

Key for HW 14

1. F1: find df/da when $f = ab + ac + bc + a'de$

$$d(ab + ac + bc + a'de)/da = (0b + 0c + bc + 0'de) \oplus (1b + 1c + bc + 1'de)$$

$$d(ab + ac + bc + a'de)/da = (bc + de) \oplus (b + c + bc)$$

$$= (bc + de) \oplus (b + c)$$

$$= (bc + de)'(b+c) + (bc + de)(b+c)'$$

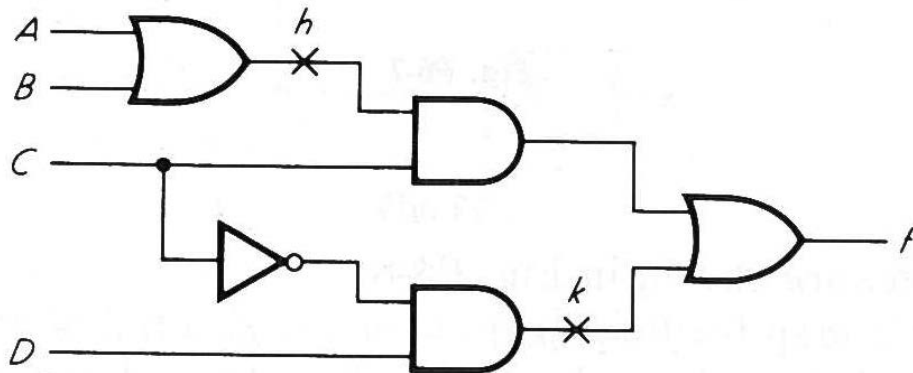
$$= (bc)'(de)'(b+c) + (bc + de)(b'c')$$

$$= (b' + c')(d' + e')(b+c) + (bcb'c' + deb'c')$$

$$= (b'd' + b'e' + c'd' + c'e')(b+c) + b'c'de$$

$$= bc'd' + bc'e' + b'cd' + b'ce' + b'c'de$$

2. For the following circuit, assume that only wires h , and k may have faults.



a. Construct a truth table including the outputs in the presence of each faults.

The different faults that may be present are:

- h stuck at 0,
- h stuck at 1,
- k stuck at 0,
- k stuck at 1.

A	B	C	D	F	F-H0	F-K0	F-H1	F-K1
0	0	0	0	0	0	0	0	1
0	0	0	1	1	1	0	1	1
0	0	1	0	0	0	0	1	1
0	0	1	1	0	0	0	1	1
0	1	0	0	0	0	0	0	1
0	1	0	1	1	1	0	1	1
0	1	1	0	1	0	1	1	1
0	1	1	1	1	0	1	1	1
1	0	0	0	0	0	0	0	1
1	0	0	1	1	1	0	1	1
1	0	1	0	1	0	1	1	1
1	0	1	1	1	0	1	1	1
1	1	0	0	0	0	0	0	1
1	1	0	1	1	1	0	1	1
1	1	1	0	1	0	1	1	1
1	1	1	1	1	0	1	1	1

b. Construct the fault table.

Note: The Columns in these tables represent faults.

The Rows in these tables represent tests.

The 1s represent points where a test can detect a fault.

A	B	C	D	H0	K0	H1	K1
0	0	0	0				1
0	0	0	1		1		
0	0	1	0			1	1
0	0	1	1			1	1
0	1	0	0				1
0	1	0	1		1		
0	1	1	0	1			
0	1	1	1	1			
1	0	0	0				1
1	0	0	1		1		
1	0	1	0	1			
1	0	1	1	1			
1	1	0	0				1
1	1	0	1		1		
1	1	1	0	1			
1	1	1	1	1			

c. Reduce the fault table.

1st, We remove dominating **columns**. We removed K1.

A	B	C	D	H0	K0	H1
0	0	0	0			
0	0	0	1		1	
0	0	1	0			1
0	0	1	1			1
0	1	0	0			
0	1	0	1		1	
0	1	1	0	1		
0	1	1	1	1		
1	0	0	0			
1	0	0	1		1	
1	0	1	0	1		
1	0	1	1	1		
1	1	0	0			
1	1	0	1		1	
1	1	1	0	1		
1	1	1	1	1		

2nd, We identify essential tests. There are no essential tests.

3rd, We remove dominated **rows**. Here we only have the test cases 0x1, 0x4, and 0x6

A	B	C	D	F-H0	F-K0	F-H1
0	0	0	1		1	
0	0	1	0			1
0	1	1	0	1		

d. Determine a minimum fault-detection experiment.

