ECE 462 (Spring 2005) Homework #6 Solutions

(A) Use truth tables to determine test vectors for h/0 and g/0.

a	b	c	f	$f_{h/0}$	$f_{g/0}$
0	0	0	1	1	1
0	0	1	0	0	1
0	1	0	0	0	0
0	1	1	1	1	1
1	0	0	0	1	0
1	0	1	1	1	1
1	1	0	1	1	1
1	1	1	0	0	0

The <abc> inputs with different output values are valid test vectors for the respective fault. Therefore, the only test vector for h/0 is <abc> = <100> and the only test vector for g/0 is <abc> = <001>.

(B) test for h/1

$$H(a,b,c) = ab'c'$$

$$F(a,b,c,H) = (a'bc' + a'b'c + abc + H)'$$

$$\frac{dF}{dH} = f_h \oplus f_{h'}$$

$$= 0 \oplus (a'bc' + a'b'c + abc)'$$

$$= (a'bc' + a'b'c + abc)'$$

$$= (a'bc')'(a'b'c)'(abc)'$$

$$= (a + b' + c)(a + b + c')(a' + b' + c')$$

$$= (a + ab + ac' + ab' + bb' + b'c' + ac + bc + cc')(a' + b' + c')$$

$$= aa' + ab' + ac' + a'b'c' + b'c' + b'c' + a'bc + bb'c + bcc'$$

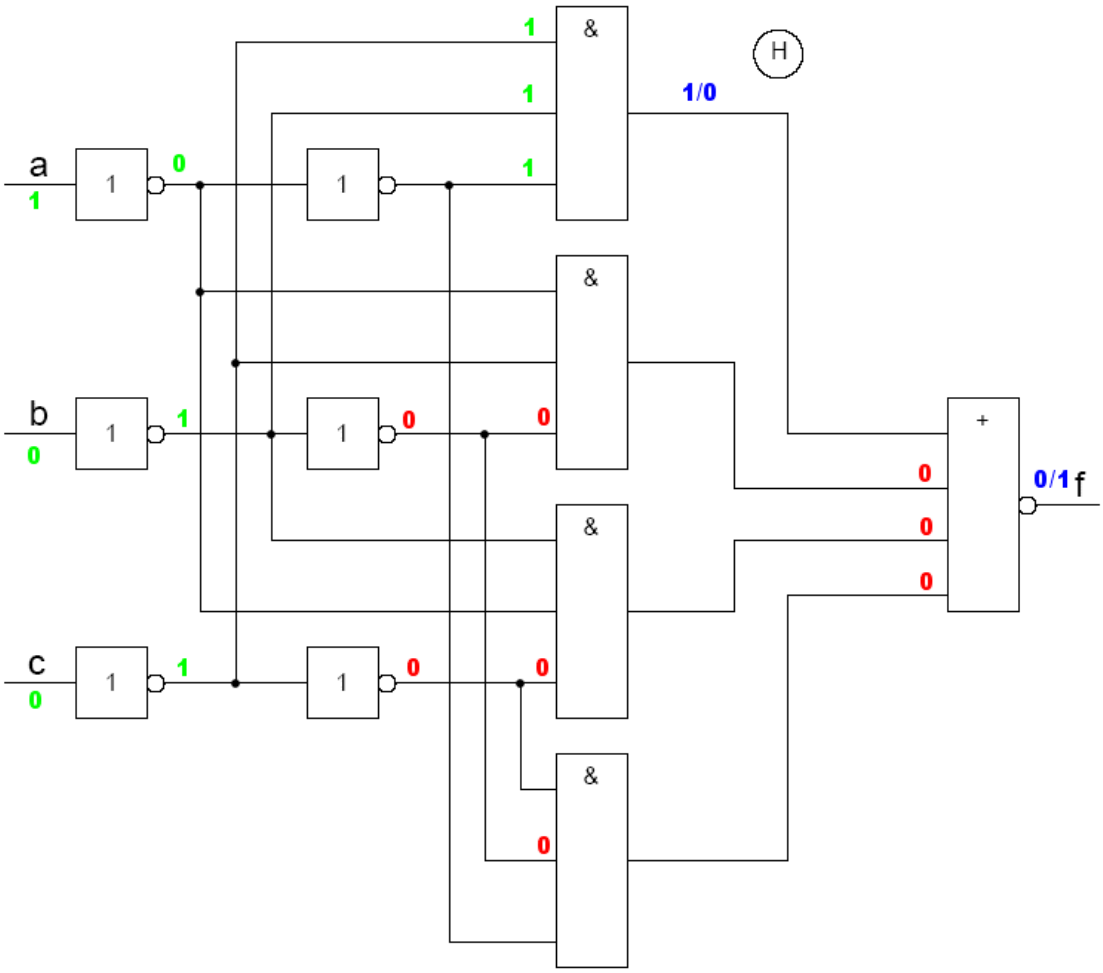
$$= ab' + ac' + b'c' + a'bc$$

Thus, F is dependent on H when dF/dH is equal to one, or when ab'+ac'+b'c'+a'bc = 1. dF/dH is equal to 1 for test vectors <abc> = <000>, <011>, <100>, <101>, <101>.

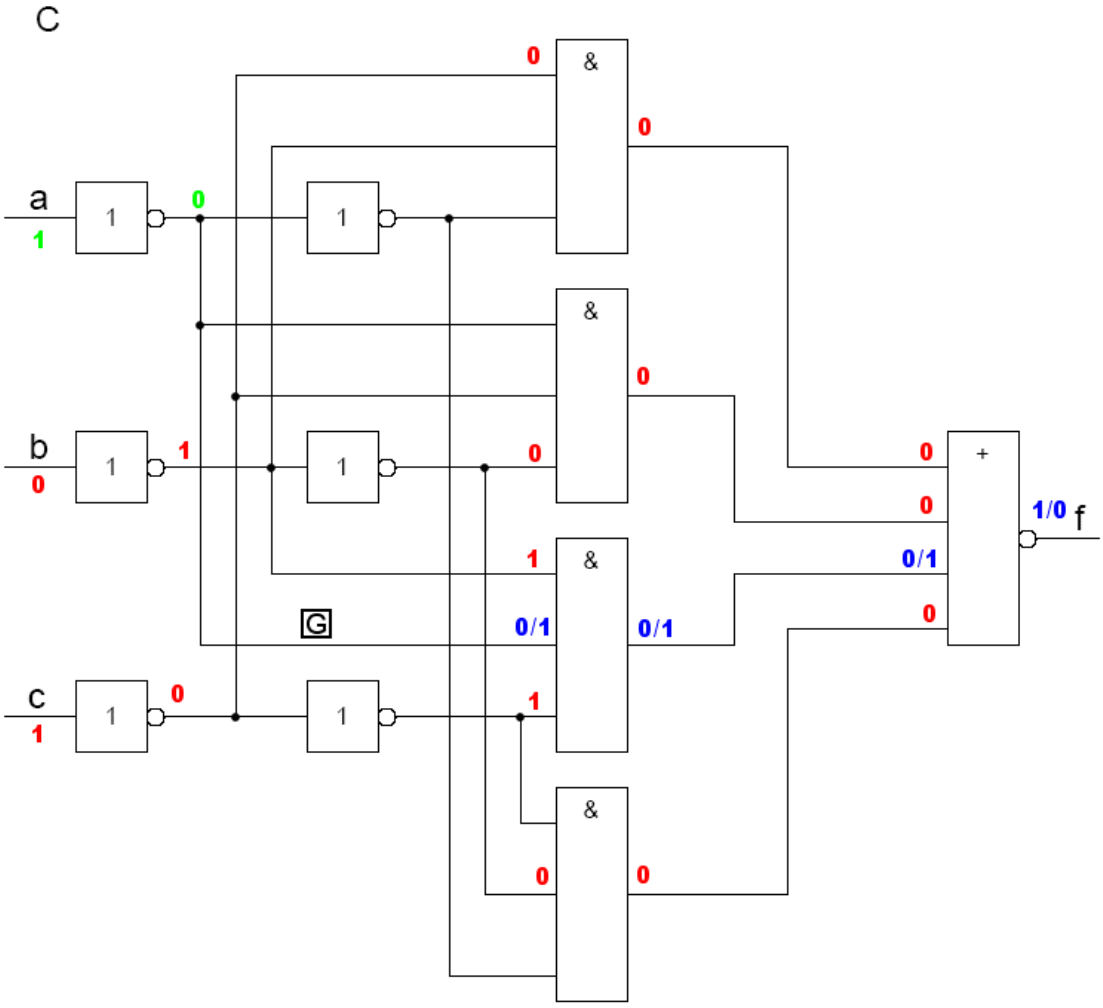
We want to test h stuck-at-1. To sensitize the fault, set H = 0. or ab'c' = 0. H will be 0 for all test vectors besides <abc> = <100>. Therefore, all the test vectors that will test h/1 are <abc> = <000>, <011>, <101>, and <101>.

