ECSE 281 HW

Tyler Yoak

1. Implement the following function using only 74x138 Binary decoders & NAND Gates

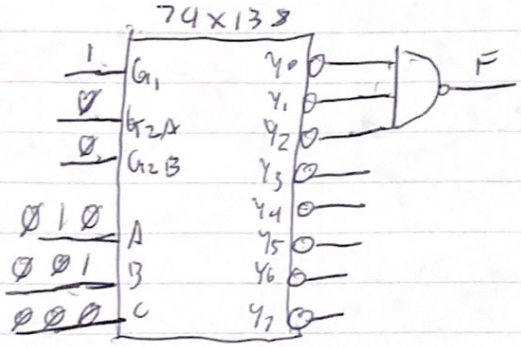
$$F = \prod_{ABC} (3, 4, 5, 6, 7)$$

$$F = \sum_{W,X,Y,Z} (2, 3, 4, 5, 8, 10, 12, 14)$$

74x138 Binary Decoders → Active Low & NAND Gates

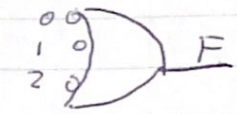
a. [redacted]

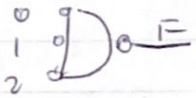
Maxterms: offsets → Product of Sums [redacted]



$$F = \prod_{ABC} (3, 4, 5, 6, 7)$$

$$= F = \sum_{ABC} (1, 2, 7)$$

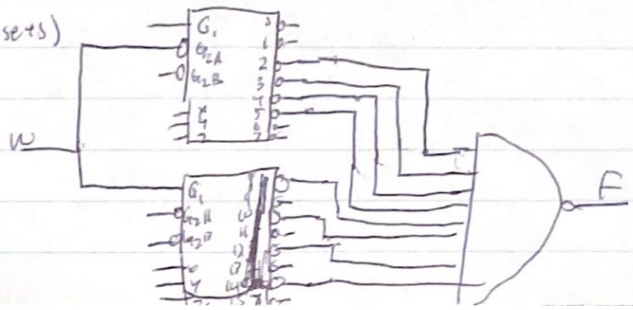




Active Low NAND F=1 AND F=0

b. $F = \sum_{W,X,Y,Z} (2, 3, 4, 5, 8, 10, 12, 14)$

Sum of Products = Minterms (Onsets)



Tyler
Youk

2. Design a 10 to 4 encoder w/ the inputs 1 on at 10 code & outputs coded ~~[illegible]~~ normally for 0-7 [binary 0000 - 0111]
& 8 coded as E [1110]
& 9 coded as F [1111]

