

1. What is flip flop? Describe the working mechanism RS flip flop.

Answer:

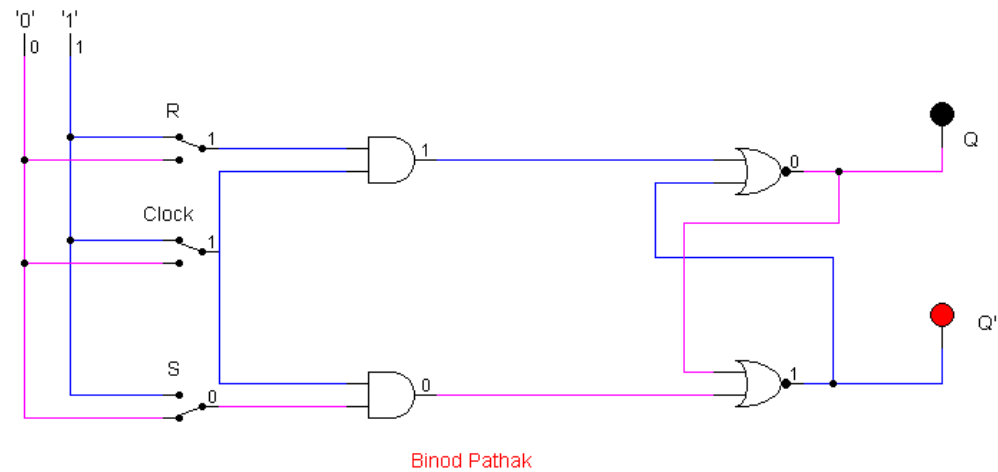
A flip-flop is a piece of equipment that can hold a single bit of information; one of its two states corresponds to a "one" and the other to a "zero." Such a circuit is referred to as sequential logic in electronics and can be used to store state.

- When the R and S have 0 (low), it shows the previous memory but when there is no previous operation it toggles.
- When $S = 0$ and $R = 1$, the values we get are: $Q = 0$ and $Q' = 1$. This output is derived from the concept of NOR gate.
- When $S = 1$ and $R = 0$, the values we get are: $Q = 1$ and $Q' = 0$. This is also derived from the truth table of NOR gate.

➤ CASE Forbidden State:

When S and R as 1, we get both get Q and Q' is 0. This case is not possible the Q and Q' cannot be same in any moment. Thus, this is known as Forbidden State.

Cases	S	R	Q	Q'
Previous output	0	0	X	X
Case 1	0	1	0	1
Memory	0	0	0	1
Case 2	1	0	1	0
Memory	0	0	1	0
Forbidden State	2	1	X	X



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

Answer:

The timing diagram for half adder, half subtractor and full adder:

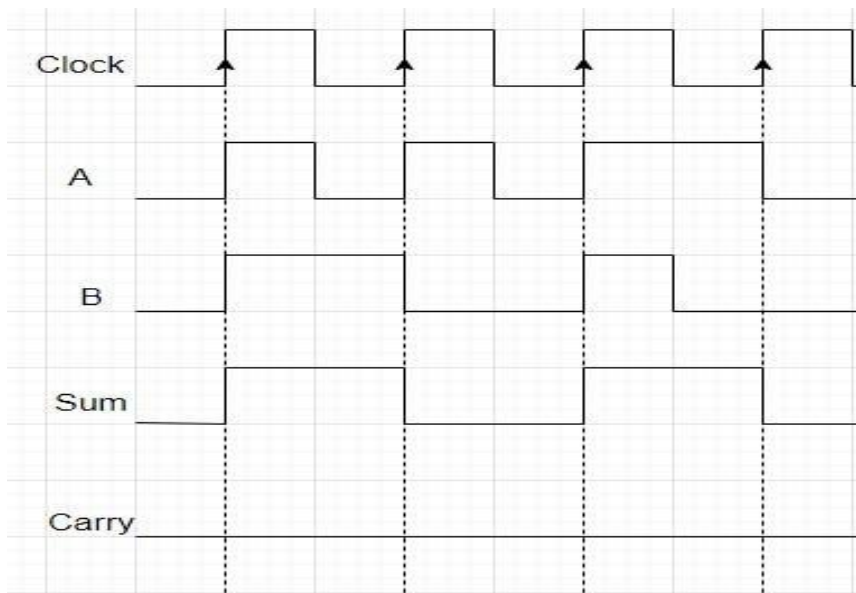


Fig: Timing diagram for half adder

Truth table:

A	B	Sum	Carry
0	0	0	0
0	1	1	0
0	0	0	0

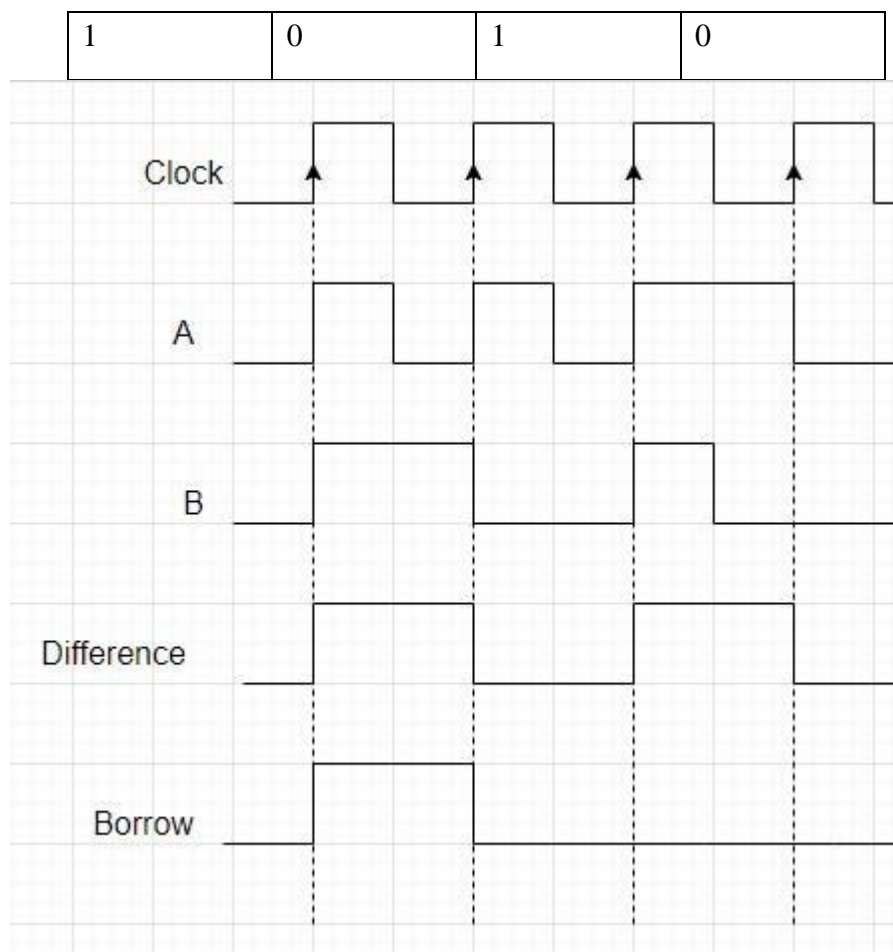


Fig: Timing diagram for half subtractor

Truth table:

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

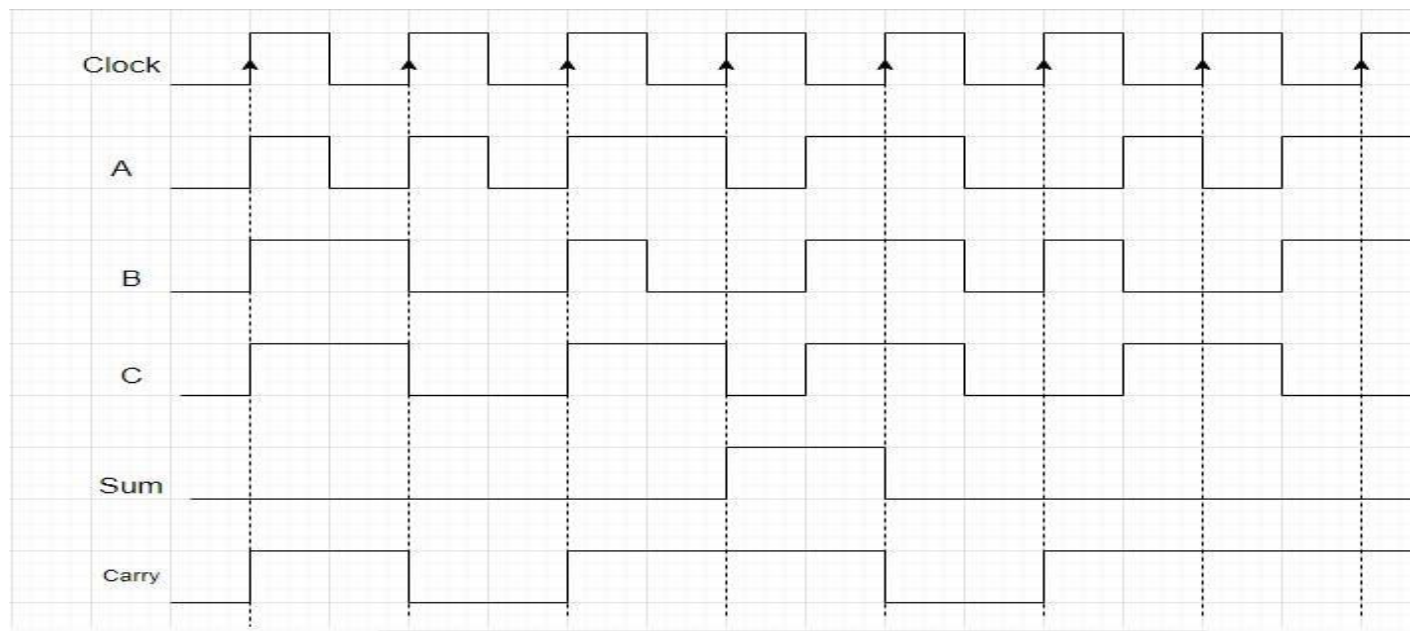


Fig: Timing diagram for full adder

Truth table:

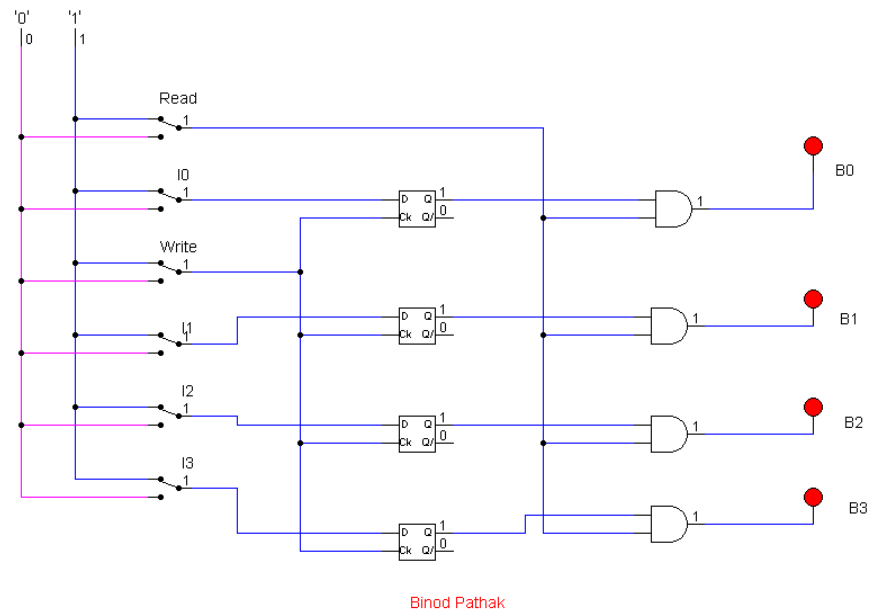
A	B	C	Sum	Carry
0	0	0	0	0
0	1	1	0	1
0	0	0	0	0
1	0	1	0	1
1	1	1	1	1
0	0	0	0	0
1	0	1	0	1
1	1	0	0	1

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

Answer:

A form of digital storage device known as a 4-bit register that stores 4 bits of binary data. It contains four flip-flops, each of which can be in the states 0 or 1. Information can be kept in the register as a 4-bit binary number. The flip-flops receive data from the clock signal and write the data into the register. The clock signal controls the

register's ability to write data. When the clock signal is applied, the data is transferred from the input to the output of the flip-flops. Following the termination of the clock signal, the data is stored in the register. Information can be kept in the registry for several purposes that includes data processing, memory access, and data manipulation.



4. Differentiate between:

Answer:

a) Flip flop and Latch

Flip Flop	Latch
Flip Flop utilizes the edge triggering approach	Latch follows a level triggering approach
The Clock signal is present	The Clock signal is not present
You can design it with latches along with a clock	You can design it with Logic Gates

b) Combinational circuit and Sequential circuit

Combinational Circuit	Sequential Circuit
It is a type of circuit that generates an output by relying on the input it receives at that instant, and it stays independent of time	It is a type of circuit in which the output does not rely on the current and the previous input
A Combinational Circuit requires no feedback for generating the next output because its output has no dependency on the time instance.	The output of a Sequential Circuit relies on both- the previous feedback and the current input.
It is very less complex in comparison.	This type of circuit is always more complex in its nature and functionality.

c) SIPO and PISO shift register

SIPO shift register	PISO shift register
It means Serial in parallel out	It means Parallel in Serial Out
It takes in input serially (one by one) and gives output instantly	It takes in input all at once and gives out output one by one