CIS 251-002, Exam 1, Spring 2003 Exam #: _____ Name: _____
First Last

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

1a) Convert the following unsigned binary integer

10 001 111

to each of the following bases. (Be sure to show your computation.)

1. Octal
2. Hexadecimal
3. Decimal

	GRADE	
1		/20
2		/20
3		/20
4		/20
5		/20
SUM		/100

b) Assuming a 16-bit word size and 2's complement number system, find the binary representations for the decimal integers: $A = -32$ and $B = +8$. Then, perform the binary addition $A + B$.

A:

B:

$A + B$:

Name: _____
First Last

2a) Using algebraic manipulations, convert the following Boolean expression to a simplified sum-of-products form.

$$WX + WY(X\overline{Z} + Z)$$

2b) Using algebraic manipulations, convert the same Boolean expression to a simplified product-of-sums form.

$$WX + WY(X\overline{Z} + Z)$$

3. Consider the following Boolean function: $f(X, Y, Z) = (XY) \oplus Z$.

a) Use a truth table to obtain both the sum-of-minterms expression and product-of-maxterms expression for f. (Express each expression both in algebraic form and decimal form.)

Truth Table:

Sum-of-minterms:

Product-of-maxterms:

b) Use a map to obtain a simplified sum-of-products expression for f

c) Implement the function using only NAND gates.

Name: _____
First Last

4. Consider the Boolean function

$$f(W, X, Y, Z) = \Sigma_m(0, 1, 4, 5, 6, 7, 13, 15) + \Sigma_d(3, 9, 11)$$

a) Use a map to obtain a simplified sum-of-products expression for f.

b) Use a map to obtain a simplified product-of-sums expression for f.

c) Implement the function f using only NOR gates.

5. A comparator circuit has two 2-bit inputs $A = (A_1, A_0)$ and $B = (B_1, B_0)$. (Note that A_0 and B_0 are the least significant bits of A and B. The inputs A and B are unsigned integers in the range 0 through 3.) The circuit compares A and B and produces the result by three outputs S, E, and G. (One of the three outputs will be 1 and the other two will be 0.)

S (smaller):	This output will be 1 when $A < B$.
E (equal):	This output will be 1 when $A = B$.
G (greater):	This output will be 1 when $A > B$.

a) Use a truth table to show the three functions S, E, and G. (List the variables in the order: A_1, A_0, B_1, B_0.)

b) Implement the three functions S, E, G using a decoder and as few additional gates as possible.