ECEN 5223 Spring 2008 Exam 1

Name: _____**Answer KEY**_____

This exam is open book, open notes, and you may use a calculator. You may not share books, or calculators. You may not use a cell phone, PDA, Ouija board, or computer during the exam. Be careful to read the instructions, the questions, and the answers carefully. Only these pages will be accepted, do not attach any other paper, as it will not be graded. You should show your work, as partial credit is possible.

1. (12 points) Consider a Manufacturing process with the following yields, followed by at testing process with the associated Fault Coverage. What will be the related AOQL and DL values?

Yield %	Fault Coverage %	AOQL %	Defect Level of Shipped Parts (in units of PPM)
92%	92%	**99.3 %**	**6648**
92%	99.9%	**99.99 %**	**83**
95%	92%	**99.6 %**	**4095**
95%	99.9%	**99.99 %**	**51**

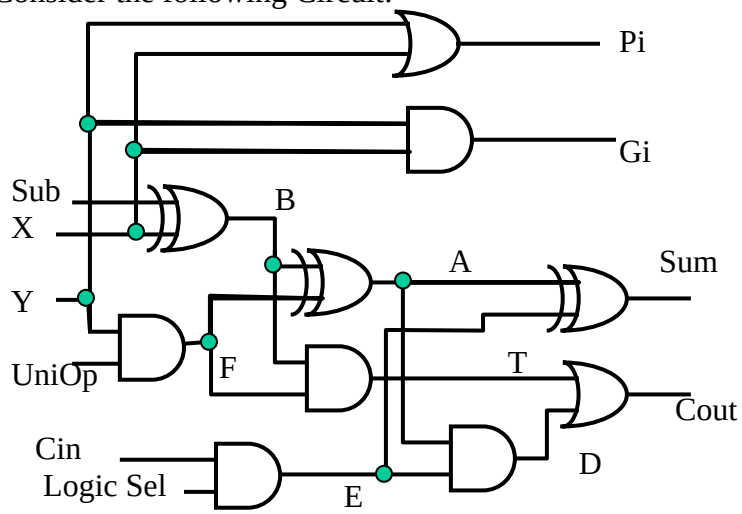
2. (5 points) What are the Five different forms of automatic test pattern generation studied in this class?

Random;
by Hand (trial and error);
Path Sensitization;
D-algorithm;
Boolean difference;

3. (4 points) List the four different types of Fault simulation studied in this class?

-Fail all
- Parallel
- Deductive
-Concurrent

Consider the following Circuit:



4. (5 points) Which nodes in the circuit do not have fanout?

Pi, Gi, Sum, Cout, Sub, UniOp, Cin, LogicSel, D, and T

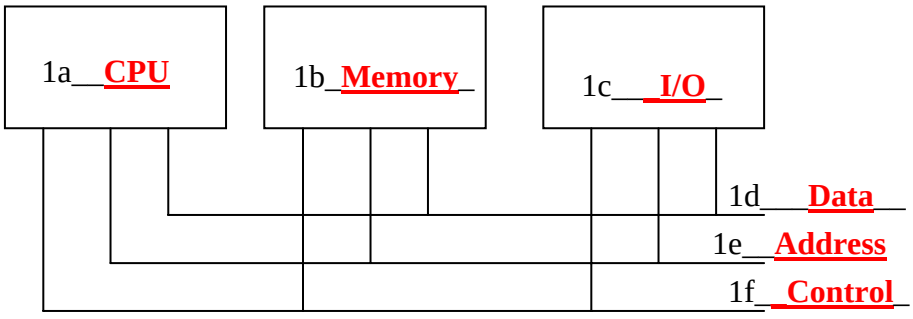
5. (5 points) Which nodes in the circuit have reconvergent fanout?

Sub, X, B, F

6. (5 points) Which nodes have reconvergent complemented fanout?

B, F

7. (5 points) Fill in the blanks on the following diagram of a general digital computer system:

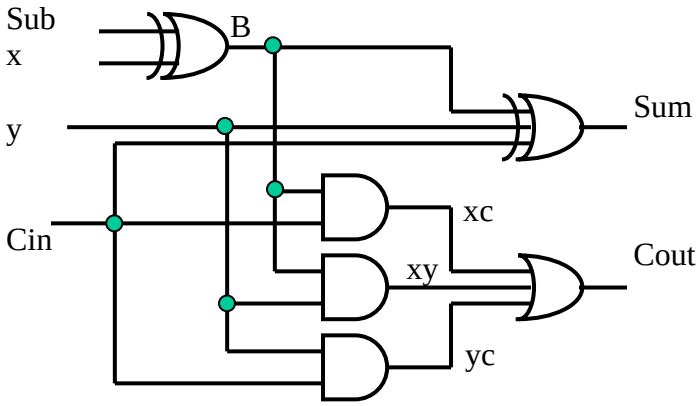


8. (5 points) For the general digital system shown in question 7, which of the three blocks could be tested using the IEEE 1149.1 standard (also called JTAG or boundary scan)?

