CIS 251-002 Midterm Exam 2, Spring'03 Exam #: _____ Name: _____
First Last

Prof. David Nassimi (Time: 1.5 hours) SS #: _____ - _____ - _____

1. A Boolean function $f(X, Y, Z)$ has a value 1 whenever two of the input variables are 1 and the third input is 0.

(a) Use a truth table to obtain a sum-of-minterms expression for f. Implement the function using a decoder and some additional gates.

	GRADE	
1		/25
2		/25
3		/25
4		/25
SUM		/100

(b) Implement the function f using a FULL ADDER (FA unit) and some additional gates. Provide a short explanation.

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2. A circuit consists of two SR flip flops with outputs (Y_1, Y_0). The flip-flops inputs are as follows:

$$S_1 = Y_0, \quad R_1 = \overline{Y_0}, \quad S_0 = \overline{Y_1}\,\overline{Y_0}, \quad R_0 = Y_0.$$

Analyze this circuit. Derive the state transition table and state diagram. Then, briefly describe what the circuit does.

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3. Design a mod-3 counter, (Y_1, Y_0), with repeated consecutive counts of $00, 01, 10$. (The counter after 10 goes back to 00.) The counter has no external inputs and advances its count with every clock cycle.

(a) Apply formal procedures to design this circuit using T flip-flops. Draw the circuit.

(b) Analyze the resulting circuit. (Derive the state transition table and state diagram.) What happens if the circuit starts in the forbiddent (unused) state 11?

4. Use formal design procedures to build a JK flip-flop from a T flip-flop.