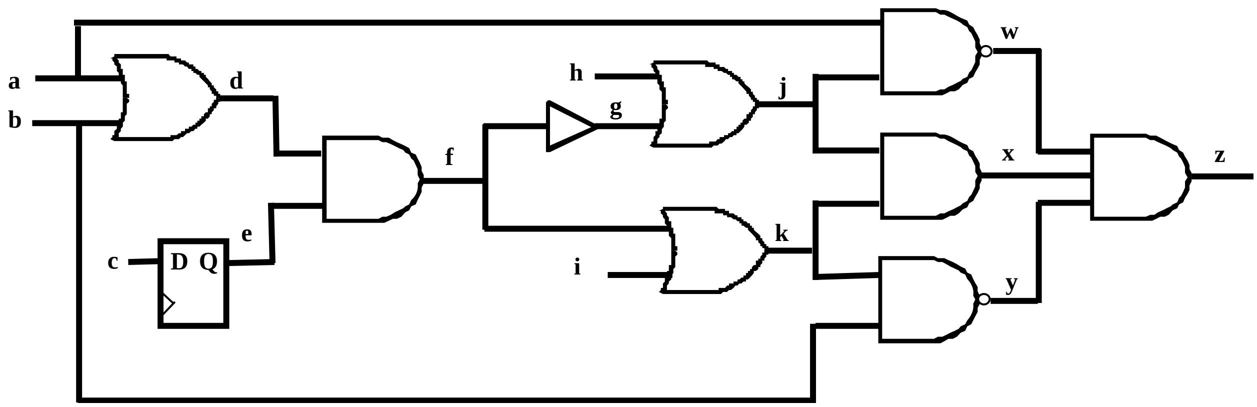
The University of Alabama in Huntsville
ECE Department
CPE 628 01
Final Exam
December 4, 2008

Name: ________________________

1. (10 points) Using the circuit shown and the D-algorithm, compute the vector that can detect the fault f/0. Note that even though the circuit is sequential, it can be viewed as a combinational circuit because the D flip-flop does not have an explicit feedback.



2. (1 point) _________________ is a mandatory instruction for standard 1149.1.

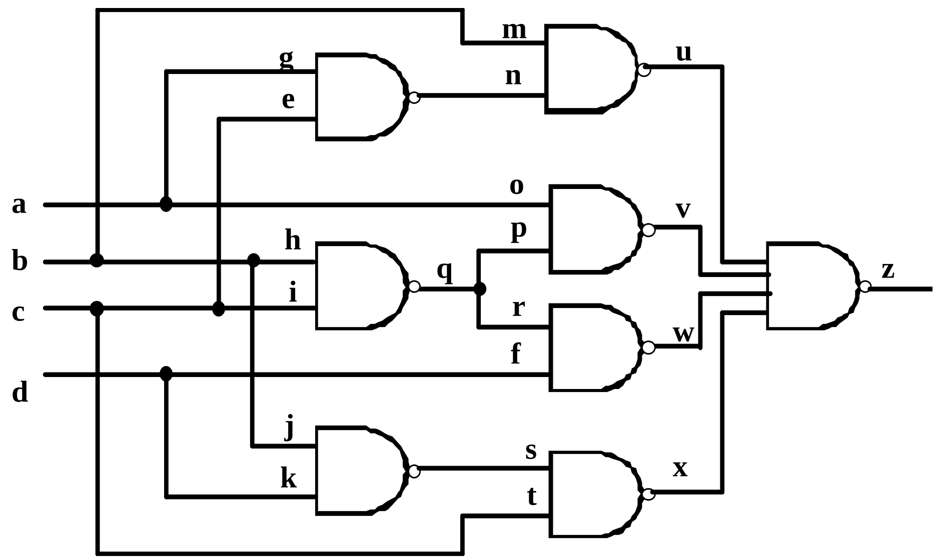
3. (1 point) The ____________________ is a 16-state finite-state machine that controls circuit operation in standard1149.1.

4. (1 point) __________________ is a derived event in 1500.

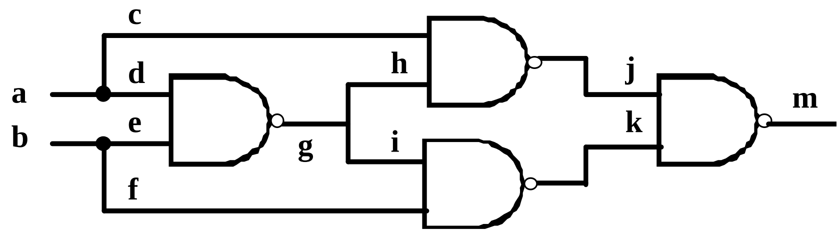
5. (1 point) 1149.6 is like 1149.1 except that it allows for _____________________.

6. (1 point) The most important feature of the 1500 standard is the provision of a ______________ on the boundary (I/O) terminals of each core.

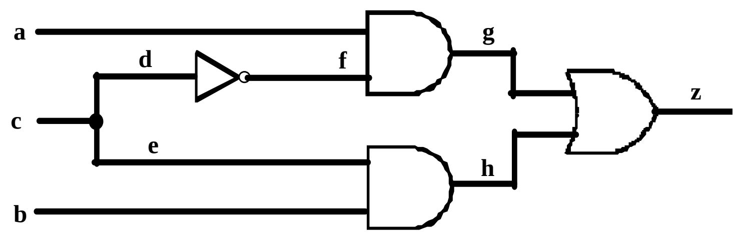
7. (10 points) For the circuit shown and the two faults α = u/0, β = a/1, use the parallel-pattern single-fault propagation technique to identify which faults can be detected by the test patterns
   (a, b, c, d) = (0, 1, 1, 1), (0, 1, 1, 0), (0, 0, 1, 0}.



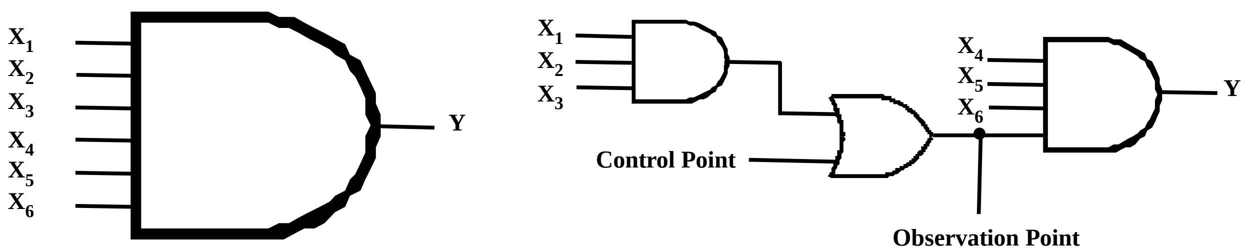
8. (5 points) Consider the combinational logic circuit below. How many possible single stuck-at faults does this circuit have? How many collapsed single stuck-at faults does this circuit have?



