# Lab 1 – Log Book

By submitting this log, I acknowledge that all work is my own and I have not received any assistance other than what is noted below.

| Date | Acknowledgement |
|---|---|
| Wednesday, June 5th, 2025 | We acknowledge all the work below is ours, and ours only. |

**List all group members:**

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Date: Wednesday, June 5th, 2025

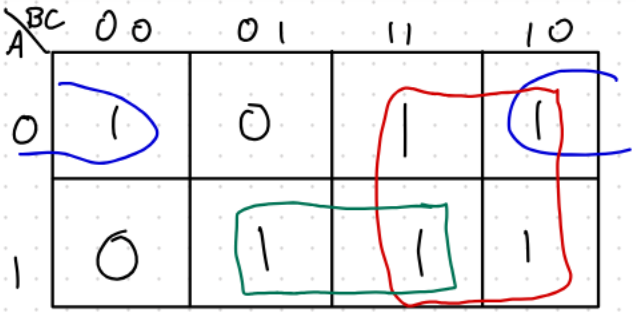
## Exercises

1. Truth table of the logic for the 7-segment display:

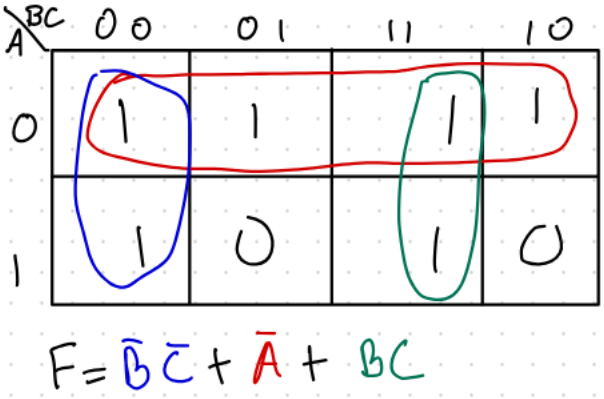
| A | B | C | a | b | c | d | e | f | g | N |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 2 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 3 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 4 |
| 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 5 |
| 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 6 |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 7 |

Karnaugh maps and simplified logic function for each of the seven segments of the seven-segment display, from 0-7 (computer typed is preferred, but you can use handwritten ones, just remember to keep everything neat and clean). (Eg. For segment a: $F = \bar{A}\bar{C} + AC + B$)

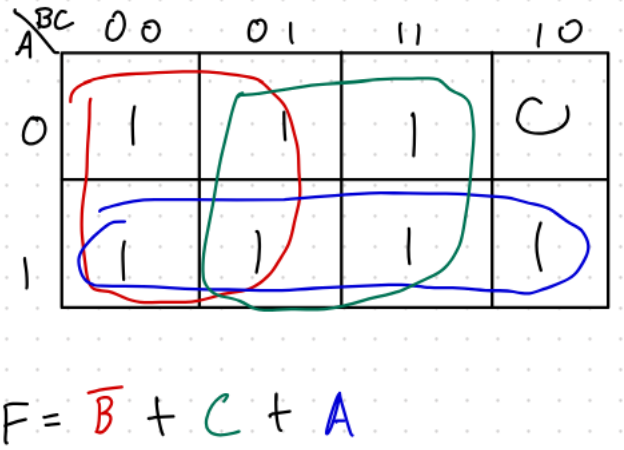
a:



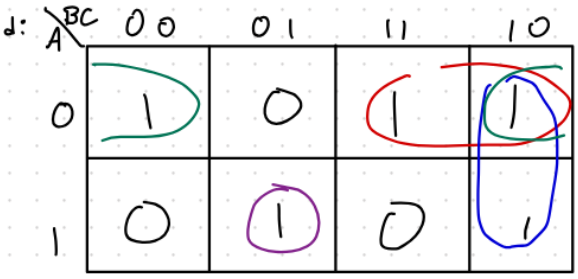

b:




c:

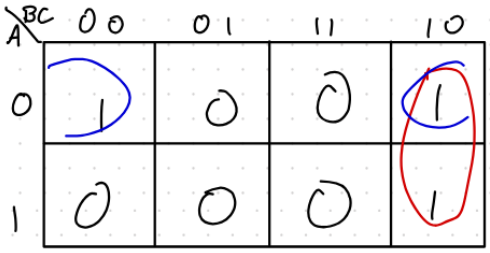


d:



