ANKARA UNIVERSITY

DEPARTMENT
OF
COMPUTER ENGINEERING

COM/BLM 275
DIGITAL LOGIC
DESIGN

LABORATORY
MANUAL

Experiment #3

Half Adders and Full Adders

Objectives:

1. Design and build half adder and full adder.

Apparatus:

1. 7408 Quadruple 2-input AND Gate
2. 7486 Quadruple 2-input Exclusive-OR Gate
3. 7432 Quadruple 2-input OR Gate
4. 4 LEDs
5. 4 Resistances (0,3 kΩ)

Theory:

A half adder is a type of adder, an electronic circuit that performs the addition of numbers. The half adder is able to add two single binary digits and provide the output plus a carry value. It has two inputs, called A and B, and two outputs S (sum) and C (carry). The common representation uses a XOR logic gate and an AND logic gate.

A full adder is able to add three single binary digits and provide the output plus a carry value. One Full Adder consists of two Half Adders and one OR gate. Therefore, a Half Adder will be designed first and then a Full Adder will be designed.

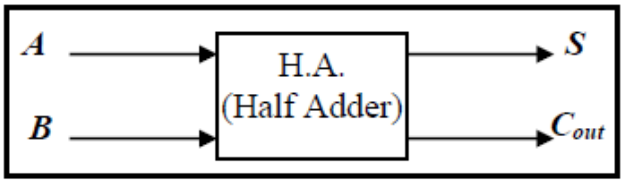
PART I: Half Adder

1. Mathematical Model

$$S=\overline{A}\bullet B+A\bullet\overline{B}=A\oplus B$$

$$C_{out}=A\bullet B$$

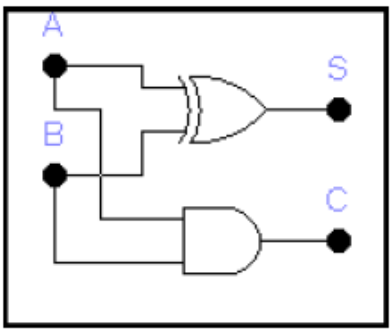
2. Functional Schema



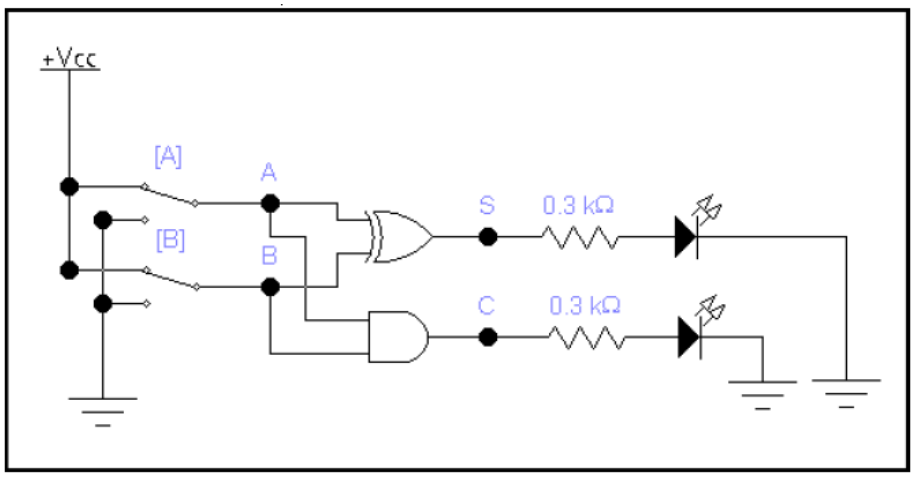
3. Truth Table

INPUTS		OUTPUTS	
A	B	S	C
L	L	L	L
L	H	H	L
H	L	H	L
H	H	L	H

4. Circuit Diagram



5. Application



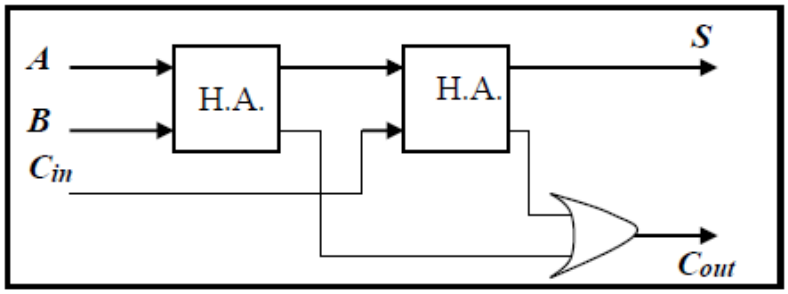
PART II: Full Adder

1. **Mathematical Model**

$$S=(A \oplus B) \oplus C_{in}$$

$$C_{out}=A \bullet B+C_{in} \bullet (A \oplus B)$$

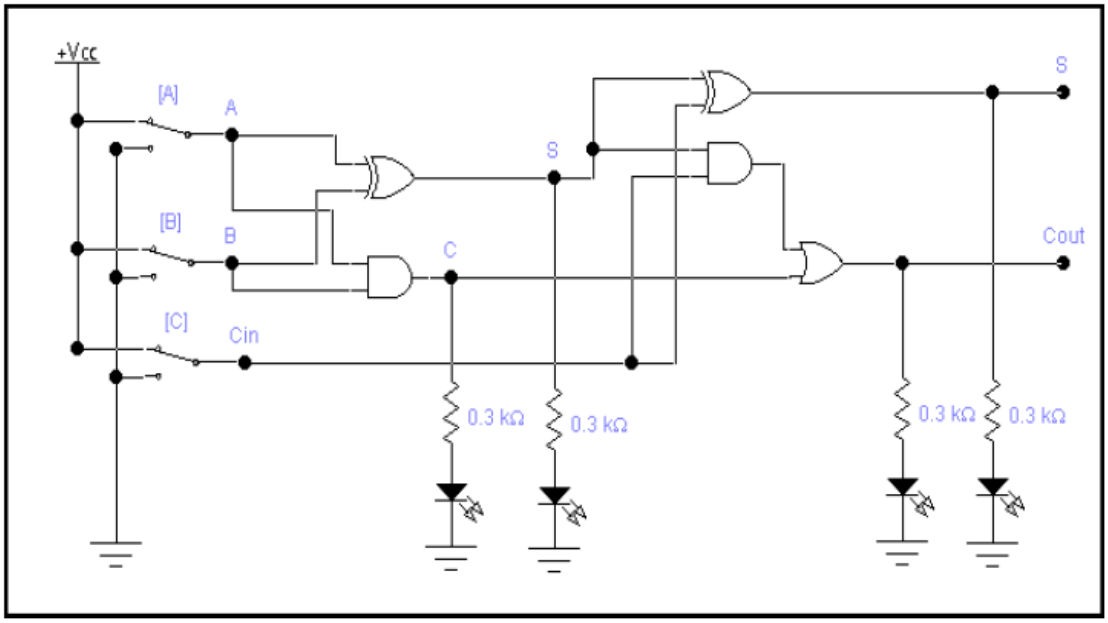
2. **Functional Schema**



3. **Truth Table**

INPUTS			OUTPUTS	
A	B	C_{in}	S	C_{out}
L	L	L	L	L
L	L	H	H	L
L	H	L	H	L
L	H	H	L	H
H	L	L	H	L
H	L	H	L	H
H	H	L	L	H
H	H	H	H	H

4. Application



a) Write down a truth table for the Half Adder
b) Construct the circuit of the Half Adder
c) Write down a truth table for the Full Adder
d) Construct the circuit of the Full Adder