Final

1.1 $\frac{4 \text{ bits}}{1 \text{ micrsec}} \cdot \frac{1000000 \text{ microsec}}{1 \text{ sec}}$

4000000 bits/sec

1.2 20 ns = pw

10 MHz = f

What is duty cycle

$10 \text{ MHz} = \frac{1}{T} \Rightarrow T = 10 \mu s$

$\text{Duty cycle} = \left(\frac{20 \text{ ns}}{10 \mu s}\right) 100\% = (.002)100$

Duty cycle = .2%

1.3 ADC range 0.0 to 2.5 volts

Digitizes analog voltages into 8 bit binary #'s

There are 255 #'s we can represent with 8 bits

There we breaks up the range by the amount of binary numbers we can represent it with

$$\frac{2.5-0}{255} = .0098$$

Therefore the ADC can detect a voltage change of $.0098 \approx .01$ volts

2.1a We need 5 bits to represent every letter in the alphabet

$$2^5 - 1 = 31$$

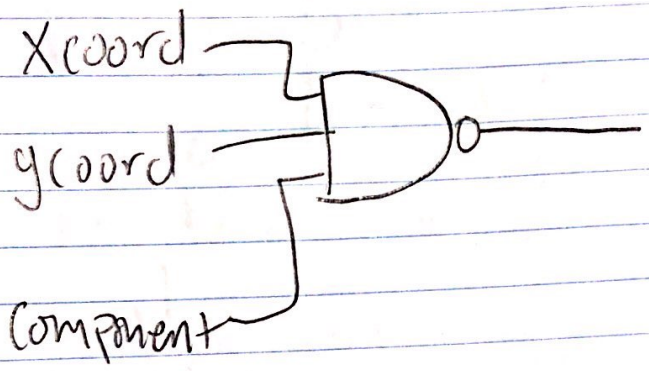
2.1b

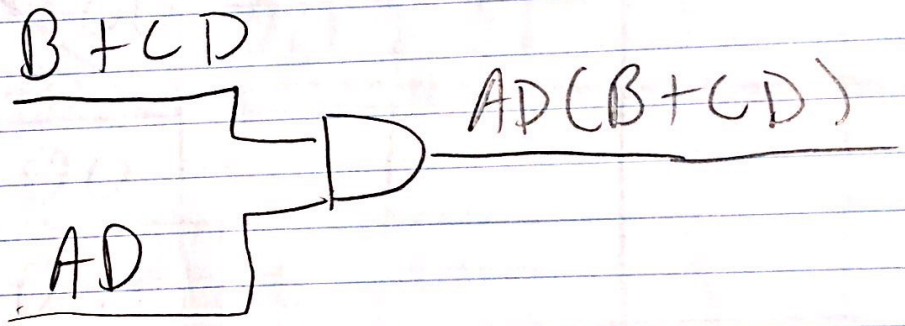
D	=	100
A	=	1
N	=	1110
I	=	1001
E	=	101
L	=	1100

2.2 only 2 bits are necessary with hexa decimal numbers

D	=	4
A	=	1
N	=	E
I	=	9
E	=	5
L	=	C

3.1





Simplified = ADB + ACDD

= ADB + ACD

= AD(B+C)

4

$$X = A + \bar{C}D + A\bar{C}\bar{D} + \bar{A}BC\bar{D}$$

AB \ CD	00	01	11	10
00				
01				
11				
10				

convert S.O.P. to S-S.O.P.

