Lab #2 (Boolean Arithmetic)

Name:_____

Date:_____

1. Given the following Truth 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

a) Write the function in its canonical form

b) Draw the K-Map of the function

c) Write the function in its simplified form

d) What is the difference in the number of gates used between canonical and simplified forms?

2. Given the following Truth Table

A	B	C	D	Y
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

a) Write the function in its canonical form

b) Draw the K-Map of the function

c) Write the function in its simplified form

d) What is the difference in the number of gates used between canonical and simplified forms?

3. Given the following Truth Table

a	b	c	d	z
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

a) Write the function in its canonical form

b) Draw the K-Map of the function

c) Write the function in its simplified form

d) What is the difference in the number of gates used between canonical and simplified forms?

Converting between Binary and Decimal Numbers

4. Convert **1110001**$_2$ to decimal (base 10)
   Use sum of expansion of products (don't skip steps!)

5. Convert **11011100**$_2$ to decimal (base 10)
   Use sum of expansion of products (don't skip steps!)

Converting between Decimal and Binary Numbers

6. Convert **35**$_{10}$ to binary (base 2)
   Use the Double-Dabble method of successive division (don't skip steps!)

7. Convert $\mathbf{111}_{10}$ to binary (base 2)
   Use the Double-Dabble method of successive divsion (don't skip steps!)

Adding Unsigned Binary Numbers

8. Add 7 + 5 in binary.
   First convert to binary, then compute the sum.

Adding Signed Binary Numbers (with Negatives)

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

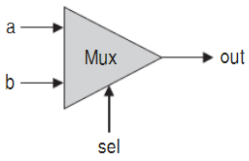
Multiplexor (Mux) Design

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

out(a,b,sel) =

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

sel	out
0	a
1	b

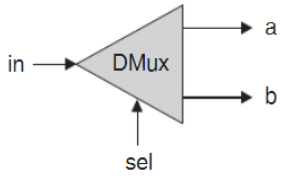



```
CHIP Mux {
   IN a, b, sel;
   OUT out;

   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:

}
```