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HARDWARE

ZAD. 1. Prove that:

$$(x\bar{y} \vee y)(x \vee \bar{y}) = x$$

ZAD. 2. Simplify following expressions:

a) $a \vee (\bar{a}b)$
b) **(*)** $ab \vee \bar{a}b\bar{c} \vee bc$
c) **(*)** $(a \vee \bar{b} \vee ab)(a \vee \bar{b})a\bar{b}$

ZAD. 3. Present following function using logic symbols:

$$(\overline{a \vee \bar{b}})(\bar{a} \vee \bar{b})$$

ZAD. 4. Based on the truth table for logic function OR design the Karnaugh map and the optimal function that is represented by it. Do it for ones and zeros.

ZAD. 5. Based on the following Karnaugh map design the optimal function that is represented by it (for ones).

a)

ab\cd	00	01	11	10
00	1	0	0	1
01	0	1	1	0
11	0	1	0	0
10	0	0	1	0

b) **(*)**

ab\cd	00	01	11	10
00	1	1	0	0
01	0	1	0	1
11	0	0	0	1
10	1	1	0	0

ZAD. 6. Design the circuit that will output 1 for even numbers. It should work for numbers from 0 to 7. Then modify it in such way so that it consists only of NAND **(*)** gates and NOR **(*)** gates (in total you should prepare three solutions). We assume that the 0 is odd.

ZAD. 7.(*) Design the adder of two two-bit numbers.

ZAD. 8.(*) Design the circuit that for four-bit number will output 1 if and only if its value is in range <7;10>.

(*) asterisk marks problems which are not solved during exercise classes and should be solved as a homework

ZAD. 9.(*) Design RS flip-flop using only two logic gates and write its truth table. Remember that the state for inputs equal to 00 is forbidden.

ZAD. 10. Convert JK flip-flop to T and D**(*)** flip-flop.

ZAD. 11. Design a ripple counter using D flip-flop.

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