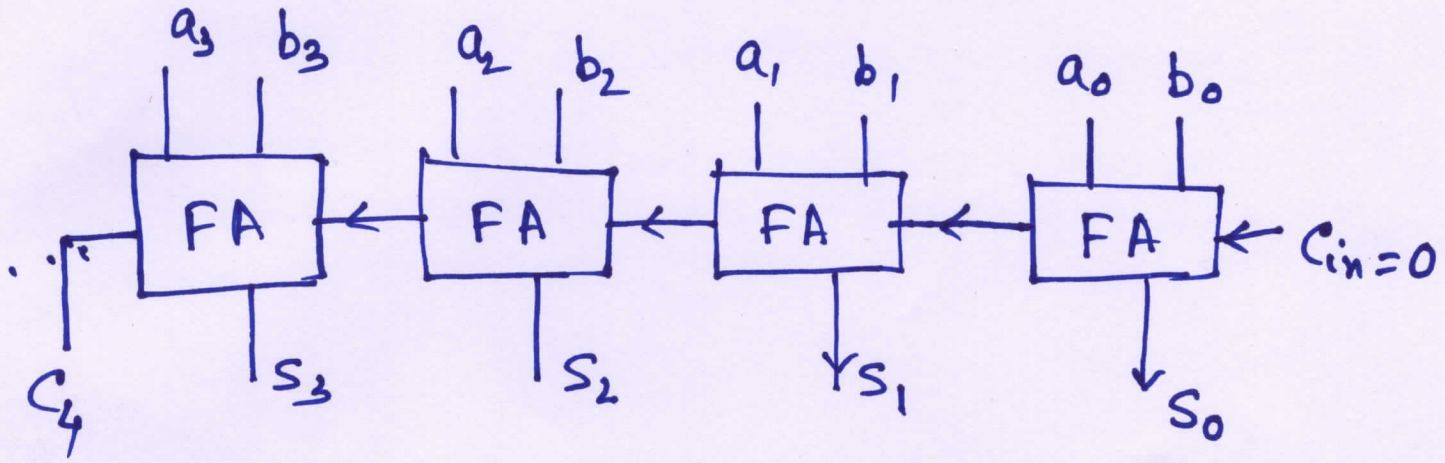
Carry Look Ahead Adder (CLA Adder)

Limitation of 'Ripple Carry Adder':



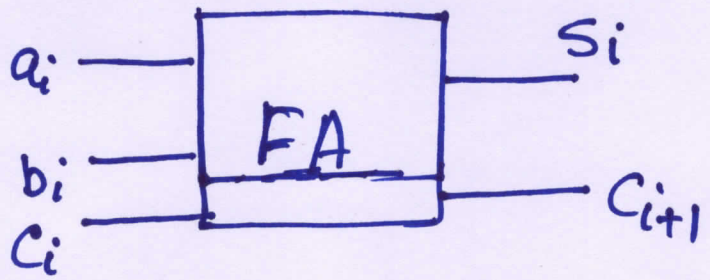
Propagation delay of one 'FA' = t_{pd}

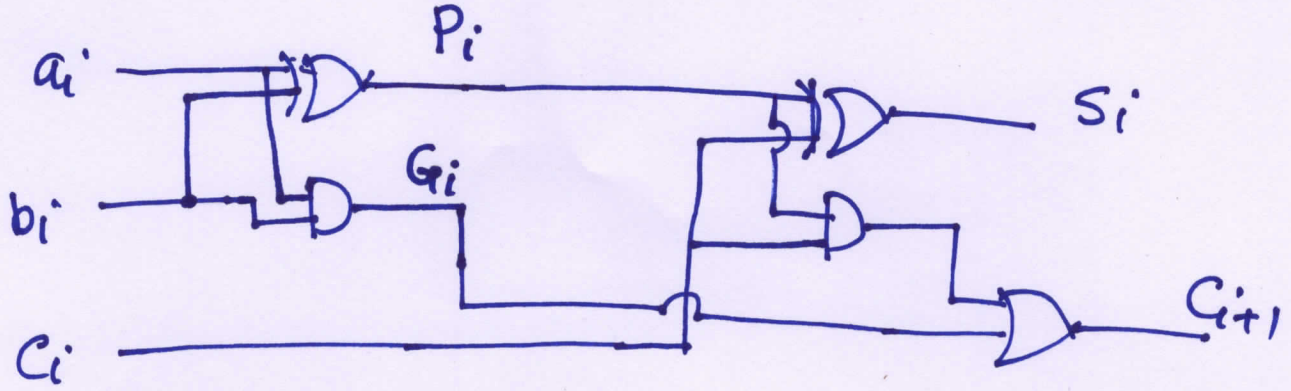
Total delay for n-bit 'Ripple Carry Adder'

$= n\, t_{pd}$

To speed up addition, we can use CLA adder.

i th 'FA'





$$\begin{cases} P_i = a_i \oplus b_i \\ G_i = a_i b_i \end{cases}$$

$$S_i = P_i \oplus C_i$$

$$\boxed{C_{i+1} = G_i + P_i C_i}$$

$\Rightarrow$ $C_1 = G_0 + P_0 C_0$ (C_0 = intial carry)

$\Rightarrow$ $C_2 = G_1 + P_1 C_1$

$= G_1 + P_1 (G_0 + P_0 C_0)$

$= G_1 + P_1 G_0 + P_1 P_0 C_0$

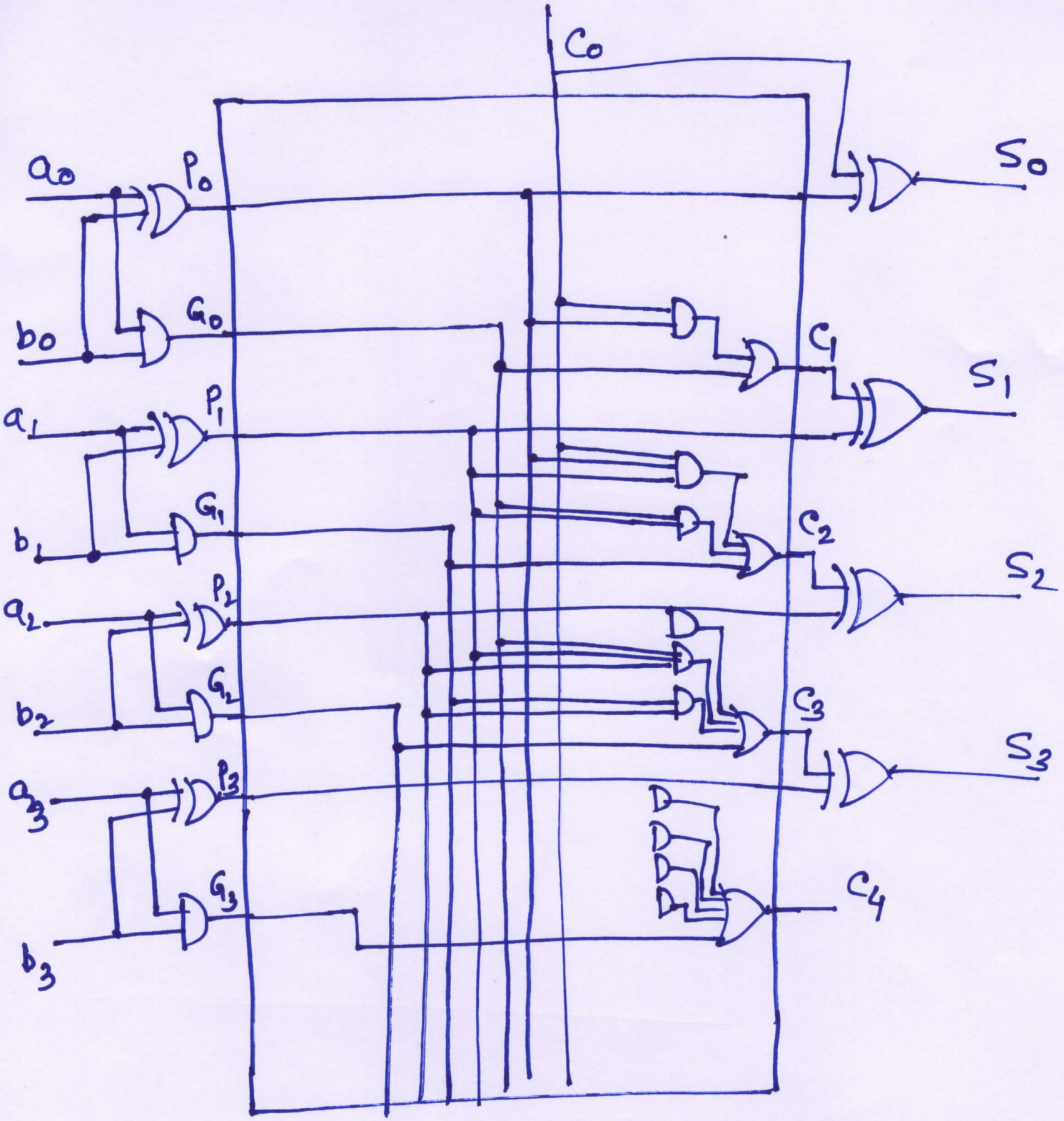
$$\Rightarrow C_3 = G_2 + P_2 C_2$$

$$= G_2 + P_2 (G_1 + P_1 G_0 + P_1 P_0 C_0)$$

$$= G_2 + P_2 G_1 + P_2 P_1 G_0 + P_2 P_1 P_0 C_0$$

$$\Rightarrow C_4 = G_3 + P_3 C_3$$

$$= G_3 + P_3 G_2 + P_3 P_2 G_1 + P_3 P_2 P_1 G_0 + P_3 P_2 P_1 P_0 C_0$$



4-bit CLA Adder

Limitation: 'FAN IN'