UNIT-5

SEQUENTIAL LOGIC CIRCUITS - II

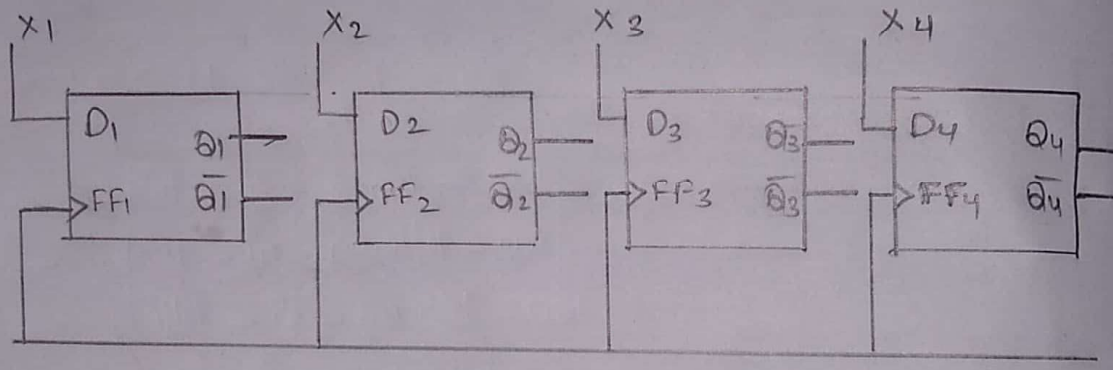
State machines

(Registers & Counters)

