

CS120A – Homework #2

Spring 2003. Professor Hwang

Given May 6, 2003. Due May 13, 2003 at the beginning of class.

No late homework accepted.

Your work must be completely typeset with a word processor. Circuit diagrams can be drawn using any drawing program or by hand but it must be very neat. Handwritten works will **NOT** be accepted. (16 points total)

1. Draw the carry-look-ahead circuit for C_3 only. Show your work on how the equation for C_3 is derived. (4)

Answer

If we let

$$g_i = x_i y_i$$

and

$$p_i = x_i + y_i,$$

then

$$c_{i+1} = g_i + p_i c_i$$

$$c_1 = g_0 + p_0 c_0$$

$$c_2 = g_1 + p_1 c_1$$

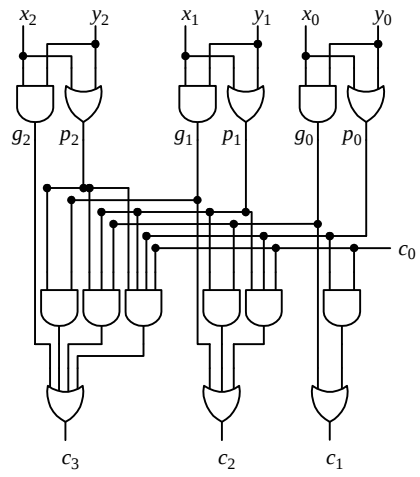
$$= g_1 + p_1 (g_0 + p_0 c_0)$$

$$= g_1 + p_1 g_0 + p_1 p_0 c_0$$

$$c_3 = g_2 + p_2 c_2$$

$$= g_2 + p_2 (g_1 + p_1 g_0 + p_1 p_0 c_0)$$

$$= g_2 + p_2 g_1 + p_2 p_1 g_0 + p_2 p_1 p_0 c_0$$

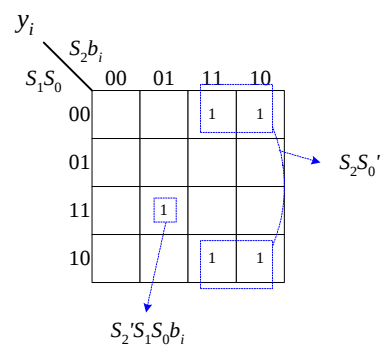
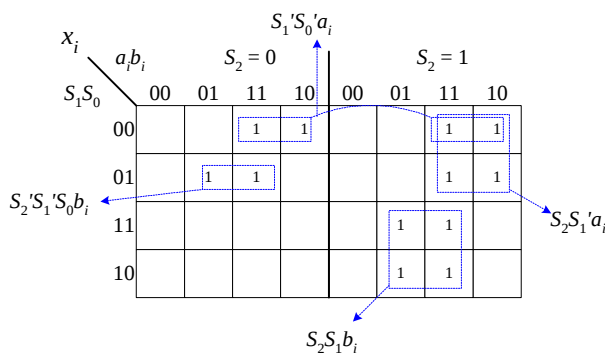


2. Draw the complete 3-bit ALU circuit having the following operations. The ALU circuit outputs a 0 if the operation cannot be performed. Use K-maps to reduce all the equations to standard form. (4)

S_2	S_1	S_0	Operation
0	0	0	Pass A through the LE
0	0	1	Pass B through the LE
0	1	0	Pass A through the AE
0	1	1	Pass B through the AE
1	0	0	$A - 1$
1	0	1	$A + 1$
1	1	0	$B - 1$
1	1	1	$B + 1$

