HOMEWORK #2

EE 119a

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①

I did V0, V1 and the non-delimiter parts of V2, V3 by inspection.

Here are the Karnaugh maps for VD, S, G:

helper variable for the block of 1s for the delimiters

VD

			I_6	0	0	0	0	1	1	1	1
			I_5	0	0	1	1	1	1	0	0
I_0	I_1	I_2	I_3 \ I_4	0	1	1	0	0	1	1	0
0	0	0	0			0		0			
0	0	0	1		1						0
0	0	1	1	1							
0	0	1	0				0			1	
0	1	1	0	0							
0	1	1	1	x							
0	1	0	1		x						
0	1	0	0		0						0
1	1	0	0	0							
1	1	0	1	x							
1	1	1	1								
1	1	1	0								
1	0	1	0		1						1
1	0	1	1								
1	0	0	1	0			x				
1	0	0	0				0			1	

$\bar{I}_0 \bar{I}_1 \bar{I}_5 \bar{I}_6$ +

$I_0 \bar{I}_1 I_2$ +

$I_4 I_6$ +

S

			I_6	0	0	0	0	1	1	1	1
			I_5	0	0	1	1	1	1	0	0
I_0	I_1	I_2	I_3 \ I_4	0	1	1	0	0	1	1	0
0	0	0	0			0		0			
0	0	0	1		0						0
0	0	1	1	0							
0	0	1	0				0			0	
0	1	1	0	0							
0	1	1	1	1							
0	1	0	1		1						
0	1	0	0		0						0
1	1	0	0	0							
1	1	0	1	1							
1	1	1	1								
1	1	1	0								
1	0	1	0		0						0
1	0	1	1								
1	0	0	1	0			1				
1	0	0	0				0			0	

$I_1 I_3 + I_3 I_5$

$I_3 (I_1 + I_5)$

G

			I_6	0	0	0	0	1	1	1	1
			I_5	0	0	1	1	0	0	1	1
I_0	I_1	I_2	I_3 \ I_4	0	1	1	0	0	1	1	0
0	0	0	0			1					1
0	0	0	1		1			1			
0	0	1	1	1							
0	0	1	0				1		1		
0	1	0	0		1			1			
0	1	0	1		1						
0	1	1	1	1							
0	1	1	0	1							
1	0	0	0				1		1		
1	0	0	1	1			1				
1	0	1	1								
1	0	1	0		1			1			
1	1	0	0	1							
1	1	0	1	1							
1	1	1	1								
1	1	1	0								

- $V0 = I_0 + I_3$
- $V1 = I_5$

helper variable for the block of 1s for the delimiters

- $VD = \bar{I}_0 \bar{I}_1 \bar{I}_5 \bar{I}_6 + I_0 \bar{I}_1 I_2 + I_4 I_6$

this term can be omitted in both V2 and V3 because $I_4 + I_4 I_6 = I_4$ and $I_6 + I_4 I_6 = I_6$

- $V2 = I_6 + VD$
- $V3 = I_4 + I_3 \bar{I}_6 + VD$
- $S = I_3 (I_1 + I_5)$
- $$G = \bar{I}_4 \bar{I}_5 \bar{I}_6 (\bar{I}_0 I_2 I_3 + \bar{I}_0 I_1 I_2 + I_0 \bar{I}_2 I_3 + I_0 I_1 \bar{I}_2) +$$

$$+ \bar{I}_4 \bar{I}_5 I_6 (\bar{I}_0 \bar{I}_2 I_3 + \bar{I}_0 I_1 \bar{I}_2 + I_0 \bar{I}_1 I_2 \bar{I}_3) +$$

