

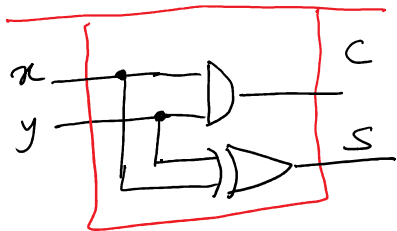
0	0	1	1	x
0	1	0	1	y
00	01	01	10	C S

x	y	C	S
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

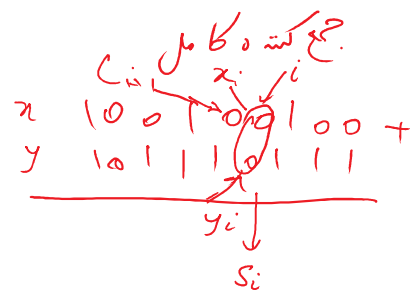
جمع کننده ناقص  
نیم جمع کننده  
Half Adder

$C = xy$   
 $S = x'y + xy' = x \oplus y$

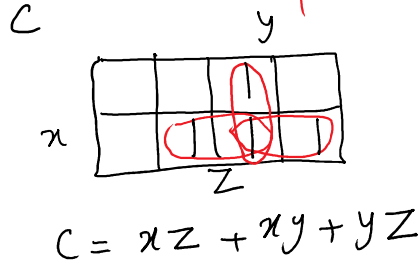


	x	y	$C_i$	$C_{in}$	C	S
	0	0	0	0	0	0
	0	0	1	0	0	1
	0	1	0	0	0	1
→	0	1	0	0	1	0
	1	0	0	0	1	0
	1	0	1	0	1	0
	1	1	0	1	1	0
	1	1	1	1	1	1

Full Adder



$C = \sum(3, 5, 6, 7)$   
 $S = \sum(1, 2, 4, 7)$



$S = x \oplus y \oplus z$

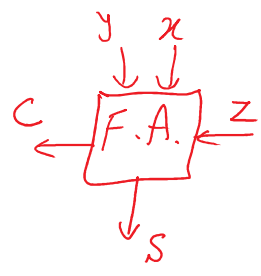
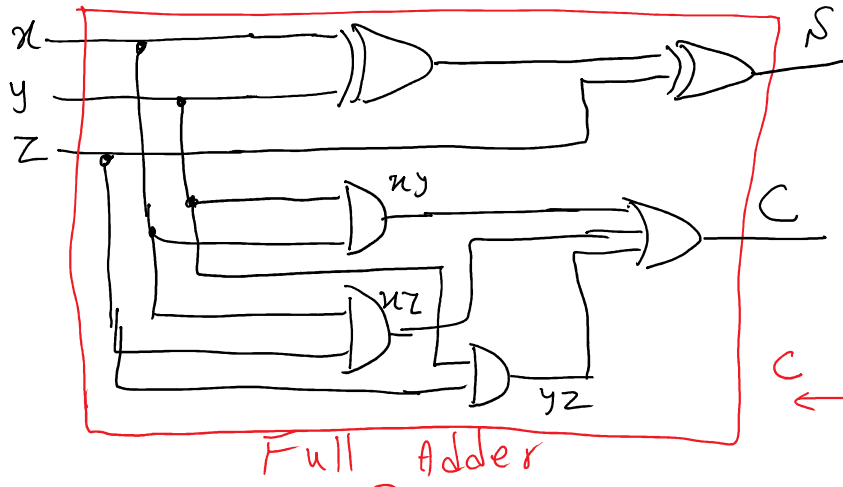
$S = x'yz' + x'y'z + xy'z' + xyz$

$S = x'(yz' + y'z) + x(yz' + yz)$

$A = yz' + y'z \rightarrow A' = y'z' + yz$

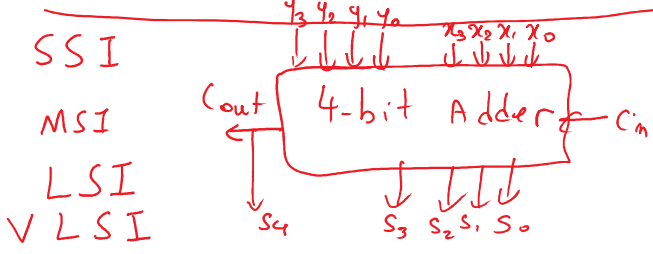
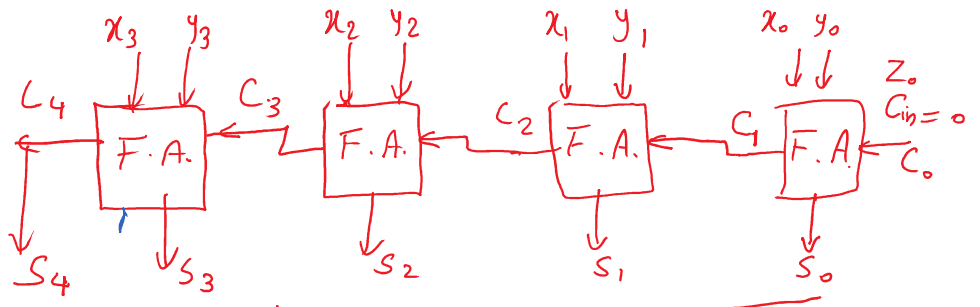
$S = x'A + xA' = x \oplus A$

$S = x \oplus (y \oplus z)$



Full Adder

$$\begin{array}{r} x_3 \ x_2 \ x_1 \ x_0 \\ + \\ y_3 \ y_2 \ y_1 \ y_0 \\ \hline S_4 \ S_3 \ S_2 \ S_1 \ S_0 \end{array}$$



SSI  
MSI  
LSI  
VLSI

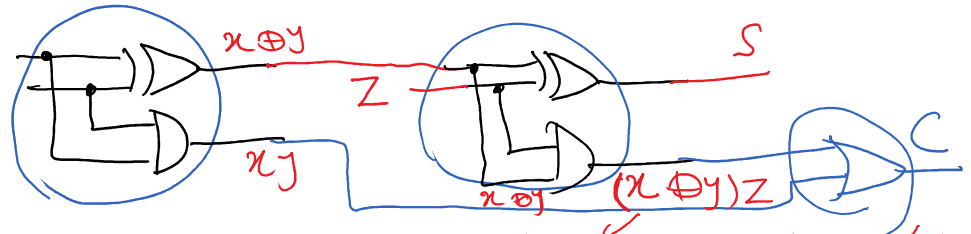
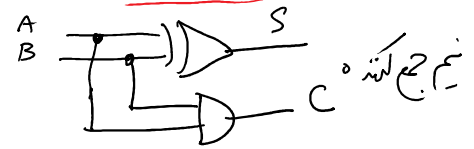
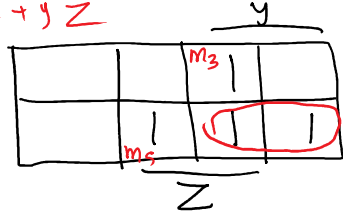
منته! می خواهم یک Full Adder با استفاده از 2 Half Adder بسازم.

$$C = \sum (3, 5, 6, 7)$$

$$C = xy + xz + yz$$

$$S = \sum (1, 2, 4, 7)$$

$$S = x \oplus y \oplus z$$



$$(x'y + xy')z = x'yz + xy'z$$

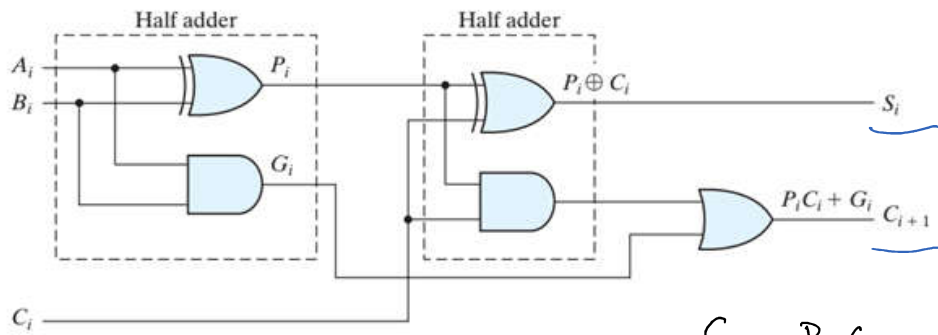
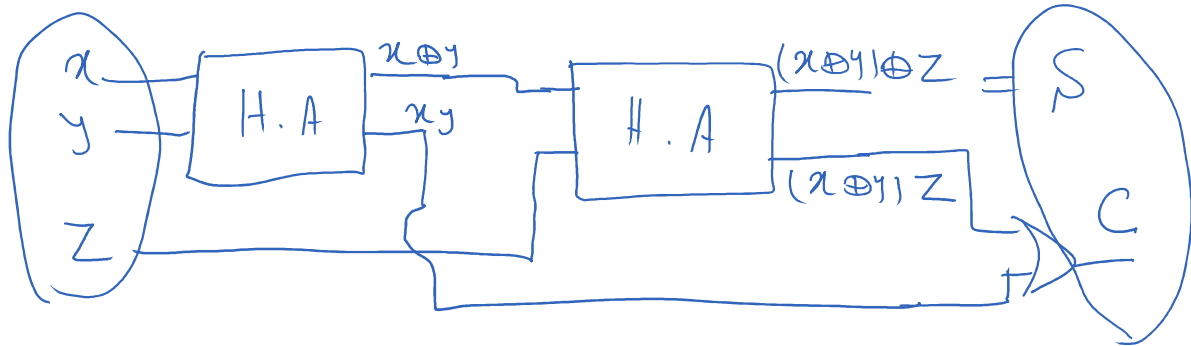
$$C = x'yz + xy'z + xy'z + xy'z + xy'z + xy'z + xy'z + xy'z$$

