

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

COMPUTER ENGINEERING DEPARTMENT

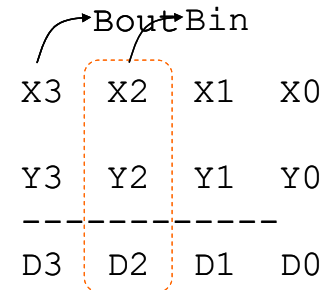
COE-200 – Fundamentals of Computer Engineering

Jan 4th, 2009 – Quiz5 (Section 02)

Student Name:

Student Number:

We would like to design a 1-bit full subtractor – This is a circuit that subtracts Y and any possible borrow, bin, from the bit X. In other words, $D = X - Bin - Y$. Note, the operation may generate a borrow, Bout, to be taken into account in the next stage. Refer to the figure on the side.



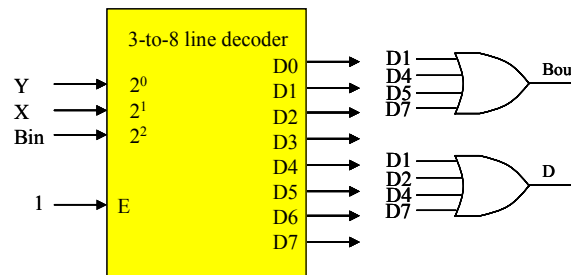
- 1) (10 points) Write the true table for the functions D and Bout.
- 2) (10 points) Implement the functions D and Bout using a 3-to-8 decoder
- 3) (10 points) Implement the function D using a 2^2 -to-1 MUX.
- 4) (10 points) Implement the function Bout using a 2^1 -to-1 MUX.

Solution:

(1) The truth table for functions D and Bout is as follows:

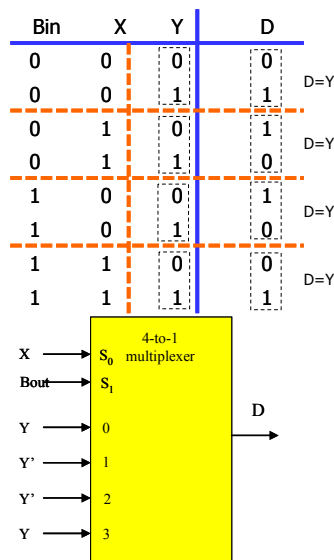
Bin	X	Y	Bout	D	Comment
0	0	0	0	0	0-0-0=0, No borrow
0	0	1	1	1	0-0-1→borrow 2, D = 2-1=1
0	1	0	0	1	1-0-0=1, no borrow
0	1	1	0	0	1-0-1=0, no borrow
1	0	0	1	1	0-1-0 → borrow 2, D = 1
1	0	1	1	0	0-1-1→ borrow 2, D = 0
1	1	0	0	0	1-1-0=0, no borrow
1	1	1	1	1	1-1-1→ borrow 2, D = 1

(2) The implementation of functions D and Bout using a 3-to-8 line decoder is as follows:

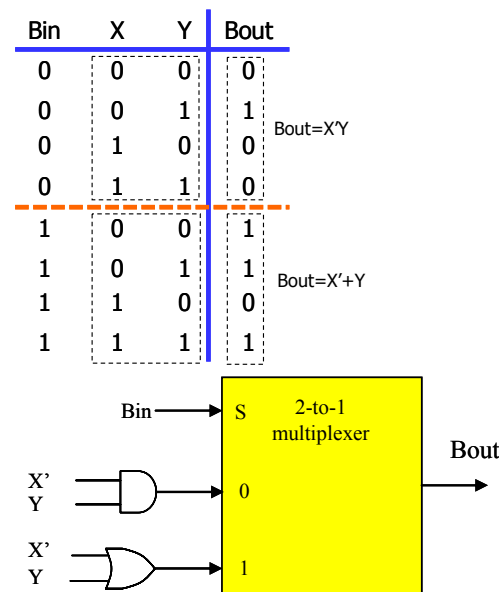


The truth table is found in lesson 3_2 page 6.

(3) D Function using a 4-to-1 MUX is as follows:



(4) Bout using a 2-to-1 MUX is as follows:



Note that solving (2), (3), and (4) needs only the truth table from (1) and does not depend on understanding the design of the 1-bit full subtractor. The truth table is found in Lesson 3_2 page 6.