Andres Antillon
HW 5 Problem Sets
ECE 2372
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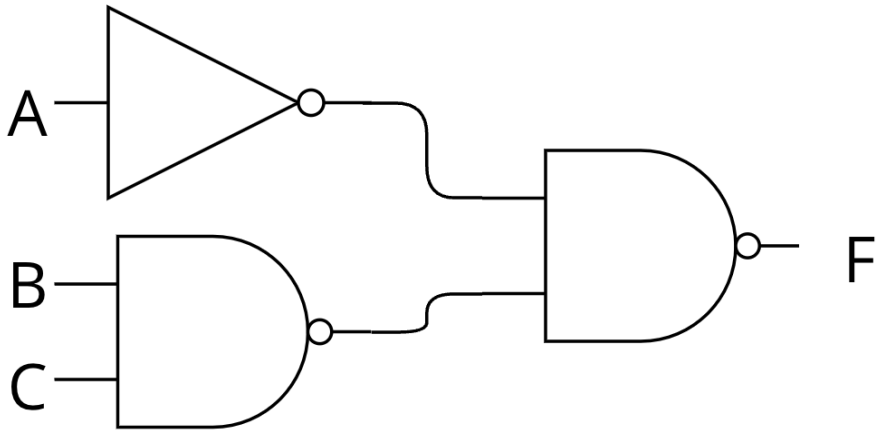
Problem 1

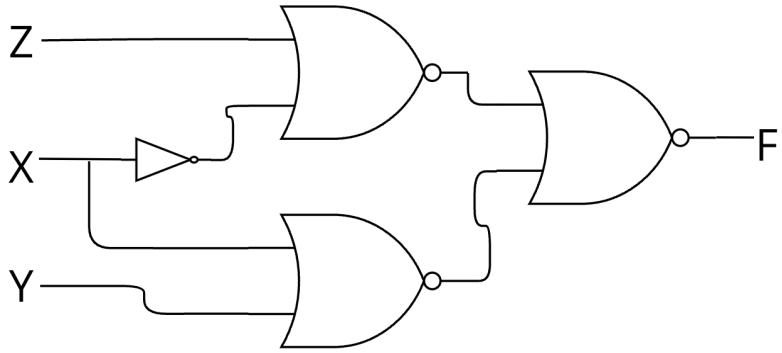
a)

i) [1 1 0] → NAND → 1
ii) [1 1 1] → NAND → 0
iii) [0 1 0] → NOR → 1
iv) [0 0 0] → NOR → 1

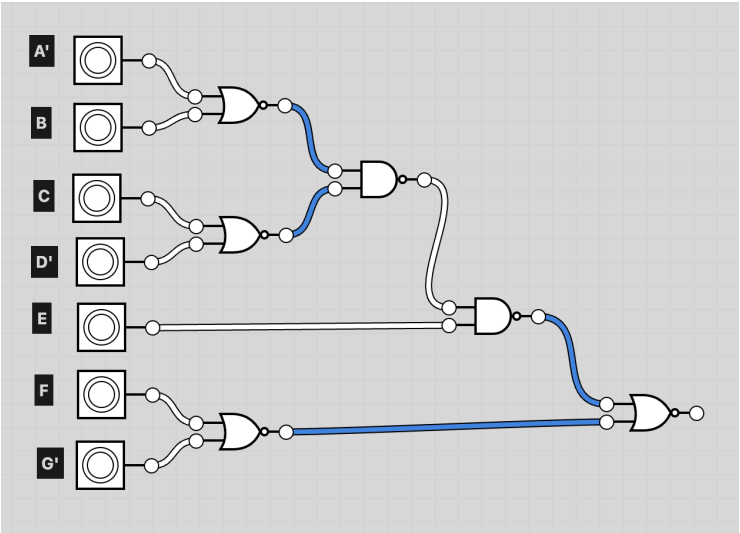
b) F = (A`(BC)`)`



c)

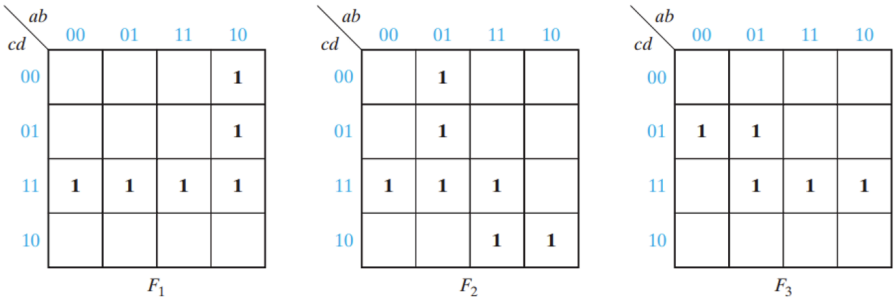


Problem 2



Problem 3

Find an expression for each of these outputs, while minimizing the overall total number of gates. Count the total number of gates. You can assume that all inputs are available in positive and inverted forms. You can assume that multi-input gates count as 1 gate each.



$F_1 \rightarrow cd + ac'$

1 OR gate
2 AND gates
3 total gates

$F_2 \rightarrow cda'b + a'bcd + ad'$

2 OR gate
3 AND gates
5 total gates

$F_3 \rightarrow a'c'd + (a'b'cd)'$

1 OR gate
2 AND gates
3 total gates

Problem 4

cd\ab	00	01	11	10
00	0			0
01			0	0
11				
10	0			0

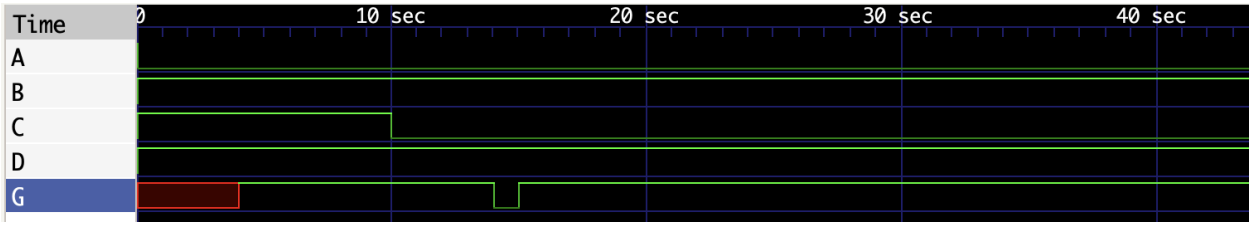
Simplified form: (b + d)(a’ + c + d’)

There’s a hazard in the transition between minterms m10 and m14.
To remove the hazard, we can add the term (c + a’ + b)

Final form: (b + d)(a’ + c + d’)(c + a’ + b)

Problem 5

a)



We can see how there is a hazard where G's value is modified after a delay.

b)

To remove the hazard we can add an AND gate for (a'bd) and pass its result to the final OR gate that produces G.