$$+ \bar{I}_0 \bar{I}_1 \bar{I}_2 \bar{I}_3 I_4 I_5 \bar{I}_6 +$$

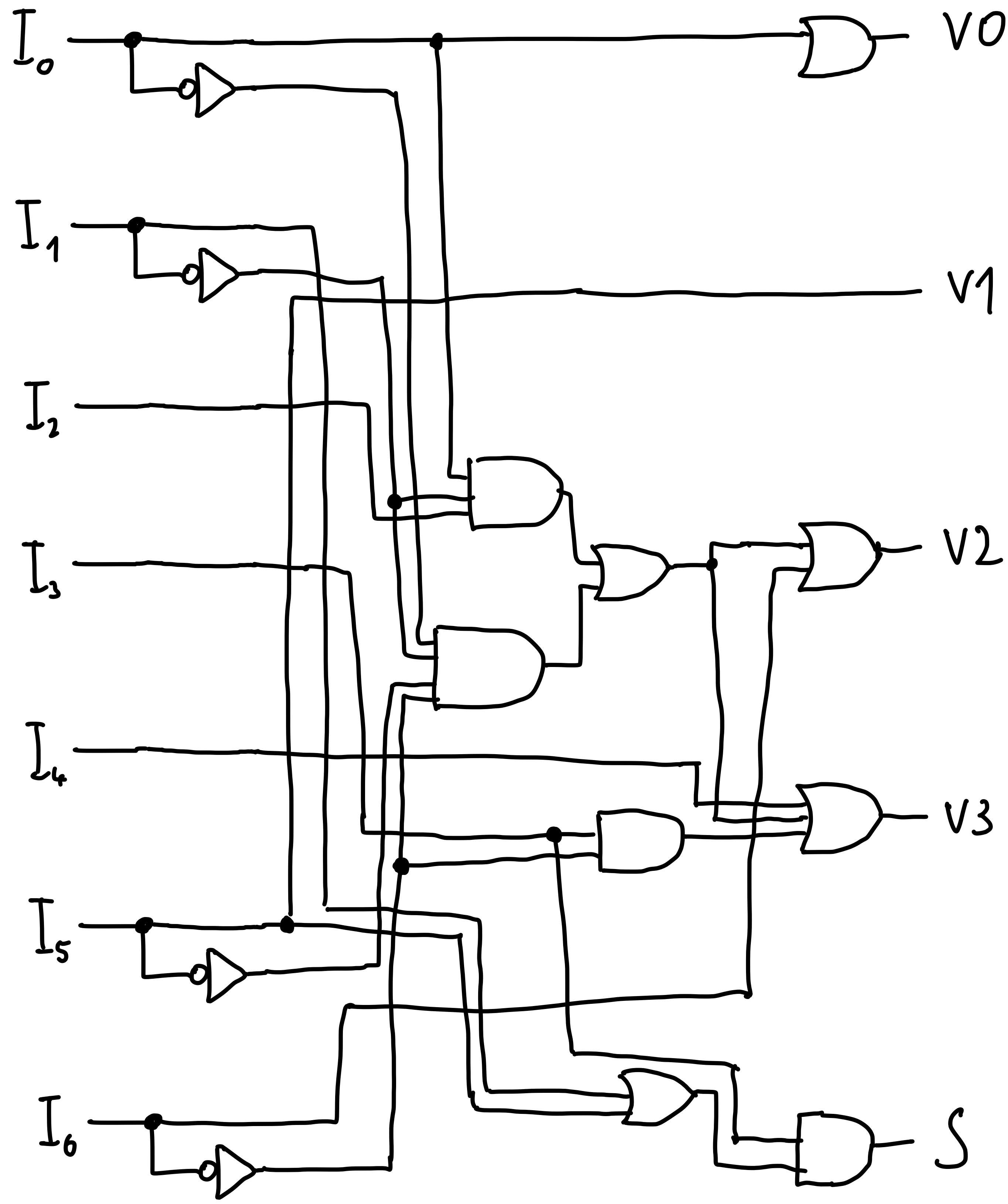
$$+ \bar{I}_4 I_5 \bar{I}_6 (\bar{I}_0 \bar{I}_1 I_2 \bar{I}_3 + I_0 \bar{I}_1 \bar{I}_2) +$$

$$+ \bar{I}_4 \bar{I}_5 I_6 (\bar{I}_0 \bar{I}_1 \bar{I}_2 I_3 + \bar{I}_0 I_1 \bar{I}_2 \bar{I}_3 + I_0 \bar{I}_1 I_2 \bar{I}_3) +$$

$$+ I_4 \bar{I}_5 I_6 (\bar{I}_6 \bar{I}_1 I_2 \bar{I}_3 + I_0 \bar{I}_1 \bar{I}_2 \bar{I}_3) +$$

$$+ \bar{I}_0 \bar{I}_1 \bar{I}_2 \bar{I}_3 \bar{I}_4 I_5 I_6$$

I'll draw logic diagrams for {V0, V1, V2, V3, S} and {G} separately.



An even more simplified expression for G using XORs (shared terms are highlighted):

