**ECSE 421 – Assignment 3**

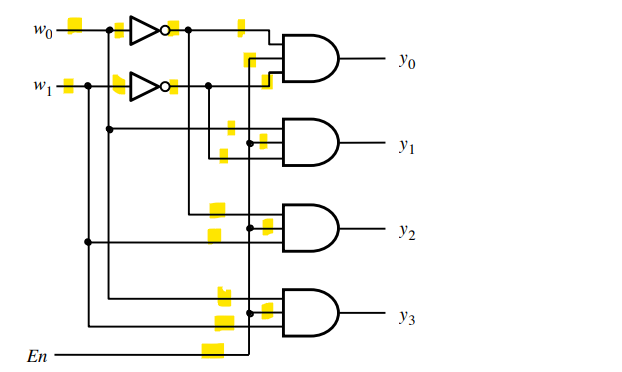
**Question 1:**

|  |  |
| --- | --- |
| **Test**  **w1w2w3w4** | **Faults Detected** |
| **0100** | c/1, d/1, w1/1, w4/1, f/1 |
| **1010** | b/0, d/0, w3/0, w4/1, f/0 |
| **0011** | f/0 |
| **1111** | f/0 |
| **0110** | b/1 c/1, d/1, w1/1, w2/0, w4/1, f/1 |
| **Total Unique Faults** | 11 |

There is a total possibility of 16 faults 8 wires with the possibility of 2 faults each. The total number of unique faults based on the given inputs is 11. The percentage of single s-a-v faults detected is 68.75%.

**Question 2:**

* 23 fault sites give 46 s-a-v faults.
* Reduced to 17 checkpoints giving 24 checkpoint faults.



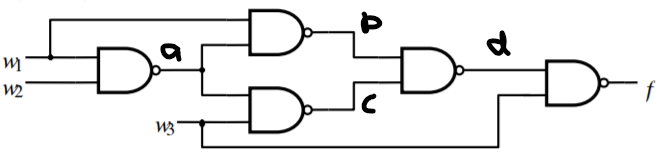
The En signal is dominant signal and needs to be set to 1 to detect all the dominant faults. To test all the other possibilities, the tests will need to include and possibilities with En set as 1. There are many equivalent tests, when En is unset. Therefore, we can choose one of the possible tests with En set as 0 to catch the En s-a-1.

The set to catch all the errors should contain all these tests:

|  |
| --- |
| **w1w2w3** |
| 000 |
| 001 |
| 011 |
| 101 |
| 111 |

**Question 3:**

A fault is detectable is there exists a test that can detect the fault. Using this diagram, we can test to see if we can detect all the possible faults.

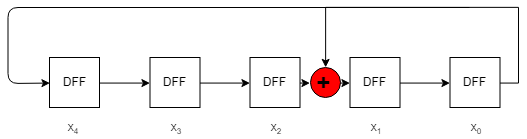


|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **w1w2w3** | **a** | **b** | **C** | **d** | **f** |
| 000 | 1 | 1 | 1 | 0 | 1 |
| 001 | 1 | 1 | 0 | 1 | 0 |
| 010 | 1 | 1 | 1 | 0 | 1 |
| 011 | 1 | 1 | 0 | 1 | 0 |
| 100 | 1 | 0 | 1 | 1 | 1 |
| 101 | 1 | 0 | 0 | 1 | 0 |
| 110 | 0 | 1 | 1 | 0 | 1 |
| 111 | 0 | 1 | 1 | 0 | 1 |

Looking at the function we derived clearly it can be implemented with a much simple circuit involving less gates with a smaller cost. Therefore, there is a lot of redundancy in the circuit which means that we would not be able to detect a s-a-1 fault on .

**Question 4:**

1. The standard (type 2) LFSR implementation for the polynomial.



1. Use the formula for an external compaction matrix
2. The following is the next 3 patterns based off the initial states (x0, x1, x2, x3, x4) = 10000. The results were all calculated in Matlab.

A = [0 1 0 0 0; 0 0 1 0 0 ;0 0 0 1 0 ;0 0 0 0 1 ; 1 0 1 0 0]

A =

0 1 0 0 0

0 0 1 0 0

0 0 0 1 0

0 0 0 0 1

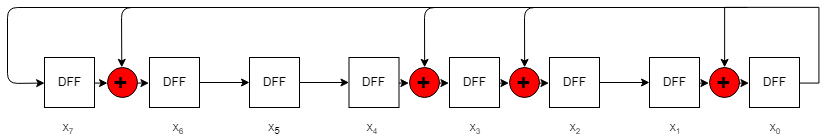
1 0 1 0 0

B = [1;0;0;0;0]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **t=** | **0** | **1** | **2** | **3** |
| **X0** | 1 | 0 | 0 | 0 |
| **X1** | 0 | 0 | 0 | 0 |
| **X2** | 0 | 0 | 0 | 1 |
| **X3** | 0 | 0 | 1 | 0 |
| **X4** | 0 | 1 | 0 | 0 |

**Question 5:**

1. The internal (type 2) LFSR implementation for the polynomial.



1. Use the given formula to find the compaction matrix.
2. The following is the next 3 patterns based off the initial states (x0, x1, x2, x3, x4, x5, x6, x7) = (0,1,0,0,1,1,1,0). The results were all calculated in Matlab.

A = [ 0 0 0 0 0 0 0 1; 1 0 0 0 0 0 0 1; 0 1 0 0 0 0 0 0; 0 0 1 0 0 0 0 0; 0 0 0 1 0 0 0 0 ; 0 0 0 0 1 0 0 1;0 0 0 0 0 1 0 1 ; 0 0 0 0 0 0 1 0]

A =

0 0 0 0 0 0 0 1

1 0 0 0 0 0 0 1

0 1 0 0 0 0 0 0

0 0 1 0 0 0 0 0

0 0 0 1 0 0 0 0

0 0 0 0 1 0 0 1

0 0 0 0 0 1 0 1

0 0 0 0 0 0 1 0

B = [0;1;0;0;1;1;1;0]

B =

0

1

0

0

1

1

1

0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **t=** | **0** | **1** | **2** | **3** | **4** | **5** |
| **X0** | 0 | 1 | 0 | 0 | 1 | 1 |
| **X1** | 1 | 0 | 0 | 1 | 1 | 1 |
| **X2** | 0 | 0 | 1 | 1 | 1 | 0 |
| **X3** | 0 | 1 | 1 | 1 | 0 | 1 |
| **X4** | 1 | 1 | 1 | 0 | 1 | 0 |
| **X5** | 1 | 1 | 0 | 1 | 0 | 1 |
| **X6** | 1 | 0 | 1 | 0 | 1 | 0 |
| **X7** | 0 | 1 | 0 | 1 | 0 | 1 |