DIGITAL LOGIC DESIGN

Lab Assignment
Sir. Muhammad Amin

HASSAN MEHDI

15453
Csc-201

Q1: Design and verify the logic circuit for the following:

(A). Half adder using logic gates

HALF ADDER:

Half Adder: A half adder is a logical circuit that performs an addition operation on two binary digits. The half adder produces a sum and a carry value which are both binary digits.

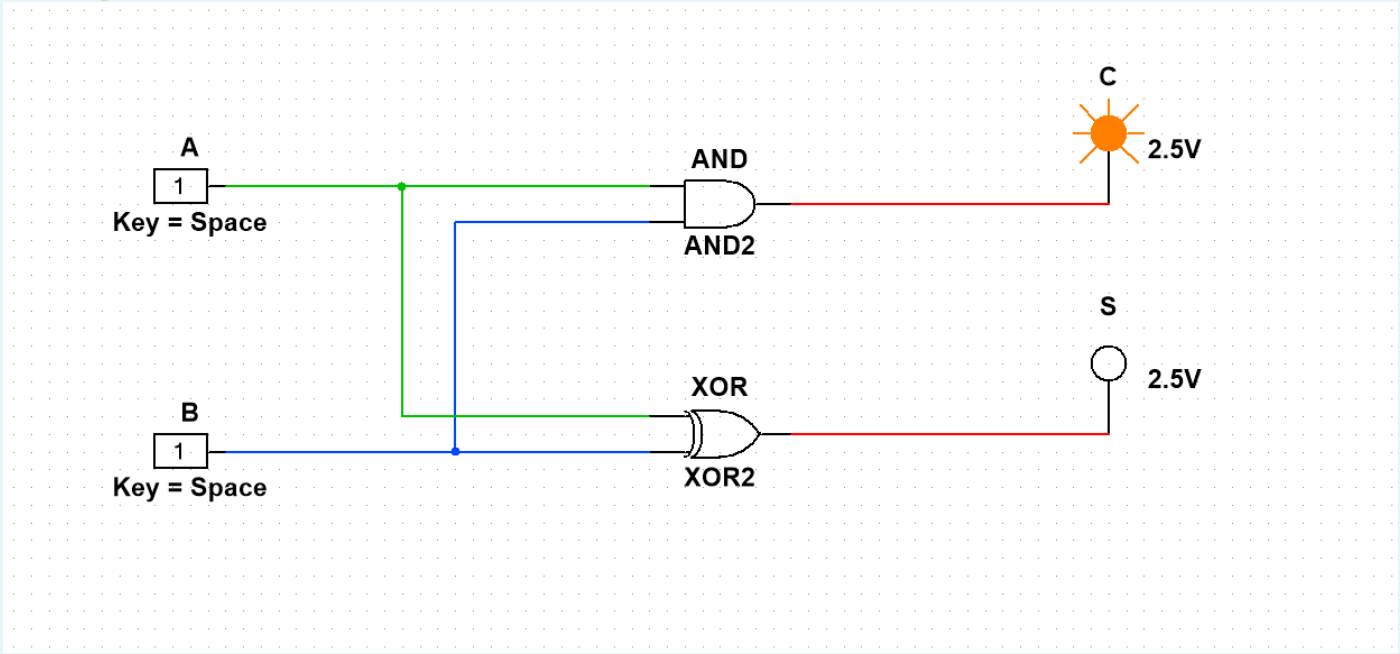
Aim:

Design and verify the logic circuit of Half adder using logic gates.

Objectives:

- **To understand the principle of binary addition.**
- To understand half adder concept.
- **Use truth table and Boolean Algebra theorems in simplifying a circuit design.**
- **To implement half adder circuit using logic gates**

Logic Circuit:



Observation Table:

Inputs		Outputs	
A	B	Sum (S)	Carry (C)
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

Conclusion:

•To add two bits we require one XOR gate(IC 7486) to generate Sum andone AND (IC 7408) to generate carry.
•To add three bits we require two half adders.

