Homework #4

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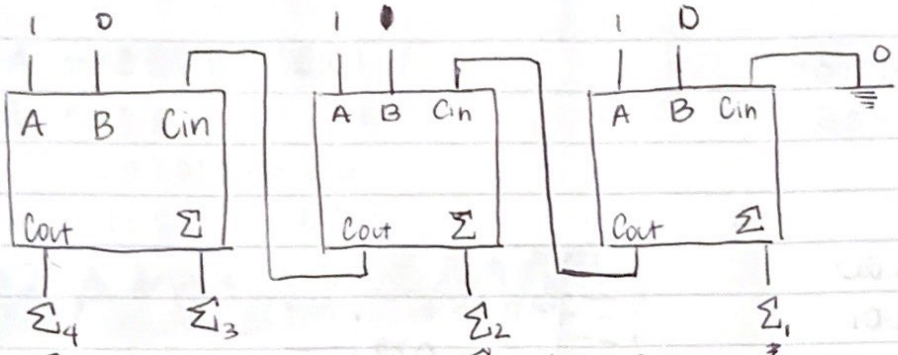
4, 7, 11, 15, 20, 21, 23, 29, 34, 45

4.



$\Sigma_1 = (A \otimes B) \otimes C_{in}$
$= (1 \otimes 0) \otimes 0$
$= 1 \otimes 0 = 1$

$C_{out} = AB + (A \otimes B) C_{in}$
$= (1)(0) + (1 \otimes 0)(0)$
$= 1 + (1)(0)$
$= 1$

$\Sigma_2 = (A \otimes B) \otimes C_{in}$
$= (1 \otimes 1) \otimes 1$
$= 0 \otimes 1$
$= 1$

$C_{out} = AB + (A \oplus B) C_{in}$
$= (1)(1) + (1 \oplus 1)(1)$
$= 1 + 0(1)$
$= 1$

$\Sigma_3 = (1 \otimes 0) \otimes 1$
$= 1 \otimes 1$
$= 0$

$\Sigma_4 = AB + (A \oplus B) C_{in}$
$= (1)(0) + (1 \oplus 0)(1)$
$= 0 + (1)(1)$
$= 1$

A = 1
B = 0
Cin = 0

A = 1
B = 1
Cin = 1

A=1
B=0
Cin=1

$\Sigma_4 \Sigma_3 \Sigma_2 \Sigma_1 = 1101$

7. $A = 1001$ $B = 1100$
$A_3 A_2 A_1 A_0$ $B_3 B_2 B_1 B_0$

1 0 1
A_0 B_0 C_0

$\Sigma_0 = A_0 + (B_0 \oplus C_0) + C_0 = 1 + 1 + 1 = 1$

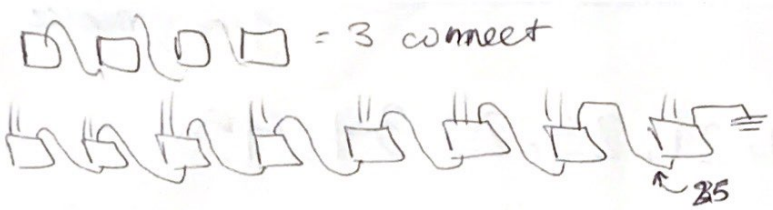
so $C_{out} = 1$

0 1 1
A_1 B_1 C_{in} → $\Sigma_1 = 0$ & $C_{out} = 1$

so $A - B = 1101$

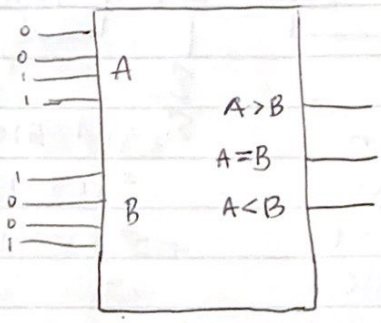
A_2 B_2 C_{in} → $\Sigma_2 = 1$
0 0 1 $C_{out} = 0$

A_3 B_3 C_{in} → $\Sigma_3 = 1$
1 0 0 $C_{out} = 0$



11. total = 40 + 6(25) + 35
= 40 + 150 + 35
= 225 ns

15 a) $A_3A_2A_1A_0 = 1100$
$B_3B_2B_1B_0 = 1001$
A > B is high and others low



b) $A_3A_2A_1A_0 = 1000$
$B_3B_2B_1B_0 = 1011$
A < B is ~~low~~ HIGH and others low

c) $A_3A_2A_1A_0 = 0100$
$B_3B_2B_1B_0 = 0100$
A = B is HIGH and others low.

20. Algebra expression: $Y = A_2A_1\bar{A}_0 + A_2A_1A_0 + \bar{A}_2A_1\bar{A}_0$

$A_0 = 10001$ so at $T_0 = (1)(0)(0) + (1)(0)(1) + 000$
$A_1 = 00110$ $= 0 + 0 + 0$
$A_2 = 11100$ $= 0$

