Digital circuits laboratory class	**Year 2024, exercise 2**
Author: Jakub Turkowski	Title of the exercise: Combinational logic circuits with static hazard
Laboratory group number: 2	Week day: Tuesday Realization date: 26.03.2024 Hours of the lab: 15:15-16:55

The function I chose for this exercise is the following: f(abcd)=a'c'd'+a'bd+bcd

It's Karnough Map looks like this:

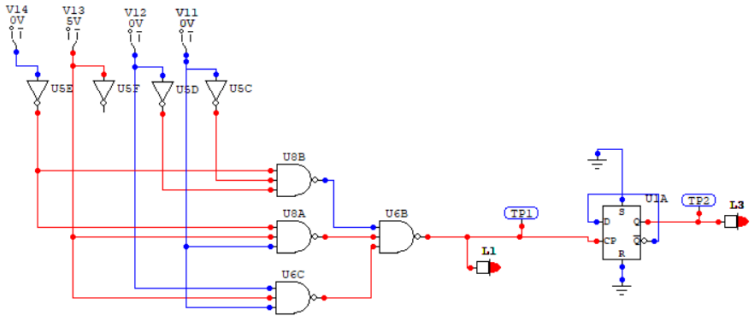
AB CD	0 0	0 1	1 1	1 0
0 0	1	1	0	0
0 1	0	1	0	0
1 1	0	1	1	0
1 0	0	0	0	0

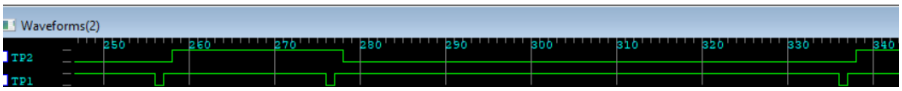
There is a risk of static hazard for the function if we implement it in the form I represented. There would be two groups which would touch but not overlap, namely a'c'd' and a'bd. More specifically, static hazard would occur when changing D from 1 to 0, while B is 1 and A and C are 0.

As the output of the circuit is used as a clock, the output of LED should change only with the change of the circuit. However when the circuit doesn't include all the right groups, the output will change for a second before getting back into the flip flop, which causes the hazard to occur. Disadvantages of the hazard detection circuit instead of an oscilloscope include:

1. Oscilloscopes are generally used for analog signals.
2. Unlike flip flops, oscilloscopes provide a visual display of signals in real-time
3. D flip-flops require a clock, limiting their flexibility compared to oscilloscopes, which can capture signals continuously or triggered based on various conditions

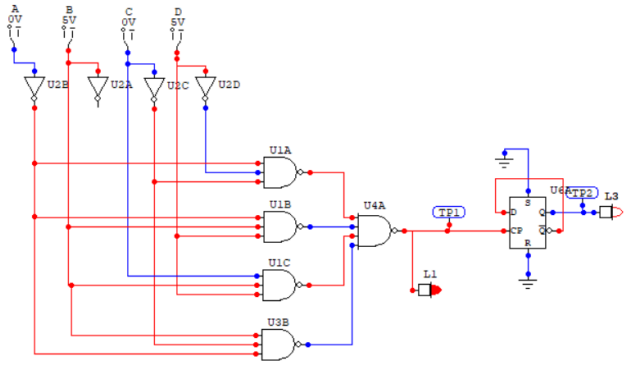
a)

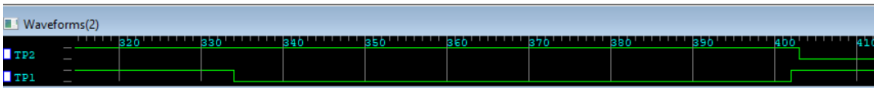




AB CD	00	01	11	10
00	1	1	0	0
01	0	1	0	0
11	0	1	1	0
10	0	0	0	0

b)





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