(1) $A(B+\bar{B})(C+\bar{C})(D+\bar{D}) + \bar{C}D(A+\bar{A})(B+\bar{B}) + A\bar{C}\bar{D}(B+\bar{B}) + \bar{A}BC\bar{D}$

(2) $(AB + A\bar{B})(CD + C\bar{D} + \bar{C}D + \bar{C}\bar{D}) + CD(AB + A\bar{B} + \bar{A}B + \bar{A}\bar{B}) + ABC\bar{D} + A\bar{B}C\bar{D} + \bar{A}BC\bar{D}$

③ $ABCD + ABC\bar{D} + AB\bar{C}D + AB\bar{C}\bar{D}$
$+ A\bar{B}CD + A\bar{B}C\bar{D} + \bar{A}BCD + \bar{A}BC\bar{D}$
$+ \bar{A}\bar{B}CD + \bar{A}\bar{B}C\bar{D} + \bar{A}B\bar{C}D + \bar{A}B\bar{C}\bar{D}$

④ $X = ABCD + ABC\bar{D} + AB\bar{C}D + AB\bar{C}\bar{D}$
$+ A\bar{B}CD + \bar{A}BCD + \bar{A}BC\bar{D} + A\bar{B}C\bar{D}$
$+ \bar{A}BC\bar{D} + A\bar{B}\bar{C}D + A\bar{B}C\bar{D}$

AB \ CD	00	01	11	10
00			✓	
01			✓	✓
11	✓	✓	✓	✓
10	✓	✓	✓	✓

$X = A + CD + \bar{A}B\bar{C}\bar{D}$

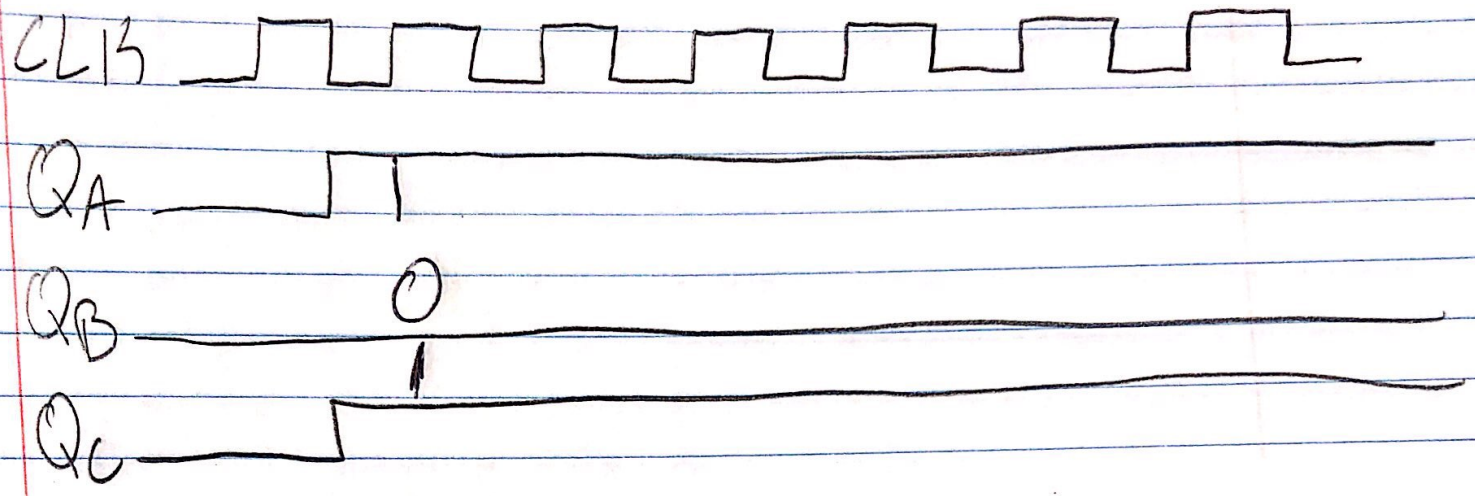
5

A	B	C	D	X
1	1	1	0	1
1	0	1	1	1
1	1	0	1	1
0	1	1	1	0

AB \ CD	00	01	11	10
00				
01			1	
11		1		1
10			1	

As we can see from the Karnaugh map we can't simplify

7



The waveforms show the binary numbers