

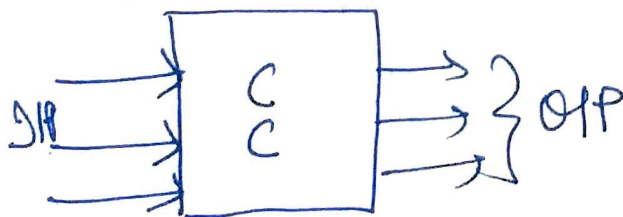
Comparison between Combinational & Sequential Circuit

Combinational Circuit

↳ OP is only dependent on present IP

Ex:- Adder
(Half & Full Adder)

$$\begin{array}{r} 1 \\ + 0 \\ \hline 1 \end{array} \text{ (No previous OP needed)}$$



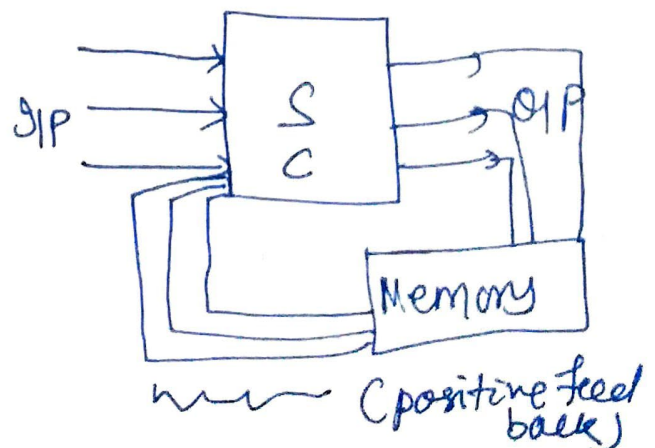
Sequential Circuit

↳ OP depends on the present IP as well as previous OP or OPs.

Ex:- Counter
(A sequential ckt to count, it adds 1 to previous OP)

$$5 \rightarrow \begin{array}{r} 4 + 1 \\ \hline \end{array} \begin{array}{l} \text{Previous} \\ \text{OP} \end{array}$$

↳ It needs a memory cell to store the previous OP (Ex:- Flip Flop)



Combinational

Sequential

* No feedback

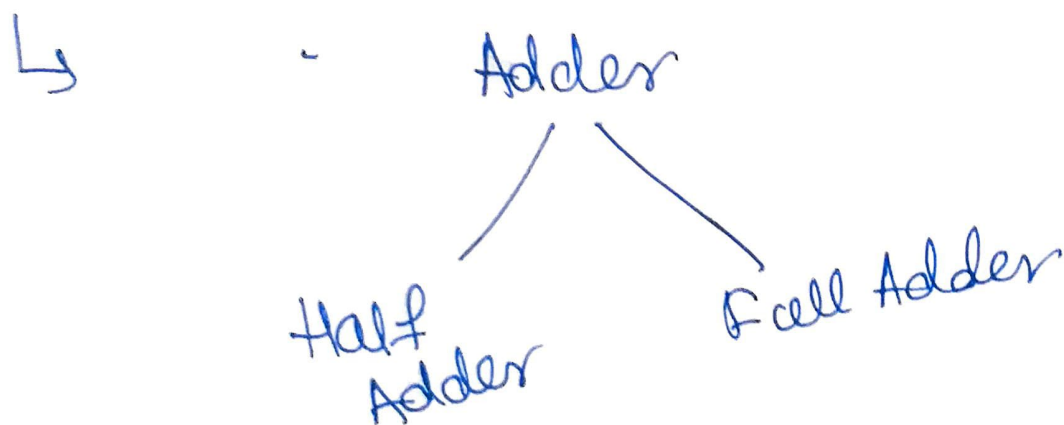
+ve feedback

* Plz check Introduction to CC
Adders

↳ Adder is a Combinational Circuit which performs addition of numbers (binary, BCD excess-3) ~~used~~

↳ Applications

- i) ALU of CPU
- 2) Calculate address indices
- iii) Increment and decrement.



