Chapter 3

Activities

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Activity 1

Derive the values of A_k and B_k (k=0, …, N-1) so that the worst case delay is obtained for the ripple-carry adder.

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Solution:

1. The worst case condition requires that a carry be generated at the *lsb* position → A_0 and B_0 = 1

2. All other stages must be in propagate mode → either A_i or B_i must be high.

3. *msb* should change status → A_i and B_i both equal to 0 or 1.

Based on above conditions:

A=00000001

B=01111111

Activity 2

Show that $C_{o,3}$ of a 4-bit ripple-carry adder can be expressed as a function of 2 group carries, i.e.

$C_{o,3}$=($G_{3,2}$, $P_{3,2}$).($G_{1,0}$, $P_{1,0}$) .($C_{i,0}$,0)

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Solution:

$$(G_{3,2}, P_{3,2}) = (G_3, P_3) \bullet (G_2, P_2) = (G_3 + P_3 G_2, P_3 P_2)$$

$$(G_{1,0}, P_{1,0}) = (G_1, P_1) \bullet (G_0, P_0) = (G_1 + P_1 G_0, P_1 P_0)$$

$$\begin{aligned}(G_{3,2}, P_{3,2}) \bullet (G_{1,0}, P_{1,0}) &= (G_3 + P_3 G_2, P_3 P_2) \bullet (G_1 + P_1 G_0, P_1 P_0) \\ &= (G_3 + P_3 G_2 + P_3 P_2 G_1 + P_3 P_2 P_1 G_0, P_3 P_2 P_1 P_0)\end{aligned}$$

$$\begin{aligned}C_{o,3} &= (G_{3,2}, P_{3,2}) \bullet (G_{1,0}, P_{1,0}) \bullet (C_{i,0}, 0) \\ &= G_3 + P_3 G_2 + P_3 P_2 G_1 + P_3 P_2 P_1 G_0 + P_3 P_2 P_1 P_0 C_{i,0}\end{aligned}$$