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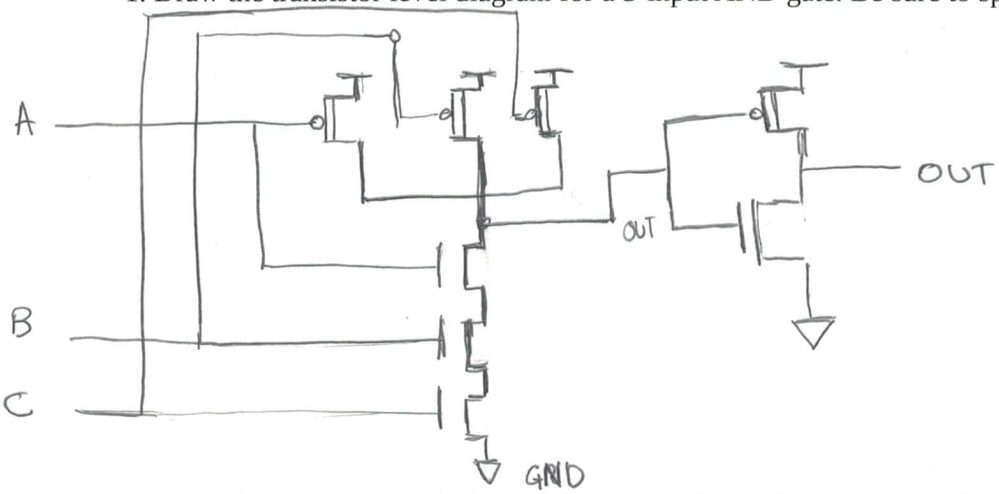
CMPE-12L

HW #5

(3.11)

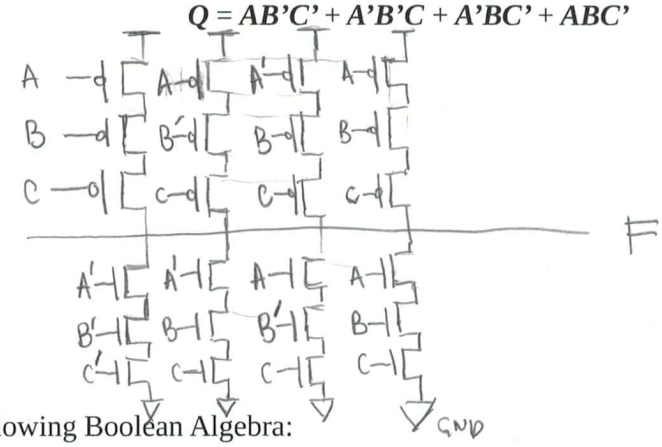
1. Draw the transistor level diagram for a 3-input AND gate. Be sure to specify Vcc and GND.



2. Draw the transistor level diagram for the Boolean Algebra below using the direct method discussed in class.

$$Q = AB'C' + A'B'C + A'BC' + ABC'$$

ABC	Q
0 0 0	0
0 0 1	1
0 1 0	1
0 1 1	0
1 0 0	1
1 0 1	0
1 1 0	1
1 1 1	0



12 pmos
12 nmos

3. Reduce the following Boolean Algebra:

$$(A'+B'+C')' + AB(A'+B')\,D + BD'A(A'+B') + BC'A$$

$$(A+B+C) + (ABA'+ABB')\,D + (BD'A\,A'+ BD'A\,B') + BC'A$$
$$(A+B+C) + (ABA'D+ABB'D) + (BD'A\,A'+ BD'A\,B') + BC'A$$
$$(A+B+C) + \cancel{(ABA'D+ABB'D)} + \cancel{(BD'A\,A'+ BD'A\,B')} + BC'A$$
$$(A+B+C) + BC'A$$
$$(A+A)(B+B) + \cancel{CC'}$$
$$A(1+A)B(1+B)$$
$$A\,B$$

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4. Reduce the following Boolean Algebra:

$$CA'D + (D'+A'+C) + ADC'B + ((A'D'C)'(C'D'A)')' + BD'C'A$$
$$CA'D + (DAC') + ADC'B + ((A'D'C)(C'D'A)) + BD'C'A$$
$$CA'D + (DAC') + ADC'B + ((A\,A')(D'D')(C\,C')) + BD'C'A$$
$$CA'D + (DAC') + ADC'B + ((\cancel{A\,A'})(\cancel{D'})(\cancel{C\,C'})) + BD'C'A$$
$$CA'D + (DAC') + ADC'B + BD'C'A$$
$$CA'D + (DAC') + ABC'(D+D')$$
$$A'CD + AC'D + ABC'$$

5. Convert the following IEEE 754 SP FP Numbers to decimal. Feel free to use a calculator on this problem only if the decimal portions of the number get very small.