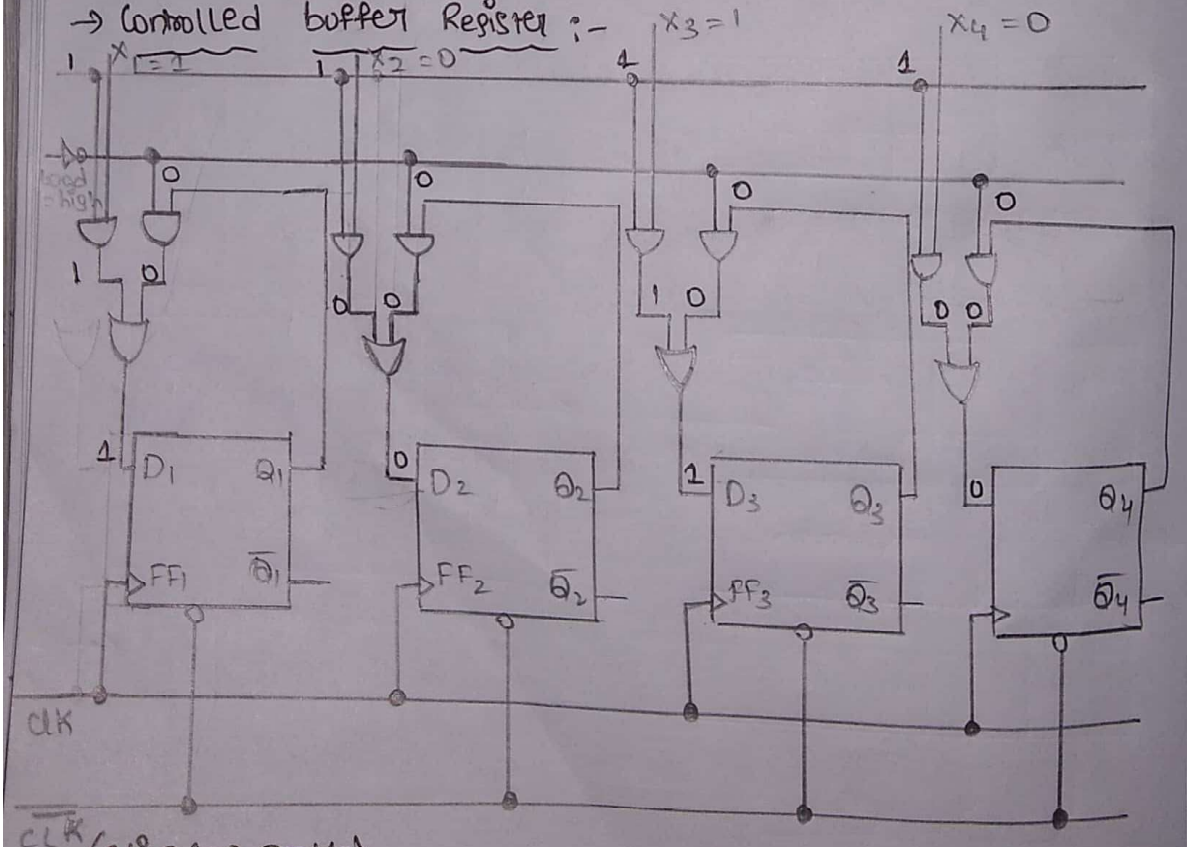
* **Registers:-**

→ shift registers

→ Buffer Registers (Parallel input (or) output) :-



→ Controlled buffer Register :-



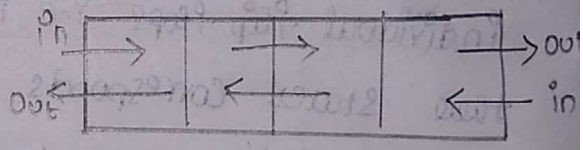
→ Data may be available in parallel form (or) in serial form
→ Multi bit data is said to be in parallel form when all the bits are available simultaneously.
→ The data is said to be in serial form when the data bits appear sequentially i.e one after the other, in time at a single terminal.
→ Data may also be transferred in parallel form (or) in serial form
→ As a flip flop can store one bit of data a '0' or a '1' it is referred to as a single bit register.
→ When more bits of data to be stored, a number of flipflops are used
→ A register is a set of flip flops used to store binary data
→ The storage capacity of a register is the number bits (1's and 0's) of digital data it can retain
→ Loading a register means setting (or) resetting the individual flip flops i.e input in the data into the register these states corresponds to bits of data to be stored
→ Shift registers are a type of logic circuits closely related to counters.
→ The basic difference between a shift register and a counter is that a shift register has no specified sequence of states except in certain very specialised applications, whereas a counter has a specified sequence of states.

Asynchronous inputs

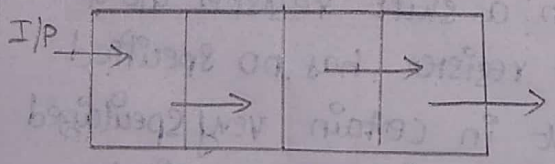
DC Set (PRE)	DC Reset (CLR)	P/R Response
0	0	Not used
0	1	Q=1
1	0	Q=0
1	1	Clocked operation.

* Types Of Shift Registers:-

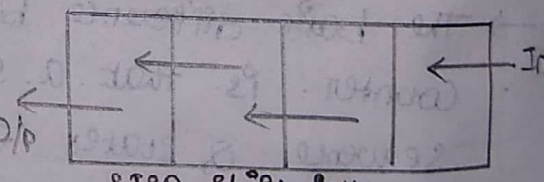
→ Serial - in - serial - out
→ Serial - in - parallel - out
→ parallel - in - parallel - out
→ parallel - in - series - out



