

# SHIFT REGISTERS

Objective:

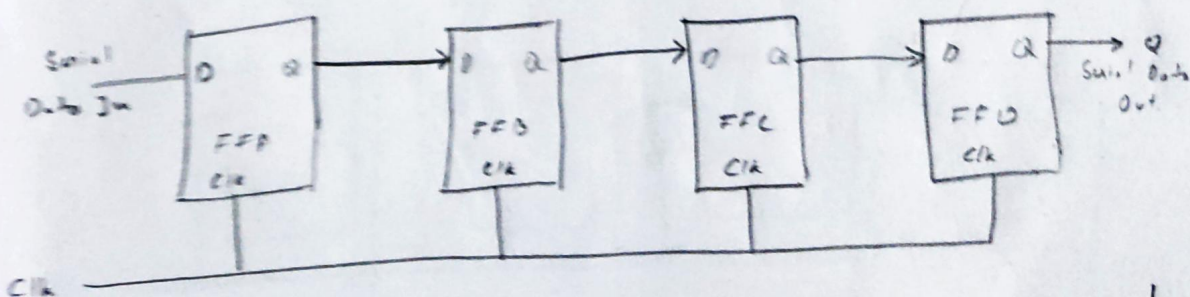
To design a register circuit

Theory:

A register is a group of binary cells suitable for including binary information. The information stored within the registers can be transferred with the help of shift registers. Shift registers are a group of flip-flops used to store multiple bits of data. The bits stored in such registers can be made to move within and in/out of registers through clock pulses.

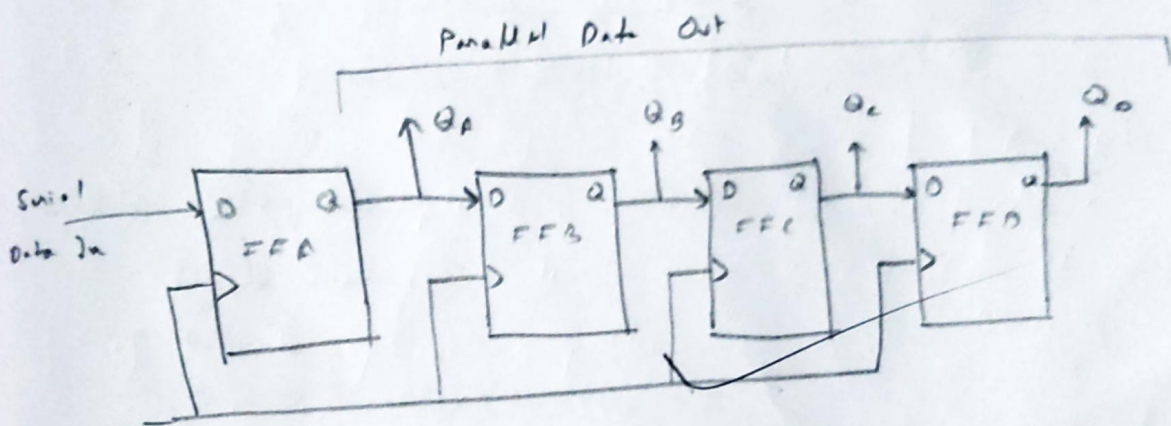
## Serial In Serial Out Register (SISO)

The circuit consists of four D-flip flops connected in a serial manner. All the flip flops are synchronous with each other since the same clock signal is provided to each flip flop. The main use of SISO register is as a delay element.



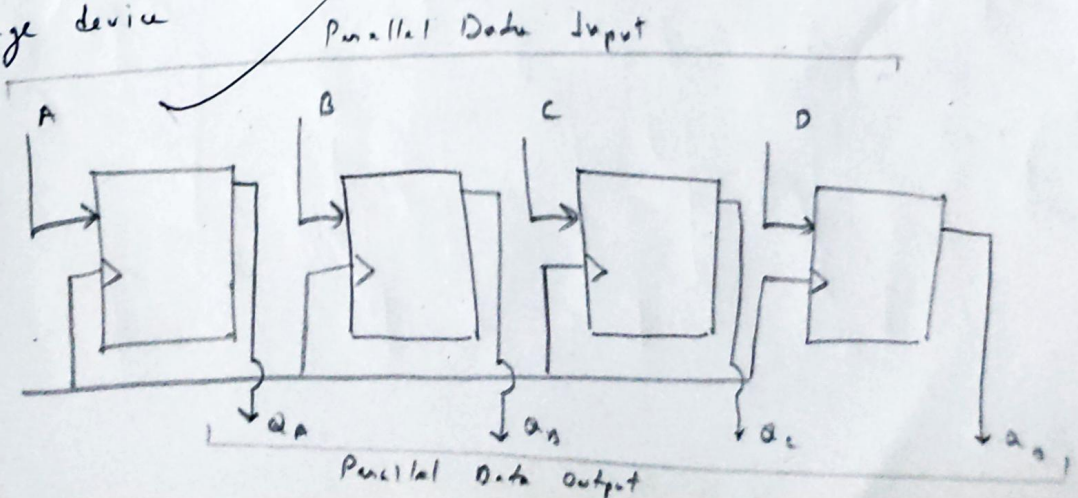
## Serial In Parallel Out Register (SIPO)

