Computer Science $03 - 60 - 265 - 01$
First Midterm Examination
Tuesday, June 1^{st} 2004

Dr. Alioune Ngom

Last Name:

First Name:

Student Number:

INSTRUCTIONS

- EXAM DURATION IS 1 HOUR AND 30 MINUTES.
- NOTES AND BOOKS ARE NOT ALLOWED.
- CHEATING IS NOT ALLOWED AND I WILL GIVE 0 FOR CHEATING.
- READ ALL QUESTIONS CAREFULLY BEFORE ANSWERING.
- WRITE YOUR FINAL ANSWERS IN THE FRONT OF PAGES. USE THE BACK OF PAGES FOR SCRAP WORKS.
- **WRITE YOUR FINAL ANSWERS WITH A PEN**.
- Attempt all questions.
- If you need to make any assumptions, state them clearly with your answers.
- Write your answer neatly. Messy work is very hard to read and may cause you to lose marks.
- Lists of Boolean properties and logic gates are given on last two pages.

Questions	Q#1	Q#2	Q#3	Q#4	Q#5	Q#6	Total
Marks							
Totals	8	10	5	12	5	10	50

Question #1: (8 points) Show the decimal value of the binary number 10101010 if it is written in the following forms.

1. UBI: _____

2. 1CF: _____

3. 2CF: _____

4. SMF: _____

Question #2: (10 points) Perform the operation

1. $10010101 + 111110101$ under 1CF arithmetic: result in binary is _____

   - Indicate if there is overflow (Yes or No): _____
   - Write the result in decimal (if valid): _____

2. $10010101 - 111110101$ under 2CF arithmetic: result in binary is _____

   - Indicate if there is overflow (Yes or No): _____
   - Write the result in decimal (if valid): _____

Question #3: (5 points) Let $f_1(x, y, z) = (x \oplus y) \cdot z$ and $f_2(x, y, z) = (x \cdot y) \oplus (y \cdot z)$

1. Determine if $f_1 = f_2$ is true, using a truth table

2. Write the CPOS of f_2: _____

Question #4: (12 points) Let $f(x, y, z) = \bar{z} + \bar{x} \cdot y$

1. Give the CSOP of f (do not use the truth table method): _____

2. Obtain a NOR expression for f: _____

3. Implement f using only NOR gates.

Question #5: (5 points) Simplify the expression: $(ab + \bar{a}\bar{b})(cd + \bar{c}\bar{d}) + \overline{ac}$

Question #6: (10 points) Convert the number

1. $(13.57)_8$ into a number in base 12
2. Verify your answer by converting back the base 12 number into base 8

Properties of Boolean Algebra

1a. $x + 0 = x$	1b. $x \cdot 1 = x$	Identity element
2a. $x + 1 = 1$	2b. $x \cdot 0 = 0$	Universal bound
3a. $x + x = x$	3b. $x \cdot x = x$	Idempotency
4a. $x + \bar{x} = 1$	4b. $x \cdot \bar{x} = 0$	Complementation
5. $\bar{\bar{x}} = x$		Involution

6a. $x + y = y + x$	Commutativity
6b. $x \cdot y = y \cdot x$	
7a. $x + (y + z) = (x + y) + z$	Associativity
7b. $x \cdot (y \cdot z) = (x \cdot y) \cdot z$	
8a. $x \cdot (y + z) = (x \cdot y) + (x \cdot z)$	Distributivity
8b. $x + (y \cdot z) = (x + y) \cdot (x + z)$	
9a. $\overline{x + y} = \bar{x} \cdot \bar{y}$	DeMorgan's law
9b. $\overline{x \cdot y} = \bar{x} + \bar{y}$	
10a. $x + (x \cdot y) = x$	Absorption
10b. $x \cdot (x + y) = x$	
11a. $(x \cdot y) + (x \cdot \bar{y}) = x$	Combining
11b. $(x + y) \cdot (x + \bar{y}) = x$	
12a. $x + y = x + z \Rightarrow y = z$	Non-Cancellation
12b. $x \cdot y = x \cdot z \Rightarrow y = z$	
13a. $x + (\bar{x} \cdot y) = x + y$	No name?
13b. $x \cdot (\bar{x} + y) = x \cdot y$	