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| **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 | 0 0 | 0 1 | 1 1 | 1 0 |
| CD |
| 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)

Obraz zawierający tekst, diagram, zrzut ekranu, linia

Opis wygenerowany automatycznie

Obraz zawierający zrzut ekranu, linia

Opis wygenerowany automatycznie

b)

Obraz zawierający tekst, diagram, Plan, linia

Opis wygenerowany automatycznie

Obraz zawierający zrzut ekranu, tekst, linia, numer

Opis wygenerowany automatycznie