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Exercise Sheet 2

Computer Engineering and Communication Networks

Handout: 26.09.2019
Discussion: 03.10.2019

1. Arithmetics

1.1. Sum up the binary numbers 10011_2 and 1011_2 .
1.2. Subtract 1010_2 from 1111_2 .
1.3. Convert the number 001111_2 to its two's complement representation and then subtract it from 011010_2.
1.4. Multiply the two binary numbers 1011_2 and 1001_2.
1.5. Multiply the two binary numbers 00001111_2 and 10000000_2.
1.6. Divide the binary number 101101_2 by 1001_2.
1.7. Divide the binary number 1111_2 by 0101_2

1.8. Tick the correct answer to the questions below. Only one answer is correct.

Question 1: Which of the following binary numbers equals the two's complement representation (6 Bit length) of the decimal number -20_{10}?
☐ 101011_2
☐ 101100_2
☐ 101010_2
☐ none of the above

Question 2: In which number representation only one representation for the number zero exists?
☐ Representation absolute value plus algebraic sign
☐ One's complement
☐ Offset-Dual representation

Question 3: Which of the following binary numbers equals the offset-dual representation (5 Bit length) of the decimal number 5_{10}?
☐ 10101_2
☐ 00101_2
☐ 10100_2
☐ none of the above

2. Combinatorial Circuits

2.1. Derive from the Boolean Algebra the following absorption laws using the axioms shown on slides M3-7/8. State in each step, which one was used.

2.1.1. $(a \wedge b) \vee (a \wedge \bar{b}) = a$

2.1.2. $(a \vee \bar{b}) \wedge b = a \wedge b$

2.2. Find the **Disjunctive Normal Form** (**DNF**) and **Conjunctive Normal Form** (**CNF**) of the truth table below:

A	b	c	Result	Minterm	Maxterm
0	0	0	**0**		
0	0	1	**1**		
0	1	0	**1**		
0	1	1	**1**		
1	0	0	**0**		
1	0	1	**0**		
1	1	0	**1**		
1	1	1	**0**		

DNF:
CNF:

2.3. Convert the given Boolean equation $y = a \wedge \bar{c} \vee b \wedge c$ into a NAND system.

2.4. Prove by using a truth table if the Boolean expression $(((a \rightarrow b) \wedge (b \rightarrow c)) \rightarrow (a \rightarrow c))$ represents a tautology, a contradiction, or nothing of all.

Truth Table for (A → B):

A	B	A → B
0	0	1
0	1	1
1	0	0
1	1	1