(B). HALF-SUBTRACTOR USING LOGIC GATES

HALF SUBTRACTOR:

The half-subtractor is a combinational circuit which is used to per -form subtraction of two bits. It has two inputs, X (minuend) and Y (subtrahend) and two outputs D (difference) and B (borrow) .

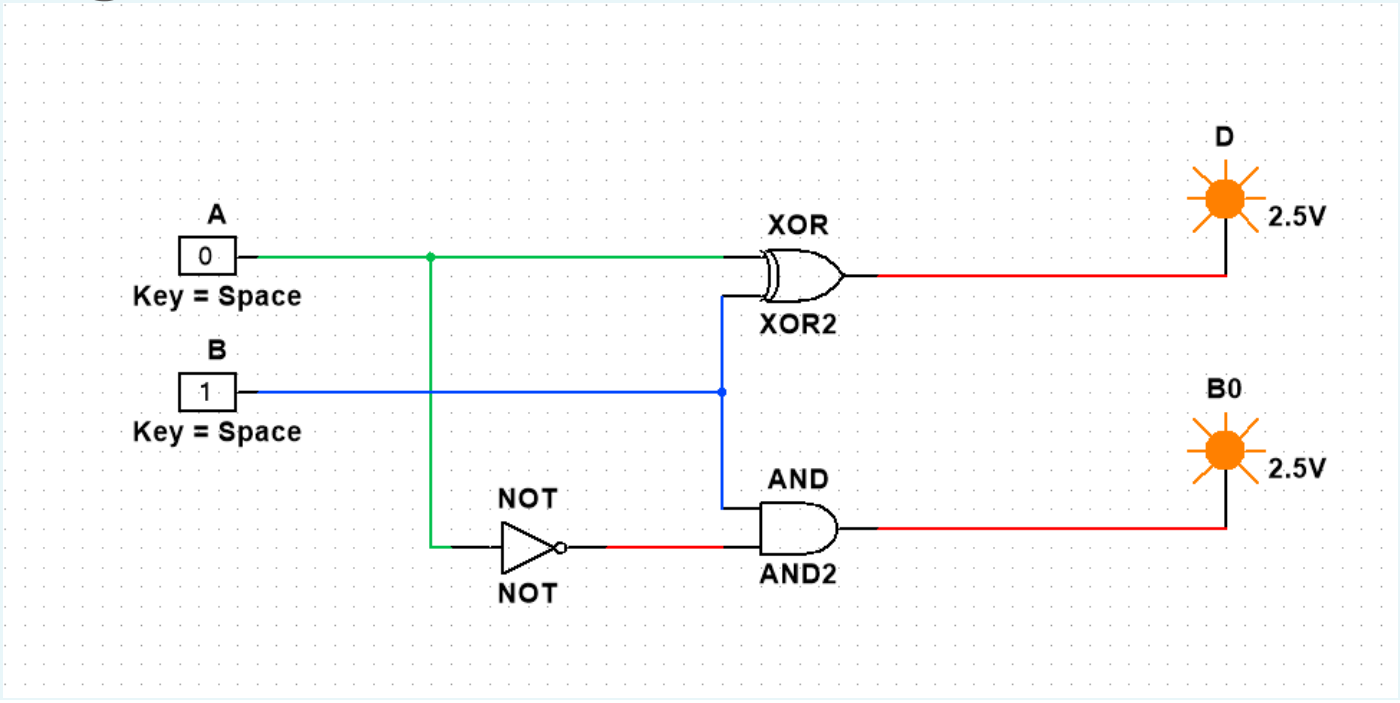
Aim:

Design and verify the logic circuit of Half -subtractor using logic gate.

Objectives:

- To understand the principle of binary subtraction.
- To understand half -subtractor concept.
- Use truth table and Boolean Algebra theorems in simplifying a circuit design.
- To implement half -subtractor circuit using logic gates

Logic Circuit:



Observation Table:

Inputs		Outputs	
A	B	D	B_o
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

Conclusion:

- To add two bits, we require one XOR gate (IC 7486) to generate Difference and one AND (IC 7408) and NOT Gate (IC 7432) to generate Borrow.
- To add three bits, we require two half subtractor.