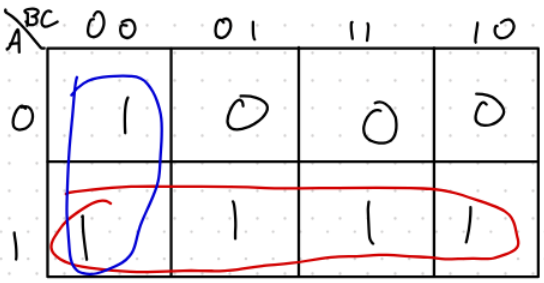

$F = \bar{A}\bar{C} + \bar{A}B + B\bar{C} + A\bar{B}C$

e:



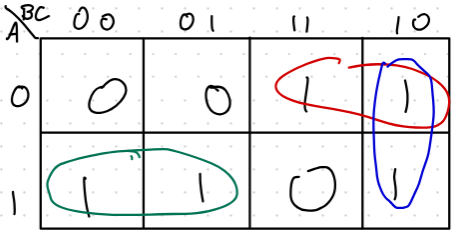

$F = \bar{A}\bar{C} + B\bar{C}$

f:



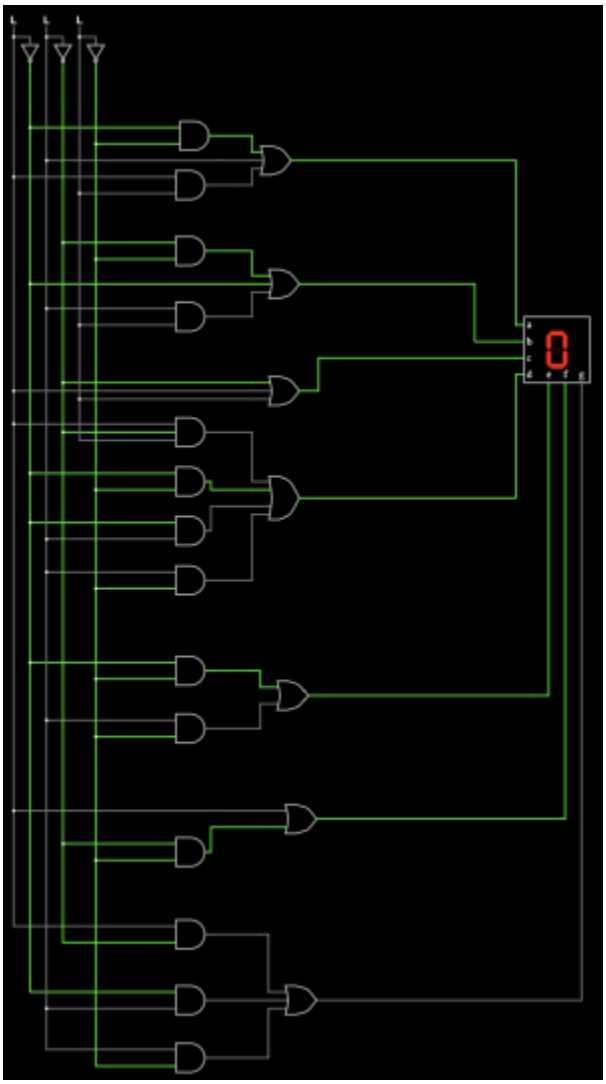

$F = A + \bar{B}\bar{C}$

g:




$F = A\bar{B} + \bar{A}B + B\bar{C}$

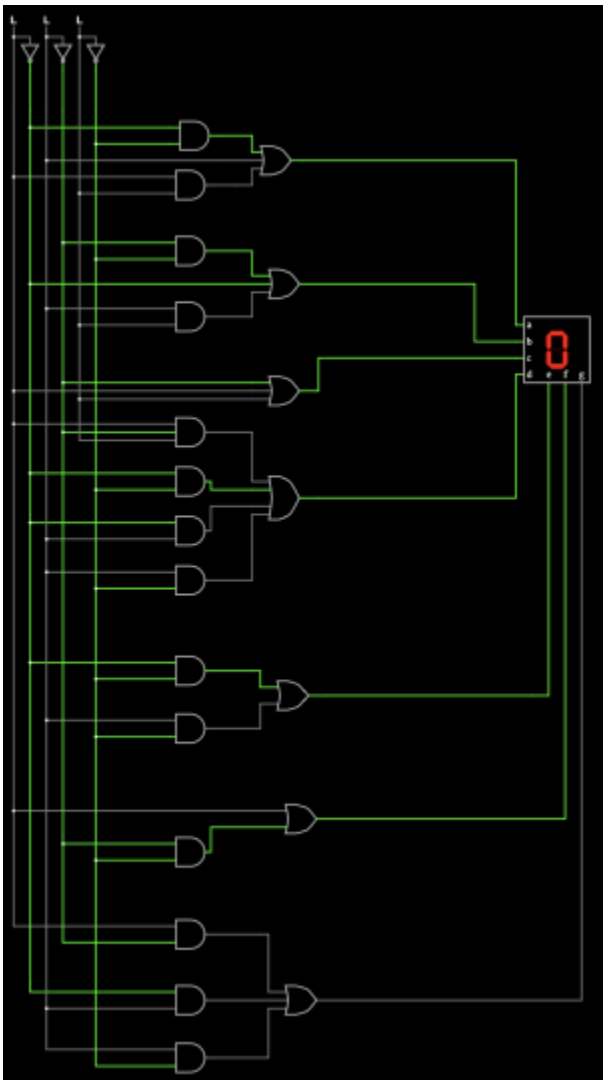
2. **Screenshot of final circuit from Falstad:**