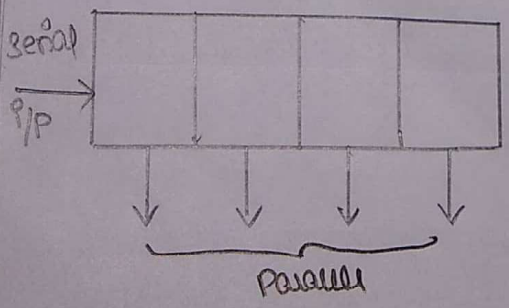
Bidirectional shift register

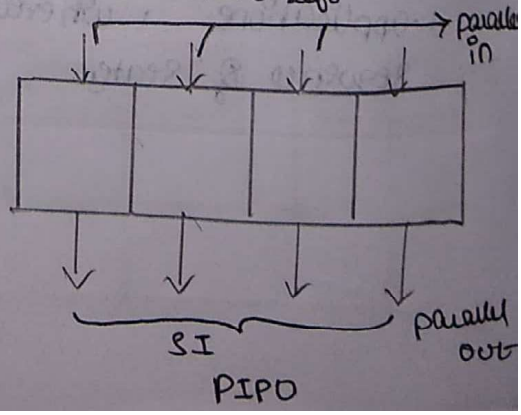


SISO shift right

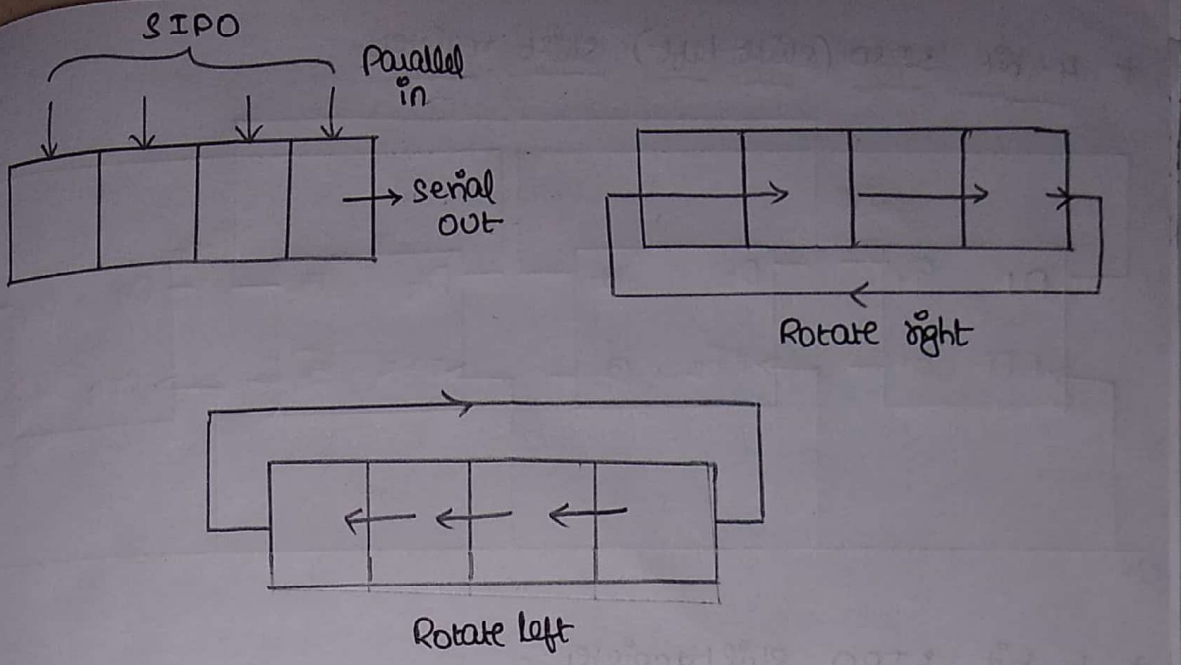


SISO shift left





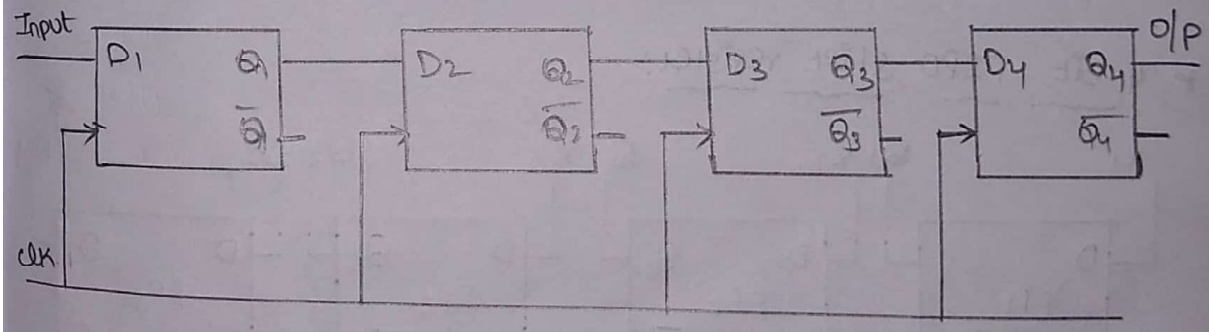
