

L9 practice problems

- The following English expression describes the way a logic circuit needs to operate in order to drive a seatbelt warning indicator in a car.

If the driver is present and the driver is not buckled up and the ignition switch is on, then turn on the warning light.

Using active high inputs driver_present, buckled_up and ignition_on, design a circuit to produce the active high output warning_light.

- Construct the truth table.

dp	bu	io	wl
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

- Write the Boolean expression for warning_light.

$$wr = dp \cdot bu \cdot io$$

(Question from Tocci, Widmer and Moss, 10th ed. Example 3-24)

dp*	bu*	io	wl*
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

- Repeat Question 1. But this time with active low inputs driver_present*, buckled_up*, ignition_on* and active low output warning_light*.

$$wr^* = dp^* + bu^* + io^*$$

- Repeat Question 1. But this time with active low inputs driver_present*, buckled_up*, active high input ignition_on and active high output warning_light*.

$$wl = dp^* \cdot bu^* \cdot io$$

dp*	bu*	io	wl
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

- A logic circuit has four inputs A, B, C*, D* and one output F.

* denotes active low signals.

The output F is only asserted when either A or C* is asserted (but not both), and either B or D* is negated (but not both).

Construct the truth table for F and obtain its canonical sum-of-minterm expression.

$$F = A'B'C^*D^* + AB'C^*D + A'BC^*D + ABC^*D^*$$

ABC*D*F
00001
00010
00100
00110
01000
01011
01100
01110
10000
10010
10101
10110
11000
11010
11100
11111