$$G = \bar{I}_4 \bar{I}_5 \bar{I}_6 (I_1 + I_3)(\bar{I}_0 \$ I_2) +$$

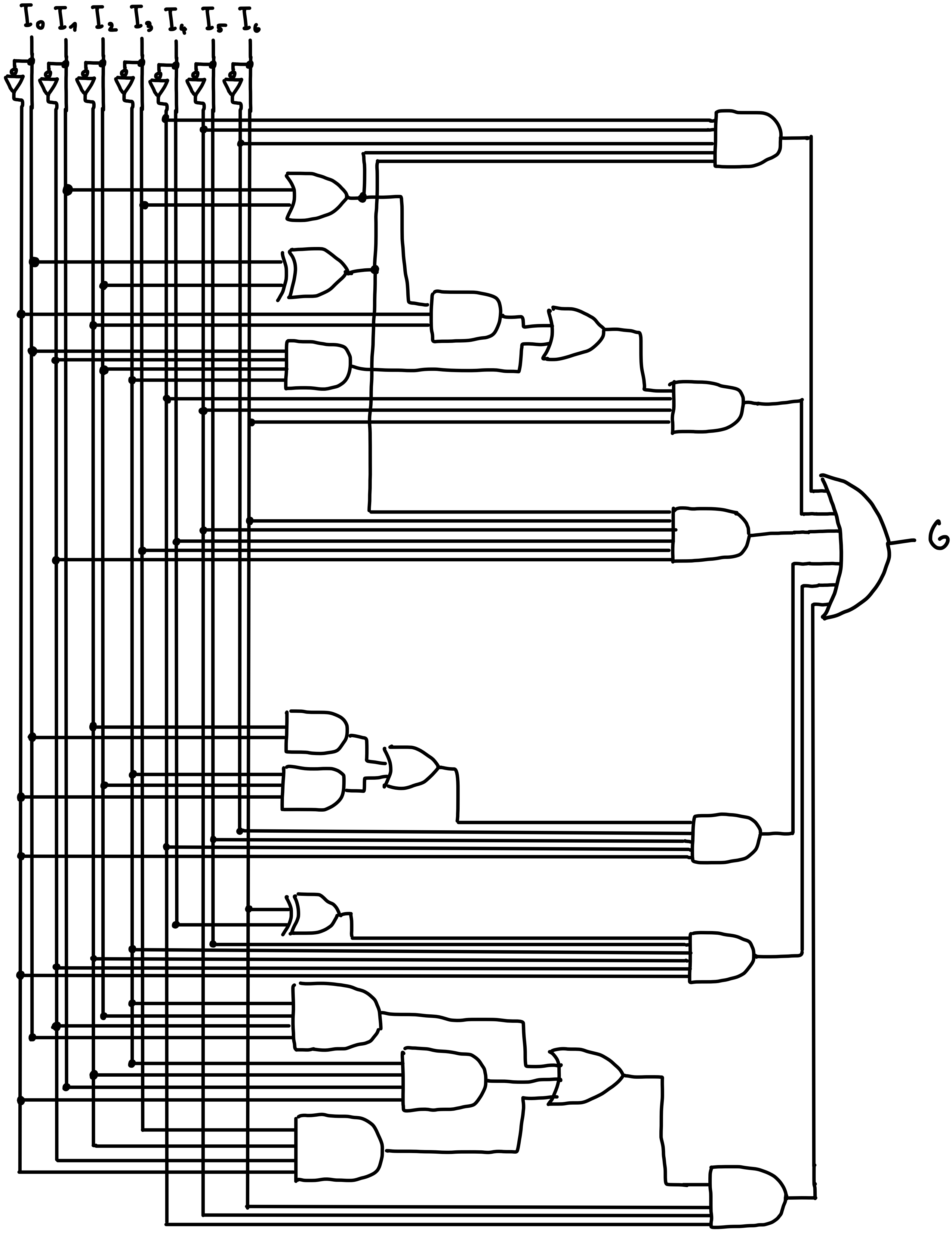
$$+ \bar{I}_4 \bar{I}_5 I_6 \left(\bar{I}_0 \bar{I}_2 (I_1 + I_3) + I_0 \bar{I}_1 I_2 \bar{I}_3\right) +$$

$$+ I_4 \bar{I}_5 I_6 \bar{I}_1 I_3 (I_0 \$ I_2) +$$

$$+ \bar{I}_4 I_5 \bar{I}_6 \bar{I}_1 \left(\bar{I}_0 I_2 \bar{I}_3 + I_0 \bar{I}_2\right) +$$

$$+ \bar{I}_0 \bar{I}_1 \bar{I}_2 \bar{I}_3 I_5 (I_4 \$ I_6) +$$

$$+ \bar{I}_4 \bar{I}_5 I_6 \left(\bar{I}_0 \bar{I}_1 \bar{I}_2 I_3 + \bar{I}_0 I_1 \bar{I}_2 \bar{I}_3 + I_0 \bar{I}_1 I_2 \bar{I}_3\right)$$



I_0 I_1 I_2 I_3 I_4 I_5 I_6
G

(2)

Flipping A can't cause a glitch because it appears in the formula only once.

Here's the Karnaugh map with pairs across terms that cause a glitch

		A	A			
B	1	1				
B	1			1	C	
					C	
		1	1			
			D	D		

$\Rightarrow$ $A\,B\,\frac{C}{\bar{C}}\,\bar{D}$

$A\,\frac{B}{\bar{B}}\,\bar{C}\,D$

Thus, the circuit glitches for $1100 \Leftrightarrow 1110$ and $1101 \Leftrightarrow 1001$.