$$(x'y + xy')Z + xy$$

$$(x \oplus y)Z + xy$$

$$(x'y + xy')Z = x'yz + xy'z$$

$m_3 \quad m_5$



$$P_i = A_i \oplus B_i$$

$$G_i = A_i B_i$$

$$S_i = P_i \oplus C_i$$

$$C_{i+1} = P_i C_i + G_i$$

$$C_1 = P_0 C_0 + G_0$$

$$C_2 = P_1 C_1 + G_1$$

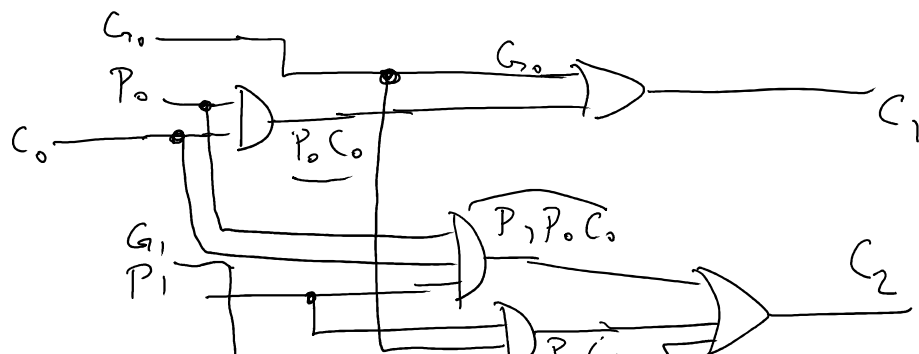
$$C_2 = P_1 (P_0 C_0 + G_0) + G_1$$

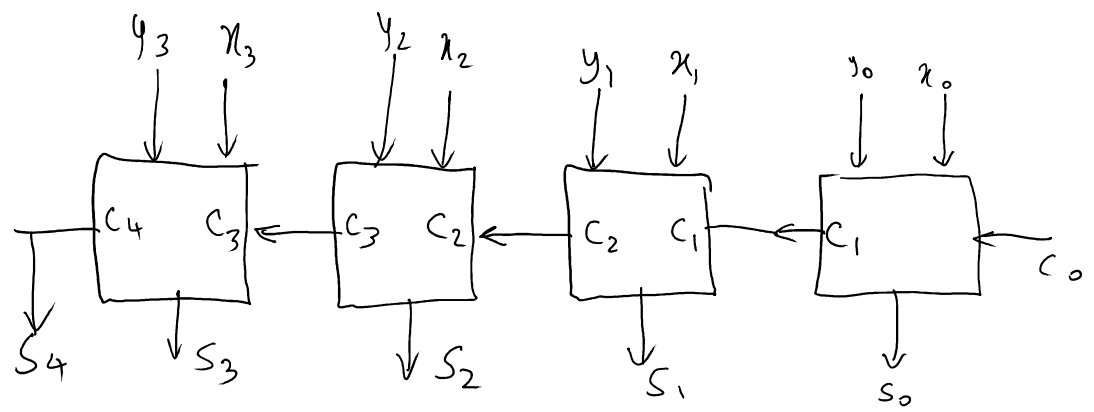
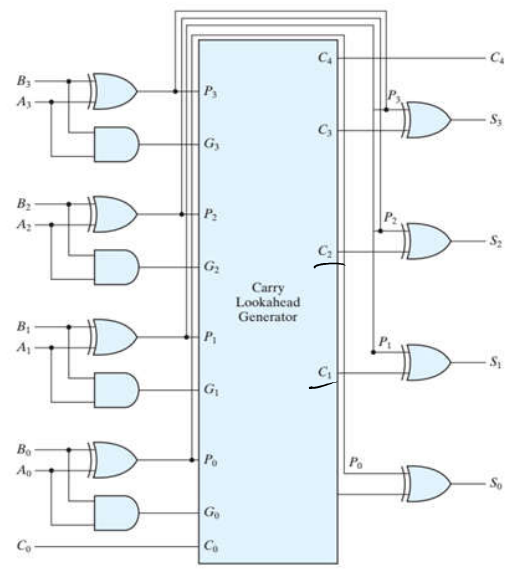
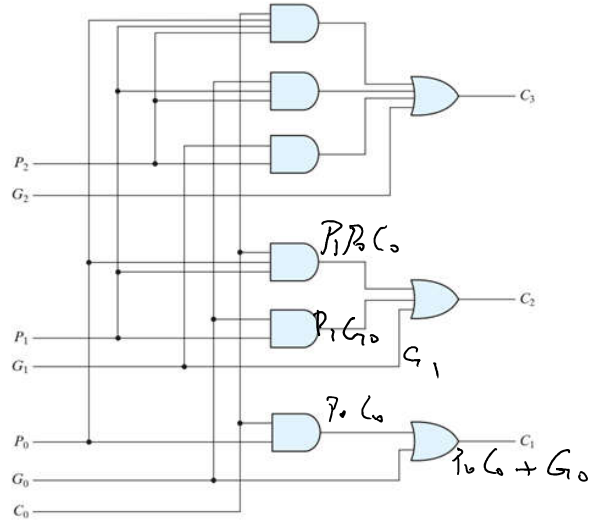
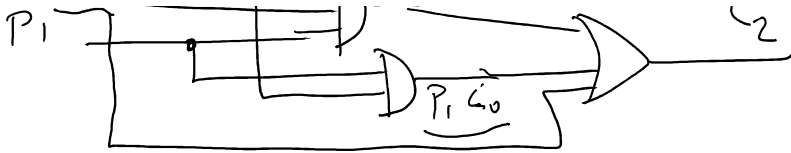
$$\rightarrow C_2 = P_1 P_0 C_0 + \overline{P_1} G_0 + G_1$$

$$C_3 = P_2 C_2 + G_2 = P_2 (P_1 P_0 C_0 + \overline{P_1} G_0 + G_1) + G_2$$

$$C_3 = P_2 P_1 P_0 C_0 + P_2 \overline{P_1} G_0 + P_2 G_1 + G_2$$

$$C_4 = P_3 C_3 + G_3 = P_3 (P_2 P_1 P_0 C_0 + P_2 \overline{P_1} G_0 + P_2 G_1 + G_2) + G_3$$