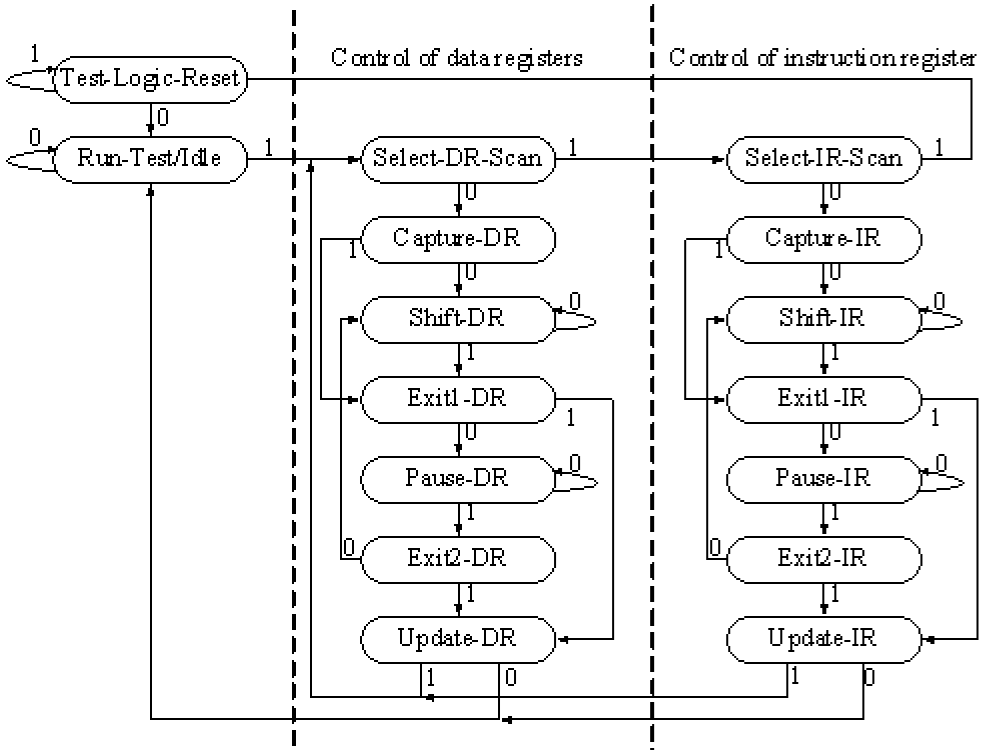
9. (5 points) Using the circuit shown, compute the detection ratio for d/1.



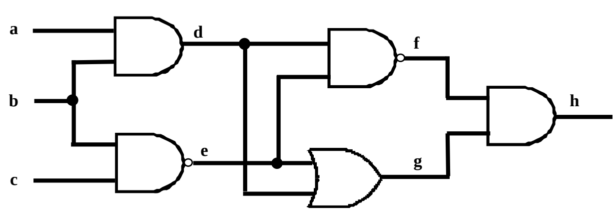
10. (5 points) For the circuit shown, calculate the detection probabilities, before and after test point insertion, for a s-a-1 fault present at Y.



11. (5 points) Assume that a 4-bit INTEST instruction is loaded into the instruction register of a boundary-scan architecture and the TAP is in the Select-DR-Scan state. Now you are going to apply 200 patterns to the internal logic and observe the test results. If the length of the boundary register is 20, then how many test cycles will be required to carry out the entire test procedure? Assume that the internal logic is a combinational circuit and that after the test procedure the circuit will return to the Test-Logic-Reset state.



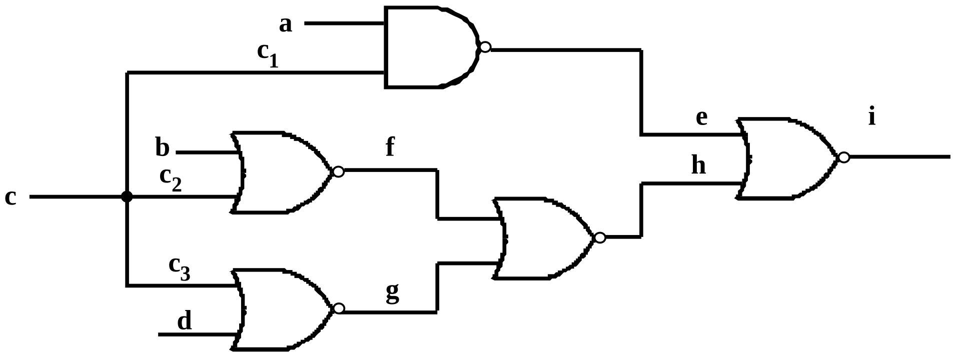
12. (5 points) Given the circuit shown. What are all the implications for e = 1?



