

March 27, 2008

COMPUTER ENGINEERING DEPARTMENT

COE 571

Digital System Testing

Major Exam I

Second Semester 2008 (072)

Time: 1:00-3:30 PM

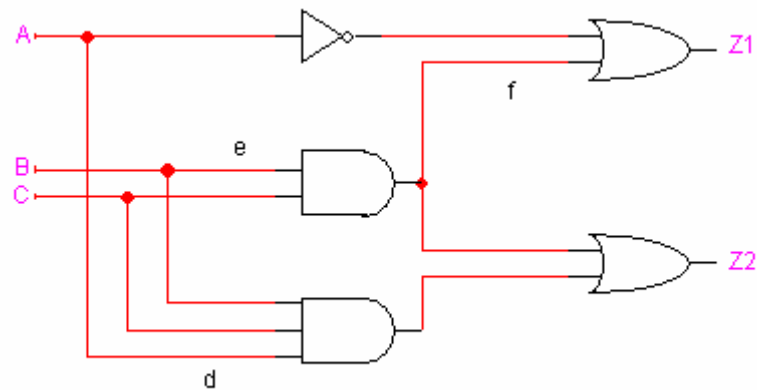
Student Name : _____

Student ID. : _____

Question	Max Points	Score
Q1	15	
Q2	55	
Q3	30	
Total	90	

Dr. Aiman El-Maleh

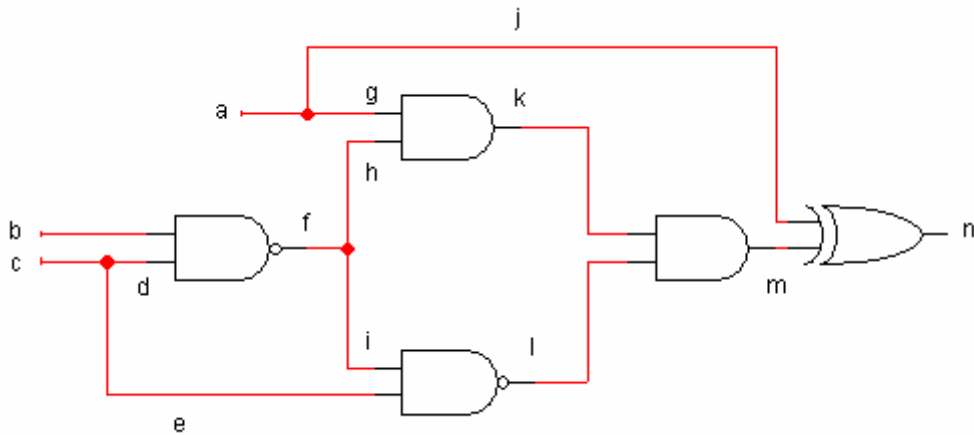
(Q1) Given the circuit shown below:



- (i) Find the set of all tests that detect the fault $d s-a-1$.
- (ii) Find a test set (if any) that detects the single stuck-at faults $e s-a-0$ and $f s-a-0$ and also distinguishes between them.
- (iii) Find the set of all tests (if any) that distinguish the multiple faults $\{e s-a-0, d s-a-1\}$ and $\{f s-a-0, d s-a-1\}$.

[55 points]

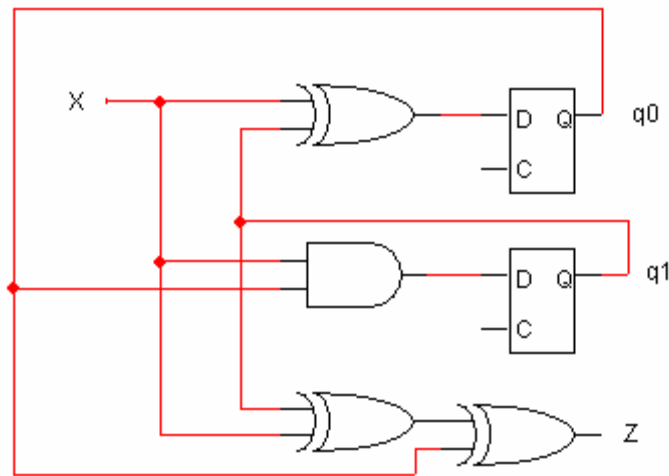
(Q2) Consider the circuit shown below:



- (i) Starting with injecting faults on each line in the circuit, perform fault collapsing based on fault equivalence and dominance relations.
- (ii) Starting with the set of faults based on the checkpoint theorem, perform fault collapsing based on fault equivalence and dominance relations.
- (iii) Considering the list of faults obtained in (i), perform deductive fault simulation of the test vector $abc=111$ and determine the detected collapsed faults. Show all the details.
- (iv) Considering the list of faults obtained in (i), perform critical path tracing of the test vector $abc=111$ and determine the detected collapsed faults. Show all the details.
- (v) Given the test set $(abc)=\{000, 001, 010, 011, 111\}$, estimate the detection probability of the fault **f stuck-at-0** by the given test set. What is the exact detection probability of the fault **f stuck-at-0** by the given test set?

[30 points]

(Q3) Consider the sequential circuit shown below, where X is a primary input and Z is a primary output:



- (i)** Show an iterative array model of three time frames for this circuit.
- (ii)** Does the circuit have a synchronizing (initializing) sequence? If yes, find one with the shortest length.
- (iii)** Derive a minimal length test sequence for detecting the fault Z s-a-0.
- (iv)** Consider the fault X s-a-1. Is the faulty machine initializable? If yes, then find a minimal length initializing sequence. Determine whether the fault X s-a-1 is detectable, strongly detectable, partially testable or redundant. If the fault is testable, derive a test sequence for it.

