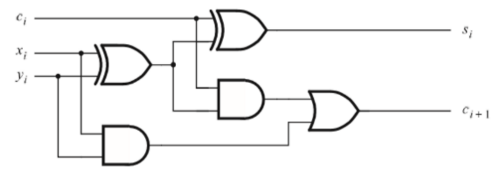
Marcus Domingo
ECE-301-002 HW 6

5.7:



c_i	x_i	y_i	c_{i+1}	s_i
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

$(x_i \oplus y_i) \oplus c_i = x_i \oplus y_i \oplus c_i$ and $(c_i \cdot (x_i \oplus y_i)) + (x_i \cdot y_i) = (x_i \cdot y_i) + (x_i \cdot c_i) + (y_i \cdot c_i)$

5.9:

x_{n-1}	y_{n-1}	c_{n-1}	s_{n-1}	c_n	$Overflow$
0	0	0	0	0	0
0	0	1	1	0	1
0	1	0	1	0	0
0	1	1	0	1	0
1	0	0	1	0	0
1	0	1	0	1	0
1	1	0	0	1	1
1	1	1	1	1	0

The truth table above represents the addition of the most-significant bit and overflow was determined by: Overflow occurs when 1) two positive numbers are added and the result is negative and 2) two negative numbers are added and the result is positive.

Looking at the truth table as well as the statement $Overflow = C_n \oplus C_{n-1}$ we see that overflow occurs in rows 1 and 6. For all the rows in the truth table $Overflow = C_n \oplus C_{n-1}$ stays true. Therefore, it is proven that $Overflow = C_n \oplus C_{n-1}$ for the addition of n-bit signed integers.

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5.10: Since: $s_k = x_k \oplus y_k \oplus c_k$

Then: $x_k \oplus y_k \oplus s_k = (x_k \oplus y_k) \oplus (x_k \oplus y_k \oplus c_k)$

$= (x_k \oplus y_k) \oplus (x_k \oplus y_k) \oplus c_k$

$= 0 \oplus c_k$

$= c_k$

5.15:

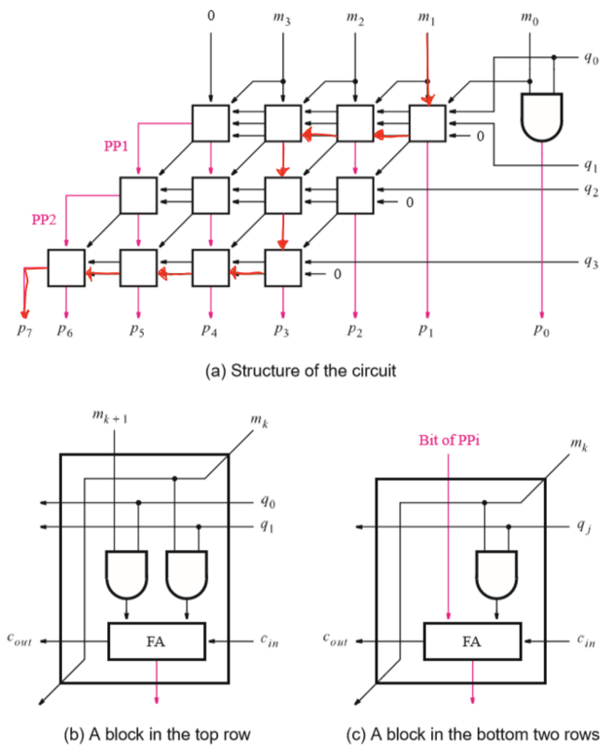

Figure 5.32 A 4 × 4 multiplier circuit.

The number of gates along this path is 25 gates, 1 initial and gate in the top row and 3 gates in every Full Adder that occurs 8 times.

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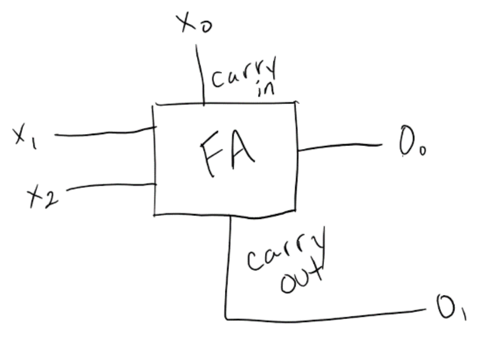
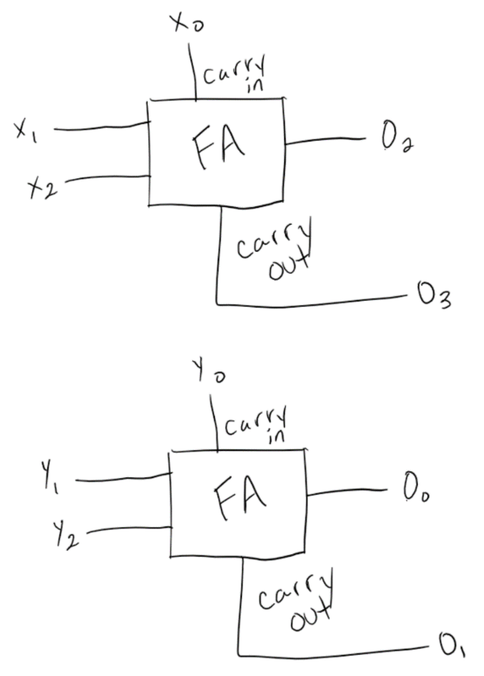
5.21:



x_0 *and* O_0 are the least significant bit and x_2 *and* O_1 are the most significant bit. The output can be represented as O_1O_0.

5.22:



$x_0, y_0,$ *and* O_0 are the least significant bit and $x_2, y_2,$ *and* O_3 are the most significant bit. The top circuit is for the last three bits of the 6-bit number and the bottom circuit is for the first three bits for the 6-bit number which can be represented as $x_2x_1x_0y_2y_1y_0$ and the output represented as $O_3O_2O_1O_0$.