Solutions to Classwork #10 #15

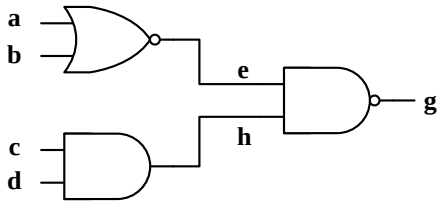
Diagnosis + Compression

Team:____ Name:_____ Score:_____ Reviewer: _____

CW 每次一小時，總共六十分，互相交換改。
各題批改標準：方法對答案錯一處扣該題總分 20% (同一原因扣一次)。方法錯一處扣 60%。有爭議給助教改。
Each CW has 60 points in total. Answer time is one hour. Swap your test sheet with others for grading purposes. Grading criteria for each problem: if an answer is wrong but the method is correct, 20% of the total score of this problem will be deducted (Multiple wrong answers with the same root cause are treated as one). 60% deduction for a wrong method. Ask the TAs if there are disputes about grading criteria.

Problem 1 Diagnosis <video 10.3> (15 points)

Consider the following circuit and single stuck-at fault model. We apply 4 patterns *abcd* = {0111, 0011 1001, 1011}. **Consider only a/0, c/1, e/1, h/0, g/0, g/1**.



A. Assume the circuit fails the 4th test pattern. Please diagnose the circuit using **dynamic cause-effect diagnosis**. **Show how you remove faults by the three rules.**

B. Show the partial fault dictionary with scores **10×TFSF – TPSF**. What's the diagnosed fault?

A. Please fill in the good values into the following table first.

pattern #	a	b	c	d	e	h	g
1	0	1	1	1	0	1	1
2	0	0	1	1	1	1	0
3	1	0	0	1	0	0	1
4	1	0	1	1	0	1	1

Step 1. Structural backtracing

Only one primary output, no faults can be eliminated

Step 2. Parity check

Example：a/0: v = 0; p = 0; f = 0 v⊕p = 0 fault remains

c/1: v = 1; p = 1; f = 0 v⊕p = 0 fault remains

e/1: v = 1; p = 1; f = 0 v⊕p = 0 fault remains

h/0: v = 0; p = 1; f = 0 v⊕p = 1 fault eliminated

g/0: v = 0; p = 0; f = 0 v⊕p = 0 fault remains

g/1: v = 1; p = 0; f = 0 v⊕p = 1 fault eliminated

Step 3. Excitation condition check

c/1 eliminated due to no excitation (c = 1 in the 4th pattern)

B. Please fill in the following table as your partial fault dictionary.

Fault	Pattern1	Pattern2	Pattern3	Pattern4	TFSF	TPSF	Score (10×TFSF - TPSF)
a/0				**X**	**1**	**0**	**10**
e/1	**X**			**X**	**1**	**1**	**9**
g/0	**X**		**X**	**X**	**1**	**2**	**8**
Test Failure				**X**			

The diagnosed single stuck-at fault is a/0

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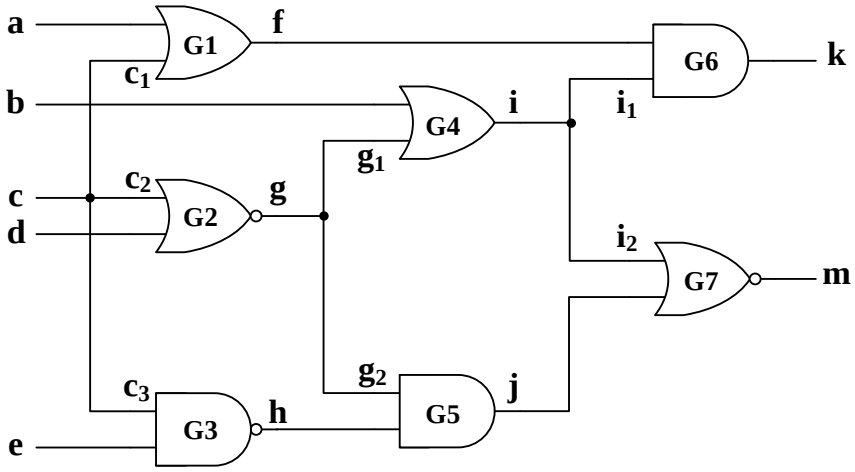
Problem 2 PODEM-X <video 15.1> (15 points)

Consider the following circuit.



The primary fault is *g* SA0 fault and **the secondary fault is *f* SA0.**

Please generate a test pattern using PODEM-X algorithm. If the test doesn't exist, please explain. Use level for easy/hard to control input when backtracing.

