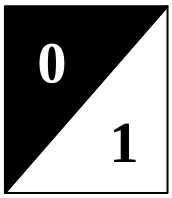
ISTANBUL TECHNICAL UNIVERSITY



COMPUTER ENGINEERING

DIGITAL CIRCUITS LABORATORY EXPERIMENT REPORT

EXPERIMENT NO: 3

EXPERIMENT NAME: BINARY NUMBERS AND ARITHMETIC OPERATIONS

EXPERIMENT DATE : 15.03.2013

GROUP NO: 6

STUDENTS WHO DID THE EXPERIMENT:

Student no	Name	Surname
040100113	MUSTAFA	UÇAR
040100117	TUĞRUL	YATAĞAN
040100124	EMRE	GÖKREM

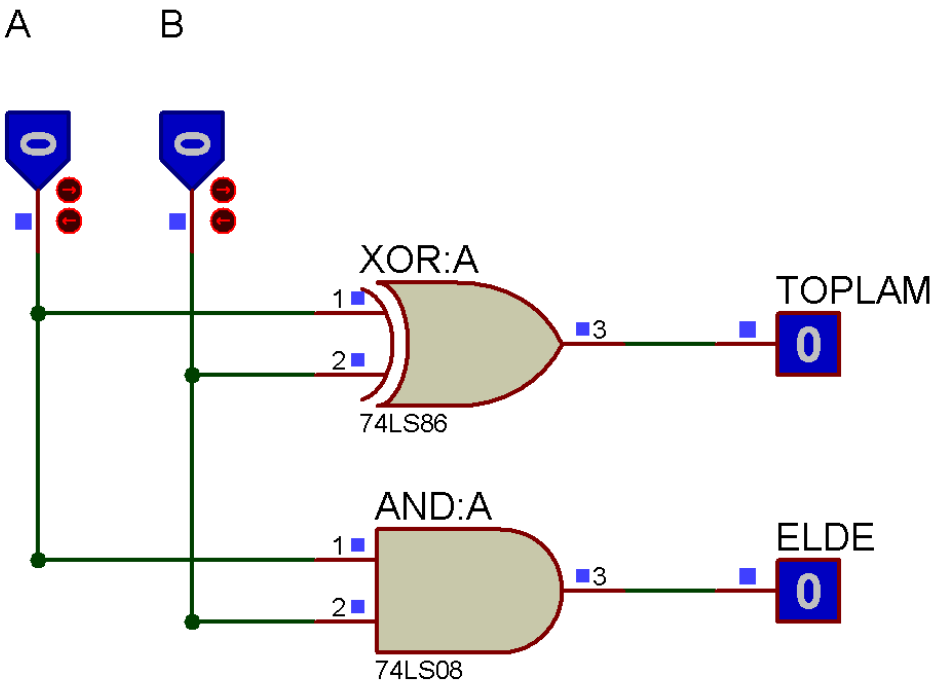
ASSISTANT NAME WHO ASSISTED THE EXPERIMENT: CUMALI TÜRKMENOĞLU

Aim: Goal of this experiment is doing addition and subtraction operations on signed and unsigned numbers on digital circuits. Also some operations are tried on an ALU.

Experiment #1

Truth table of a half adder is shown blow. All values are obtained from experiment.

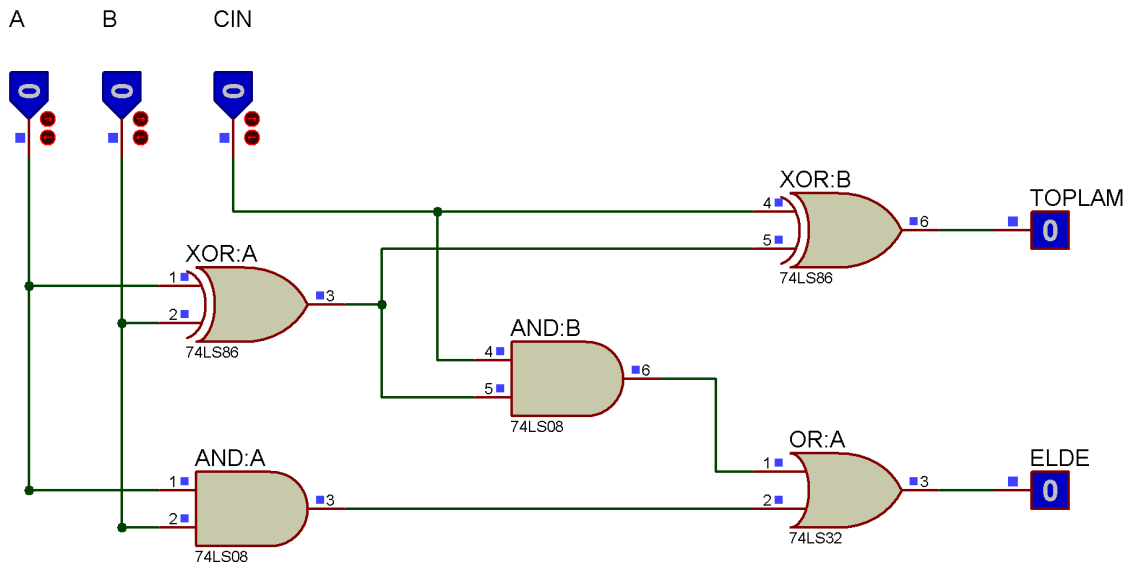
A	B	C	S
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0