(Two bits addition does not depend on Carry)

$$\text{Sum} = A \oplus B$$
$$\text{Carry} = A \cdot B$$

(Two bit addition considers Carry)

$$\text{Sum} = A \oplus B \oplus C$$
$$\text{Carry} = AB + C_{in}(A \oplus B)$$

or

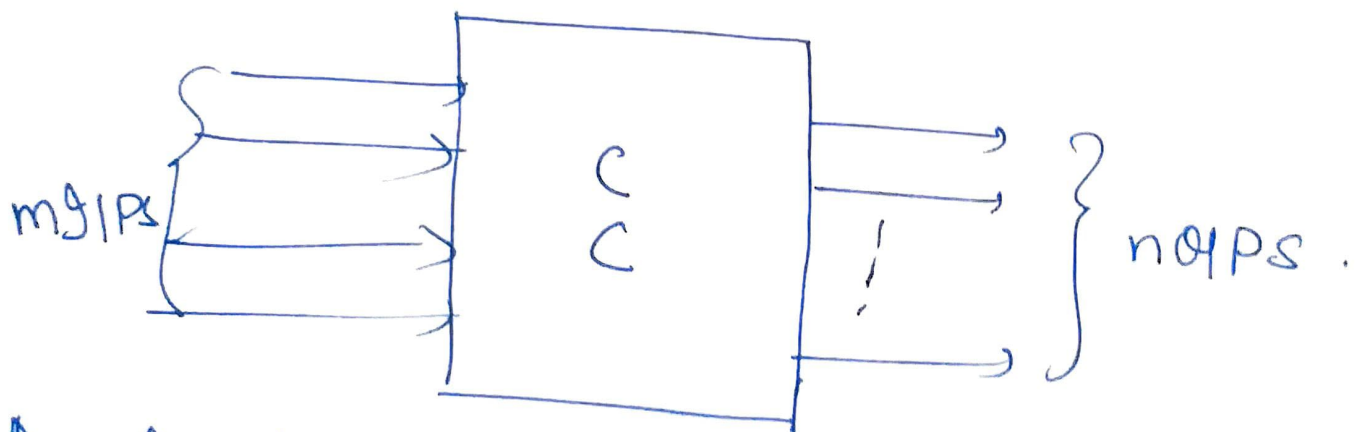
$$AB + \bar{A}C_{in} + BC_{in}$$

Combinational Circuit

↳ When logic gates are connected together to produce a specified OP on specified condition or combination of IP variable with no memory involved

