

Lab #2 (Boolean Arithmetic)

Name: _____

Date: _____

1. Given the following Truth Table	a) Write the function in its canonical form																																				
<table><tr><td>A</td><td>B</td><td>C</td><td>F</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td></tr></table>	A	B	C	F	0	0	0	0	0	0	1	1	0	1	0	0	0	1	1	1	1	0	0	0	1	0	1	1	1	1	0	1	1	1	1	1	<div>F = AB + C</div>
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2. Given the following Truth Table					a) Write the function in its canonical form																																																																																								
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Converting between Binary and Decimal Numbers

4. Convert **1110001**₂ to decimal (base 10)
Use sum of expansion of products (don't skip steps!)

$$(1 \times 2^6) + (1 \times 2^5) + (1 \times 2^4) + (0 \times 2^3) + (0 \times 2^2) + (0 \times 2^1) + (1 \times 2^0) = 113$$

5. Convert **11011100**₂ to decimal (base 10)
Use sum of expansion of products (don't skip steps!)

$$(1 \times 2^7) + (1 \times 2^6) + (0 \times 2^5) + (1 \times 2^4) + (1 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (0 \times 2^0) = 220$$

Converting between Decimal and Binary Numbers

6. Convert **35**₁₀ to binary (base 2)
Use sum of expansion of products (don't skip steps!)

35/2	17/2	8/2	4/2	2/2	1/2
17	8	4	2	1	0
1	1	0	0	0	1

which translates to 100011 from right to left.

7. Convert **111**₁₀ to binary (base 2)

Use sum of expansion of products (don't skip steps!)

111/2	55/2	27/2	13/2	6/2	3/2	1/2
55	27	13	6	3	1	0
1	1	1	1	0	1	1

which translates to 1101111 from right to left.

Adding Unsigned Binary Numbers

8. Add 7 + 5 in binary.

First convert to binary, then compute the sum.

7/2	3/2	1/2				
3	1	0		0	1	1
1	1	1		0	1	0
7=111				-----		
				1	1	0

5/2	2/2	1/2
2	1	0
1	0	1
5=101		

$$7 + 5 = 111 + 101 = 1100$$

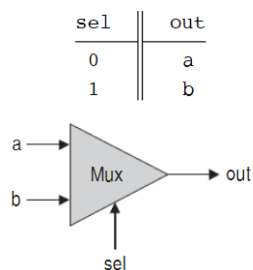
Adding Signed Binary Numbers (with Negatives)

9. Add $7 + (-5)$ in binary. Same as subtraction.
First convert to binary, then compute the sum.

Multiplexor (Mux) Design

10. Write the Boolean function for the output (out). Use K-maps if needed.
Then write the HDL code.

a	b	sel	out
0	0	0	0
0	1	0	0
1	0	0	1
1	1	0	1
0	0	1	0
0	1	1	1
1	0	1	0
1	1	1	1



out(a,b,sel) =

CHIP Mux {
 IN a, b, sel;
 OUT out;

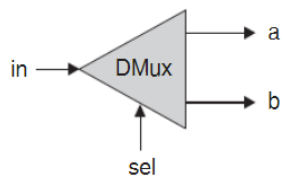
PARTS:

}

Demultiplexor (DMux) Design

11. Write the Boolean function for the output (out). Use K-maps if needed.
Then write the HDL code.

sel	a	b
0	in	0
1	0	in



a(in, sel) =

b(in, sel) =

```
CHIP DMux {
  IN in, sel;
  OUT a, b;
```

PARTS:

```
}
```