(C). J K FLIP FLOP

J-K Flip Flop:

A flip-flop is a circuit that has two stable states and can be used to store state information. The circuit can be made to change state by signals applied to one or more control inputs and will have one or two outputs

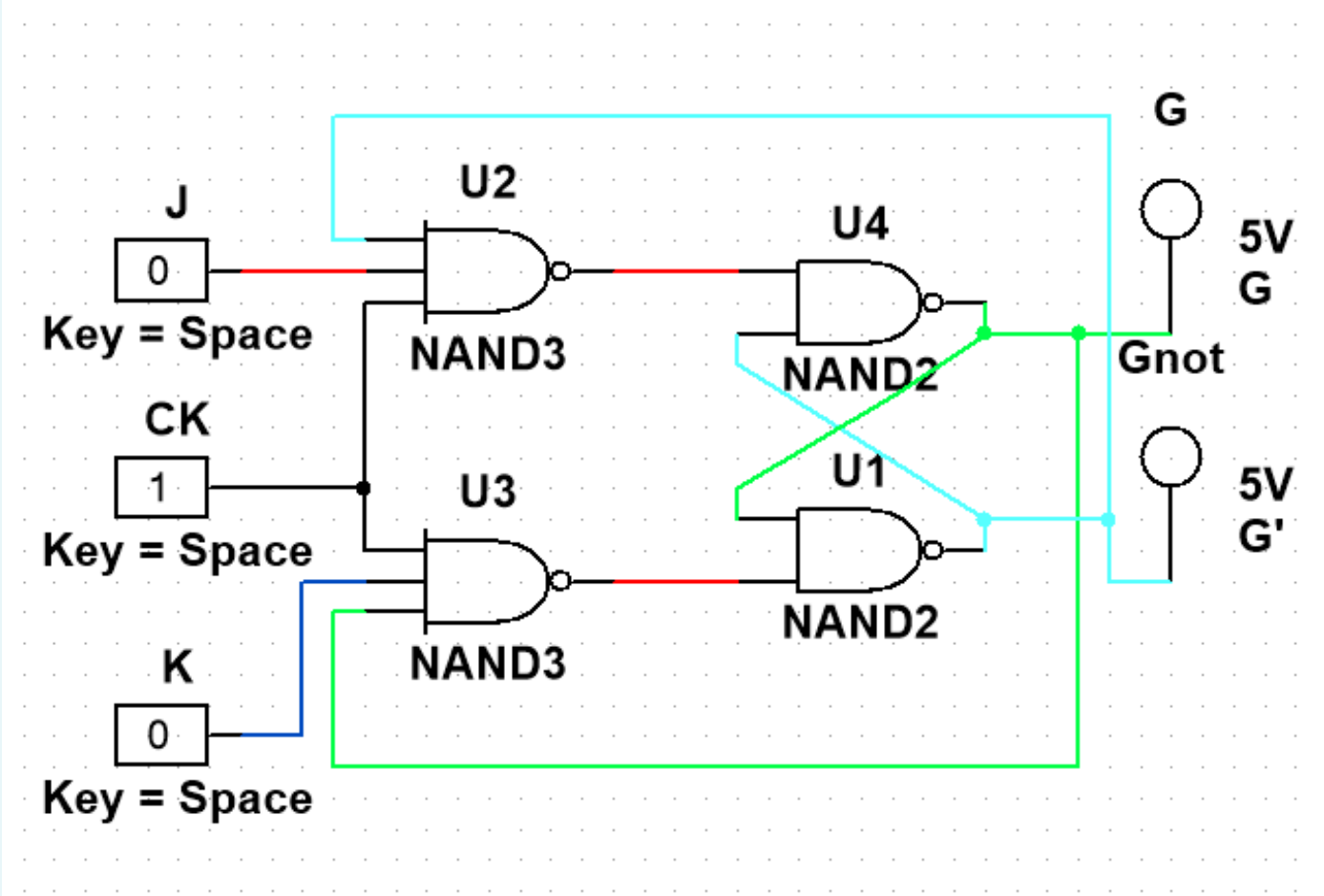
Aim:

To Design and verify the truth table of J K Flip flop using IC 7473.

