

Homework #1 ECE 461

Ladder Logic. Due Monday, August 28th

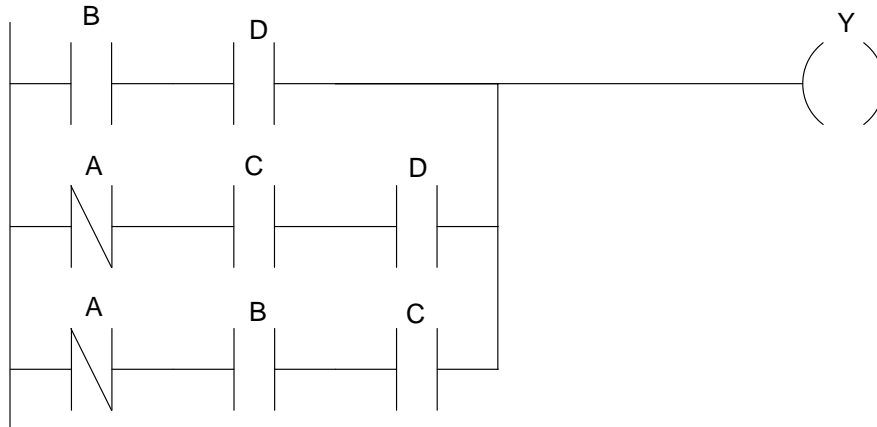
1) Write a Ladder Logic program to implement the following logic function: $Y = f(A,B,C,D)$

		CD			
		00	01	11	10
AB	00	0	0	1	0
	01	0	1	1	1
	11	0	1	1	0
	10	0	0	0	0

Circle the ones

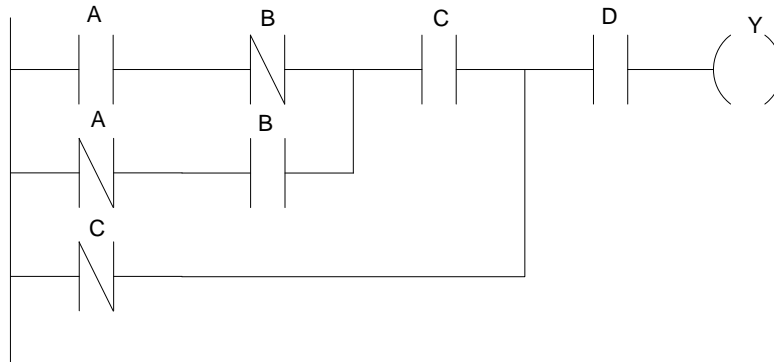
$$Y = BD + \bar{A}CD + \bar{A}BC$$

Parallel is OR, series is AND



There are other solutions.

2) Determine the logic function which corresponds to the following ladder logic program:



Series is AND, parallel is OR

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

In terms of a Karnough map

Y(A,B,C,D)		CD			
		00	01	11	10
AB	00	0	1	0	0
	01	0	1	1	0
	11	0	1	0	0
	10	0	1	1	0

3) Write a ladder logic program to meet the following requirements:

I/O:

- Input: Button 1,2,3,4
- Output: 1 (red) and 3 (green)

How they relate:

- When you press button #1 (the top button), it checks buttons 2, 3, and 4.
- If button 2 & 3 were pressed and 4 is not pressed, the green goes on (password correct)
- Otherwise, the red light goes on (password incorrect)

Using Karnough Maps (A = button 1, B = button 2, C = button 3, D = button 4)

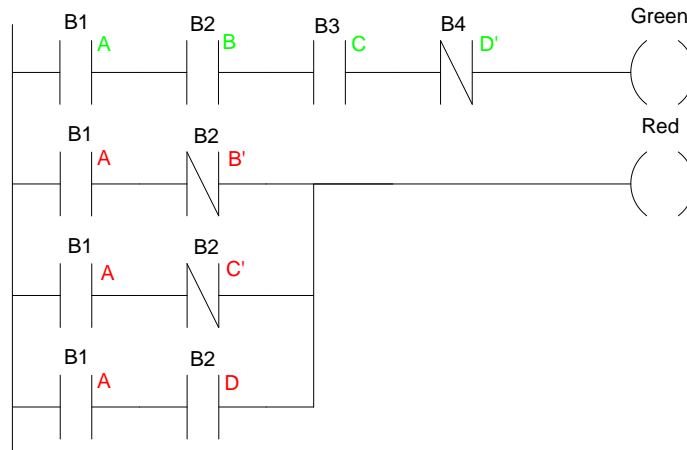
Green		CD			
		00	01	11	10
AB	00	0	0	0	0
	01	0	0	0	0
	11	0	0	0	1
	10	0	0	0	0

Red		CD			
		00	01	11	10
AB	00	0	0	0	0
	01	0	0	0	0
	11	1	1	1	0
	10	1	1	1	1

One solution is

$$Green = A \cdot (BC\bar{D})$$

$$Red = A\bar{B} + A\bar{C} + AD$$



A second solution is to use the output from the previous rung. If you press button #1 (test password) and it's not correct, it's incorrect