Experiment #2

Truth table of a full adder is shown blow. All values are obtained from experiment.

A	B	C_i	C_O	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

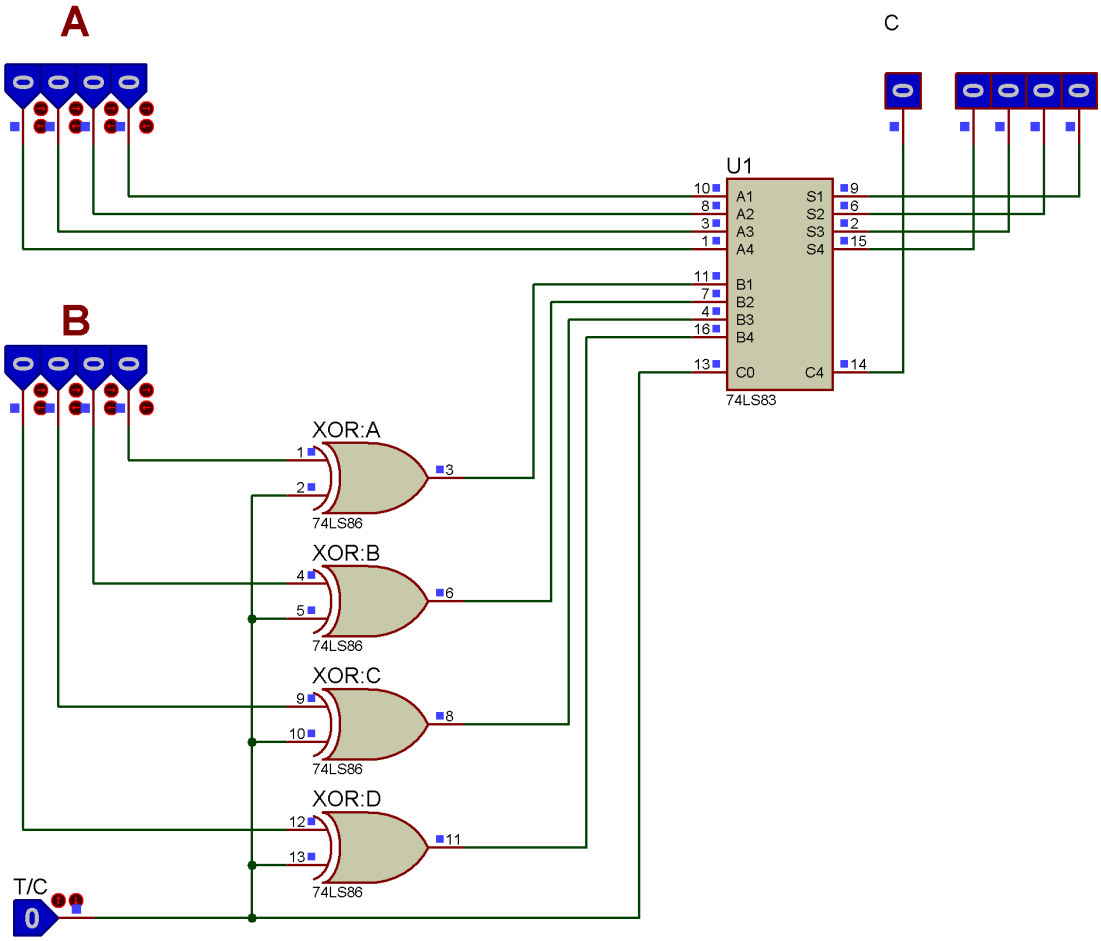


Experiment #3

Expected results on addition and subtraction operations in 4-bit circuit are shown in table blow. All results obtained from experiment.

