BIRZEIT UNIVERSITY

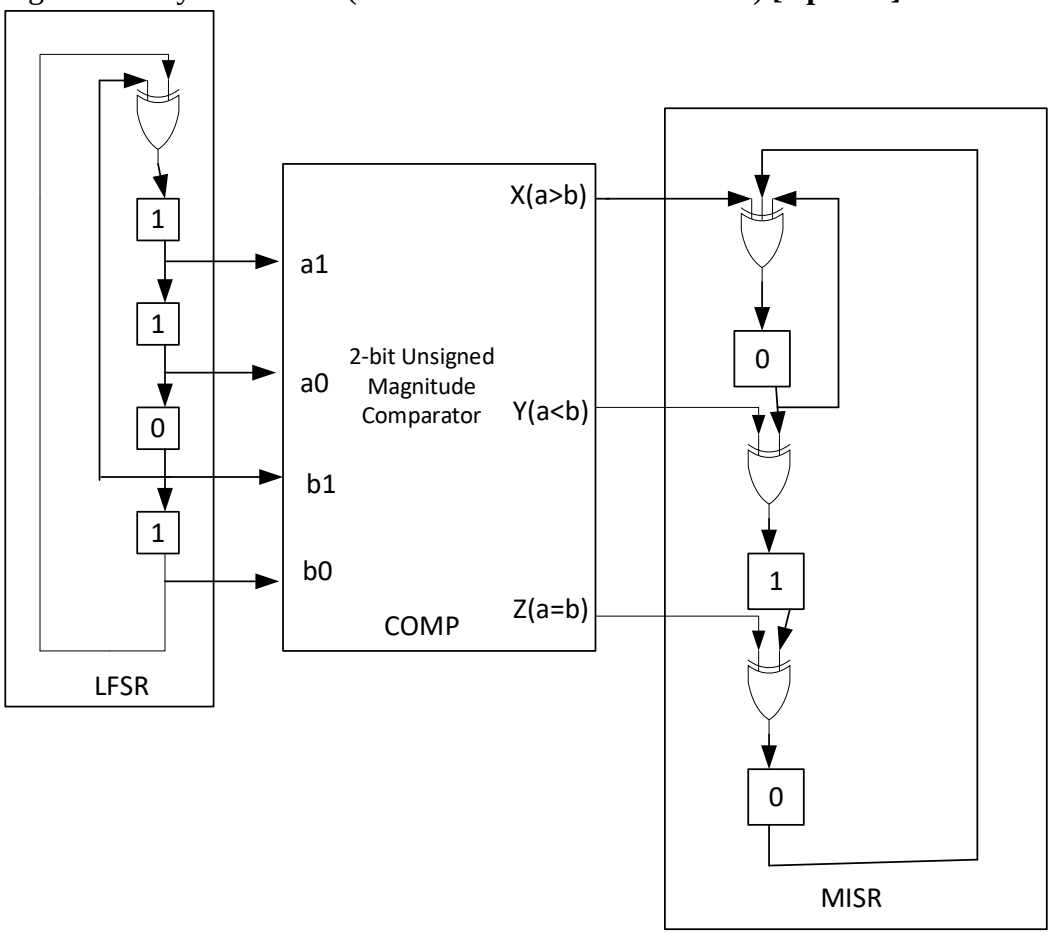
**Faculty of Engineering and Technology**
**Electrical and Computer Engineering Department**

**Final Exam** **First Semester 2021-2022**
***Instructor: Dr. Abdellatif S. Abu-Issa*** **Duration: 135 minutes**

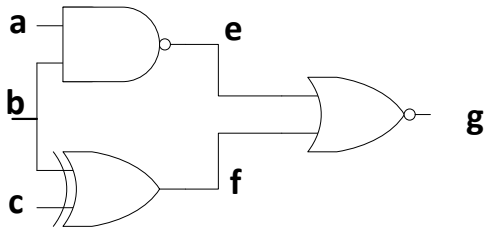
**Q1) (20 points)**

The following figure shows a Built-In Self-Test Circuit for a 2-bit magnitude comparator. The test vectors are generated using a 4-bit LFSR and the results are analysed using a 3-bit MISR as shown in the figure.

a) Show the first 6 test vectors generated by the LFSR. The first vector of the LFSR is "1101", you should show the next 5 test vectors. **[5 points]**
b) What is the fault free signature of this system after we apply these test vectors? (Initial value of the MISR "010") **[8 points]**
c) Assume that the output Z(a=b) is Sa1. What is the signature after we apply the same test vectors generated by the LFSR? (Initial value of MISR is "010" ) **[7 points]**



**Q2) (20 points)** For the circuit shown in the following figure:



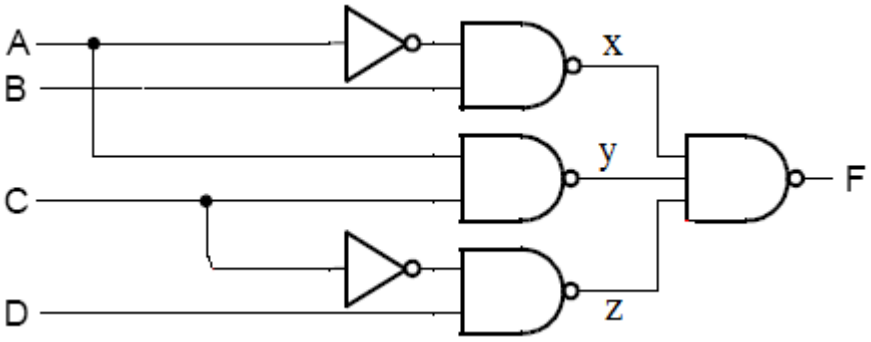

a. Use the Boolean Difference Method to find when output g is sensitive to input b? Then find the test vectors for b sa0. (6 points)
b. Use D-Algorithm to find all test vectors for f sa1. (5 points)
c. Find all the test vectors for g sa1. (2 points)
d. Find all the test vector for g sa0. (2 points)
e. Find all the test vectors for e sa0. (2 points)
f. State all the faults that can be detected by Test Vector abc = 010. (3 points)

**Q3) 40 points**

**a)** For the following circuit

**i)** Determine the type of Hazard and the values of inputs at which hazard may occur. ***[3 points]***

**ii)** Draw the hazard-free circuit. ***[7 points]***




**b)** Show the primitive flow table of a negative edge D-FF (D Flip Flop). **(8 points)**

**c)** Given the following primitive flow table, go through asynchronous procedure design to implement the circuit using SR latches. **(22 points)**

| Stable State | Inputs | | output | Notes |
|---|---|---|---|---|
| | x1 | x2 | Q | |
| a | 1 | 1 | 1 | After c |
| b | 0 | 1 | 0 | After e |
| c | 0 | 1 | 1 | After a, f |
| d | 1 | 0 | 0 | After a, e, f |
| e | 1 | 1 | 0 | After b, d |
| f | 0 | 0 | 1 | After b , c, d |

☺ Good Luck ☺