Show the internal circuit

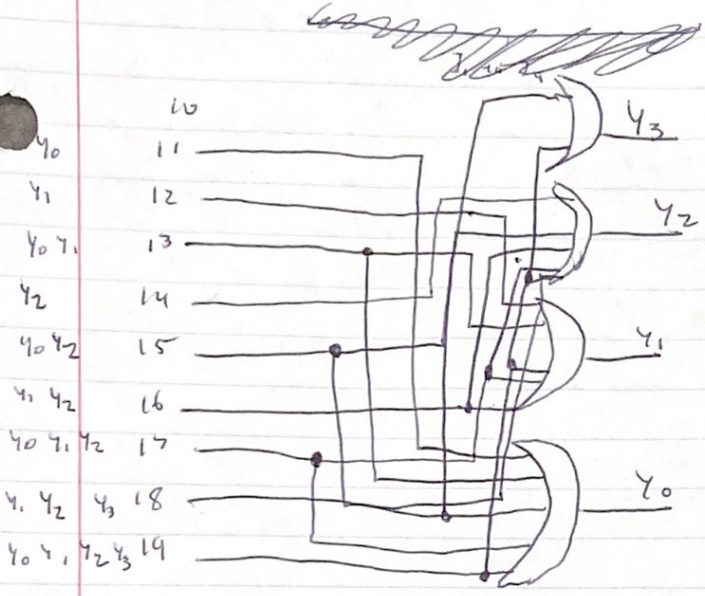
10 to 4 encoder

Y_3: $I_8 + I_9$

Y_2: $I_4 + I_5 + I_6 + I_7 + I_8 + I_9$

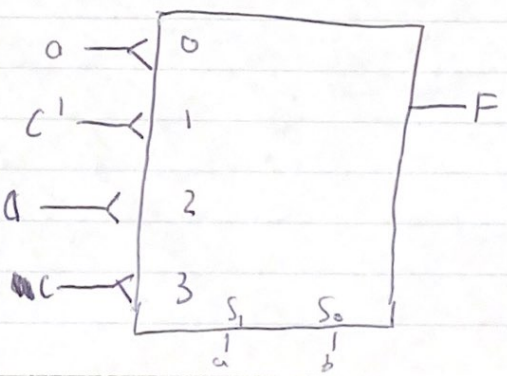
Y_1: $I_2 + I_3 + I_6 + I_7 + I_8 + I_9$

Y_0: $I_1 + I_3 + I_5 + I_7 + I_9$



3. Implement the following only using a single 4x1 multiplexer & inverters

a	b	c	F	
0	0	0	0	> a
0	0	1	0	
0	1	0	1	> c'
0	1	1	0	
1	0	0	1	> a
1	0	1	1	
1	1	0	0	> c
1	1	1	1	



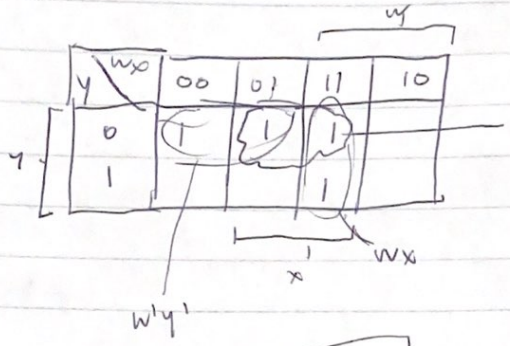
Tyler Houk

9. For the logic expression below, find all of the static hazards and design a hazard-free circuit that realizes the same logic function.

~~F = W~~

$F = w \cdot x + w' \cdot y'$

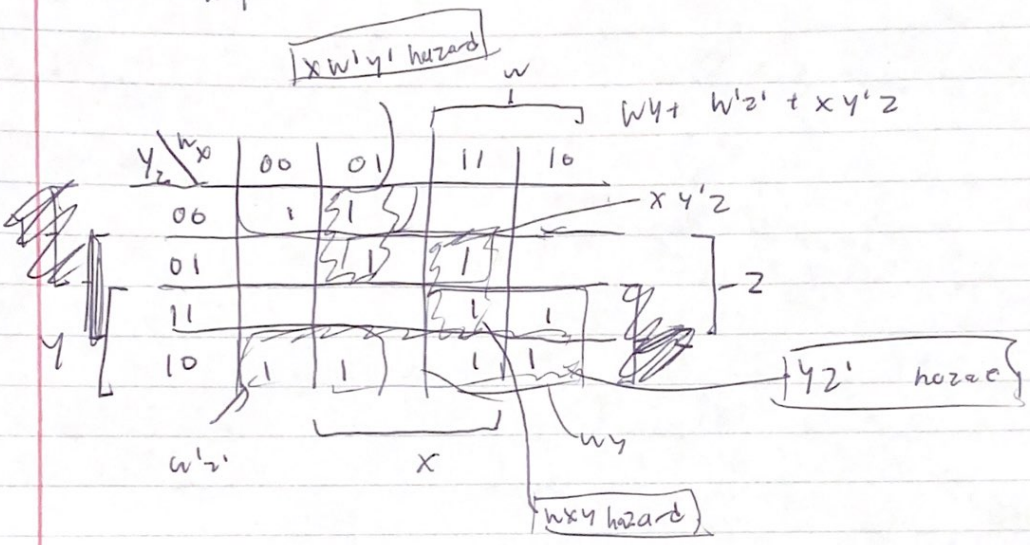
$F = w \cdot y + w' \cdot z' + x \cdot y' \cdot z$



Static hazard

$x \cdot y'$

$F = w'y' + wx + xy'$



$F = \underbrace{wy + w'z' + xy'z}_{\text{original}} + \underbrace{xw'y' + yz' + wxy}_{\text{removals}}$

Tyler York

5. Design an 8x1 multiplexer (8 data sources / 1 bit of data from each source)

using 2x1 multiplexers only. You can use as many 2x1 multiplexers as needed. Clearly label all inputs and outputs.