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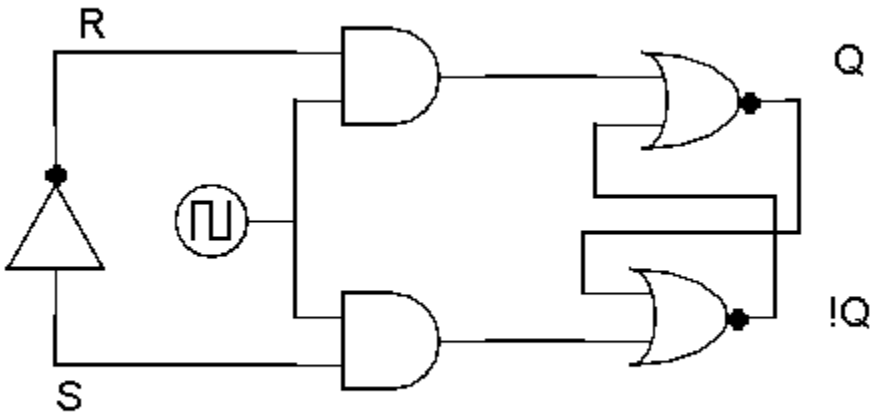
Instruction:

Complete all questions in **1 hour.**

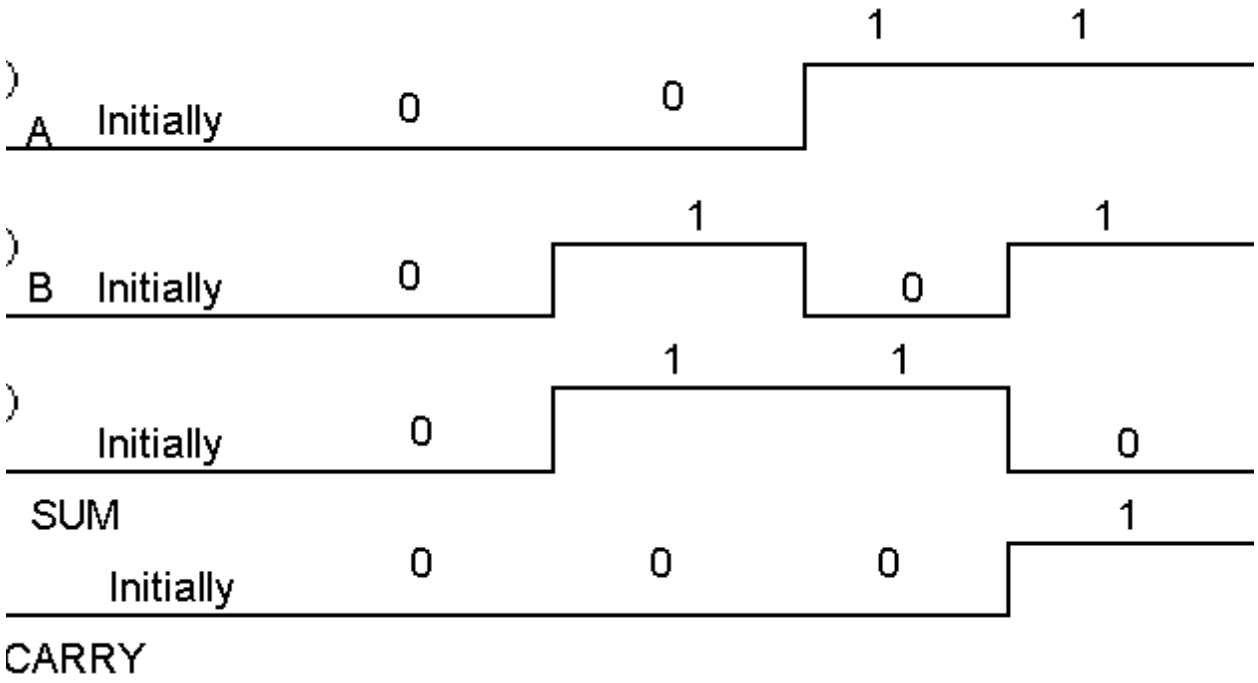
1. What is flip flop? Describe the working mechanism RS flip flop.
   Flip flop is a building block used to store binary information (0 or 1) and can be used To build sequential circuits.
   The working mechanism of the RS flip flop is simple.



RS flip-flop is a simple type of sequential logic circuit. Its two inputs are R and S and outputs are Q and !Q. When R is set to high, output Q is low regardless of the set input. So when the set input is high, Q becomes high as well regardless of reset input. If both inputs are set to 0, the output Q will hold onto its current state which is 0 or 1 depending on the previous outputs.