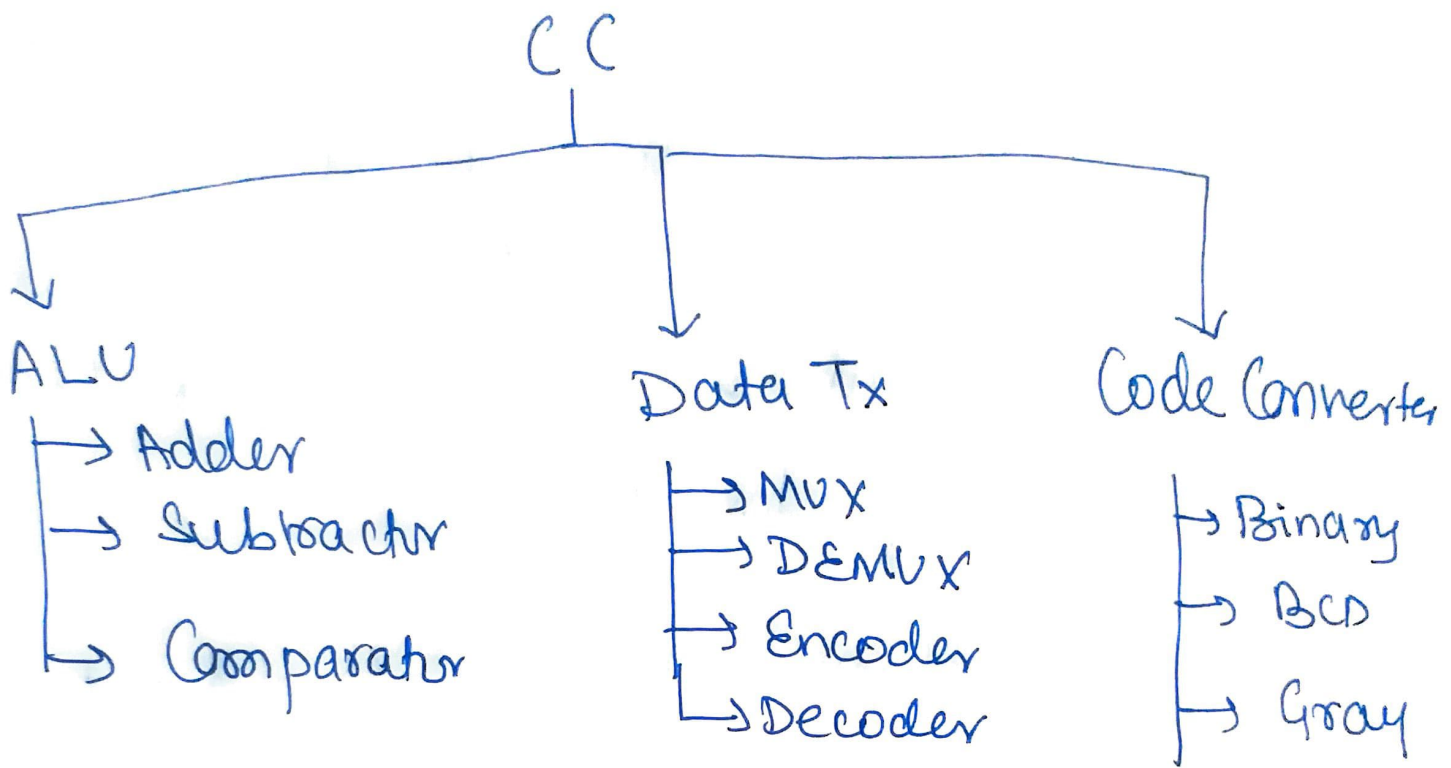
OP depends only on present IP

$$OP = f(IP)$$



Applications

- 1) used in ALU
- 2) Data Transmitter / Data Transmission
- 3) Code Converter.