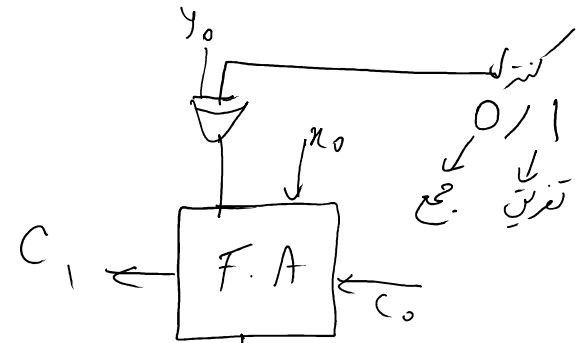
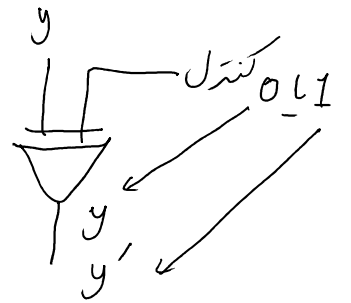
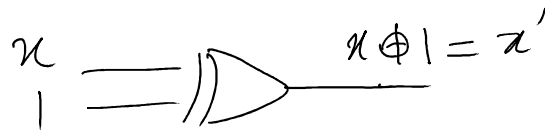
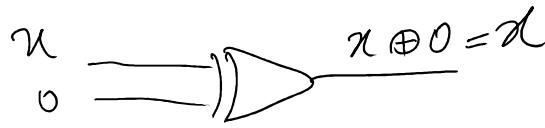
$$x_3 x_2 x_1 x_0 + y_3 y_2 y_1 y_0$$

$$x_3 x_2 x_1 x_0 - y_3 y_2 y_1 y_0 \rightarrow x_3 x_2 x_1 x_0 + 144401 \approx$$

$$\begin{array}{cccc} x_3 & x_2 & x_1 & x_0 & + \\ y_3 & y_2 & y_1 & y_0 & \\ \hline S_4 & S_3 & S_2 & S_1 & S_0 \end{array}$$

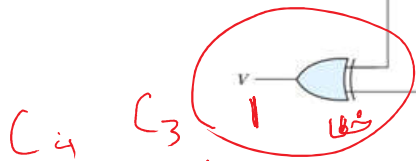
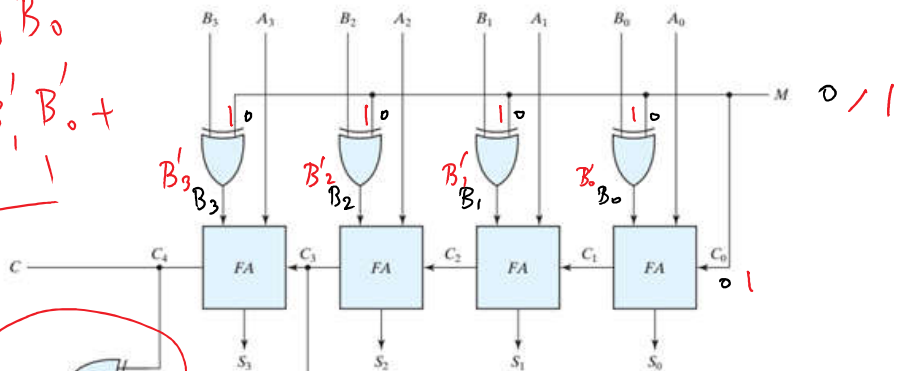
$$\begin{array}{cccc} x_3 & x_2 & x_1 & x_0 & - \\ y_3 & y_2 & y_1 & y_0 & \rightarrow \\ \hline & & & & (y_3 y_2 y_1 y_0)_{F_2} \end{array}$$

$$2^{\text{تم}}(y) = 1^{\text{تم}}(y) + 1$$



$$S = x_0 + (y_0 + 1)$$

$$\begin{array}{cccc} B_3 & B_2 & B_1 & B_0 \\ \downarrow & \downarrow & \downarrow & \downarrow \\ B'_3 & B'_2 & B'_1 & B'_0 & + \\ \downarrow & \downarrow & \downarrow & \downarrow \\ C_4 & C_3 & C_2 & C_1 & \end{array}$$



$$\begin{array}{cccc} A_3 & A_2 & A_1 & A_0 \\ B_3 & B_2 & B_1 & B_0 \end{array}$$

$$A_1 + B_1 + C_1$$

$$A_1 + B'_1 + C_1$$

$$A_0 + B_0 + 0$$

$$S_0 = A_0 + B'_0 + 1$$

نتیجه 2 بیت - B0