

# Carry Lookahead Adder

Last updated 1/7/25

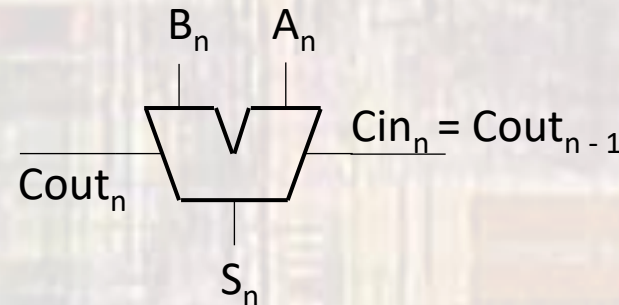
# Carry Lookahead Adder

- Want to speed up the carry path (vs the Ripple Carry Adder)

- Consider just the carry, and 1 column
- Generate a carry if A and B are both 1
  - $G_i = A_i B_i$
- Propagate a carry if A or B is 1 and  $C_{in}$  is 1
  - Define the propagate signal -  $P_i C_{in}$ 
    - Where  $P_i = A_i + B_i$

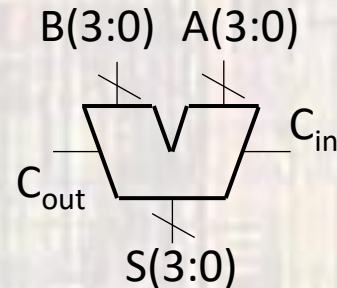
$$\begin{array}{r} 1111 \\ 1111 \\ + 1001 \\ \hline 1000 \end{array}$$

- $C_{out} = G_i + P_i C_{in}$
- $S = A \oplus B \oplus C_{in}$



# Carry Lookahead Adder

- Expand the Generate/Propagate to multiple bits (block)
  - Generate:  $G_{i:j} = 1$  if  $C_{out} = 1$  independent of the carry into the block
    - $G_{3:0} = G_3 + P_3(G_2 + P_2(G_1 + P_1G_0))$
  - Propagate:  $P_{i:j} = 1$  if  $C_{out} = 1$  when carry in for the block = 1
    - $P_{3:0} = P_3P_2P_1P_0$
  - Carry out of the block
    - $C_i = G_{i:j} + P_{i:j}C_{j-1}$
    - $C_{out} = G_{3:0} + P_{3:0}C_{in}$

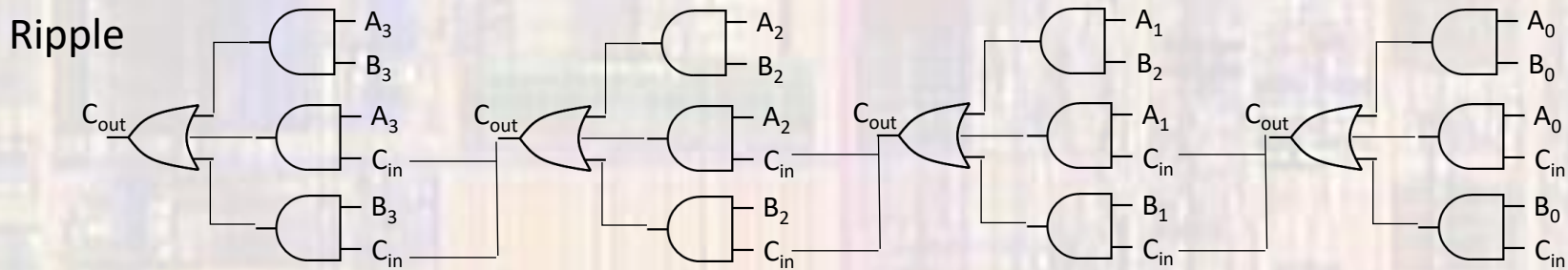




# Carry Lookahead Adder

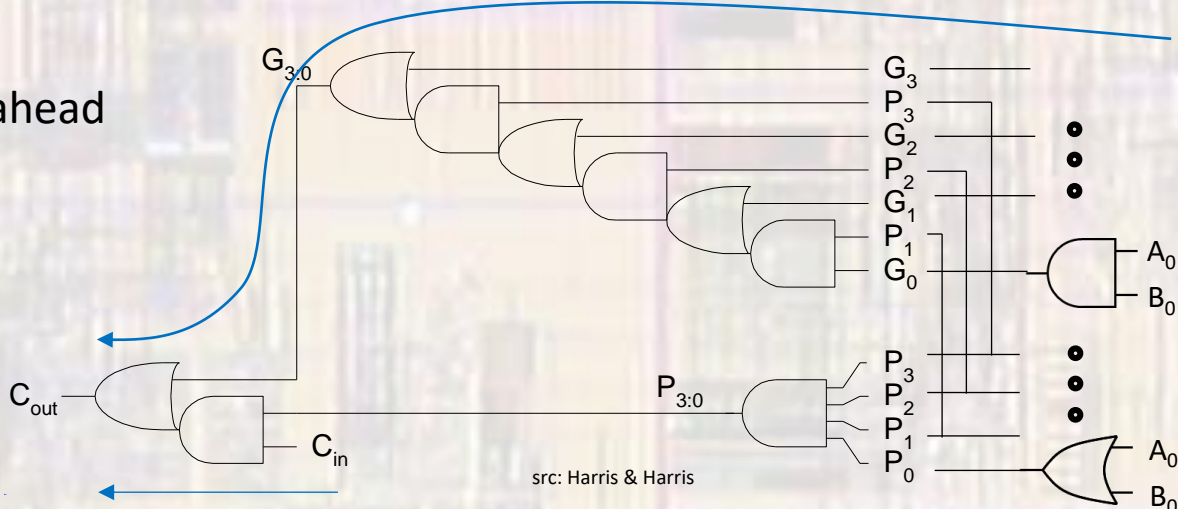
- Delay Comparison – 4 bits

8 (and/or) gate delays



8 (and/or) gate delays

Carry Lookahead



2 (and/or) gate delays

# Carry Lookahead Adder

- Delay Comparison – 32 bit adder