This shift register allows serial input (one bit after the other through a single data line) and produces a parallel output is known as Serial In Parallel Out register. The main use of SIPO register is to convert Serial Data into Parallel Data.



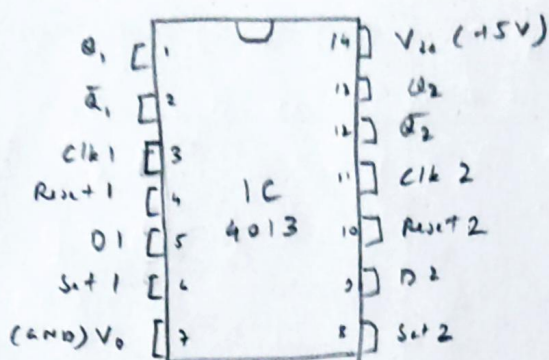
## Parallel In Parallel Out Register (PIPO)

The shift register which allows parallel input to each flip flop (separately) and in a simultaneous manner and also produces a parallel output is called Parallel In Parallel Out shift register. Its main use is as a temporary storage device.





## Pin Diagram:



Dual D-Flip flop (IC 4013)

## Materials Required:

- Digital Trainer Kit
- Wires
- Dual D Flip-Flop (IC 4013) x2

## Verification Table:

Serial In Serial Out Register

CLK	CLK	Serial Data Input (D)	Serial Data Output (Q)
0		1	0
1		0	0
2		0	0
3		0	0
4		0	1
5		0	0

## Serial In Parallel Out Register

Clk	Serial Data Input (D)	Parallel Data Output			
		Q <sub>A</sub>	Q <sub>B</sub>	Q <sub>C</sub>	Q <sub>D</sub>
0					
1	0	0	0	0	0
2	1	1	0	0	0
3	0	0	1	0	0
4	0	0	0	1	0
5	0	0	0	0	1
	0	0	0	0	0

## Parallel In Parallel Out Register

Clk	Parallel Data Input				Parallel Data Output			
	A	B	C	D	Q <sub>A</sub>	Q <sub>B</sub>	Q <sub>C</sub>	Q <sub>D</sub>
0	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0
2	0	0	0	0	0	1	0	0
3	0	0	0	0	0	0	1	0
4	0	0	0	0	0	0	0	1
5	0	0	0	0	0	0	0	0

## Conclusion :

Registers are a very widely used component and a very integral part of modern day electronics with its applications ranging from holding data instructions and memory address in a CPU to lighting components as well as telecommunication devices.



# ADDER - SUBTRACTOR

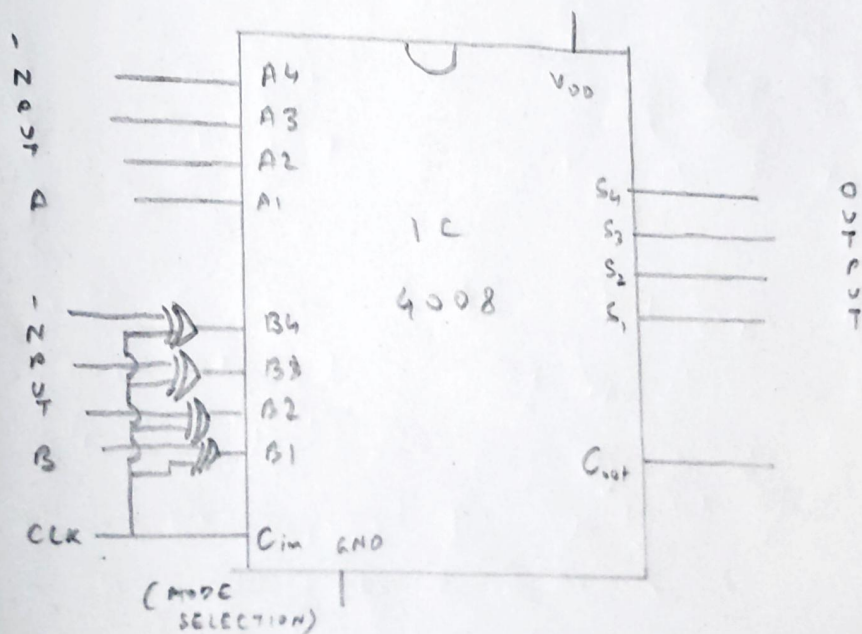
Objective:

To design an adder-subtractor composite circuit.

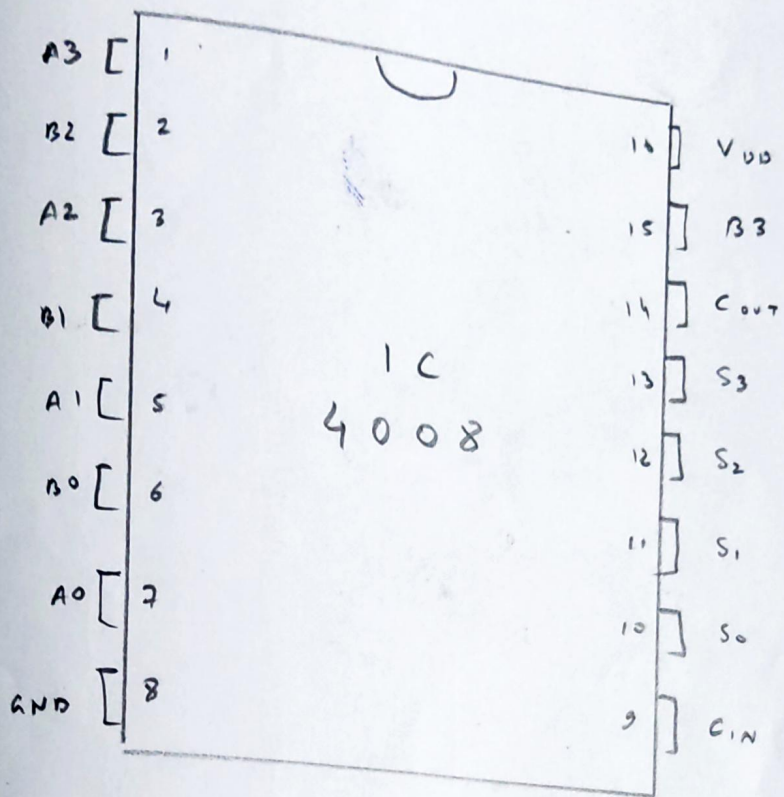
Theory:

An adder-subtractor circuit is a digital circuit that performs both addition and subtraction of binary numbers. The Adder-Subtractor circuit is also known as the arithmetic and logic unit and is an essential component of a computer.

It is a versatile component capable of performing both addition and subtraction in a very cost effective solution on a very easy to design circuits whose uses are widespread in digital systems.



Pin Diagram :



P. T. O.

Materials Required:

Sr. no.	Item	Specification	Qty.
1	Digital Trainer Kit	for constructing circuit	1
2	Wires	for transferring electronic signals	1
3	IC 4070 (XOR)	4 x 2-bit XOR operation	1
4	IC 4008 (Adder-Subtraction composite)	Completed IC with necessary operations for addition-subtraction	1

Verification Table:

Mode	INPUT								OUTPUT				
	A <sub>4</sub>	A <sub>3</sub>	A <sub>2</sub>	A <sub>1</sub>	B <sub>4</sub>	B <sub>3</sub>	B <sub>2</sub>	B <sub>1</sub>	S <sub>4</sub>	S <sub>3</sub>	S <sub>2</sub>	S <sub>1</sub>	C <sub>0</sub>
Add	0	0	1	1	0	0	1	0	0	1	0	1	0
Sub	0	0	1	1	0	0	1	0	0	0	0	1	1
Add	1	0	1	1	0	0	0	1	1	1	0	0	0
Sub	0	1	1	0	0	1	0	1	0	0	0	1	1

Conclusion:

Adder-Subtraction circuit is an essential component of digital systems and used in many applications such as digital computers, digital signal processing systems etc. It is a valuable component for any digital system and in the field of digital electronics.