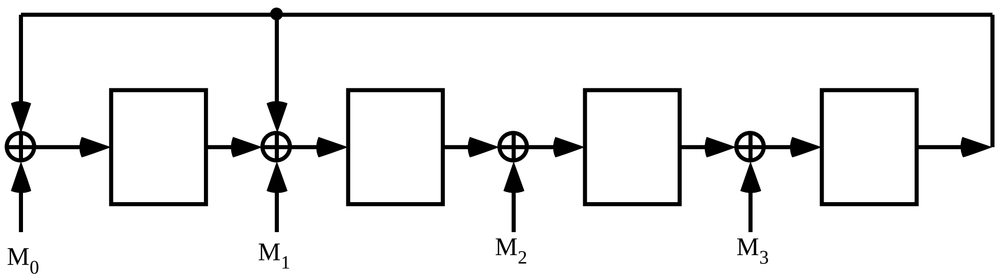
13. (10 points) Consider the dictionary of excited and detected stuck-at faults of a test set shown in the table below. Construct the smallest set of vectors that can detect as many transition faults as possible using only these five stuck-at vectors.

Vectors	Excited Faults	Detected Faults
V_1	a/0, b/1, c/0, d/0	c/0, e/1
V_2	c/0	e/1
V_3	d/0, e/0	a/0, b/1, c/1
V_4	a/0, b/0,	d/1, e/1
V_5	c/1, d/0	a/1, d/1

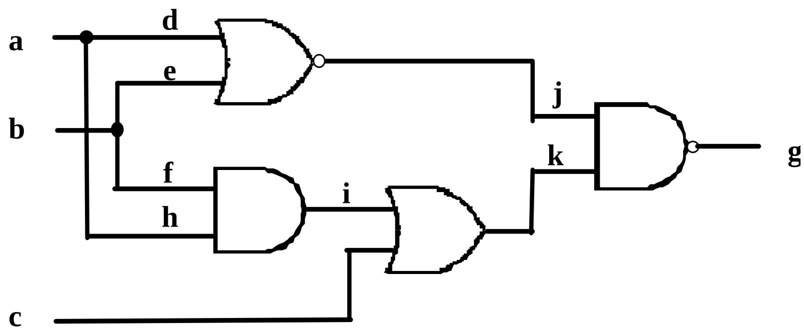
14. (10 points) Using the circuit shown, use PODEM to compute a vector that can detect the fault h s-a-0.



15. (10 points) Consider the four-stage MISR shown using $f(x) = 1 + x + x^4$. Let M_0 = {011011}, M_1 = {101101}, M_2 = {010101}, and M_3 = {011110}. Compute the fault-free signature. fault-free Then, compute the signature for the faulty sequences M_0' = {011100}, M_1' = {111101}, M_2' = {010111}, M_3' = {011111}. Explain why the fault sequences are detected or not detected.

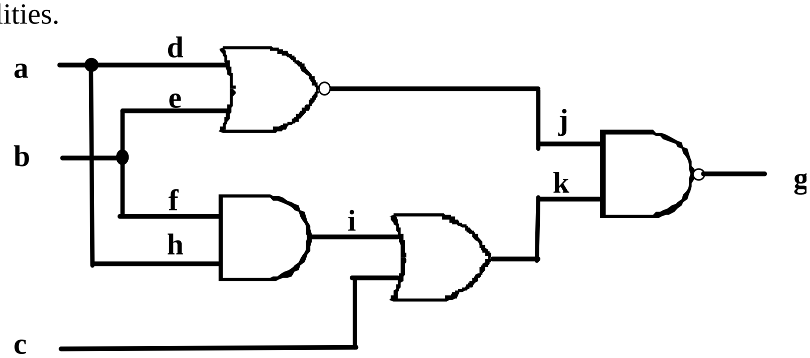


16. (10 points) For the circuit shown, calculate the probability-based controllabilities.



Line	0-C/1-C
a	______/______
b	______/______
c	______/______
d	______/______
e	______/______
f	______/______
h	______/______
i	______/______
j	______/______
k	______/______
g	______/______

17. (10 points) For the circuit shown and the SCOAP controllabilities given, calculate the SCOAP observabilities.



Line	CC0/CC1/CO
a	1/1/______
b	1/1/______
c	1/1/______
d	1/1/______
e	1/1/______
f	1/1/______
h	1/1/______
i	2/3/______
j	2/3/______
k	4/2/______
g	6/3/______