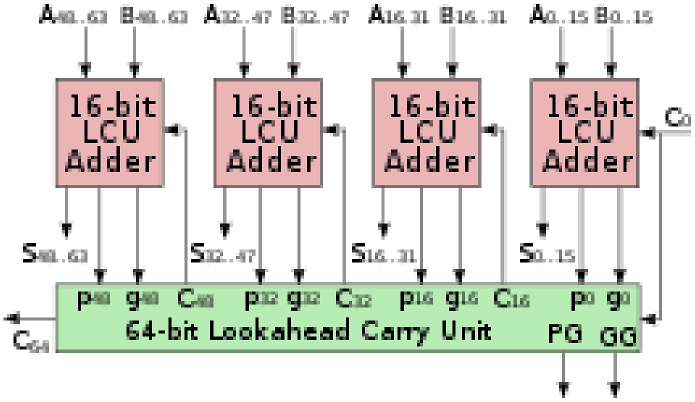
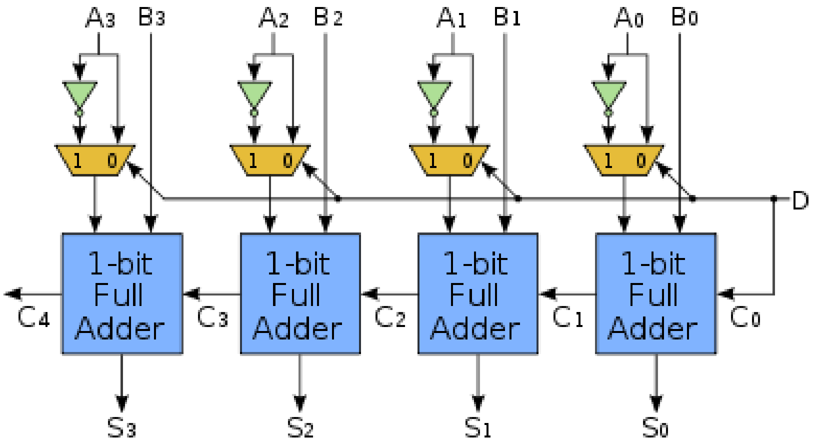
1. More on CLAs
    a. $C_{i+1} = G_i + P_iC_i$, where C is the carry
        i. $G_i = A_iB_i$, $P_i = A_i \oplus B_i$
        ii. Can expand this out
            1. $C_1 = G_0 + P_0 * C_0$
            2. $C_2 = G_1 + P_1 * C_1 = G_1 + P_1 * (G_0 + P_0 * C_0) = G_1 + P_1 * G_0 + P_1 * P_0 * C_0$
            3. $C_3 = G_2 + P_2 * C_2 = G_2 + P_2 * (G_1 + P_1 * C_1) = G_2 + P_2 * (G_1 + P_1 * (G_0 + P_0 * C_0))$
               $= G_2 + (P_2 * G_1) + (P_2 * P_1 * G_0) + (P_2 * P_1 * P_0 * C_0)$
            4. $C_4 = G_3 + P_3 * C_3 = G_3 + P_3 * G_2 + (P_3 * P_2 * G_1) + (P_3 * P_2 * P_1 * G_0) + (P_3 * P_2 * P_1 * P_0 * C_0)$

    b. Process

    c. Can expand this 4-bit adder to further levels, like a 64-bit unit


$A_{48..63}$ $B_{48..63}$ $A_{32..47}$ $B_{32..47}$ $A_{16..31}$ $B_{16..31}$ $A_{0..15}$ $B_{0..15}$
16-bit LCU Adder
16-bit LCU Adder
16-bit LCU Adder
16-bit LCU Adder
C_0
$S_{48..63}$
$S_{32..47}$
$S_{16..31}$
$S_{0..15}$
p_{48} g_{48} C_{48} p_{32} g_{32} C_{32} p_{16} g_{16} C_{16} p_0 g_0
64-bit Lookahead Carry Unit
PG GG
C_{64}

2. Subtractors



3. Comparators

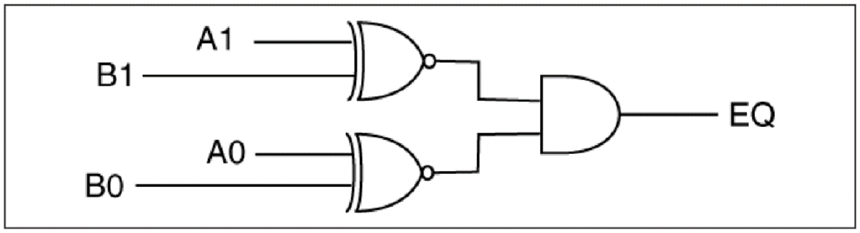


Figure 11.10: The final circuit for the 2-bit comparator as equation (e) in Figure 11.9.

4. Arithmetic logic unit (ALU)
    a. Each cell of the ALU has one of each type of gate in it

5. Error detection and correction
    a. Error types
    b. Will focus on errors that involve bits changing value
    c. Measure of size of error
    d. Three possible outcomes
    e. Will look at SECDED

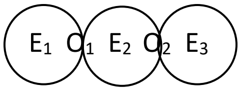
6. Parity
    a. Errors with a Hamming distance of 1

    b. *Even parity*

        i. *Odd parity*

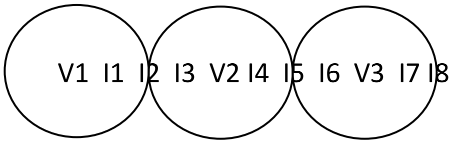
        ii. Example for even parity
            1. C denotes the position of the check bit
            2. C1001 ->
            3. C1101 ->

        iii. Even parity creates valid code words



Circles have a radius of one Hamming distance.

    c. Two bit errors



Circles have a radius of two Hamming distance.