Objectives:

- To understand the principle of operation of sequential circuit
- To differentiate between combinational circuit and sequential circuit.
- To get familiar with basic Flip flops
- Determine the logic operation of JK flip flops.
- Connect and observe the state transition of JK as connected to the clock generator circuit.

Logic Circuit:



Observation Table:

CK	J	K	Q	$\overline{Q}$
1	0	0	-	-
1	0	1	0	1
1	1	0	1	0
1	1	1	0	1

Conclusion:

The function table of JK flip flop using IC 7473 has been verified.

(D) SERIAL IN-SERIAL OUT SHIFT REGISTER

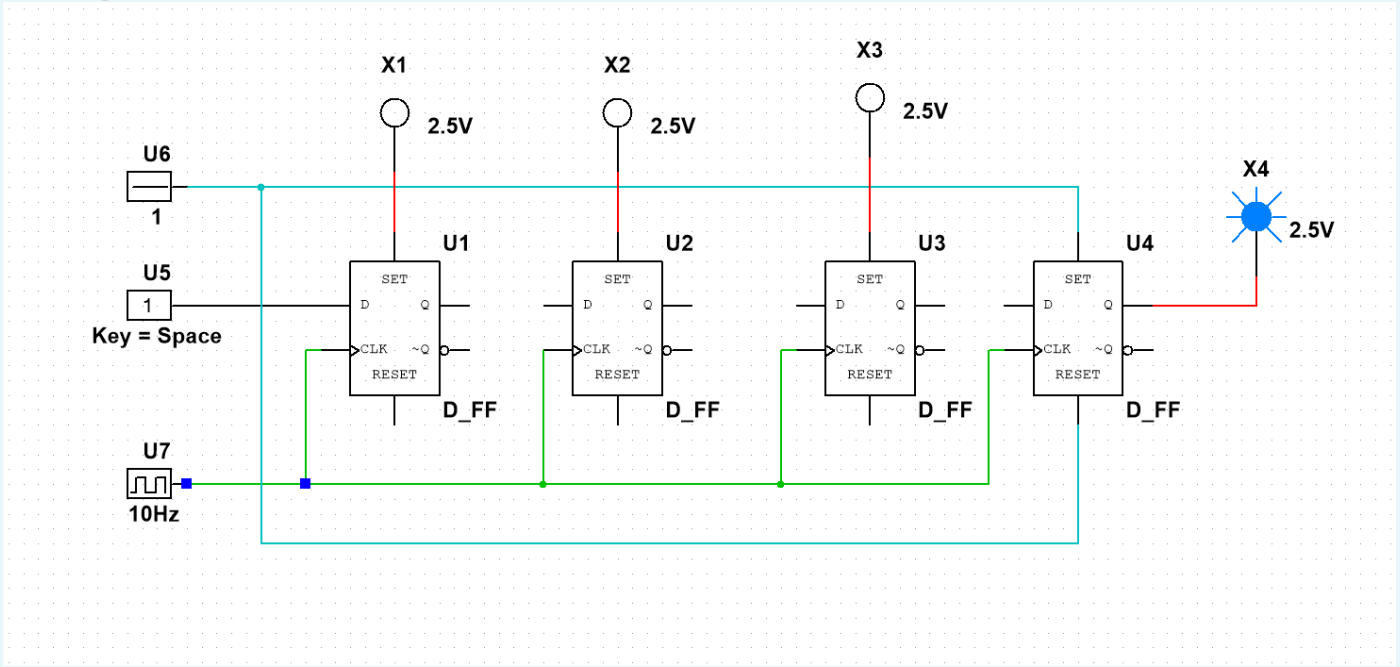
Aim:

To Design and verify the function of Truth Table.

Objectives:

To investigate the operation of the shift registers.