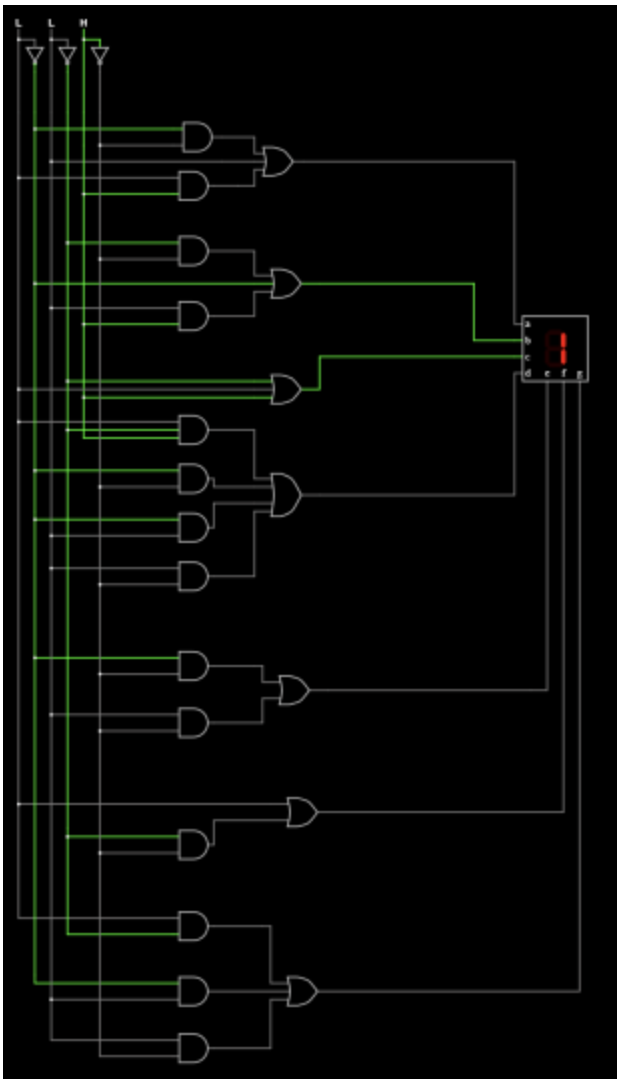


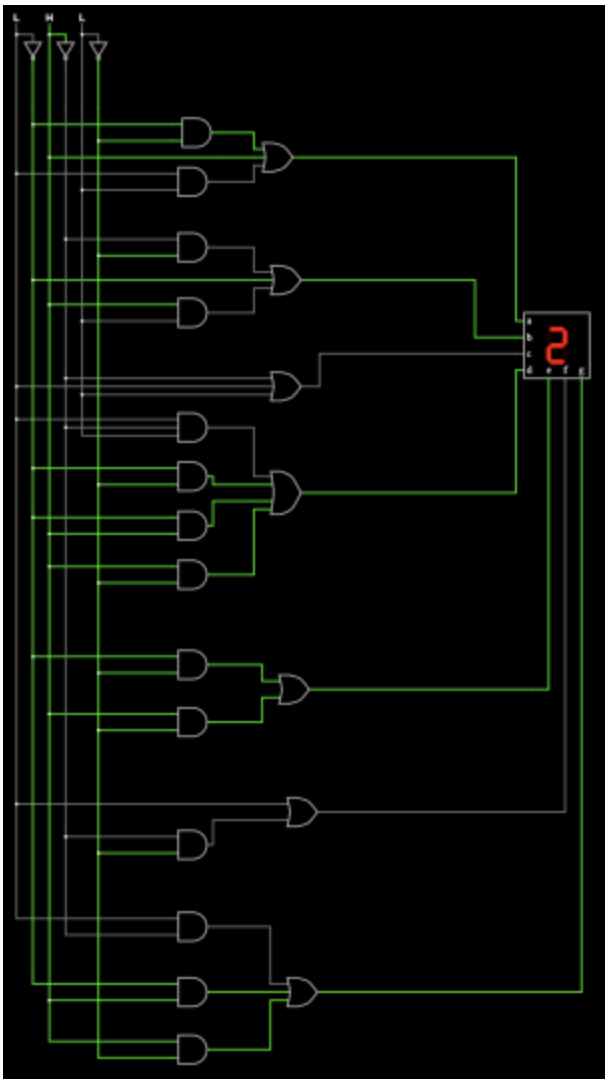
**Briefly describe your testing method and the result:**

