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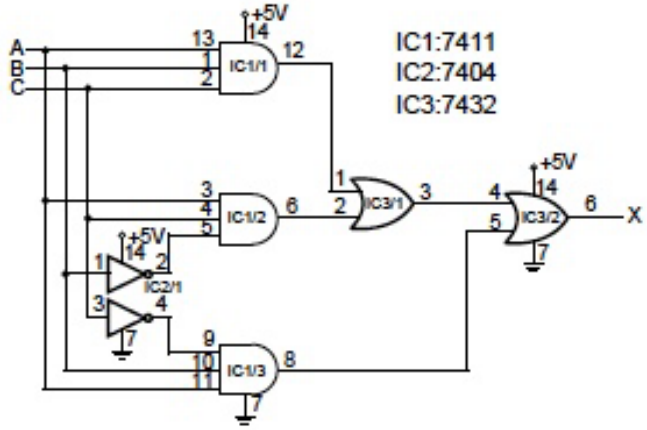
Laboratory 3

Boolean Algebra

1. Given a circuit as shown in the following figure:



1.1 Connect the circuit. Use logic switch to supply inputs as specified. The output signals should be connected to the logic monitor. Record the results in the following truth table.

A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

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1.2 Find and simplify the Boolean expression for the given circuit

$$ABC + AB\bar{C} + A\bar{B}C$$
$$= AB(C+\bar{C}) + A\bar{B}C$$
$$= AB + A\bar{B}C$$
$$= A(B+\bar{B}C)$$
$$= A(B+C)$$

1.3 Connect the circuit according to the simplified Boolean expression found in 1.1. Redo the experiment as in 1.1.

A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

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1.4 What can be concluded from the experiment?

By simplifying the boolean expression, we can make the circuit smaller and easier to produce.

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2. Assignments

2.1 Given the following truth table

A	B	C	X
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

a) Find a Boolean expression in sum of product (SOP) form. Connect the circuit according to the obtained SOP form and show the results are consistent with the given truth table.

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b) Find a Boolean expression in product of sum (POS) form. Connect the circuit according to the obtained POS form and show the results are consistent with the given truth table.

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2.2 Design a digital circuit that receives inputs as a BCD code of decimal digits (0-9). The circuit shall provide the following results and display in binary format. Use logic monitor D0 – D4 to display the results, where D0 is a least significant bit (LSB).

a) The circuit shall double the input value

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b) The circuit shall triple the input value

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2.3 Given the Boolean expression as X = A'B' + B'C' + CD + A'D' + B'D:

a) Construct a truth table for the given Boolean expression:

A	B	C	D	X
0	0	0	0	
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

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b) Simplify the given Boolean expression and connect the corresponding circuit to show that the results are consistent with the truth table found in a)

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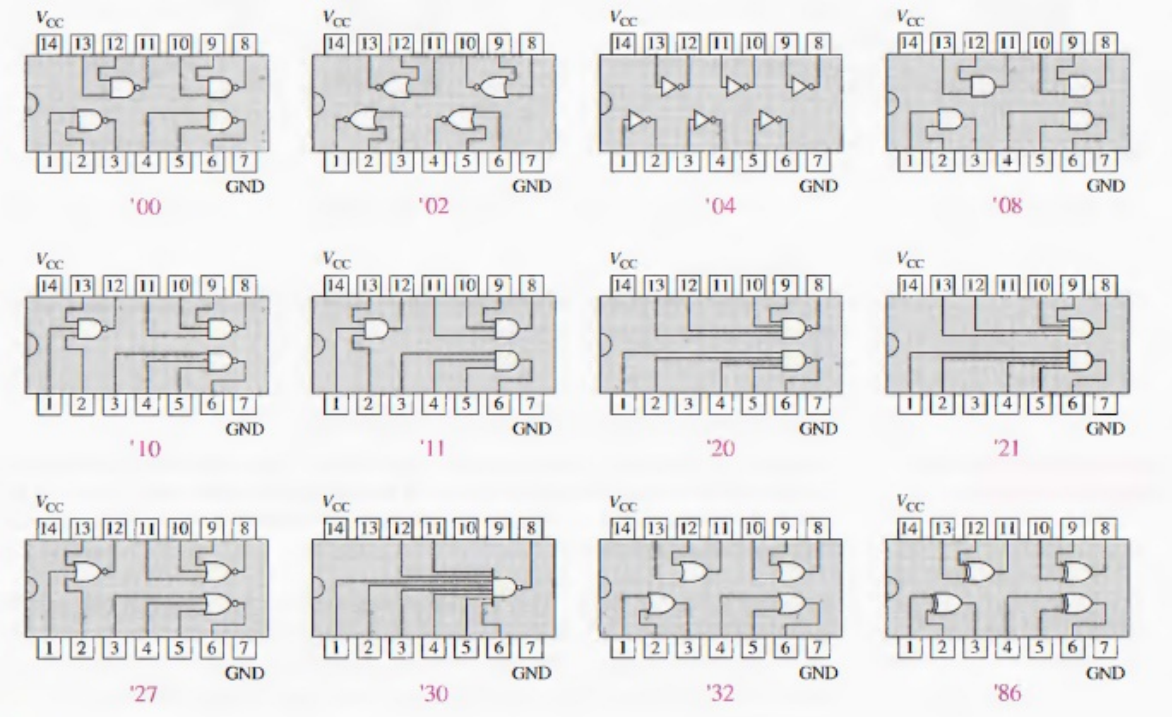
Logic Diagram of frequently used gates