TOTAL: _____/10

ECE 543: Introduction to Digital Systems

Homework #4

Due: Friday, November 5th, 2021 (6 P.M.)

Student Name: _____

Note:
- **Please use these sheets as cover pages.**
- **Your work must be hand-written (no typing please).**
- **Homework must be submitted electronically through Canvas in a PDF format.**

Part #1: Do the following problems from "Fundamentals of Digital Logic with Verilog Design" by Brown & Vranesic (3rd Edition).

Problems from Chapter 3:
3.3, 3.4, 3.5 (make sure to include carry-in and carry-out for each bit position)

Part #2: Solve the following problems.

1. Implement the following Boolean functions with an 8x1 MUX and external gates (AND, OR, and NOT).

(a)

A	B	C	F1
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

(b)

A	B	C	D	F2
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

2. Implement the Boolean functions given in Question 1 above with a 4x1 MUX and external gates (AND, OR, and NOT).

3. Implement the following Boolean function using a 1x8 DEMUX and external gates (AND, OR, and NOT).

A	**B**	**C**	**F**
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

4. Implement the following Boolean function using a 3x8 Decoder and external gates (AND, OR, and NOT).

$$F(A, B, C) = AC + \bar{B}$$

3.3

a. 0111011110

256+128+64+16+8+4+2 = 479

b. 1101100111

-128+64+32+4+2+1 = -231

c. 3751

$3\times8^3 + 7\times8^2 + 5\times8^1 + 1\times8^0$

1536 448 40 1

a. 479

b. -231

c. -510

3.4

a. 0000100001 73

0111011110010 1906

1000001111 -95

1110010111110 -1630

b. 1111011011 73

1000100011101 1906

0111101000000 -95

0001101000001 -1630

c. 1111011011111 73

1000100011110 1906

0111101000001 -95

0001101000010 -1630

3.5

00110110 + 01000101 = 01111011

01110101 + 11011110 = 1 00000011 overflow

11101111 + 10111000 = 1 00010111 overflow

00110110 - 00101011 → 00110110 + 11010101 = 00001011

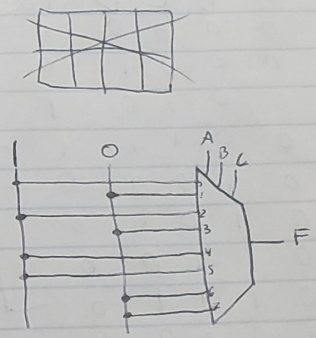
01110101 - 11010110 → 01110101 + 00101010 = 10011111 overflow

11010011 - 11101100 → 11010011 + 00010011 = 11100111

1.

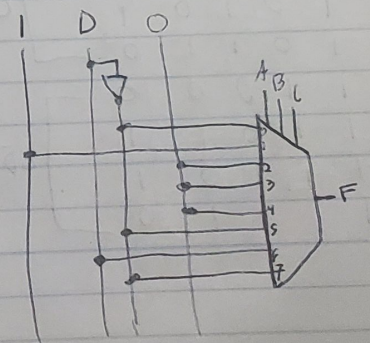
a)

A	B	C	F1
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0



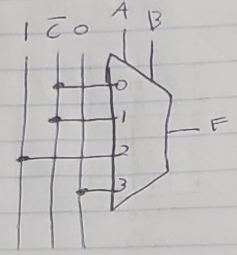
b)

A	B	C	D	F2	
0	0	0	0	1	$\bar{D}$
0	0	0	1	0	
0	0	1	0	1	1
0	0	1	1	1	
0	1	0	0	0	0
0	1	0	1	0	
0	1	1	0	0	0
0	1	1	1	0	
1	0	0	0	0	0
1	0	0	1	0	
1	0	1	0	1	$\bar{D}$
1	0	1	1	0	D
1	1	0	0	1	
1	1	0	1	0	$\bar{D}$
1	1	1	0	1	
1	1	1	1	0	

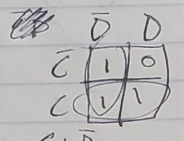


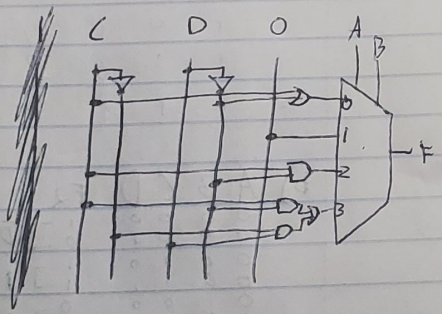
2.

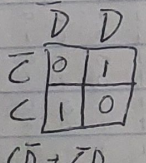
A	B	C	F1	
0	0	0	1	$\bar{C}$
0	0	1	0	
0	1	0	1	$\bar{C}$
0	1	1	0	
1	0	0	1	1
1	0	1	1	
1	1	0	0	0
1	1	1	0	



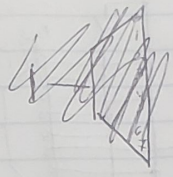
A	B	C	D	F2	
0	0	0	0	1	$C+\bar{D}$
0	0	0	1	0	
0	0	1	0	1	
0	0	1	1	1	
0	1	0	0	0	0
0	1	0	1	0	
0	1	1	0	0	
0	1	1	1	0	
1	0	0	0	0	$C\bar{D}$
1	0	0	1	0	
1	0	1	0	1	
1	0	1	1	0	
1	1	0	0	0	$C\bar{D}+\bar{C}D$
1	1	0	1	1	
1	1	1	0	1	
1	1	1	1	0	

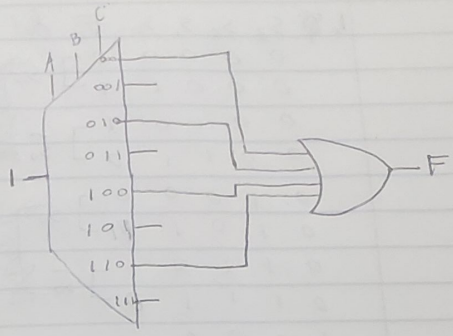






3.





4.

W_2	W_1	W_0	F
A	B	C	
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1