All three.

9. (5 points) How many test vectors are required to exhaustively test the following circuit?

$2^4 = 16$



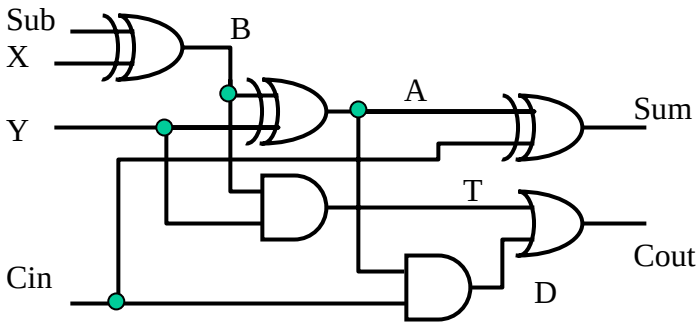
10. (5 points) How many Stuck-at faults are possible for the this circuit?

38 = 20 stem faults + 18 gate-input faults

11. (6 points) For the circuit in question 9, which Stuck-at faults are detected by the test vector (X,Y,Cin,Sub) = {0, 1, 1, 0}?

SUM-S@1, Cout-S@0, X-S@1, Y-S@0, Sub-S@1, Cin-S@0, B-S@1, yc-S@0, BinSum-S@1, YinSum-S@0, Yin_yc-S@0, Cin_Sum-S@0, Cin_yc-S@0
13 faults detected

Consider the following implementation of the same function?



12. (5 points) How many Stuck-at faults are possible for the this circuit?

    36 = 20 stem faults + 16 gate-input faults

13. (6 points) Which Stuck-at faults are detected by the test vector (X,Y,Cin,Sub) = {0, 1, 1, 0}?

    SUM-S@1, Cout-S@0, X-S@1, Y-S@0, Sub-S@1, Cin-S@0, B-S@1, A-S@0, D-S@0, BinA-S@1, YinA-S@0, CinD-S@0, CinSum-S@0, AinSum-S@0, AinD-S@0
    15 faults detected.

The multiple-choice questions in the following section are worth 3 points for a correct answer, -1 point for an incorrect answer, and 0 points for an unanswered question.

14. How many different values can be generated with a type 1 LFSR that implements 4th order primitive polynomial with a seed of all 1s? **C**

A) 7
B) 8
C) 15
D) 16
E) None of the above

15. How many different values can be generated with a type 1 LFSR that implements 4th order primitive polynomial with a seed of all 0s? **E**

A) 7
B) 8
C) 15
D) 16
E) None of the above

16. Why do we only consider single stuck-at faults rather than multiple stuck-at faults? **E**

A) Because the probability of multiple stuck-at faults is very low relative to the probability of a single stuck-at fault.
B) Because the number of multiple-fault faulty circuits is too large.
C) Because the likelihood of a physical defect causing multiple stuck-at faults is small.
D) Because fault simulation, test generation, and digital system testing is already too hard.
E) All of the above
D) None of the above

17. The purpose for production testing is? **C**

A) To ensure that the design is correct.
B) Find where a physical failure is.
C) To determine whether a part contains a defect.
D) To provide justification for purchasing expensive test equipment
E) None of the above

18. The purpose for Automatic Test Pattern Generation is? **D**

A) To ensure that the design is correct.
B) Find where a physical failure is.
C) To determine whether a part contains a defect.
D) Derive a high fault coverage test set.
E) None of the above

19. A break in the metal connecting two conductors is a? **B**

A) Physical failure mechanism.
B) Physical failure mode.
C) Electrical fault model.
D) Logical fault model.
E) None of the above

20. A node in a circuit that stays at ground when is should be 5 volts is a? **C**

A) Physical failure mechanism.
B) Physical failure mode.
C) Electrical fault model.
D) Logical fault model.
E) None of the above

21. (6 points) Fill in the missing values in following table for the LFSR used as a pattern generator.

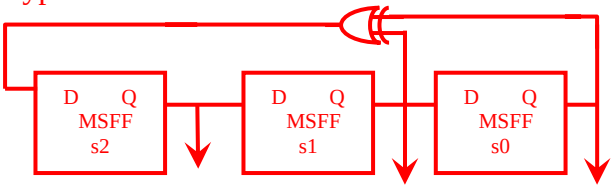
	Type I LFSR for polynomial $X^3 + X^2 + 1$		Type II LFSR for polynomial $X^3 + X^2 + 1$
initial condition	001		001
	100		101
	010		111
	101		**110**
	110		011
	111		100
	011		**010**
	001		001

The following are optional bonus questions. No test total will exceed 100%. Therefore, the bonus points will be added to your score only up to a total of 100%.

22. (5 points extra credit) What is the answer_____**42**_____

23. (5 points each extra credit) Draw the logic circuits for the LFSRs for question 21.

Type 1 external XOR for 1 + x + x3



Type 2 internal XOR for $1 + x^2 + x^3$