a. 0x40490FD0

0 1000 0000 100 1001 0000 1111 1101 0000
=> 128 – 127 = **1** => **E = 1**
1100 1001 0000 1111 1101 0000
11.00100100001111 1101 0000
3.($2^{-3}+2^{-6}+2^{-11}+2^{-12}+2^{-13}+2^{-14}+2^{-15}+2^{-16}+2^{-18}$)
= 3.14159011840821

b. 0x44D41000

0 100 01001 101 0100 0001 0000 0000 0000
=> 128+8+1 = 137
=> 137 – 127 = 10 => **E = 10**
1.1010100 0001 0000 0000 0000
=> 1101 0100 000.1 0000 0000 0000
$2^{10} + 2^9 + 2^7 + 2^5 = 1696$
$2^{-1} = ½ = .5$
=> 1696.5

c. 0x3B950000

0011 1011 1001 0101 0000 0000 0000 0000
=> *1+2+4+16+32+64 = 119*
=> *119 – 127 = -8* => ***E = -8***
1.001 0101 0000 0000 0000 0000
.00000001 0010101 0000 0000 0000 0000
=> $2^{-8} + 2^{-11} + 2^{-13} + 2^{-15}$
=> *0.004547119140625*

d. 0x429C0000

0100 0010 1001 1100 0000 0000 0000 0000
=> 1+4+128 = 133
=> 133 -127 = 6 => **E=6**
=> 1001101.100000000 ->
=> 1.0011100000000-> => 1001110.00→
=> 64 + 14 = 78
=> 78

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6. Convert the following decimal numbers to IEEE (Institute for Electrical and Electronics Engineers) 754 SP FP and give the result in Hex.

a. 1

BIN = 1
=> 1.00000000000000000000000000000000
E = 0 + 127 = 127 - > 011111111
0011 1111 1000 0000 0000 0000
=> 0x3F800000

Binary: 00111111100000000000000000000000
HEX: 0x3F800000

b. -254.125

.125 * 2 = **0**.250
.250 * 2 = **0**.500
.500 * 2 = **1**.0
0 * 2 = **0**.0
=> 1111111.0010
=> 1.1111110001000..
=> 7+128 = 134 => **E = 7**
=> $1.11111100010 * 2^7$
=> 1100 0011 0111 1111 0001 0000 0000 0000
=> C 3 7 E 2 0 0 0
=> 0xC37E2000

Binary: 1100 0011 0111 1110 0010 0000 0000 0000
HEX: 0xC37E2000

c. 3/64

=> 3/64 = 0.046875
0.046875 * 2 = **0**.09375
0.09375 * 2 = **0**.1875
0.1875 * 2 = **0**.375
0.375 * 2 = **0**.75
0.75 * 2 = **1**.5
0.5 * 2 = **1**.0
0.0 * 2 = **0**.0
E = -5 => -5 + 127 = 122
=> 122 – 64 = 58 – 32 = 26 – 16 = 10 -8 = 2 -2 =0
=> 01111010

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=> 0.0000110
=> $1.10*2^{-5}$
0 01111010 1000 0000 0000 0000 0000 0000

0011 1101 0100 0000 0000 0000 0000 0000
3 D 4 0 0 0 0 0

Binary: 0011 1101 0100 0000 0000 0000 0000 0000
HEX: 0x3D400000

d. -33.1

.1 * 2 = **0**.2
.2 * 2 = **0**.4
.4 * 2 = **0**.8
.8 * 2 = **1**.6
.6 * 2 = **1**.2
~~.2 * 2 = **0**.4~~
=> .00011 (repeating)
33 = 100001
sign = 1
=> 100001.00011
$1.0000100011 * 2^5$
=> 5+127 = 132
132 – 128 … = 10000100
=>1100 00100 00001000110 0110 0110 0110
1100 0010 0000 0100 0110 0110 0110 0110
6 2 0 4 6 6 6 6
0xC2046666

Binary: 1100 0010 0000 0100 0110 0110 0110 0110
HEX: 0xC2046666

1.5
—
C

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7. Perform the Following math operations on Floating Point Numbers. Note that while you may check your answer you should perform the operation in binary.

a. 0x47250000*0x42fe0000

0[1000 1110][010 0101 0000 0000 0000 0000]

⇒ 142 - 127 = 15 ⇒ E = 15

⇒ Mantissa = 1010 0101 0000 0000 0000 0000

0[100 00101][1111110 0000 0000 0000]

⇒ 133 - 127 = 6 ⇒ E = 6

⇒ Mantissa = 1111.1110 0000 0000 0000

⇒ 1.01001011
× 01.1111111

1 0 1 0 0 1 0 1
1 0 1 0 0 1 0 1 0
1 0 1 0 0 1 0 1 0 0
1 0 1 0 0 1 0 1 0 0 0
1 0 1 0 0 1 0 1 0 0 0 0
1 0 1 0 0 1 0 1 0 0 0 0 0
1 0 1 0 0 1 0 1 0 0 0 0 0 0

1.0 1 0 0 1 1 1 0 1 1 1 0 1 1

∴ 01001010101001110110110110000000

⇒ 0x4AA3AD68

5364480

(1024,5) (1026.0)

b. 0x44801000-0x44804000

0[100 01001][000 0000 0001 0000 0000 0000]

0[100 01001][000 0000 0100 0000 0000 0000]

137 - 127 ⇒ E = 10

129 - 127 ⇒ E₂ = 2

= 8

⇒ 1.00000000001
−1.00000000010

∴ 1.11111111101

= -1.5

⇒ 10111111110000000000000000000000

∴ 0xbfc00000