PIPO



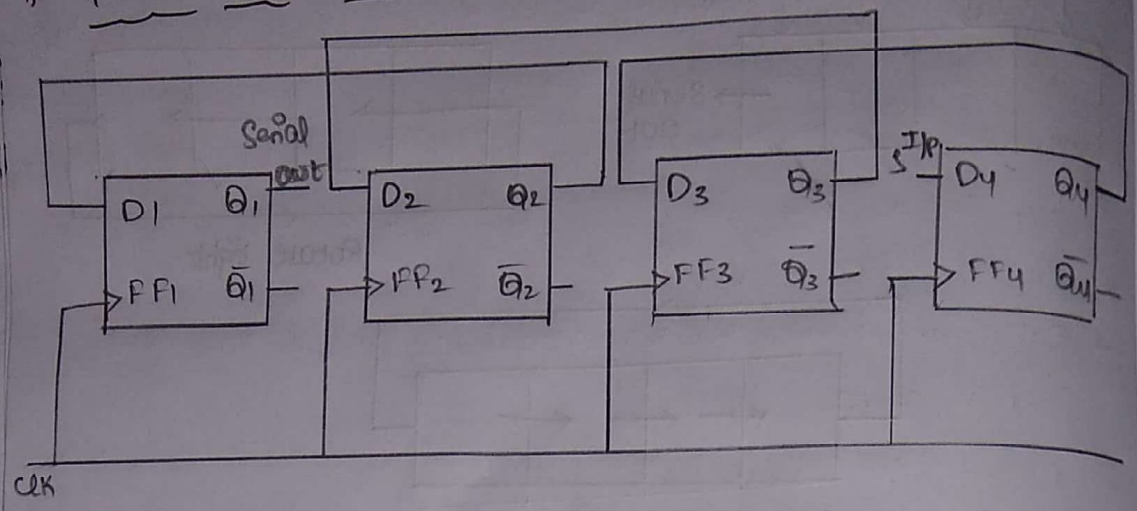
→ A number of flip flops such that data may be shifted into and shifted out is called shift register.

→ Data maybe shifted into or out of the register either in serial form or in parallel form.