ADDITION				
UNSIGNED A	**UNSIGNED B**	**CARRY**	**BINARY RESULT**	**DECIMAL RESULT**
0101	0111	0	1100	12
1101	1001	1	0110	22
1111	1111	1	1110	30
0110	1101	1	0011	19
SIGNED A	**SIGNED B**	**OVERFLOW**	**BINARY RESULT**	**DECIMAL RESULT**
0101	0111	1	1100	12
1101	1001	1	0110	6
1111	1111	0	1110	2
0110	1101	0	0001	1

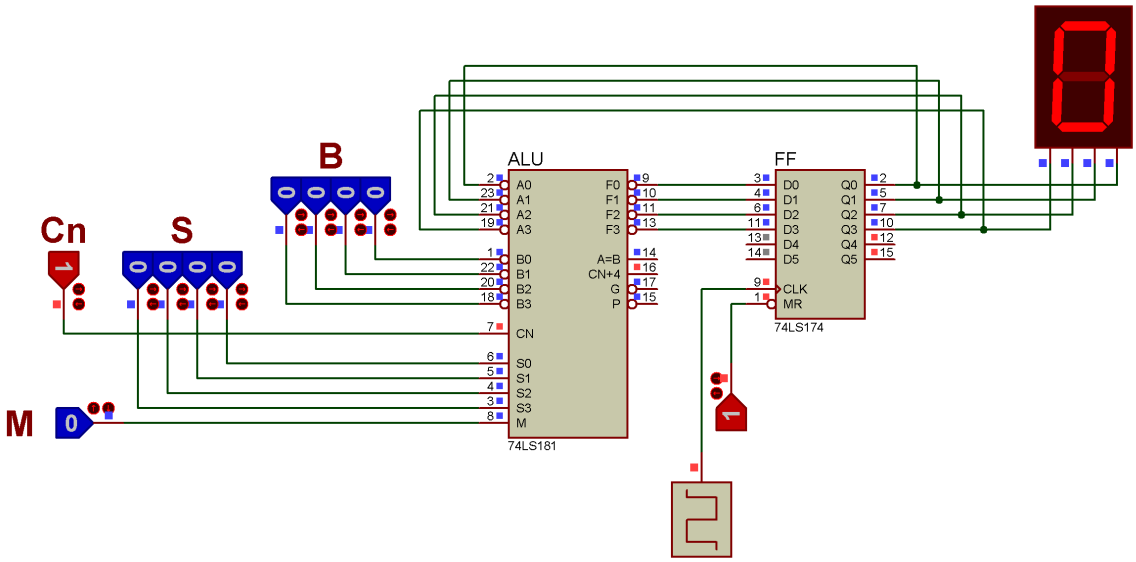
SUBTRACTION				
UNSIGNED A	**UNSIGNED B**	**BORROW**	**BINARY RESULT**	**DECIMAL RESULT**
0101	0111	1	1110	14
1101	1001	0	0100	4
1111	1111	0	0000	0
0110	1101	1	1001	9
SIGNED A	**SIGNED B**	**OVEFLOW**	**BINARY RESULT**	**DECIMAL RESULT**
0101	0111	0	1110	-2
1101	1001	1	0100	4
1111	1111	0	0000	0
0110	1101	0	1001	-7


A
B
C
U1
A1
A2
A3
A4
B1
B2
B3
B4
C0
S1
S2
S3
S4
C4
74LS83
XOR:A
XOR:B
XOR:C
XOR:D
74LS86
T/C
0

Experiment #4

DM74LS1814-Bit Arithmetic Logic Unit Function Table

Mode Select Inputs				Active HIGH Operands & F_n Outputs	
				Logic	Arithmetic (Note 2)
S3	S2	S1	S0	(M = H)	(M = L) (C_n = H)
L	L	L	L	$\overline{A}$	A
L	L	L	H	$\overline{A} + \overline{B}$	A + B
L	L	H	L	$\overline{A}$ B	A + $\overline{B}$
L	L	H	H	Logic 0	minus 1
L	H	L	L	$\overline{AB}$	A plus A$\overline{B}$
L	H	L	H	$\overline{B}$	(A + B) plus A$\overline{B}$
L	H	H	L	A ⊕ B	A minus B minus 1
L	H	H	H	A$\overline{B}$	AB minus 1
H	L	L	L	$\overline{A} + B$	A plus AB
H	L	L	H	$\overline{A} \oplus \overline{B}$	A plus B
H	L	H	L	B	(A + $\overline{B}$) plus AB
H	L	H	H	AB	AB minus 1
H	H	L	L	Logic 1	A plus A (Note 1)
H	H	L	H	A + $\overline{B}$	(A + B) plus A
H	H	H	L	A + B	(A + $\overline{B}$) plus A
H	H	H	H	A	A minus 1



Answer of Question #3