Primary Fault: *g* SA0

Initial objective: g = 1

Backtrace to PI: c = 0

Implication: h = 1

Backtrace to PI: d = 0

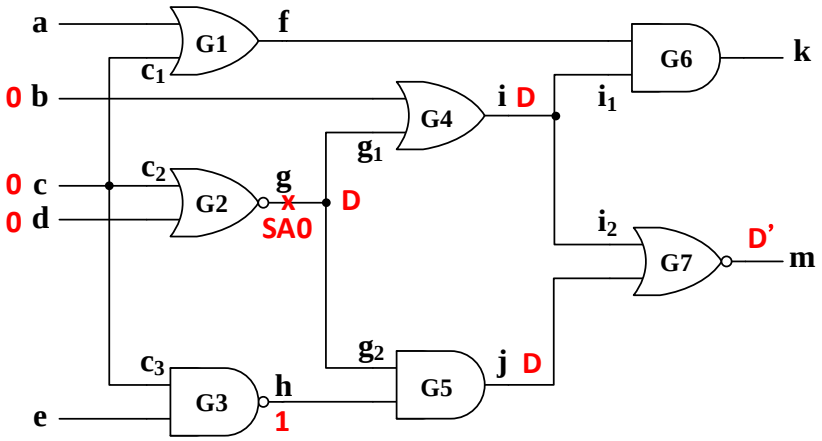
Implication: $g = g_1 = g_2 = D$, $j = D$

Objective: $i_2 = 0$

Backtrace to PI: b = 0

Implication: $i = i_1 = i_2 = D$, $m = D'$

Test cube: *abcde* = x 0 0 0 x



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(change D to 1, D' to 0 due to single fault assumption)

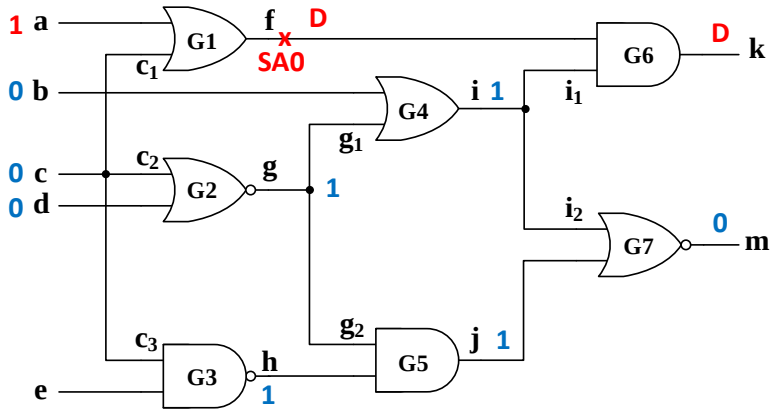
Choose secondary fault = *f* SA0

Objective: f = 1

Backtrace to PI: a = 1

Implication: f = D, k = D, fault detected

New test cube: *abcde* = 1 0 0 0 x



Problem 3 Static Test Compression<Video 15.2> (15 points)

Consider the following covering table (X = detection). Please answer

A. Which are essential faults?

B. Which are dominated rows?

C. After remove dominated rows, which are dominating columns?

D. What is minimum test set?

E. List 01-ILP objective and all constraints (consider the original table)

	f_1	f_2	f_3	f_4	f_5
t_1	X		X		X
t_2		X	X		
t_3	X			X	
t_4	X	X	X		X

A. f_4

B. t_1、t_2

C. f_1 is dominating column

D. t_3、t_4

E. $t_i = 1$ if test *i* is selected; $t_i = 0$ otherwise.

Objective: min $t_1 + t_2 + t_3 + t_4$

Constraint1: $t_1 + t_3 + t_4 \geq 1$ (for f_1)

Constraint2: $t_2 + t_4 \geq 1$ (for f_2)

Constraint3: $t_1 + t_2 + t_4 \geq 1$ (for f_3)

Constraint4: $t_3 \geq 1$ (for f_4)

Constraint5: $t_1 + t_4 \geq 1$ (for f_5)