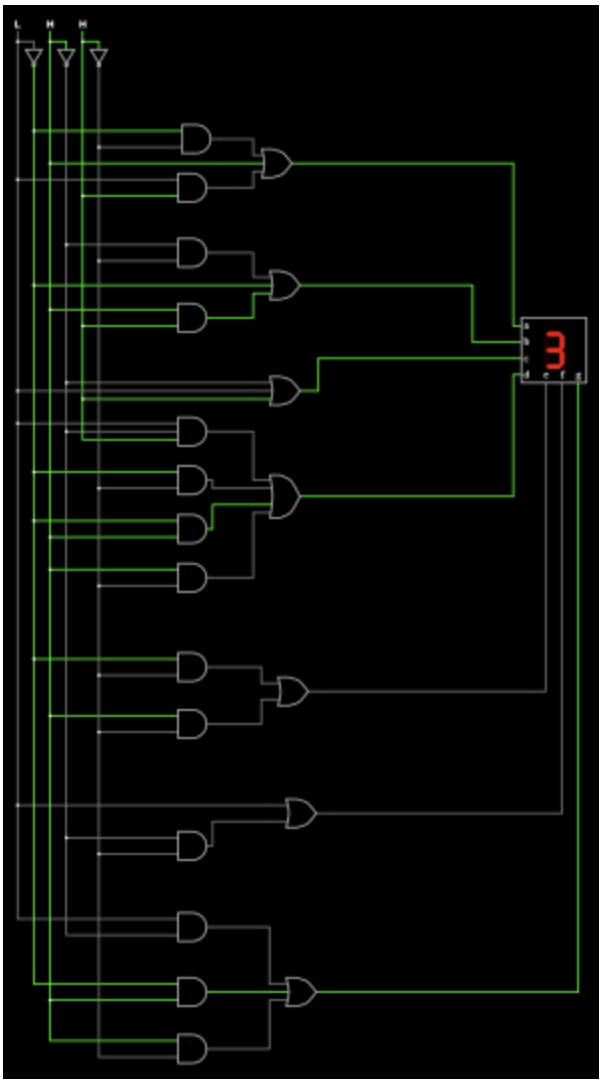
Our testing method involved going through each possible combinations of our inputs, A, B, and C. By matching our input combinations to our truth table above, we expected certain outputs on the 7-segment LED display and confirmed the logic and correctness of the circuit. See results of

