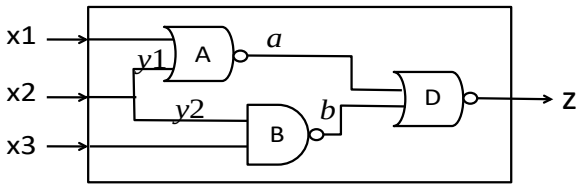
國立清華大學 電機工程學系
105 學年度第一學期
EE-6250 超大型積體電路測試 VLSI Testing
Homework #1 (佔學期總成績 10 分)
(每人一組) Due on Nov. 10, 2016
Late Homeworks will NOT be accepted !

1. Consider the testing of a gate-level circuit as shown below. The primary input signals are {x1, x2, x3} and the primary output signal is {z}. The output signals of logic gates {A, B} are denoted as {*a*, *b*}, and the branches of primary input signal x2 is called y1 and y2, respectively.



   (a) (40%) Write a C or C++ program that can **exhaustively simulate the logic behavior of the given circuit** under each of the 2^3 = 8 input vectors). Note that this can be done by executing the following Boolean equations in sequence in your program:

   ***a* = ~(x1 or x2);**
   ***b* = ~(x2 and x3);**
   z = ~(*a* or *b*);

   List the results as a truth table for output signal *z*. (Note this truth table contains 8 entries, one for each input combination).

   (b) (30%) Enhance your program so that it can perform **exhaustive fault simulation** for the following stuck-at faults {*a*-sa-0, *a*-sa-1, *b*-sa-0, *b*-sa-1, z-sa-0, z-sa-1}. Note that you need to report the total number of possible test patterns for each of the above stuck-at faults, by filling out a table as shown below.

Fault	*a*-sa-0	*a*-sa-1	*b*-sa-0	*b*-sa-1	z-sa-0	z-sa-1
# Test patterns						

   (Hint: perform fault injection, run exhaustive simulation on the faulty circuit, and then compare the results with those of the fault-free circuit. The fault injection can be done **manually** by changing the compiled code. Note that this part should be done automatically by program as well.)

   (c) (30%) Manually derive the fault list at signals {*y*1, *y*2, *a*, *b*, *z*} in **inductive fault simulation algorithm**. for input pattern {(x1=0, x2=1, x3=1)}. Fill out the following form:

Fault	*y*1	*y*2	*a*	*b*	*z*
Fault List					

Note: 繳交資料: (1) Combine your answers to the above questions (a)-(c) into a single PDF file. (2) Append to the above combined file your source code of your C or C++ program. (3) Attach a cover page with your 系所，中英文姓名，學號等資訊 before submitting your all-in-one file to our【清華大學-數位學習系統】(http://lms.nthu.edu.tw).