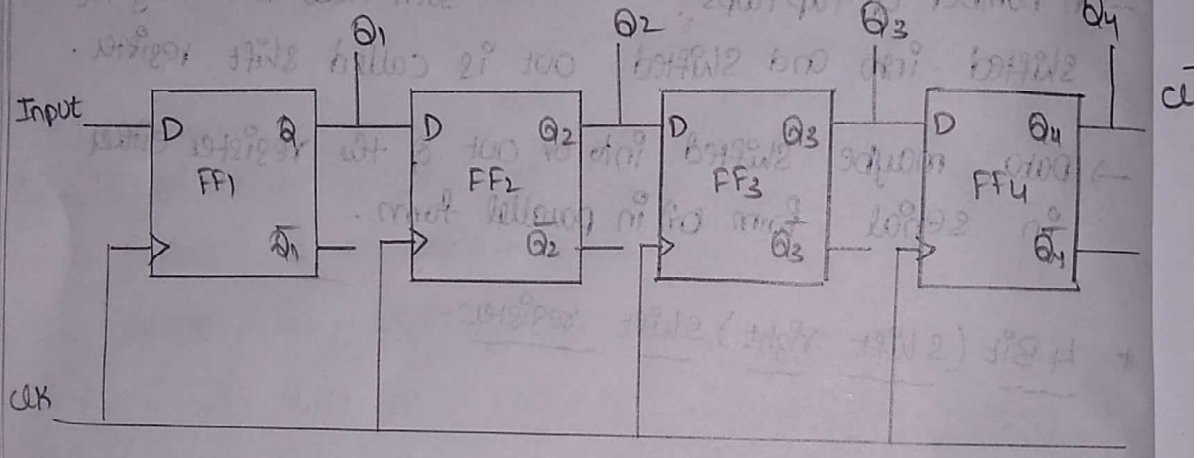
* 4 Bit (Shift right) shift register :-



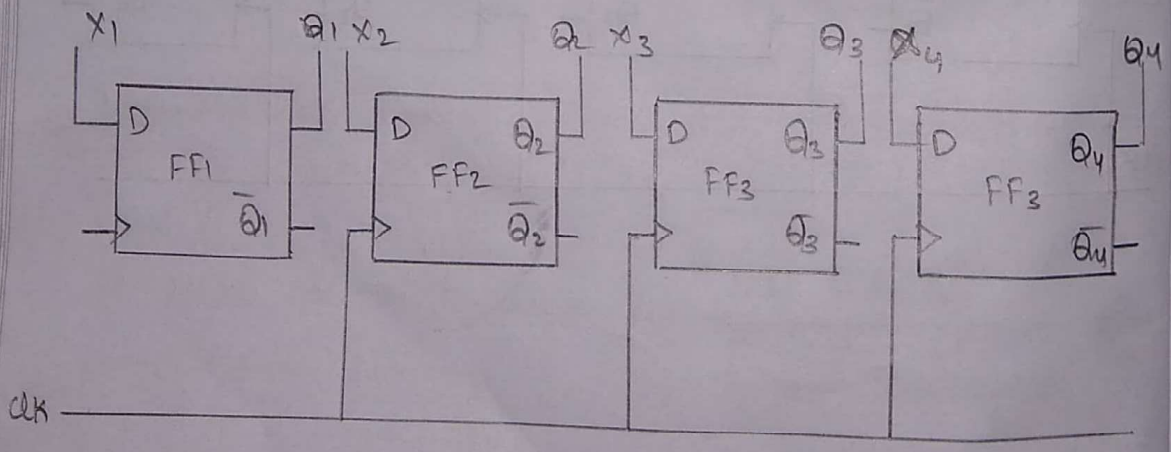
* 4-bit SISO (shift left) shift register:-