(C)

h stuck-at-0



g stuck-at-1



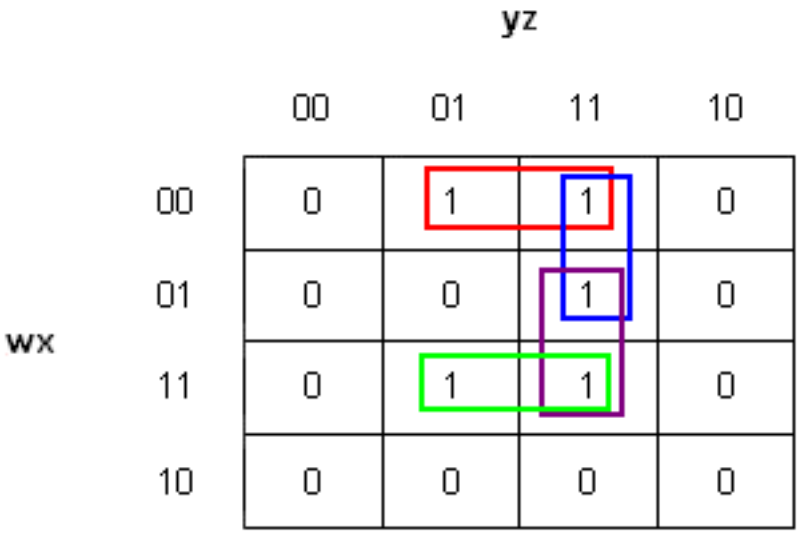
(D)

xyz	f	$f_{x/1}$	$f_{y/1}$	$f_{z/1}$	$f_{a/1}$	$f_{b/1}$	$f_{c/1}$	$f_{d/1}$	$f_{e/1}$	$f_{g/1}$	$f_{h/1}$	$f_{f/1}$
000	0	0	0	0	0	0	0	0	1	1	1	1
001	0	0	1	0	0	0	1	0	1	1	1	1
010	0	1	0	1	1	0	0	1	1	1	1	1
011	1	1	1	1	1	1	1	1	1	1	1	1
100	0	0	1	0	0	1	0	0	1	1	1	1
101	0	0	1	0	0	1	1	0	1	1	1	1
110	1	1	1	1	1	1	1	1	1	1	1	1
111	1	1	1	1	1	1	1	1	1	1	1	1

Fault classes: $f_{x/1} = f_{z/1} = f_{a/1} = f_{d/1}$
$f_{y/1}$

$f_{b/1}$
$f_{c/1}$
$f_{e/1} = f_{g/1} = f_{h/1} = f_{f/1}$

(E) $\sum(1,3,7,13,15)$



Prime Implicants: w'x'z, w'yz, xyz, wxz

A B C D

	1 3	**3 7**	**7 13**	**13 15**
A	**X**			
B		**X**		
C			**X**	
D				**X**

Hence, all the prime implicants are needed in the minimal hazard free sum.
f = w'x'z + w'yz + xyz + wxz