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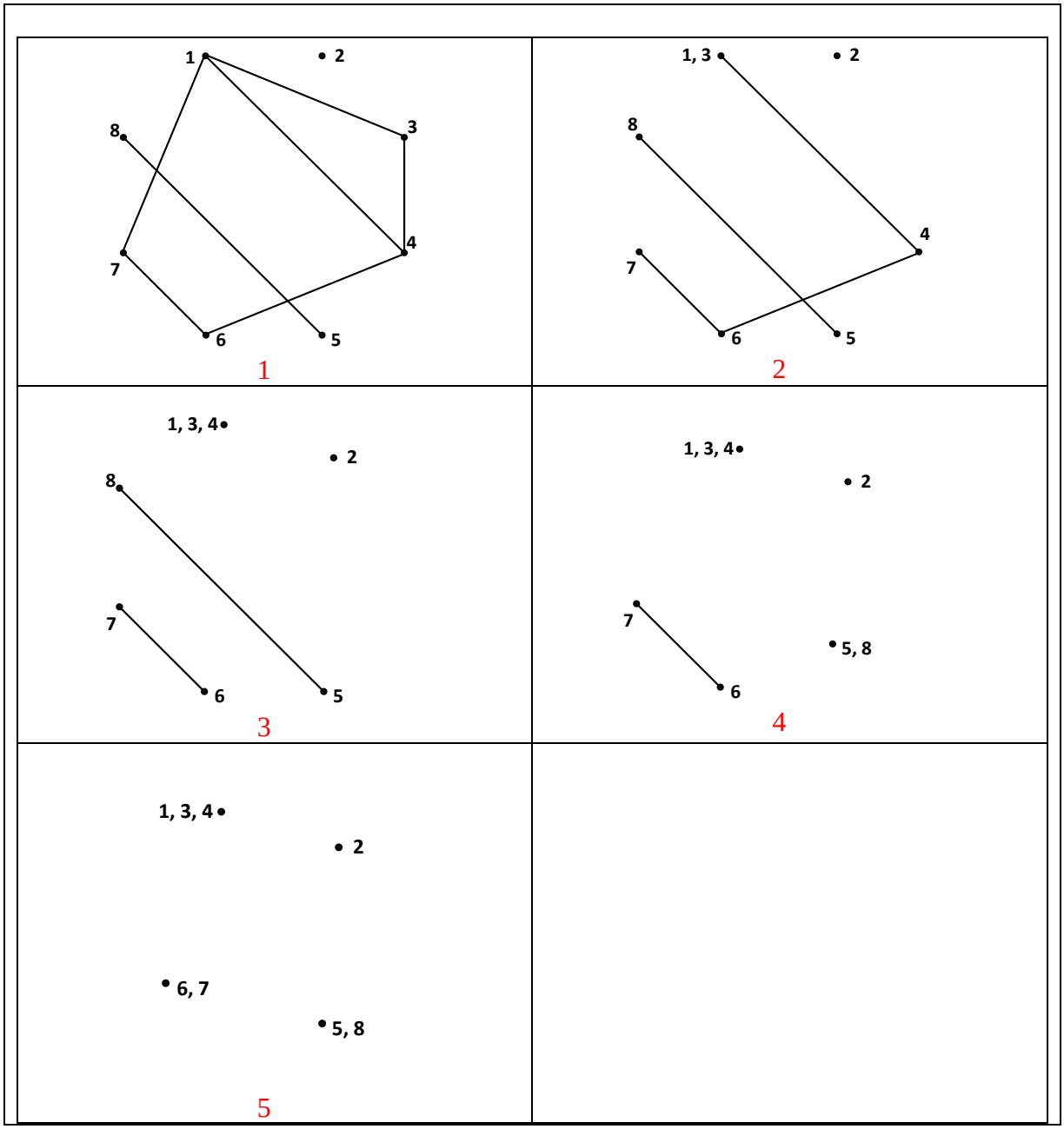
Problem 4 Tseng-Siewiorek Algorithm <video 15.2> (15 points)

For the following patterns, please use Tseng-Siewiorek Algorithm to find minimal test cube.

Pattern						
1	1	X	0	X	X	X
2	0	X	0	0	1	0
3	1	0	0	1	0	X
4	X	0	X	1	X	1
5	X	1	1	X	1	1
6	0	X	X	1	0	X
7	X	1	0	1	0	0
8	1	X	1	0	X	X



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Problem 5 PODEM-X <video 15.1> (self-practice)

Please redo problem 2 using PODEM-X, **while swap the primary and the secondary fault**. (Primary fault *f* SA0, secondary fault *g* SA0)

Primary Fault: *f* SA0

Initial objective: f = 1

Backtrace to PI: a = 1

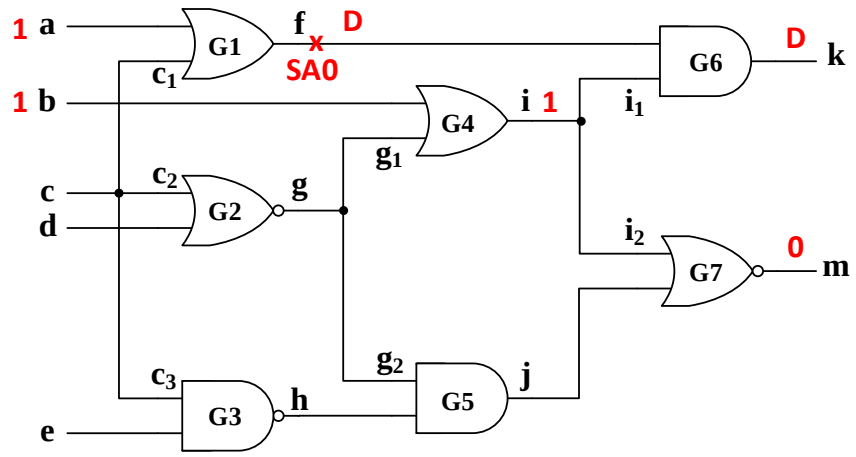
Implication: f = D

Objective: i_1 = 1

Backtrace to PI: b = 1

Implication: i = i_1 = i_2 = 1, k = D, m = 0

Test cube: *abcde* = 1 1 x x x



Since there is no PO = X, we cannot target the secondary fault.