Logic Circuit:



Observation Table:

CLK	Q0	Q1	Q2	Q3
Initial	0	0	0	0
1	0	0	0	0
2	1	0	0	0
3	0	1	0	0
4	1	0	1	0

Conclusion:

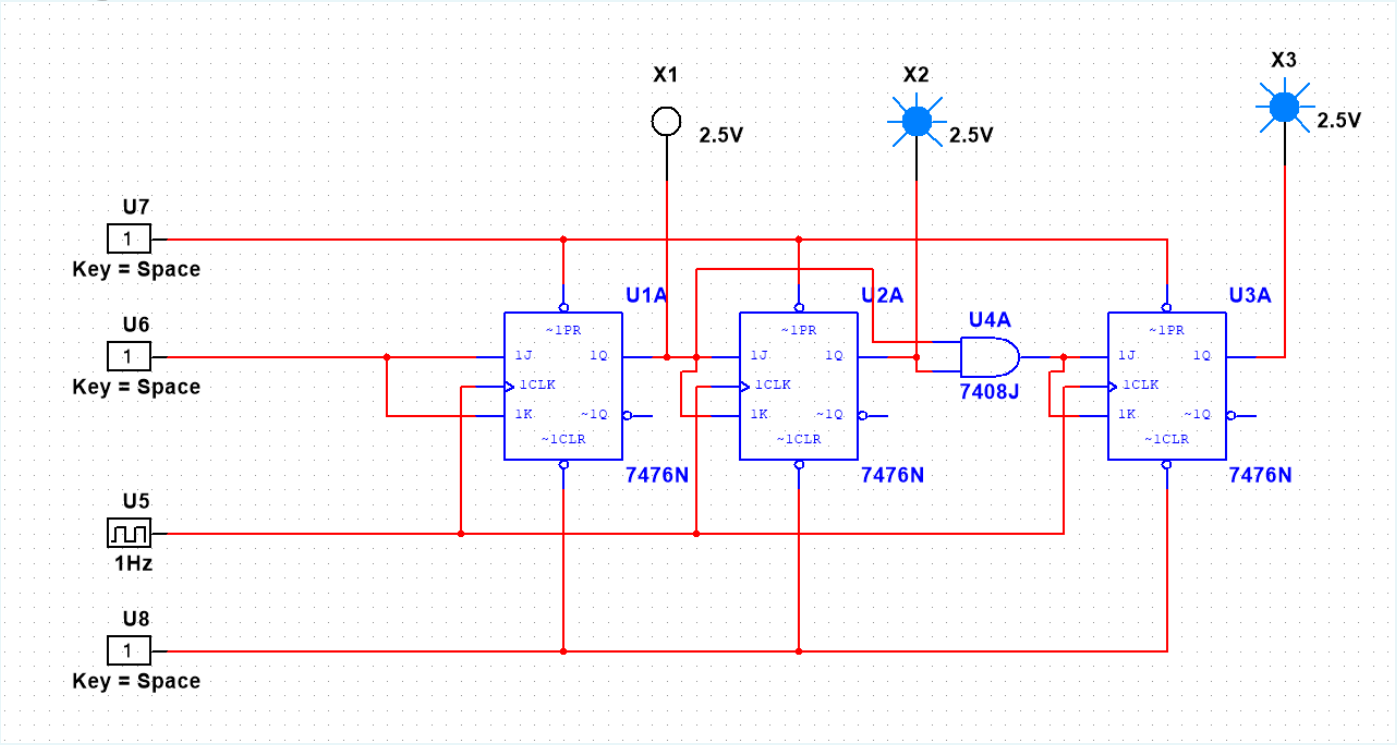
various types of shift register have been implemented and verified using ICs.

(E) Synchronous BCD Counter

Aim:

Realization of 3-bit synchronous counter design.

Logic Circuit:



Observation Table:

CLK	Q0	Q1	Q2
Initial	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1
8 (Recycles)	0	0	0

Conclusion:

03-bit synchronous counter has been implemented and verified using ICs.