CIS 251-002/004, Midterm 1, Spring'04 Exam #: _____ Name: _____
First Last

Prof. David Nassimi (Time: 80 minutes) SS #: _____ - _____ - _____

1. (a) Convert the decimal integer 58 to binary, octal, and hexadecimal. (Show the computation.)

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

Binary:

Octal:

Hex:

(b) Perform each of the following additions directly in the specified bases:

```
        Binary:              Octal:               Hex:
        ------               -----                ---
Carry:
        1 1 0 0 1 0          7 6 1                C F 9
      + 0 1 0 1 1 1        + 6 7 3            +   C 7 A
        -----------          -----              -------
```

(c) Assuming 16-bit word size and 2's complement number system, show the representation for the negative number -58.

2. Using algebraic manipulations, obtain a simplified **sum-of-products** expression for each of the following functions.

   (a) $f = XY + X\overline{Y}Z + \overline{X}Z$

   (b) $f = (X + \overline{Y} + Z)(X + Y + \overline{Z})$

3. (a) Show the truth table for the following function.

$$f = (X \oplus Y)(X + Z)$$

(b) Express the **sum-of-minters** expression for the above function f. (Write the expression in both algebraic form and decimal-notation form.)

4. (a) Use a map to find a simplified **sum-of-products** expression for:
$f(X, Y, Z) = \Sigma_m(0, 2, 4, 6, 7)$

(b) Use a map to find a simplified **product-of-sums** expression for:
$f(W, X, Y, Z) = \Sigma_m(0, 3, 6, 7, 8, 11, 14, 15) + \Sigma_d(5, 13)$

5. A comparator circuit has two integer inputs $X = (X_1, X_0)$ and $Y = (Y_1, Y_0)$. The inputs X and Y are unsigned integers in the range 0 to 3, and X_0 and Y_0 are the least significant bits of X and Y. The circuit has a single output G which will have a value of 1 whenever $X > Y$.

   (a) Using a K-map, obtain a simplified sum-of-products expression for G.

   (b) Draw the 2-level NAND circuit to implement G. Provide a brief explanation of the circuit.