

EE115B-Digital Circuits
2nd semester AY 2021/2022

HW1

Due on March 30, 2022

1. Number conversion (5 points each)

(1) $1111011111_2 = 247_{10}$ D = F7 H

(2) $(6DF7)_{16} = (01101101111111)_2$

(3) $(143)_{10} = (10001111)_2$

(4) $(82)_{10} = (1010010)_2$

(5) $(110111)_2 = (55)_{10}$

(6) $(11011110111)_2 = (6F7)_{16}$

(7) $(32)_{10} = (20)_{16}$

00100000

$2^7 + 15$
 $2 \overline{)143}$
 $2 \overline{)71}$
 $2 \overline{)35}$
 $2 \overline{)17}$
 $2 \overline{)8}$
 $2 \overline{)4}$
 $2 \overline{)2}$
 $2 \overline{)1}$
 0

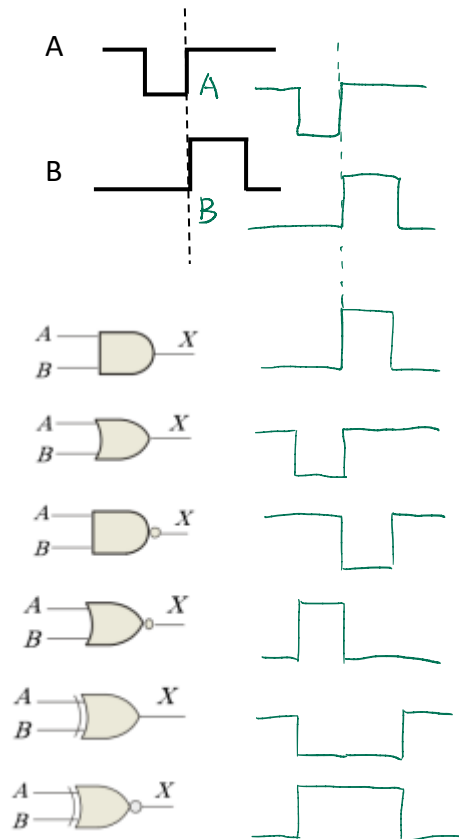
$2^6 + 2^4 + 2$
 $2 \overline{)82}$
 $2 \overline{)41}$
 $2 \overline{)20}$
 $2 \overline{)10}$
 $2 \overline{)5}$
 $2 \overline{)2}$
 $2 \overline{)1}$
 0

2. Code conversion (10 points)

Decimal	Binary	8421 BCD Code
0	00000	0000
1	00001	0001
2	00010	0010
3	00011	0011
4	00100	0100
5	00101	0101
6	00110	0110
7	00111	0111
8	01000	1000
9	01001	1001
10	01010	0001 0000
11	01011	0001 0001
12	01100	0001 0010
13	01101	0001 0011
14	01110	0001 0100
15	01111	0001 0101
16	10000	0001 0110
17	10001	0001 0111
18	10010	0001 1000
19	10011	0001 1001
20	10100	0010 0000
21	10101	0010 0001
22	10110	0010 0010
23	10111	0010 0011
24	11000	0010 0100
25	11001	0010 0101
26	11010	0010 0110

27	11011	00/00111
28	11100	00/01000
29	11101	00/01001
30	11110	001/0000
31	11111	001/0001

3. Plot the output (X) waveforms (10 points)



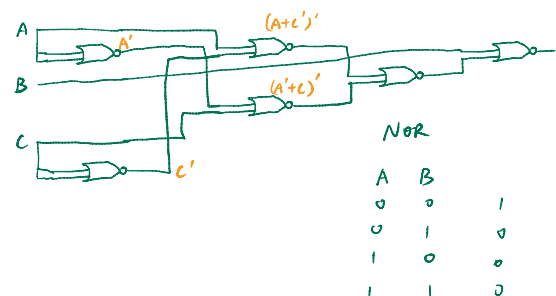
4. Simplify the following expression (10 points)

$$L = AD + A\overline{D} + \overline{A}B + \overline{A}C + BD + \overline{A}\overline{B}EF + \overline{B}EF$$

$$L = A + A'C + BD + B'EF = A + C + BD + B'EF$$

5. Transform the logical expression $L = \overline{A}\overline{B}C + \overline{A}B\overline{C}$ and draw the corresponding circuits (only use the 2-input NOR gate). (20 points)

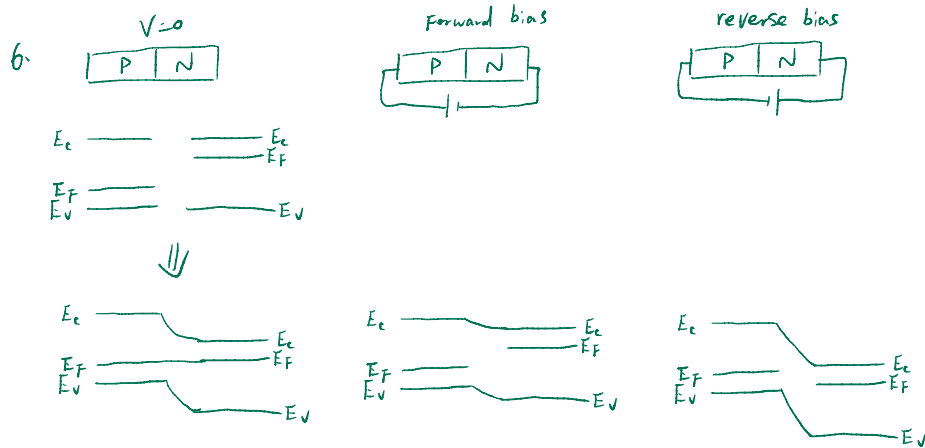
$$\begin{aligned} & A'B'C + AB'C' \\ &= B'(A'C + Ac') \\ &= [B'(A'C + Ac')]'' = [B + (A'C + Ac')']' \\ &= [B + [(A'C)'] + (Ac')']]' \\ &= [B + [(A+c)'] + (A'+c)']]' \end{aligned}$$



6. Draw the energy band diagram for the forward and reverse biased P-N junction (5 points)

7. Draw the logic diagram based on the truth table. (10 points)

A	B	C	L
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0



7. $L = A'Bc + ABc'$