Four bit Parallel Adder Using Full Adder

↳ $A = 1$ without Carry

$B = 1$
 $\underline{10} \rightarrow$ Half Adder

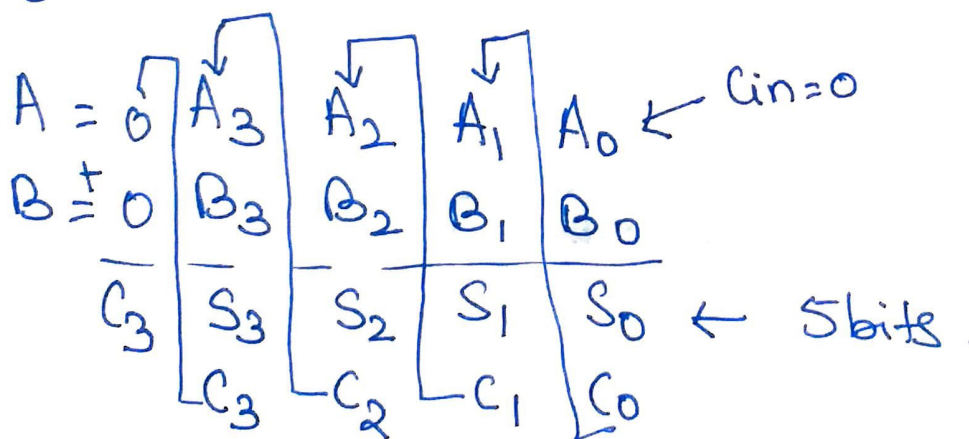
with Carry $C_{in} = 1$

~~$\begin{array}{r} 1 \\ + 1 \\ \hline 10 \end{array}$~~

$\begin{array}{r} 1 \\ + 1 \\ \hline 10 \\ 1+ \end{array}$

$\underline{11} \rightarrow$ Full Adder

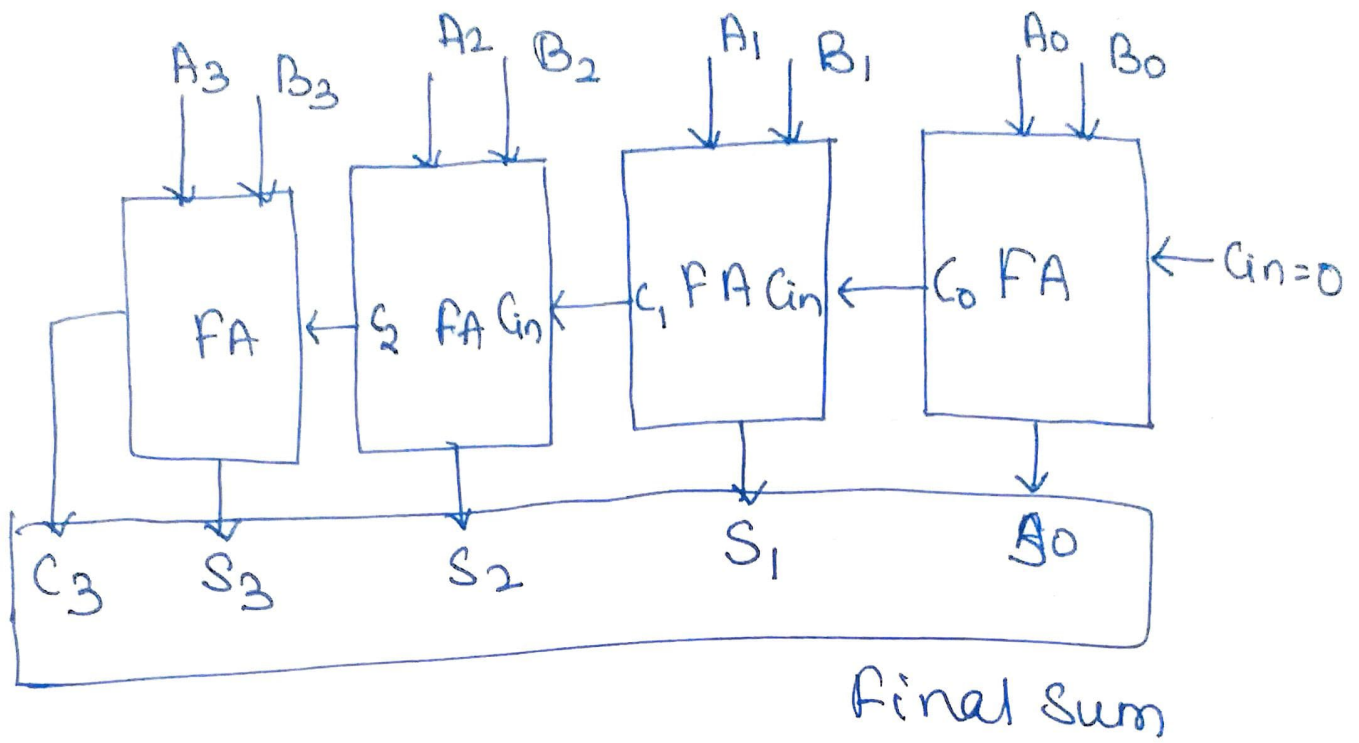
↳ ~~Multi~~ Multi bit no we need 4 bit 11el Adder