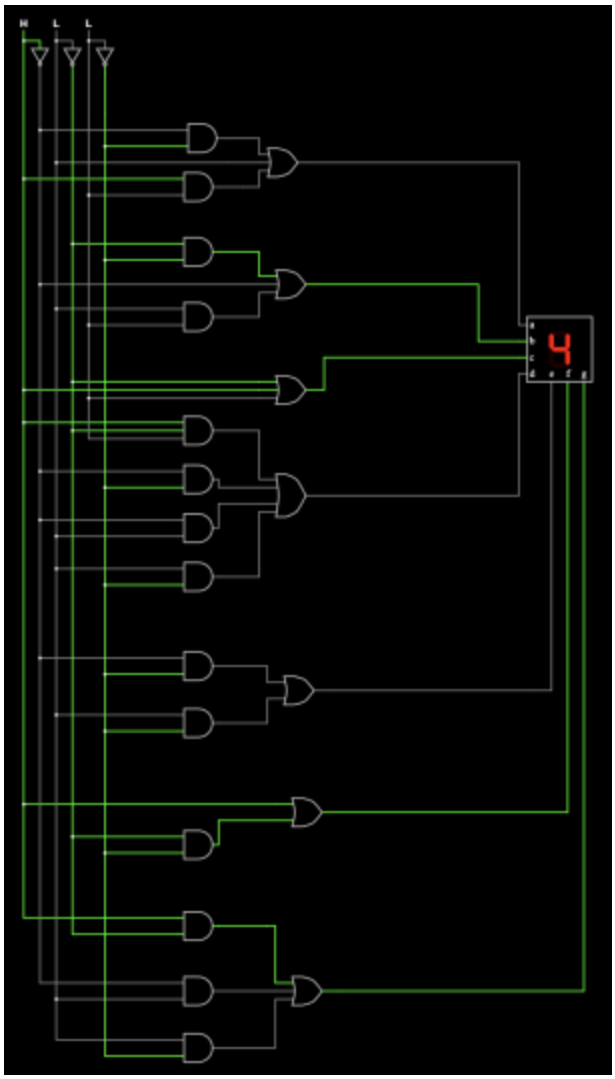
testing below:

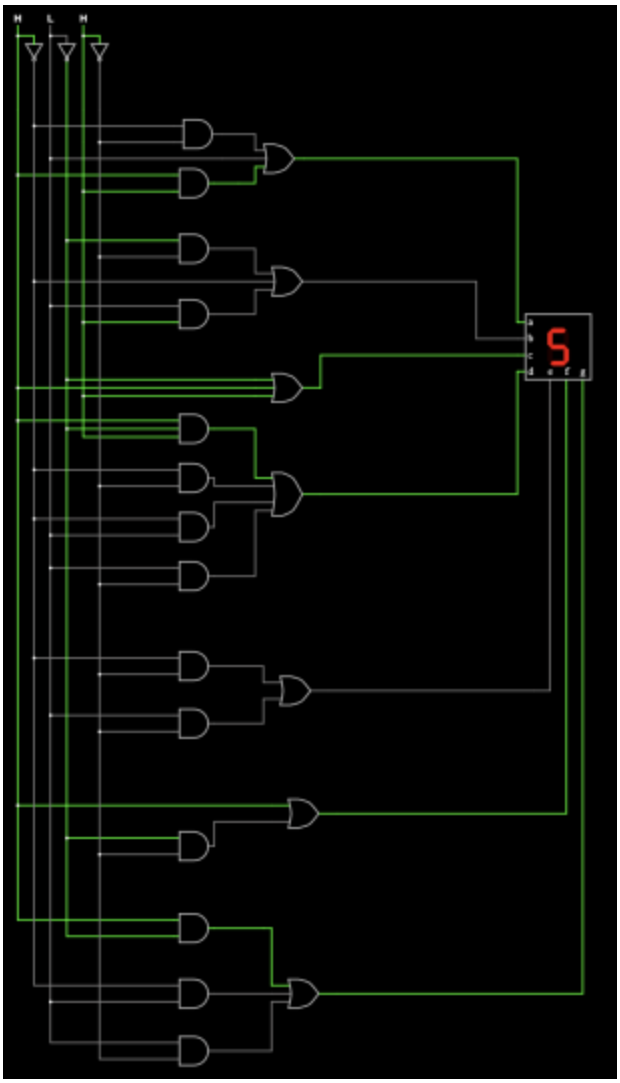


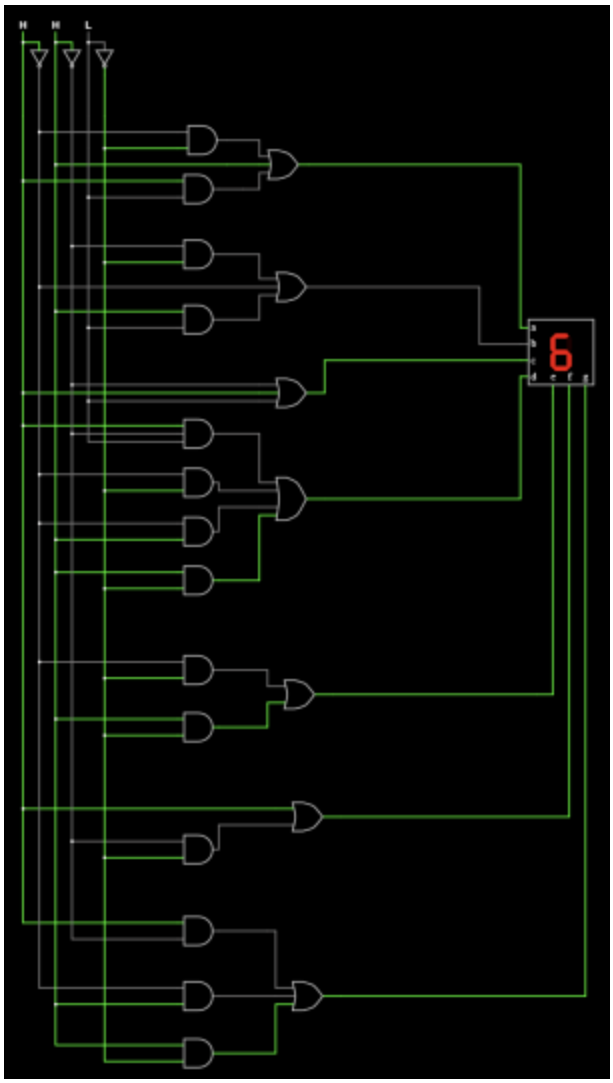

L
L
M

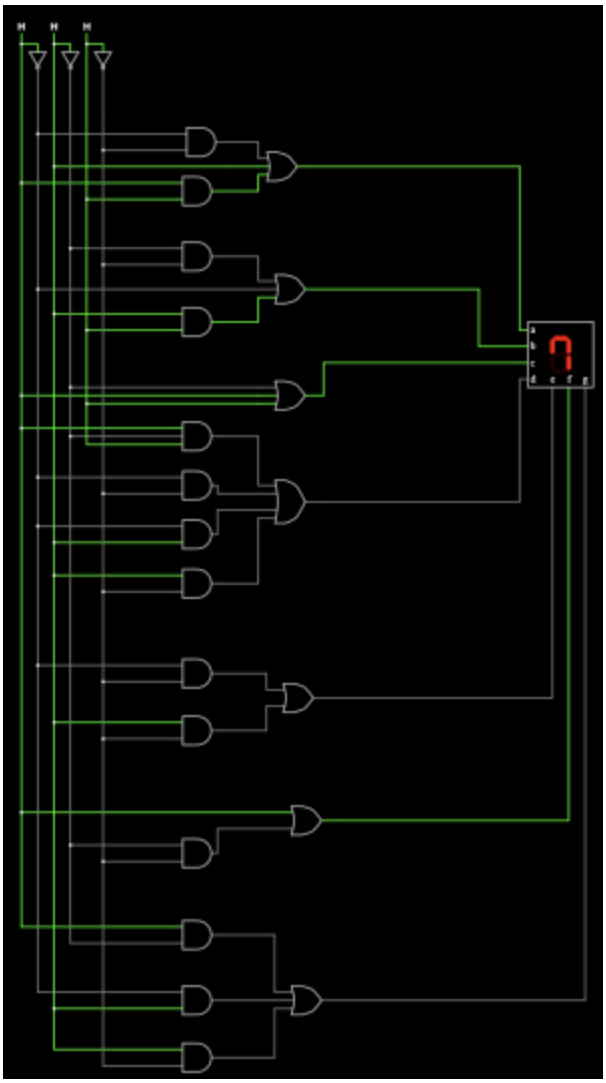

L
H
L
2


L
H
H
3


H
L
L
4


H
L
H
5

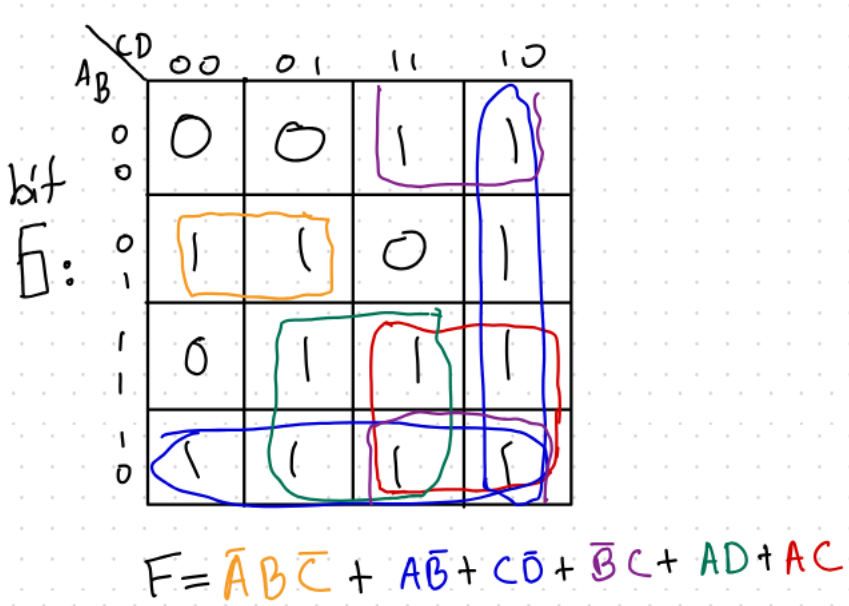

H
H
L
6

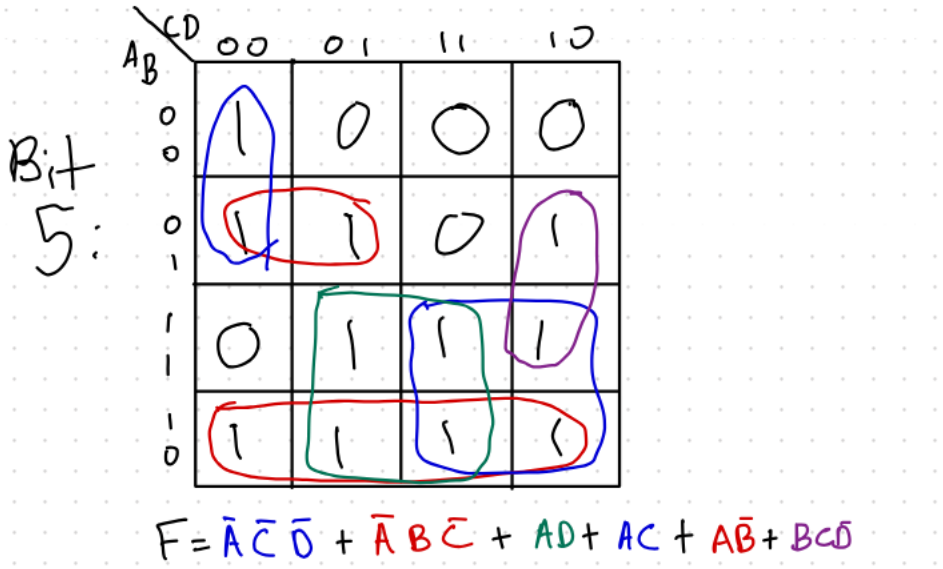


3. [Bonus] Truth table for 4-input seven-segment display for hex values 0-F

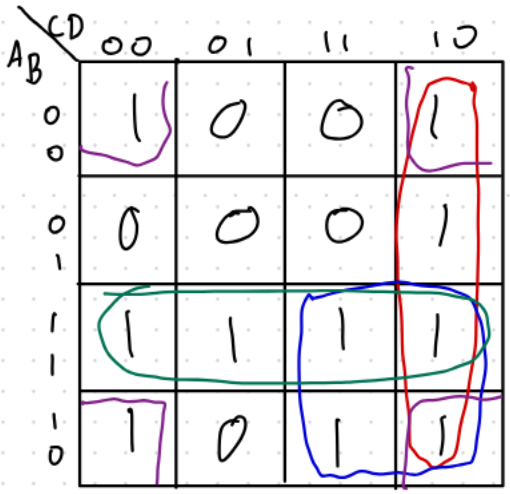
| Display Value | Input A | Input B | Input C | Input D | Output (from bit 6-0) |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0111111 |
| 1 | 0 | 0 | 0 | 1 | 0000110 |
| 2 | 0 | 0 | 1 | 0 | 1011011 |
| 3 | 0 | 0 | 1 | 1 | 1001111 |
| 4 | 0 | 1 | 0 | 0 | 1100110 |
| 5 | 0 | 1 | 0 | 1 | 1101101 |
| 6 | 0 | 1 | 1 | 0 | 1111101 |
| 7 | 0 | 1 | 1 | 1 | 0100111 |
| 8 | 1 | 0 | 0 | 0 | 1111111 |
| 9 | 1 | 0 | 0 | 1 | 1101111 |
| A | 1 | 0 | 1 | 0 | 1110111 |
| B | 1 | 0 | 1 | 1 | 1111100 |
| C | 1 | 1 | 0 | 0 | 0111001 |
| D | 1 | 1 | 0 | 1 | 1011110 |
| E | 1 | 1 | 1 | 0 | 1111001 |
| F | 1 | 1 | 1 | 1 | 1110001 |