$T_1 = 101 + 100 + 001$
$= 0 + 0 + 0$
$= 0$

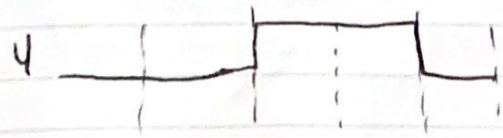
$T_2 = 110 + 110 + 011 = 1 + 0 + 0 = 1$

$T_3 = 011 + 010 + 111 = 0 + 0 + 1 = 1$

$T_4 = 000 + 001 + 100 = 0 + 0 + 0 = 0$

00110

Sole output wave

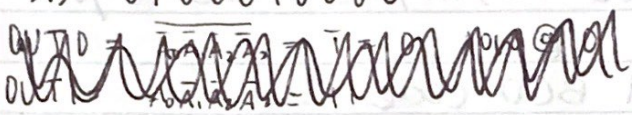


21. $A_0 = 0000010001$

$A_1 = 0001100110$

$A_2 = 0010101010$

$A_3 = 0100010000$



OUT0 = 0000 → active low @ t_0 + t_{10}

OUT1 = 1000 → active low @ t_9

OUT2 = 0100 → active low @ t_3 + t_{17}

OUT3 = 1100 → active ~~low~~ HIGH

OUT4 = 0010 → active low @ t_2 + t_6

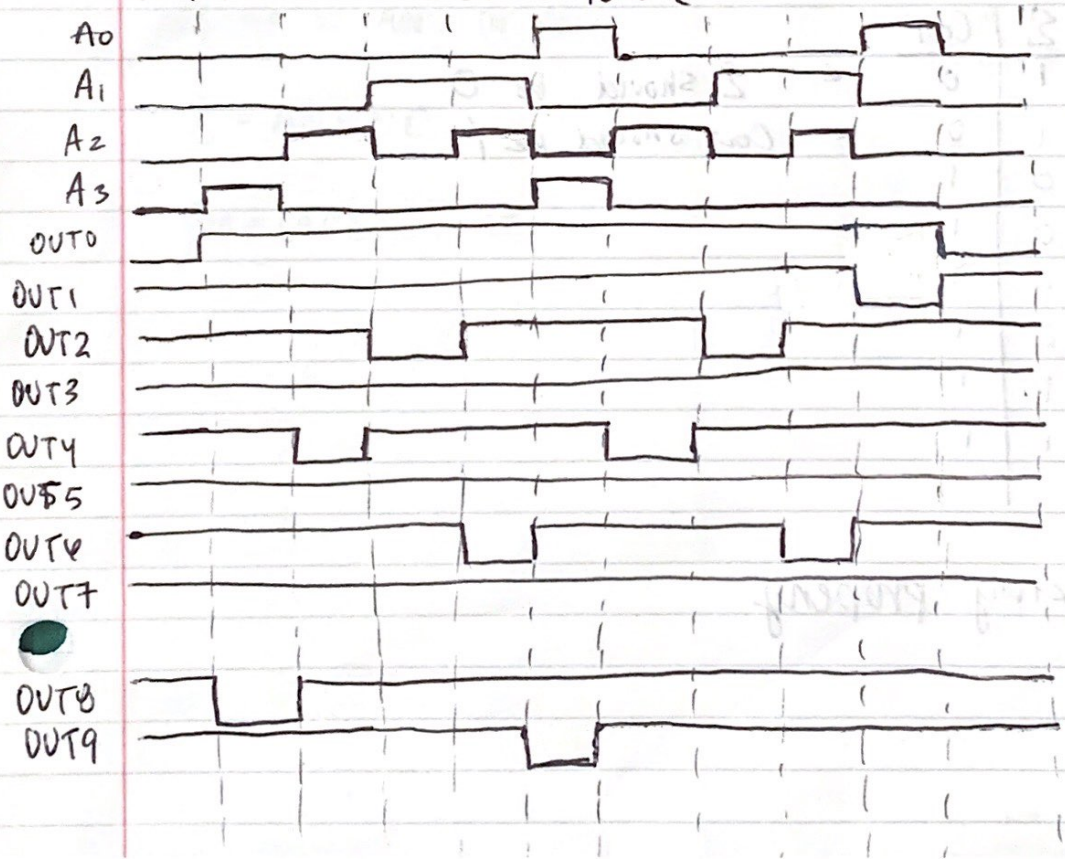
OUT5 = 1010 → active HIGH

OUT6 = 0110 → active low @ t_4 + t_8

OUT7 = 1110 → active high

OUT8 = 0001 → active low @ t_1

OUT9 = 1001 → active low @ t_5



23. If we assume input 3 + 9 are high then,
when only D3 high then A_1 & A_0 high.
when only D9 high then A_3 & A_0 high.
so in total they produce A_0, A_1, A_3 to be high.
The output would be 1011.
1011 is not valid BCD code.

29.

S_0	0	0	1	1	1	0	0	1	0	1	0
S_1	0	1	0	1	0	1	0	0	1	1	0
	D_0	P_1	D_2	B_3	D_2	P_1	D_0	D_2	P_1	D_3	D_0
	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	0	1	1	0	1	1	0	1	1	0	0

Y =

34.

A	B	Cin	Σ	Cout	
0	0	0	1	0	← Σ should be 0
0	0	1	1	0	← Cout should be 1
0	1	0	0	1	
0	1	1	0	1	
1	0	0	0	1	
1	0	1	0	1	
1	1	0	1	1	
1	1	1	1	1	

not working propeny

45. $C_{out} = 3, 5, 6, 7$

AB \ Cin	0	1
00	0	0
01	0	1
11	1	1
10	0	1

→ so $C_{out} = AB + ACin + BCin$

$\Sigma = 1, 2, 4, 7$

AB \ Cin	0	1
00	0	1
01	1	0
11	0	1
10	1	0

$$\Sigma = \bar{A}B\bar{Cin} + A\bar{B}\bar{Cin} + \bar{A}\bar{B}Cin + ABCin$$
$$= \bar{Cin}(\bar{A}B + A\bar{B}) + Cin(\bar{A}\bar{B} + AB)$$
$$= \bar{A}B + A\bar{B} + \bar{A}\bar{B} + AB$$
$$= \bar{A}(B + \bar{B}) + A(\bar{B} + B)$$
$$= 1$$

Replace w/ AND-OR gates

$\Sigma = A \oplus B \oplus C$

$Cin = (A \oplus B)Cin + AB$