Answer

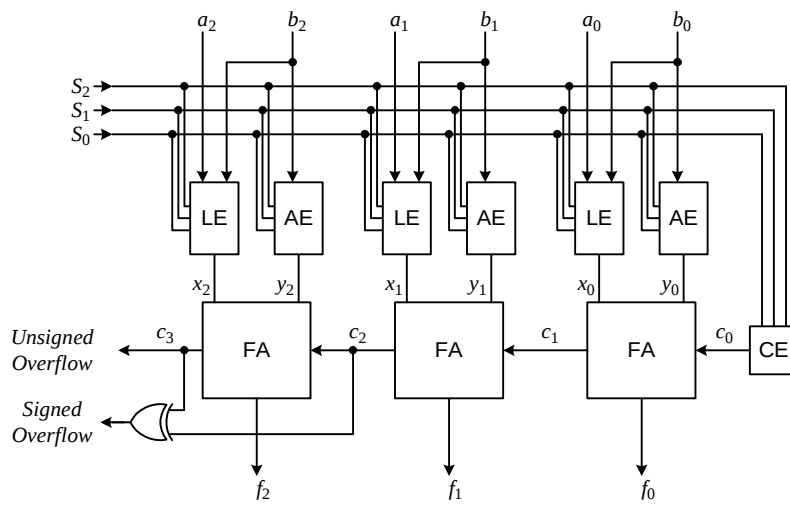
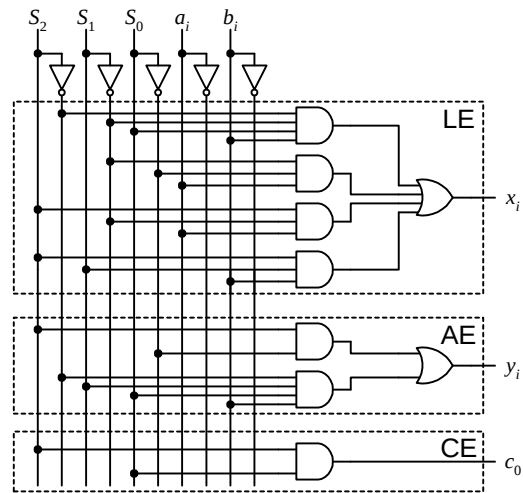
S_2	S_1	S_0	Operation	LE x_i	AE y_i	CE c_0
0	0	0	Pass A through the LE	a_i	0	0
0	0	1	Pass B through the LE	b_i	0	0
0	1	0	Pass A through the AE	0	0	0
0	1	1	Pass B through the AE	0	b_i	0
1	0	0	$A - 1$	a_i	1	0
1	0	1	$A + 1$	a_i	0	1
1	1	0	$B - 1$	b_i	1	0
1	1	1	$B + 1$	b_i	0	1



$$x_i = S_2'S_1'S_0b_i + S_1'S_0'a_i + S_2S_1'a_i + S_2S_1b_i$$

$$y_i = S_2S_0' + S_2'S_1S_0b_i$$

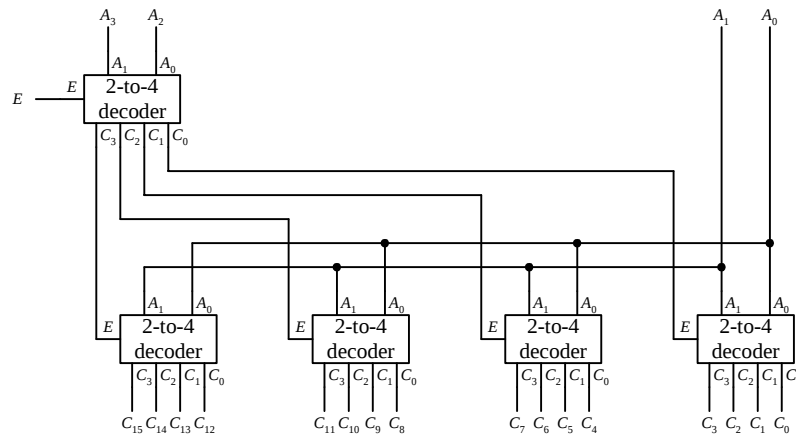
$$c_0 = S_2S_0$$



3. Draw the circuit for the 4-to-16 decoder using only 2-to-4 decoders.

(4)

Answer

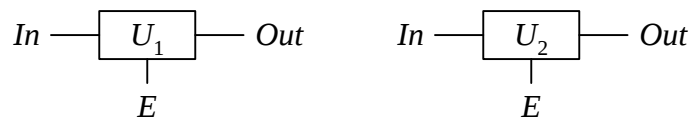


4. Assume that we have two components U_1 and U_2 whose operations are defined according to the truth tables below. Both of these components have two inputs and one output. Derive and draw the circuit for the tri-state buffer using these two components. Be careful that no short circuits are created anywhere in the circuit. Note that a Z value combined with a 0 gives a 0, and when combined with a 1 gives a 1. (4)

U_1		
E	In	Out
0	$\times$	Z
1	0	0
1	1	Z

U_2		
E	In	Out
1	$\times$	Z
0	0	Z
0	1	1

Logic symbols:



Answer