Karnaugh maps and simplified functions:


bit 6:
CD
AB
00
01
11
10
F = ĀBC̄ + AB̄ + CD̄ + B̄C + AD + AC

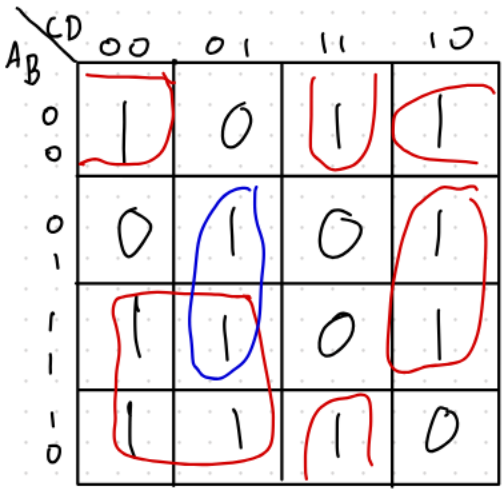

Bit 5:
CD
AB
00
01
11
10
F = ĀC̄D̄ + ĀBC̄ + AD + AC + AB̄ + BCD̄

Bit 4:



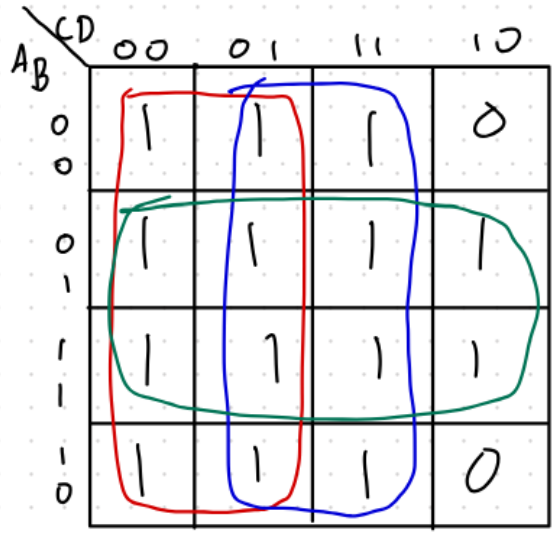

$F = \bar{B}\bar{D} + AC + AB + C\bar{D}$

Bit 3:



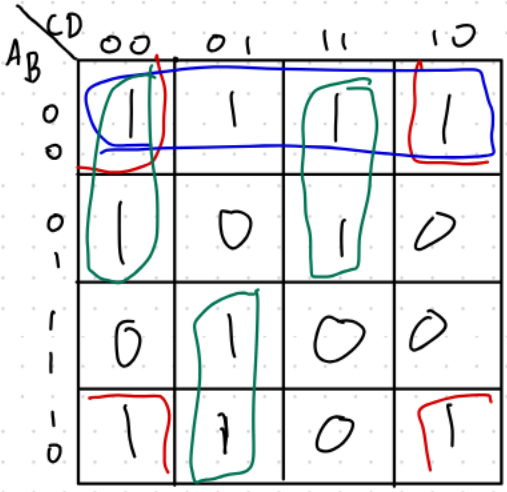

$F = \bar{A}\bar{B}\bar{D} + B\bar{C}D + A\bar{C} + \bar{B}CD + BC\bar{D}$

Bit 2:



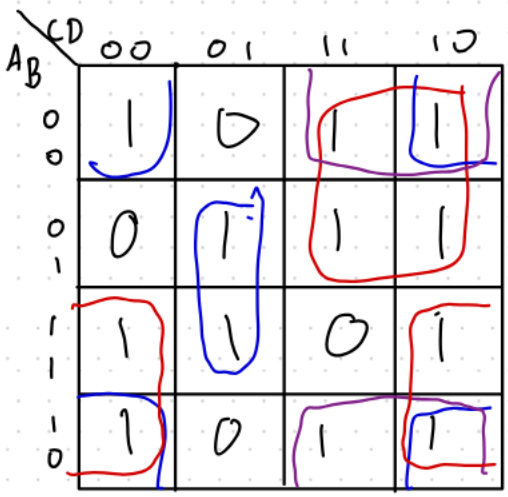

$F = \bar{C} + D + B$

Bit 1:




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

Bit 0:




$F = \bar{B}\bar{D} + A\bar{D} + B\bar{C}D + \bar{B}C + \bar{A}C$