Applying the following:

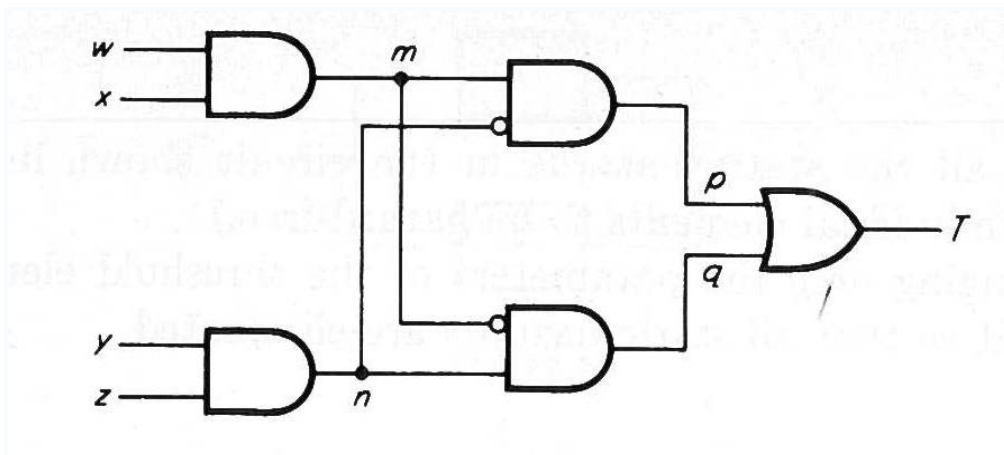
- > 0001, if we get a '0', then there is a fault
- > 0010, if we get a '1', then there is a fault
- > 1001, if we get a '1', then there is a fault.

Note: there are various possible solutions to the above depending on what rows the student deleted.

3.

For the following circuit, assume that only wires m, n, p, and q may have faults.

- a. Construct a truth table including the outputs in the presence of each fault
- b. Construct the fault table
- c. Reduce the fault table. Determine a minimum fault-detection experiment.



Set of faults

m1 = m stuck at 1

m0 = m stuck at 0

n1 = n stuck at 1

n0 = n stuck at 0

p1 = p stuck at 1

p0 = p stuck at 0

q1 = q stuck at 1

q0 = q stuck at 0

a. Construct a truth table including the outputs in the presence of each fault

w	x	y	z	T	Tm0	Tm1	Tn0	Tn1	Tp0	Tp1	Tq0	Tq1
0	0	0	0	0	0	1	0	1	0	1	0	1
0	0	0	1	0	0	1	0	1	0	1	0	1
0	0	1	0	0	0	1	0	1	0	1	0	1
0	0	1	1	1	1	0	0	1	1	1	0	1
0	1	0	0	0	0	1	0	1	0	1	0	1
0	1	0	1	0	0	1	0	1	0	1	0	1
0	1	1	0	0	0	1	0	1	0	1	0	1
0	1	1	1	1	1	0	0	1	1	1	0	1
1	0	0	0	0	0	1	0	1	0	1	0	1
1	0	0	1	0	0	1	0	1	0	1	0	1
1	0	1	0	0	0	1	0	1	0	1	0	1
1	0	1	1	1	1	0	0	1	1	1	0	1
1	1	0	0	1	0	1	1	0	0	1	1	1
1	1	0	1	1	0	1	1	0	0	1	1	1
1	1	1	0	1	0	1	1	0	0	1	1	1
1	1	1	1	0	1	0	1	0	0	1	0	1

b) **Fault table**

w	x	y	z	M0	M1	N0	N1	P0	Q0	Q1	P1
0	0	0	0		1		1			1	1
0	0	0	1		1		1			1	1
0	0	1	0		1		1			1	1
0	0	1	1		1	1			1		
0	1	0	0		1		1			1	1
0	1	0	1		1		1			1	1
0	1	1	0		1		1			1	1
0	1	1	1		1	1			1		
1	0	0	0		1		1			1	1
1	0	0	1		1		1			1	1
1	0	1	0		1		1			1	1
1	0	1	1		1	1			1		
1	1	0	0	1			1	1			
1	1	0	1	1			1	1			
1	1	1	0	1			1	1			
1	1	1	1	1		1				1	1

c) **Reduced fault table**

1st remove dominating columns

Q1, P1 are identical

M0, N1 dominate P0

M1, N0 dominate Q0

w	x	y	z	P0	Q0	{Q1, P1}
0	0	0	0			1
0	0	0	1			1
0	0	1	0			1
0	0	1	1		1	
0	1	0	0			1
0	1	0	1			1
0	1	1	0			1
0	1	1	1		1	
1	0	0	0			1
1	0	0	1			1
1	0	1	0			1
1	0	1	1		1	
1	1	0	0	1		
1	1	0	1	1		
1	1	1	0	1		
1	1	1	1			1

2nd - Find essential tests - none

3rd remove dominated **rows**

w	x	y	z	P0	Q0	{Q1, P1}
1	0	1	1		1	
1	1	1	0	1		
1	1	1	1			1

d) **Fault Expiement**

w	x	y	z	Tp0	Tq0	Tq1,Tp1
1	0	1	1		1	
1	1	1	0	1		
1	1	1	1			1

The fault experiment:

1. Apply 1011 If output is 0, there is a fault
2. Apply 1110 If output is 0, there is a fault
3. Apply 1111 If output is 1, there is a fault

Note, there are various correct responses to this last part depending on which dominated rows the student deletes.