We can fix this by adding a term for each of the pairs:

$$Y = (A \cdot B \cdot \bar{C}) + (B \cdot C \cdot \bar{D}) + (\bar{B} \cdot \bar{C} \cdot D) + (A \cdot B \cdot \bar{D}) + (A \cdot \bar{C} \cdot D)$$

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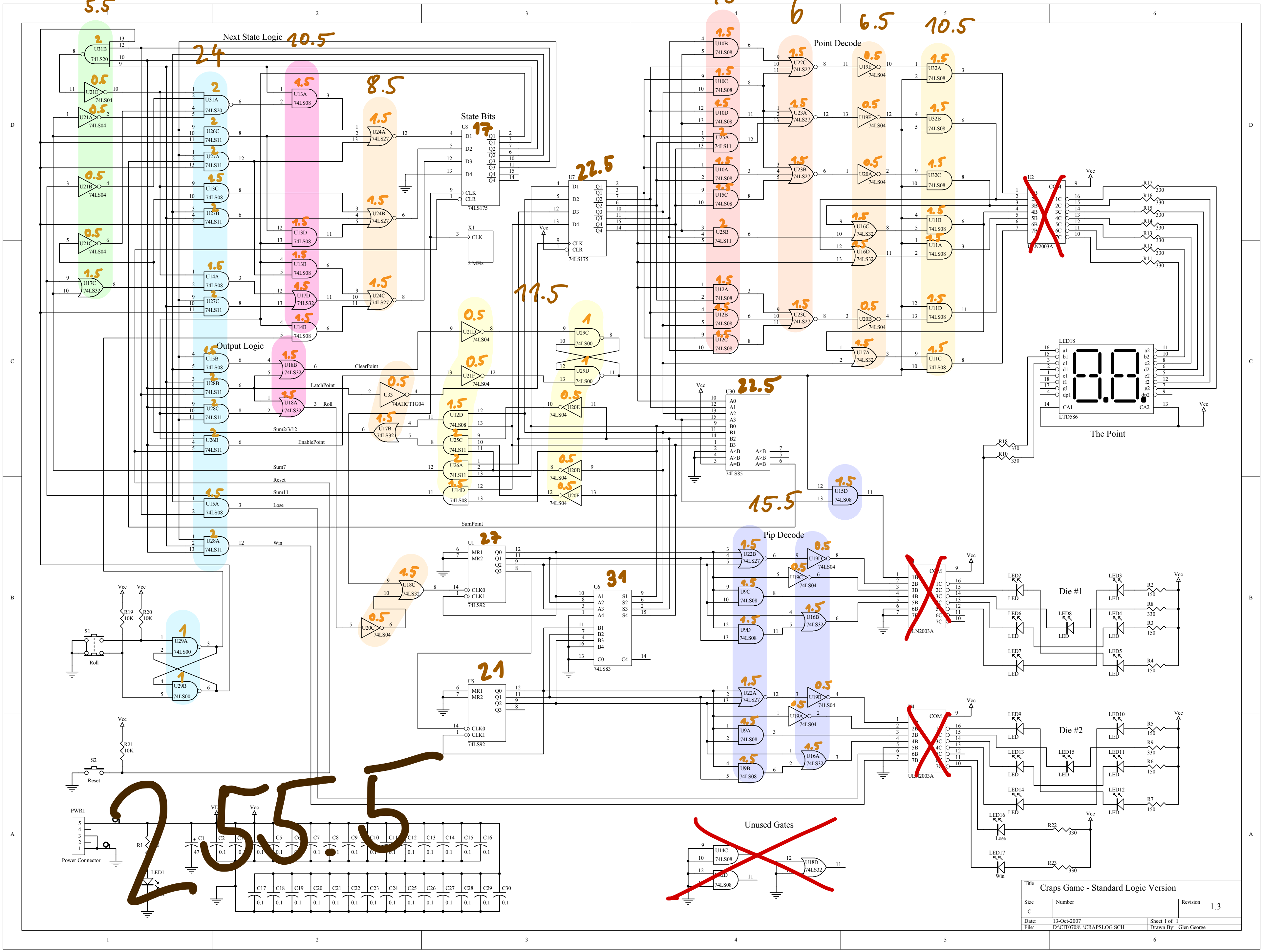

Next State Logic
State Bits
Point Decode
Output Logic
Pip Decode
Die #1
Die #2
The Point
Unused Gates
Roll
Reset
Power Connector
Craps Game - Standard Logic Version
Revision 1.3
Date: 13-Oct-2007
File: D:\CIT0708\...\CRAPSLOG.SCH
Sheet 1 of 1
Drawn By: Glen George
5.5
24
10.5
8.5
17
22.5
16
6
6.5
10.5
11.5
27
31
21
15.5
22.5
255.5