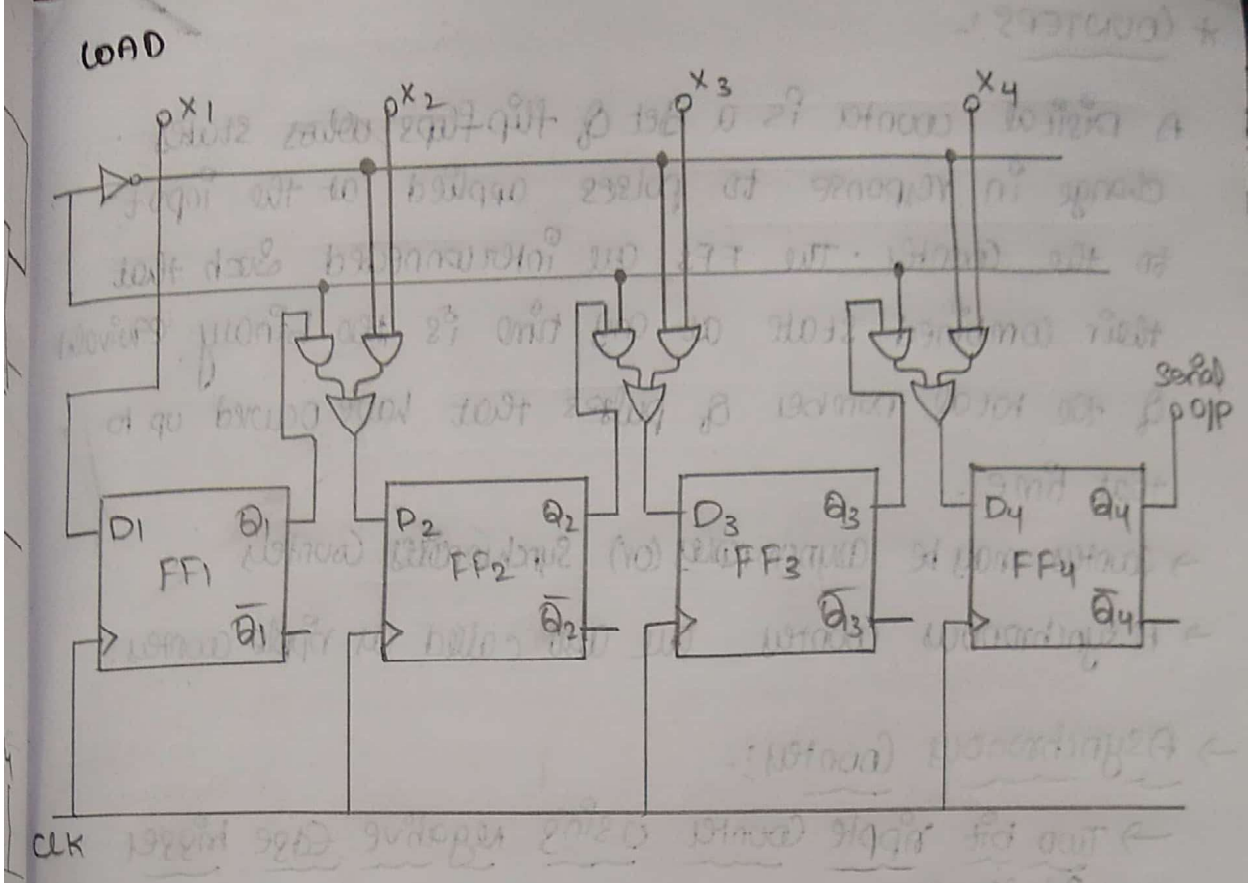


* 4-bit SIPO shift register:-

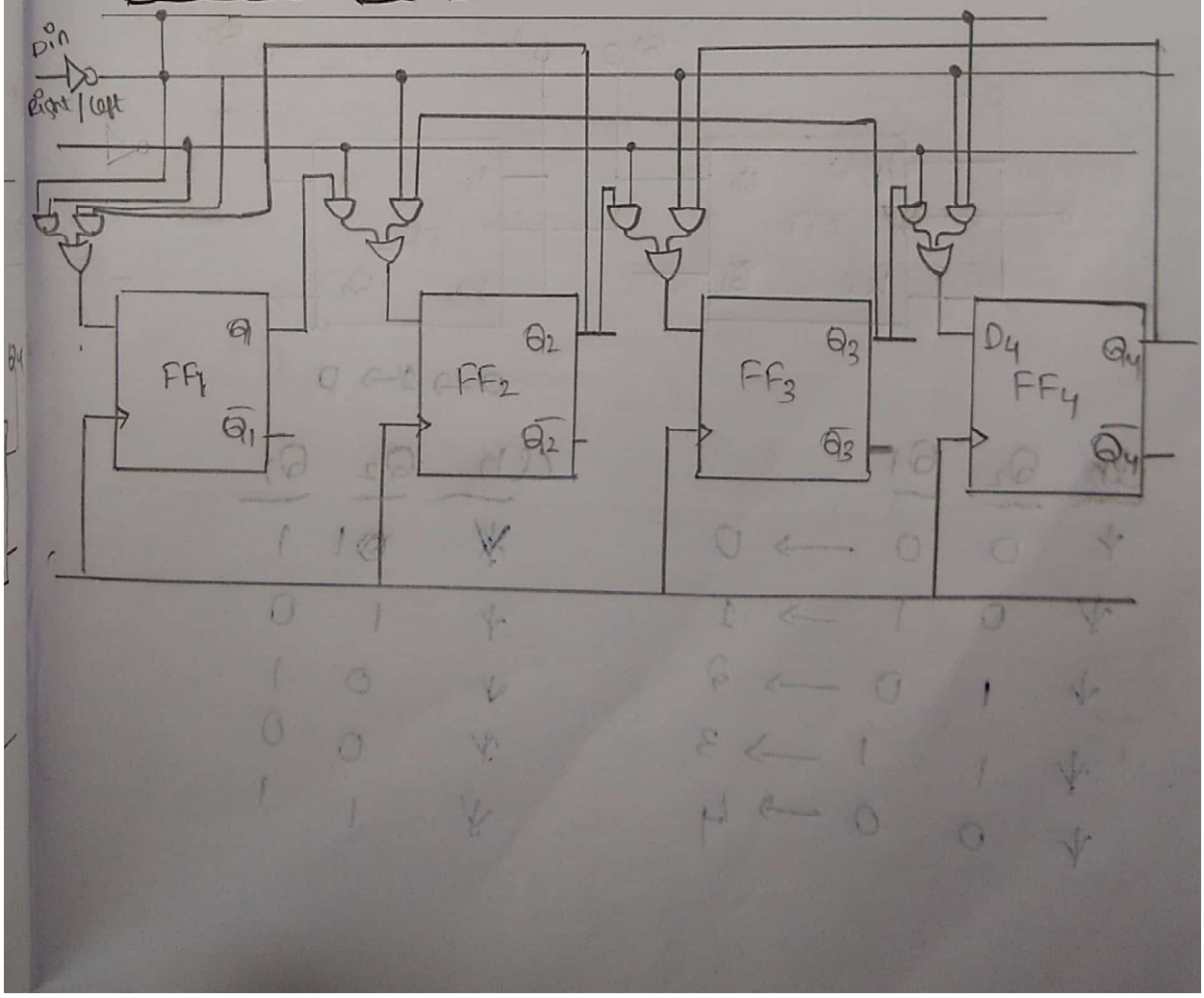


* 4-bit PIPO shift register:-





* Bidirectional Shift Register :- (SISO)



* COUNTERS :-

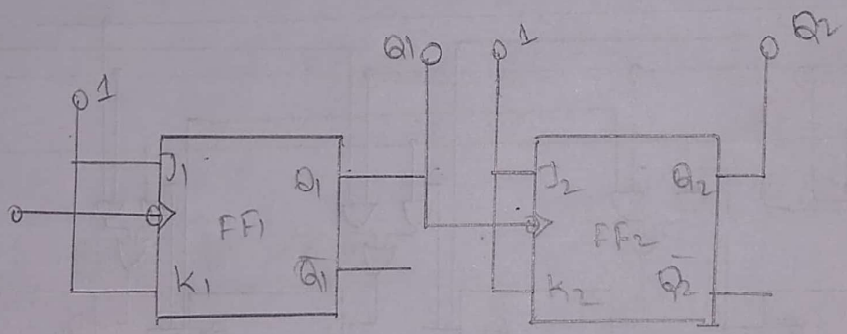
A Digital counter is a set of flip-flops whose states change in response to pulses applied at the input to the counter. The FFs are interconnected such that their combined state at any time is the binary equivalent of the total number of pulses that have occured up to that time.

→ Counters may be Asynchronous (or) Synchronous Counters.

→ Asynchronous Counters are also called as ripple counters.

→ Asynchronous Counters :-

→ Two bit ripple counter using negative edge triggered flip flops.



0 → 1 → 0

Clk	Q_2	Q_1	
↓	0	0	→ 0
↓	0	1	→ 1
↓	1	0	→ 2
↓	1	1	→ 3
↓	0	0	→ 4

CLK	Q_2	Q_1
↓	1	1
↓	1	0
↓	0	1
↓	0	0
↓	1	1