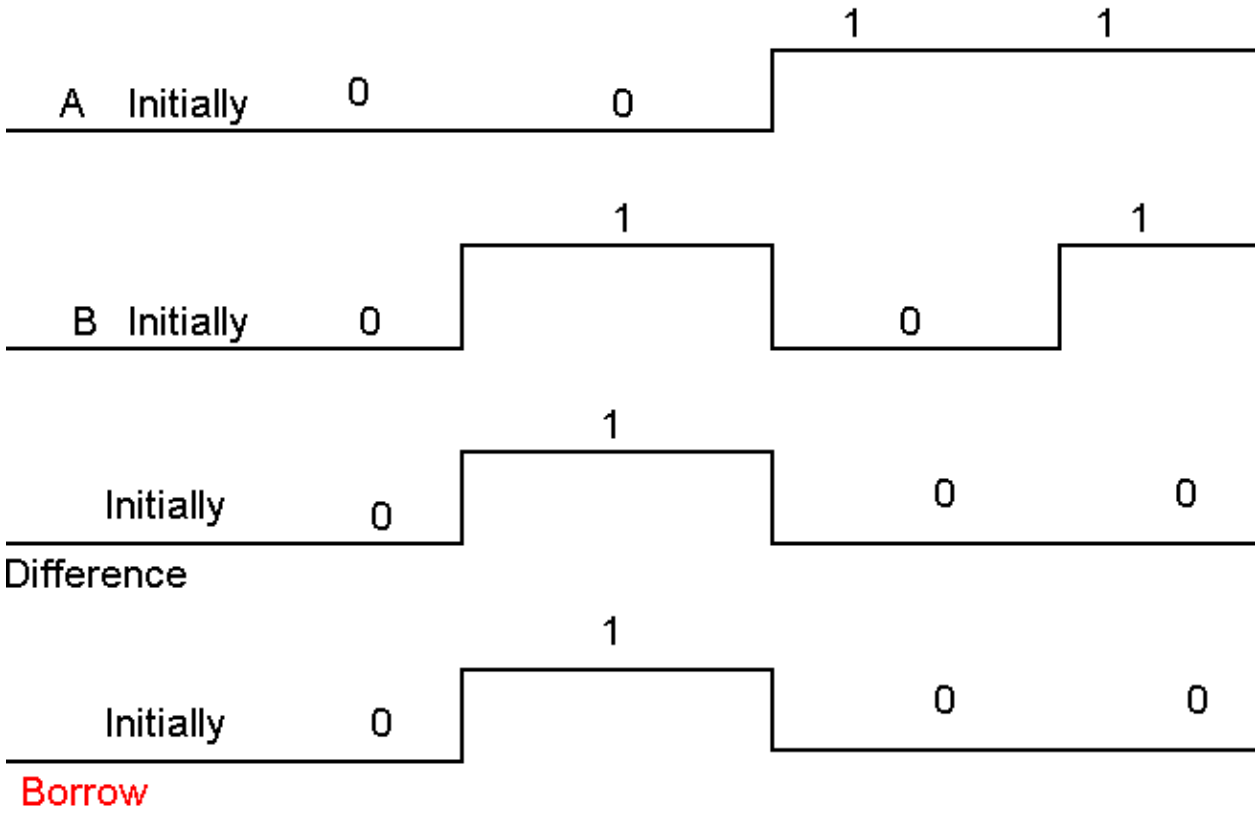
2. Construct the timing diagram for half adder and half subtractor, full adder.
   For half adder:

A	B	SUM	CARRY
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1



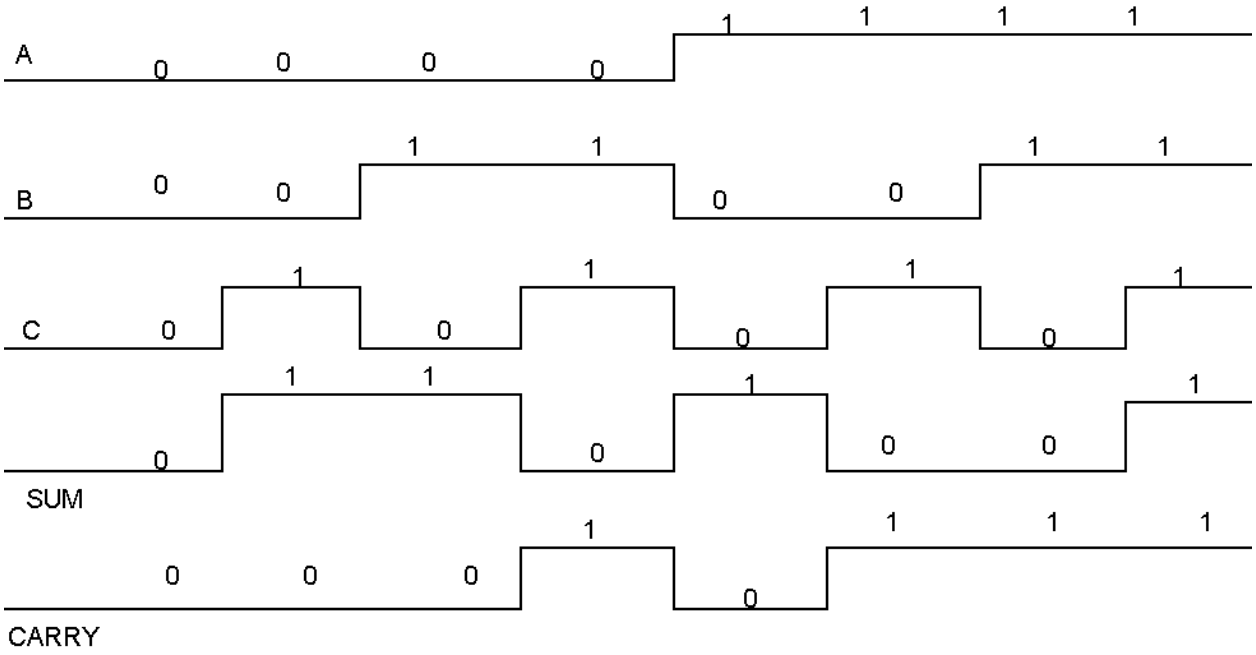
For half subtractor:

A	B	Difference	Borrow
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

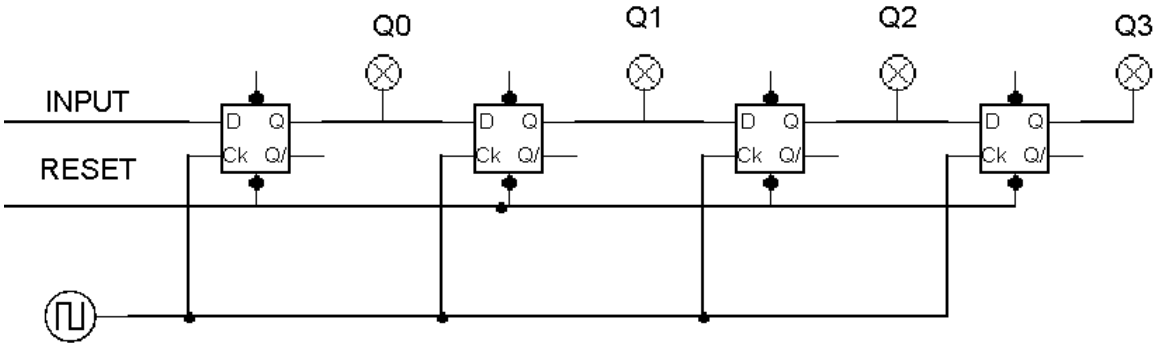


For Full adder:

A	B	Cin	SUM	CARRY
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1


A
0 0 0 0 1 1 1 1
B
0 0 1 1 0 0 1 1
C
0 1 0 1 0 1 0 1
SUM
0 1 1 0 1 0 0 1
CARRY
0 0 0 1 0 1 1 1

3. Describe the working mechanism of a 4-bit register by constructing the circuit using D flip flop.



This is a 4- bit register consisting of D flip flops arranged in such a way that output of one goes into another so that the binary numbers stored move from one flip flop to another controlled by the clock. The clock inputs of all the flip flops connect to a common line ,so they receive clock signals simultaneously. All of the flip flops perform this operation together in the rising age.
In the above diagram, Q0, Q1, Q2 and Q3 are the outputs. I would like to mention the truth table of this register as well. It is given below:

Outputs	Q0	Q1	Q2	Q3
Reset	0	0	0	0
Clock cycle 1	1	0	0	0
Clock cycle 2	0	1	0	0
Clock cycle 3	0	0	1	0
Clock cycle 4	0	0	0	1

This table shows that the values are high only once in each of the outputs.

4. Differentiate between:
    a) Flip flop and Latch

Flip Flop	**Latch**
1.Flip Flops have clocks.	1.Latch has a signal.
2.Flip Flops are used as building blocks.	2. Latch is used in digital circuits.
3.It is edge-triggered.	3. It is level sensitive.

b) Combinational circuit and Sequential circuit

Combinational Circuit	Sequential Circuit
1. Its output depends only on current input.	1. Its output depends on past output as well as current input.
2. It is composed of logic gates only.	2. It is composed of logic gates and flip flops.
3. It performs logical operations.	3. It stores and manipulates data.

c) SIPO and PISO shift register

SIPO shift register	PISO shift register
1. It takes an n-bit-wide signal and lets you individually shift those bits out, one at a time.	1. It lets you shift each of the bits in sequentially, and present outputs in parallel.
2. It loads data serially and outputs it in parallel.	2. It loads data parallelly and outputs it serially.