Final Exam S1
Computer Architecture

Duration: 1 hr. 30 min.

Last name: .... First name: .... Group: ....

Write answers only on the worksheet.
Do not show any calculation unless you are explicitly asked.
Do not use a pencil or red ink.

Exercise 1 (2 points)

Convert the following numbers from the source form into the destination form. Do not write down the result in a fraction or a power form (e.g. write down 0.25 and not ¼ or 2^{-2}).

Number to Convert	Source Form	Destination Form	Result
101011011.01011	Binary	Decimal	
B09.58	Hexadecimal	Decimal	
999	Decimal	Base 9	
3245.43	Base 8	Hexadécimale	

Exercise 2 (5 points)

Perform the following 8-bit binary operations (the two operands and the result are 8 bits wide). Then, convert the result into unsigned and signed decimal values. If an overflow occurs, write down 'ERROR' instead of the decimal value.

Operation	Binary Result	Decimal Value	
		Unsigned	**Signed**
11000111 + 10000101			
01010110 - 11110101			
00101110 - 10101100			
11010001 + 00001010			
01101011 - 01001000			

Exercise 3 (5 points)

According to the truth table, complete the the Karnaugh maps below (__draw also the circles__). Then, give the most simplified expression for *W, X, Y* and *Z* (do not simplify by using the EXCLUSIVE-OR operator). **No points will be given to an expression if its Karnaugh map is wrong.** Note that when $DCBA > 1001_2$, then *W, X, Y* and *Z* are undefined.

D	C	B	A	W	X	Y	Z
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	0
0	0	1	1	0	1	0	0
0	1	0	0	0	1	0	1
0	1	0	1	1	0	0	0
0	1	1	0	1	0	0	1
0	1	1	1	1	0	1	0
1	0	0	0	1	1	0	0
1	0	0	1	1	1	0	1

BA

W	00	01	11	10
00				
01				
11				
10				

DC

W =

BA

X	00	01	11	10
00				
01				
11				
10				

DC

X =

BA

Y	00	01	11	10
00				
01				
11				
10				

DC

Y =

BA

Z	00	01	11	10
00				
01				
11				
10				

DC
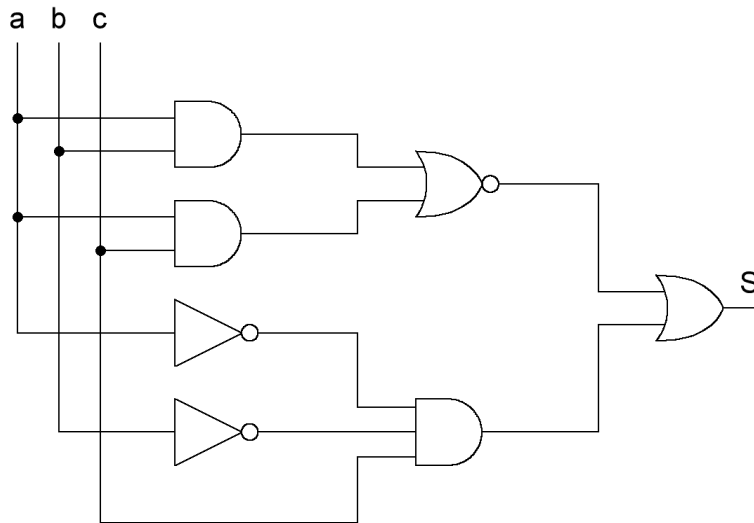
Z =

Finally, simplify *Y* by using the EXCLUSIVE-OR operator:

Y =

Exercise 4 (3 points)

We want to simplify the following circuit diagram:

1. Without any simplifications, give the *S* output in terms of *a, b* and *c*.

  S =

2. Give the most simplified expression of *S*.

  S =

3. From the most simplified expression, draw a new circuit diagram by using three NOT gates, one two-input AND gate and one two-input OR gate.

Exercise 5 (5 points)

Let us consider the three following expressions:

$S1 = \overline{(A + \overline{B} + C).(A + \overline{C}).(\overline{A} + \overline{B})}$

$S2 = A.B.C + A.\overline{B}.\overline{C} + \overline{A}.B.\overline{C} + A.\overline{B}.C$

$S3 = A \oplus (B.\overline{C})$

1. Give the most simplified expression of *S1*. **The result must be given as a sum of products (without parentheses)**.

S1 =

2. Write down the minterm canonical form of *S1*.

S1 =

3. Write down the maxterm canonical form of *S2*.

S2 =

4. Is it true that S2 = S3? (Answer "Yes" or "No")

5. Determine the *m* and *n* integers so that the following identity is true: $2^m - 2^n = 4064$

m =   **n =**

Feel free to use the blank space below if you need to: