

LOOK - AHEAD - CARRY ADDITION. ①

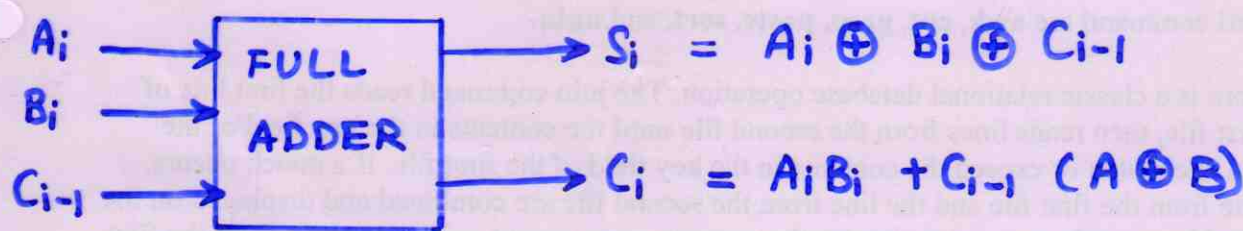
C_2	C_1	C_0	-	i/p carry for full Adder
A_3	A_2	A_1	A_0	
+	B_3	B_2	B_1	B_0
Cout	S_3	S_2	S_1	S_0

t_p - propagation delay of full adder.

- result S_0 & C_0 is obtained after the delay of t_p
- result S_1 & C_1 after the delay of $2t_p$.
- result S_2 & C_2 after the delay of $3t_p$.
- result S_3 & Cout after the delay of $4t_p$.

Hence, for N-Bit Parallel Adder, total delay time is $N t_p$.

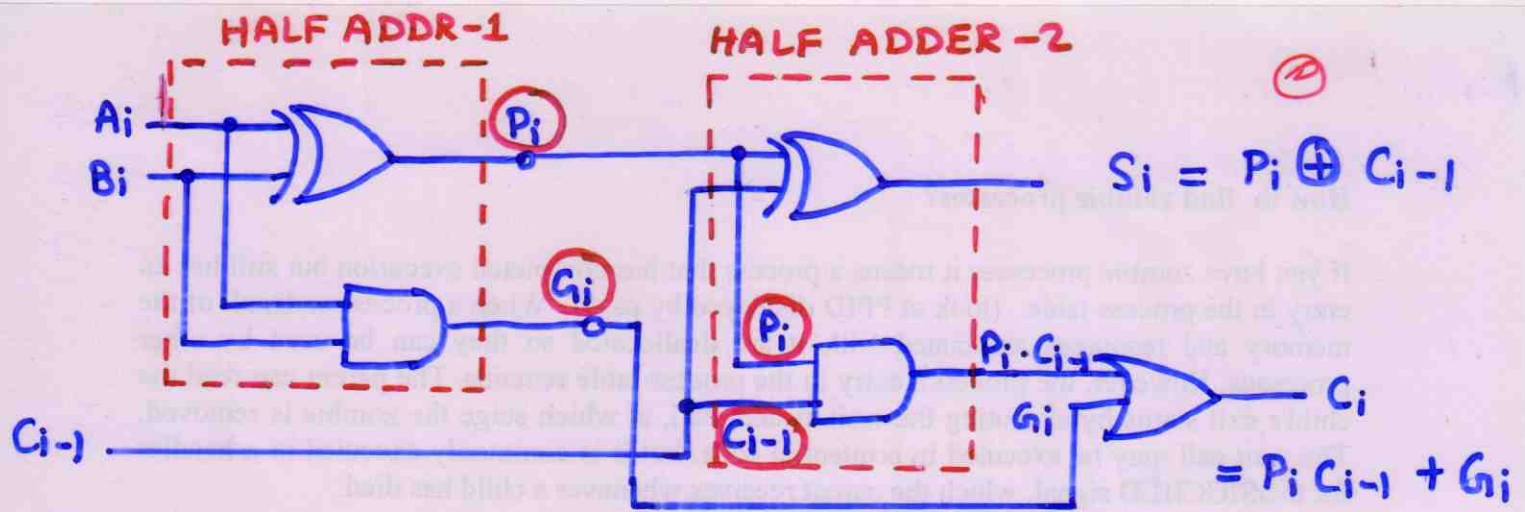
→ Parallel Adder has larger propagation delay & hence low speed of operation. this limitation is overcome in Carry Look Ahead Adder.



Carry Propagate function $P_i = A_i \oplus B_i$ ∵ associated with propagation of Carry from C_{i-1} to C_i

Carry Generate function $G_i = A_i B_i$ ∵ its value doesn't depend on i/p carry (C_{i-1})

Hence, $S_i = P_i \oplus C_{i-1}$
 $C_i = G_i + P_i C_{i-1}$



Carry o/p from first full Adder,

$$C_0 = G_0 + P_0 C_{-1}$$

Carry o/p from second,

$$C_1 = G_1 + P_1 C_0 = G_1 + P_1 (G_0 + P_0 C_{-1})$$

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

Carry o/p from third,

$$C_2 = G_2 + P_2 C_1 = G_2 + P_2 (G_1 + G_0 P_1 + P_0 P_1 C_{-1})$$

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

Carry o/p from four,

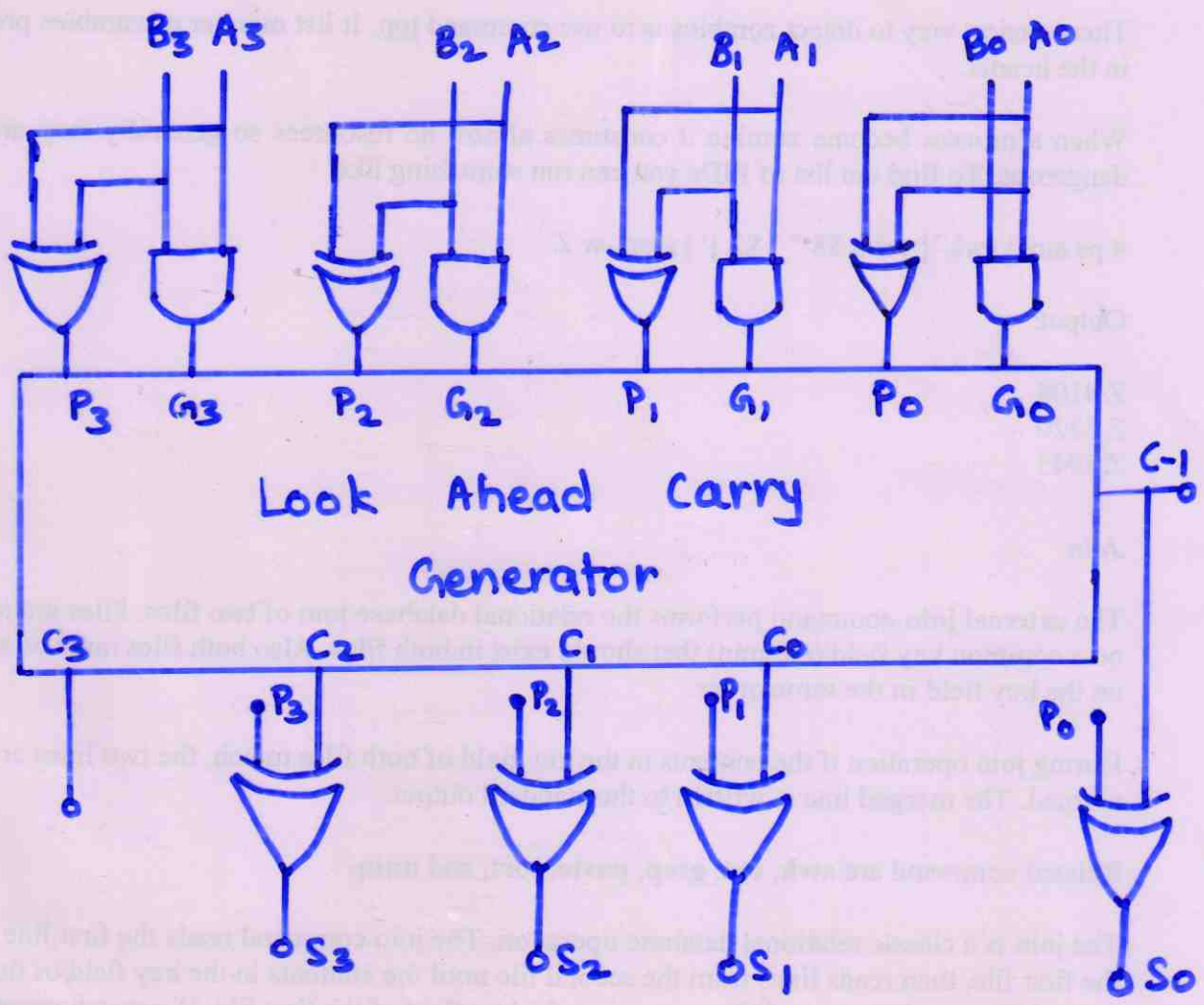
$$C_3 = G_3 + G_2 P_3 + G_1 P_2 P_3 + G_0 P_1 P_2 P_3 + P_0 P_1 P_2 P_3 C_{-1}$$

Expression for carry o/p of each stage in 4-bit parallel Adder.

Variables are $G_0, G_1, G_2, G_3, P_0, P_1, P_2, P_3, C_{-1}$

- G variables are generated from A and B i/ps using AND
- P variables are generated from A and B i/ps using EX-OR
- If G, P and C_{-1} are at a time available, then it is possible to produce carry o/p C_0, C_1, C_2, C_3

- The advantage of generating carry o/p using this method is that propagation delay of only two gates will be involved.
- these carry outputs are connected to the carry inputs of succeeding stage. This eliminates problem.



LOOK AHEAD CARRY GENERATOR FOR 4-BIT ADDER.

where,

$$S_i = P_i \oplus C_{i-1}$$

$$P_i = A_i \oplus B_i$$

$$G_i = A_i \cdot B_i$$

IC 74182 is Look Ahead Carry Generator.