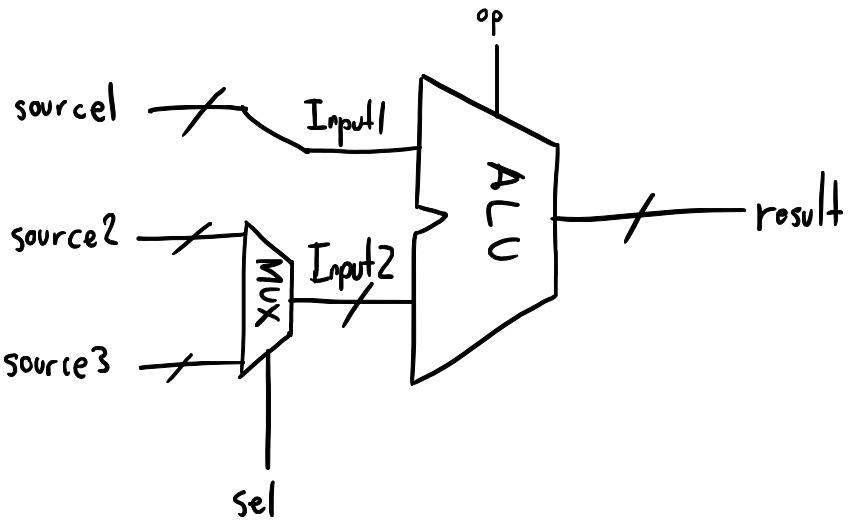
3) Find the correspondent decimal number of the following binary representations.

Binary representation (8 bit)	Sign Magnitude	1's Complement	2's Complement
10011011 (16+8+2+1) → 27	-27	-100	-101
11010100 (64+16+4) → 84	-84	-43	-44

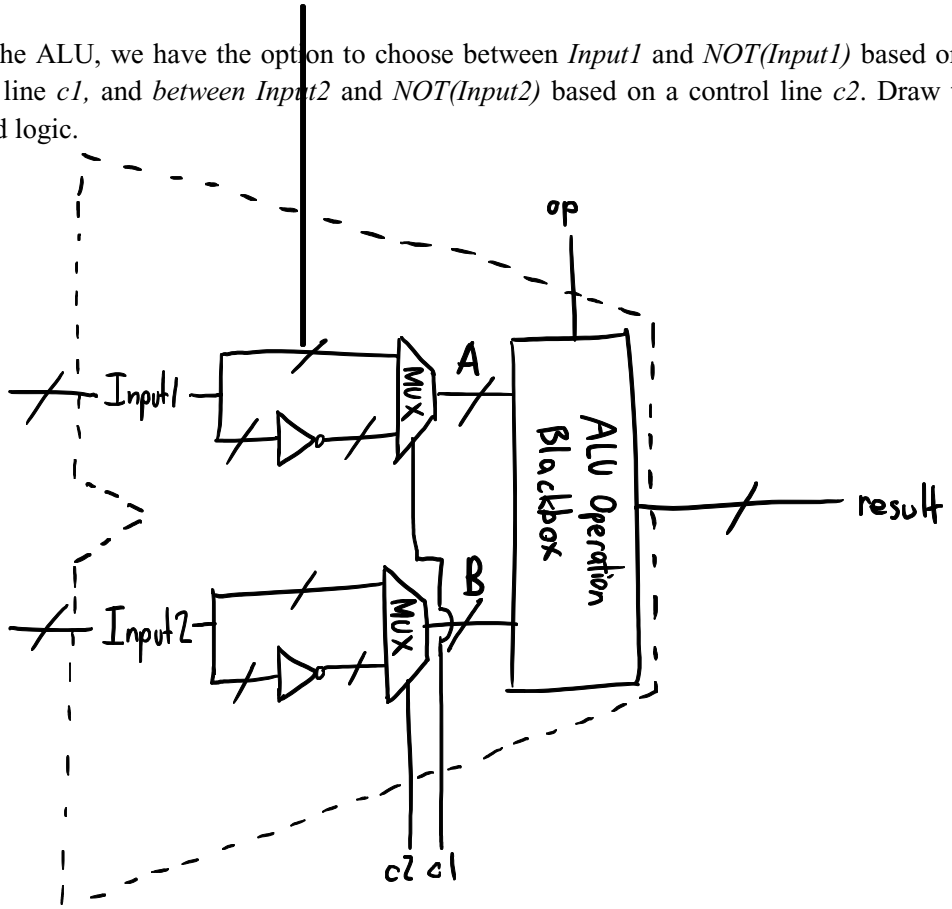
11001100 (64+32+4) → 100 | $-128+27 = -101$

