Carry Look Ahead Adder (CLA)

↳ Carry depends on Sum

↳ Speed than Full Adder

↳ Propagation delay of Full Adder is more

↳ Predict the Carry, which is predicted before.

A	B	Cin	Co
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

~~4 bit FSM~~

A⊕B=1, cin=1 <

A⊕B=1, Cin=0, Co=0.

A⊕B=1, cin=1

→ If A & B is high Co is high.

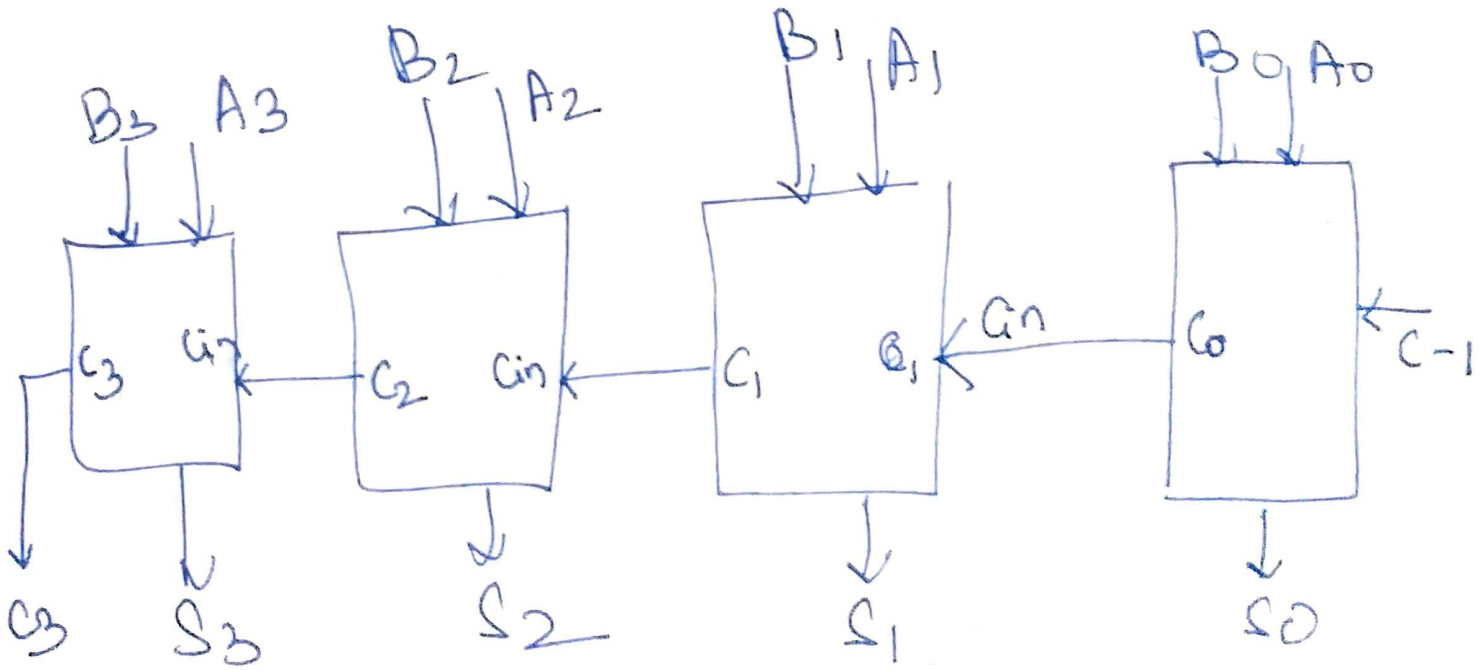
$C_0 = A \cdot B + (A \oplus B) \cdot C_{in}$

Carry generator → Carry is generated due to A & B → G

Carry propagator → In this Carry C_0 is generated when C_{in} is propagated → P

$$C_0 = G + P C_{in}$$

$$C_{in} = G + P C_{in-1}$$



~~Cin~~ C_{-1} (Carry I/P) → C_0 (Carry O/P)

C_1 (Carry I/P) → C_2 (Carry O/P)

$C_{in-1} = C_0 =$

$C_i = G_i + P_i C_{i-1}$

A, B, C_{i-1} } Calculate the Sum & Carry

$i = 0$

$C_0 = G_0 + P_0 C_{0-1} \Rightarrow C_0 = G_0 + P_0 C_{-1}$ — (1)

↳ (A)

$i = 1$

$C_1 = G_1 + P_1 C_0$ — (2)

$C_1 = G_1 + P_1 (G_0 + P_0 C_{-1})$

$\boxed{C_1 = G_1 + P_1 G_0 + P_1 P_0 C_{-1}}$ → (3)

C_1 depends on C_{-1}, C_{-1} is our input so, it need not wait for the sum to get C_1 (S_1)

$i = 2$

$C_2 = G_2 + P_2 C_1$

Substitute C_1

$C_2 = G_2 + P_2 (G_1 + P_1 G_0 + P_1 P_0 C_{-1})$

$C_2 = G_2 + P_2 G_1 + P_1 P_2 G_0 + P_1 P_2 P_0 C_{-1}$

↳ (C)

↳ This helps save time.

↳ So if C_{-1} is there I can get any carry value.

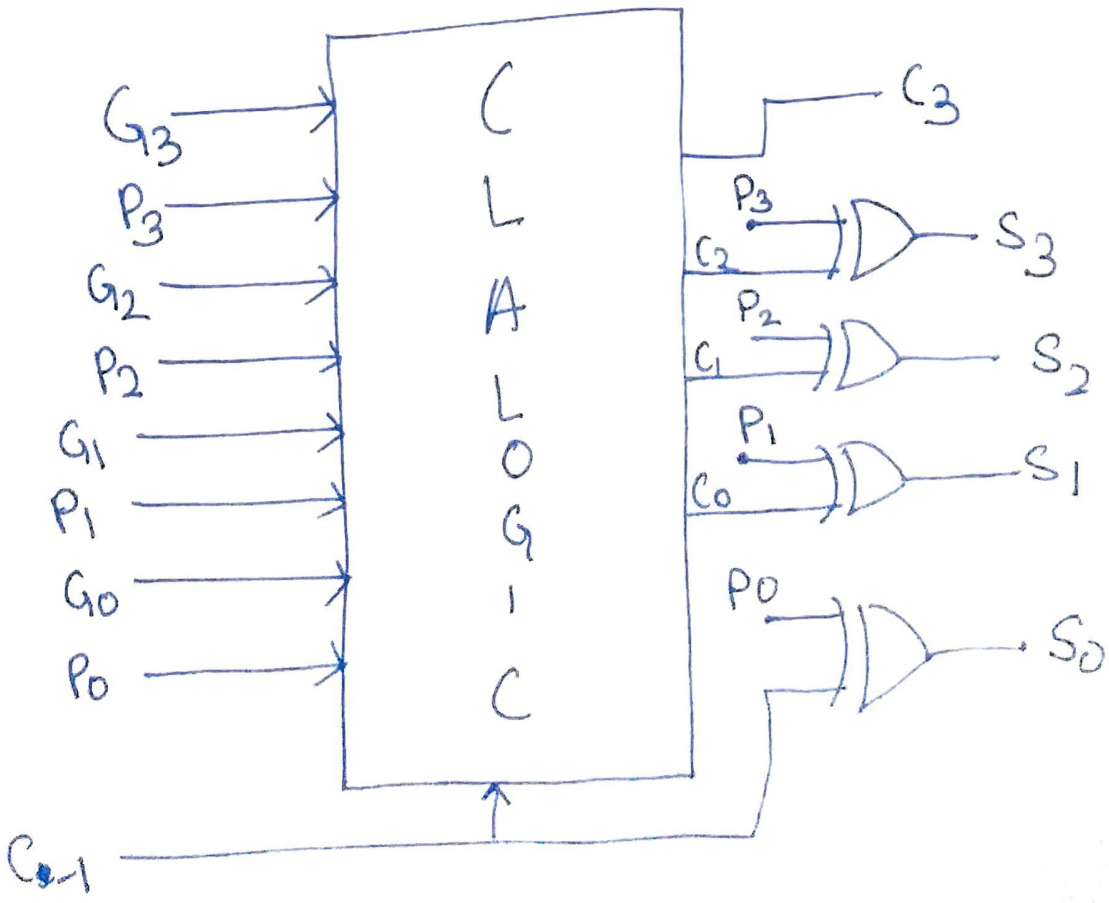
$i = 3$

$$C_3 = G_3 + P_3 C_2$$

$$= G_3 + P_3 \left[G_2 + P_2 G_1 + P_1 P_2 G_0 + P_1 P_2 P_0 C_{-1} \right]$$

$$C_3 = G_3 + P_3 G_2 + P_2 P_3 G_1 + P_1 P_2 P_3 G_0 + P_0 P_1 P_2 P_3 C_{-1}$$

(8+1)



$$G_3 = A_3 \cdot B_3$$

$$P_3 = A_3 \oplus B_3$$

$$G_2 = A_2 \cdot B_2$$

$$P_2 = A_2 \oplus B_2$$

$$G_1 = A_1 \cdot B_1$$

$$P_1 = A_1 \oplus B_1$$

$$G_0 = A_0 \cdot B_0$$

$$P_0 = A_0 \oplus B_0$$

$$S_3 = \underbrace{A_3 \oplus B_3}_{P_3} \oplus C_2$$