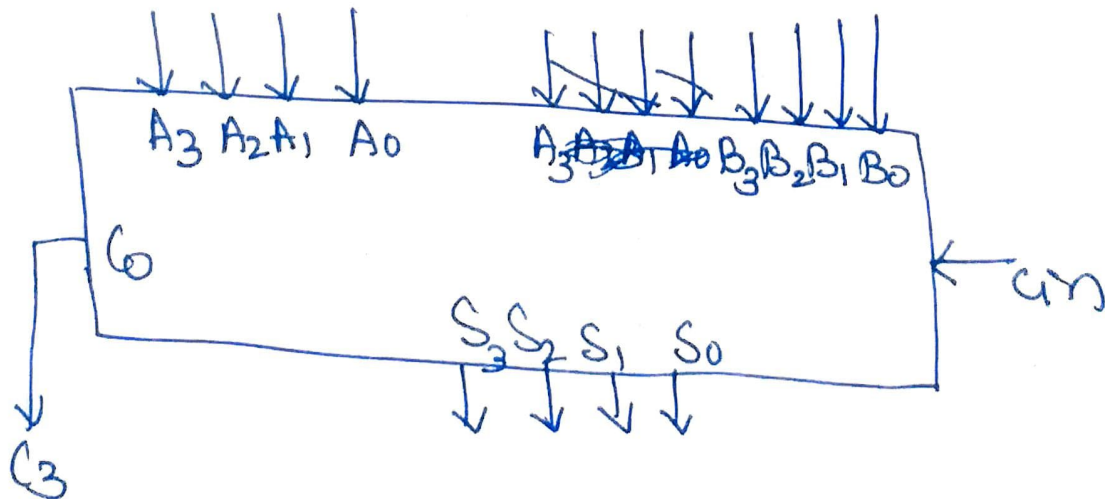
$\begin{array}{r} 5 \\ + 5 \\ \hline 10 \\ \hline \end{array}$
 2 digit

$C_3 \rightarrow 1 \text{ or } 0$
 Sum is
 If C_3 is 0 then 4 bit sum
 else sum is 5 bits

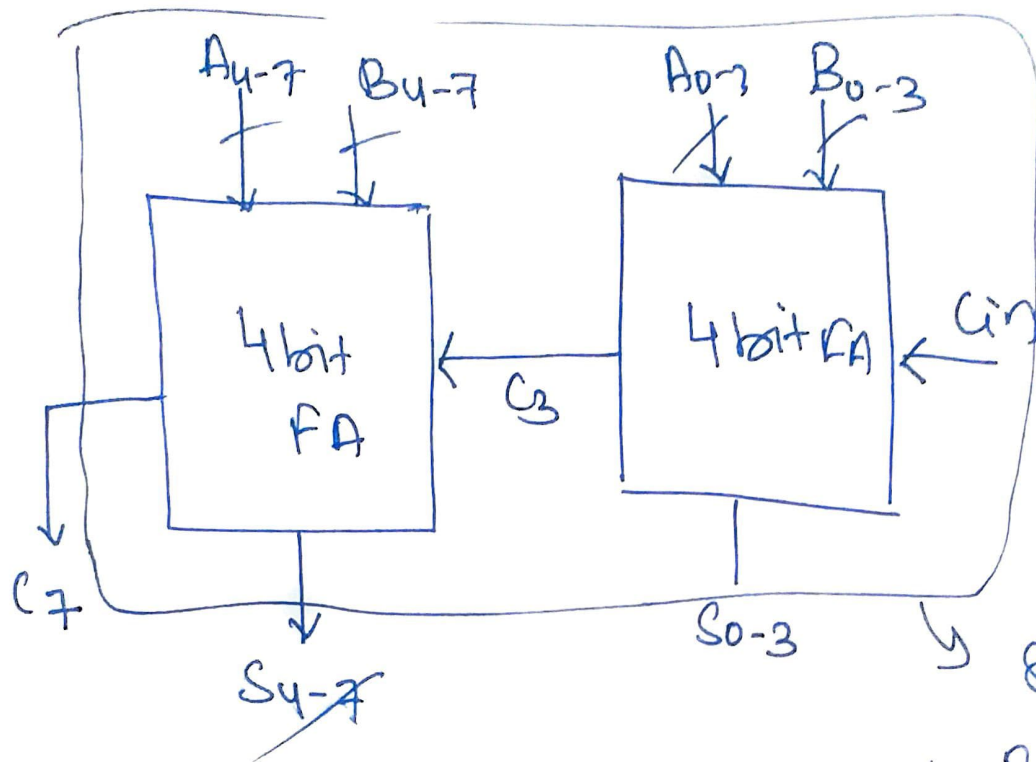
2 4 bits sum
 may be 4 bit
 or 5 bit



- ↳ IC 74HC283 is 4 bit Full Adder
- ↳ 8 bit, 16 bit can also be obtained.



IC representation



8-bit FA
using two
4-bit FAs.