01010111 (32+8+2+1) → 43 | $-128+84 = -44$

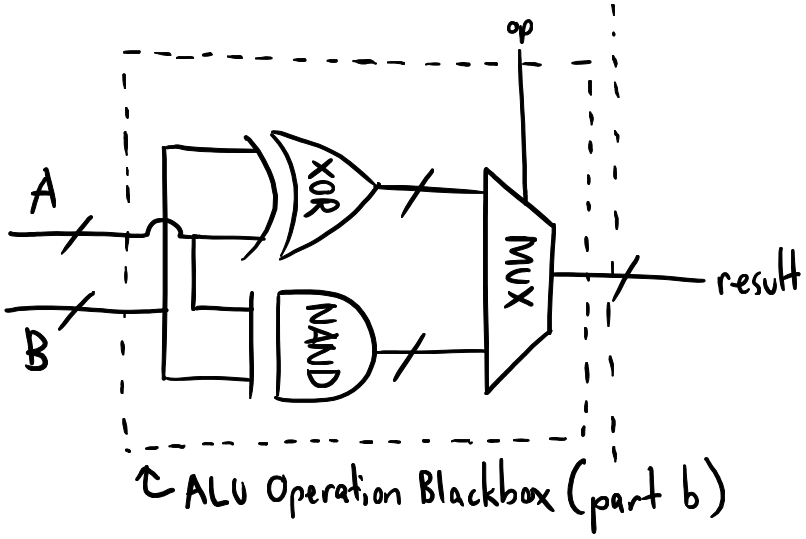
4) Suppose we are implementing an ALU which always takes two inputs. The first input comes from *source1*, but the second input might come from either *source2* or *source3* based on some selection line *sel*.
   a) Draw a black box for the ALU and add the required logic to support both *source2* and *source3* based on *sel*.



   b) Inside the ALU, we have the option to choose between *Input1* and *NOT(Input1)* based on a control line *c1,* and *between Input2* and *NOT(Input2)* based on a control line *c2*. Draw the required logic.

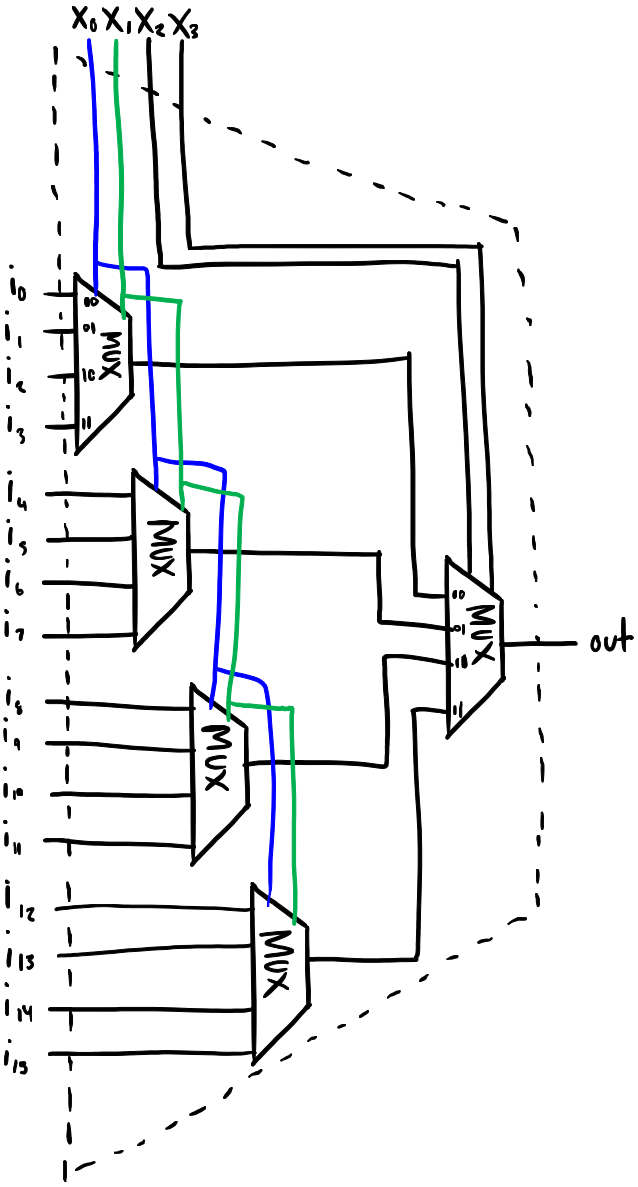


c) Finally, our ALU has two different instructions named XOR and NAND. Draw the required logic, assuming that the operation selection line is named *op*.



5) Design a 16-to-1 multiplexer using only 4-to-1 multiplexers.

Hint: A 16-to-1 multiplexer needs 4 select lines named ($X_3X_2X_1X_0$). X_3 as the MSB and X_0 as the LSB.



Good Luck