Points missed: _____ Student's Name: _____

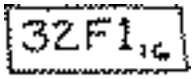
Total score: _____ /100 points

East Tennessee State University
Department of Computer and Information Sciences
CSCI 2150 (Tarnoff) – Computer Organization
TEST 1 for Fall Semester, 2002

Section 001

Read this before starting!

- The total possible score for this test is 100 points.
- This test is closed book and closed notes
- You may use one sheet of scrap paper that you will turn in with your test.
- You may NOT use a calculator
- **All answers must have a box drawn around them. This is to aid the grader (who might not be me!) Failure to do so might result in no credit for answer. Example:**



- **1 point will be deducted** per answer for missing or incorrect units when required. **No** assumptions will be made for hexadecimal versus decimal, so you should always include the base in your answer.
- If you perform work on the back of a page in this test, indicate that you have done so in case the need arises for partial credit to be determined.

"Fine print"

Academic Misconduct:

Section 5.7 "Academic Misconduct" of the East Tennessee State University Faculty Handbook, June 1, 2001:

"Academic misconduct will be subject to disciplinary action. Any act of dishonesty in academic work constitutes academic misconduct. This includes plagiarism, the changing of falsifying of any academic documents or materials, cheating, and the giving or receiving of unauthorized aid in tests, examinations, or other assigned school work. Penalties for academic misconduct will vary with the seriousness of the offense and may include, but are not limited to: a grade of 'F' on the work in question, a grade of 'F' of the course, reprimand, probation, suspension, and expulsion. For a second academic offense the penalty is permanent expulsion."

Basic Rules of Boolean Algebra:		
	1. $A + 0 = A$	**7.** $A \cdot A = A$
	2. $A + 1 = 1$	**8.** $A \cdot \overline{A} = 0$
	3. $A \cdot 0 = 0$	**9.** $\overline{\overline{A}} = A$
	4. $A \cdot 1 = A$	**10.** $A + AB = A$
	5. $A + A = A$	**11.** $A + \overline{A}B = A + B$
	6. $A + \overline{A} = 1$	**12.** $(A + B)(A + C) = A + BC$
DeMorgan's Theorem:	$\overline{(AB)} = (\overline{A} + \overline{B})$	$\overline{(A + B)} = (\overline{A}\ \overline{B})$

Short-ish Answer (2 points each)

1.) How many cells does a Karnaugh map with 3 input variables have?

a.) 4 b.) 6 c.) 8 d.) 9 e.) 16 f.) None of the above

2.) In a 4-variable Karnaugh map, how many variables (e.g., A, B, etc.) does a product have if the rectangle it was derived from contains 4 cells? (Hint: Draw an example & see what result you get.)

a.) 1 b.) 2 c.) 3 d.) 4

3.) True or False: The expression $(A \bullet \overline{C}) + (\overline{B} \bullet C) + (\overline{A \bullet B} \bullet C)$ is in correct Sum-of-Products form.

4.) The AND operation in boolean algebra is analogous to what algebraic operation?

5.) True or False: The inversion bar (NOT operation) in boolean algebra works the same as an algebraic negative sign.

6.) True or False: The number 111010100000100001 is a valid BCD number.

7.) True or False: The floating-point number 10011011011010011011001011000010 is negative.

8.) True or False: The 8-bit number 10010101_2 represents the same decimal value in unsigned binary as it does in 2's complement.

9.) What is the **minimum** number of bits needed to represent 132_{10} in signed magnitude representation?

a.) 6 b.) 7 c.) 8 d.) 9 e.) 10 f.) None of the above

10.) Which of the following is the lowest possible value for a 9-bit signed magnitude binary number?

a.) 0 b.) -512 c.) -256 d.) -511 e.) -255 f.) -127 g.) None of the above

11.) Write the complete truth table for a 2-input XOR gate.

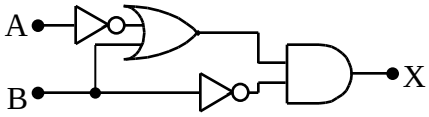
A	B	X

12.) For the truth table to the right, would a Product-of Sums or a Sum-of-Products expression have fewer terms?

A	B	C	X
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

Medium-ish Answer (5 points each)

13.) Write the boolean expression exactly as it is represented by the circuit below. **Do not simplify!**



14.) Draw the circuit exactly as it is represented by the Boolean expression $\overline{A \cdot B} + C$.

15.) Convert $011110011010010101001 0_2$ to hexadecimal.

16.) Convert the decimal number 549731 to BCD.

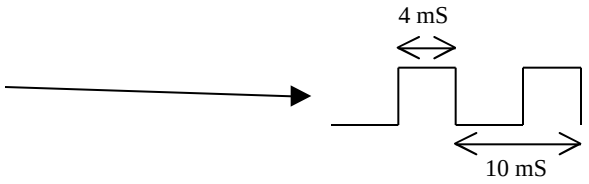
17.) Create a Karnaugh map from the truth table below. **Do not worry about making the rectangles.**

A	B	C	X
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

18.) Apply DeMorgan's Theorem to distribute inverse to individual terms. **Do not simplify.**

$$\overline{D(C + B)(A + B)}$$

19.) What is the duty cycle of this periodic signal?



Longer Answers (Points vary per problem)

20.) Construct the truth table for the Boolean expression shown below. (6 points)

$A \cdot \overline{B} \cdot C + \overline{A} \cdot B + \overline{A} \cdot \overline{C}$

A	B	C	X

21.) Fill in the blank cells of the table below with the correct numeric format. ***For cells representing binary values, only 8-bit values are allowed!*** If a value for a cell is invalid or cannot be represented in that format, write "X". Use your scrap paper to do your work. (3 points per cell)

Decimal	2's complement binary	Signed magnitude binary	Unsigned binary
200			
	10110000		
-56			

22.) Mark each equation as ***true*** or ***false*** depending on whether the right and left sides of the equal sign are equivalent. (3 points each)

a.) $\overline{B}(A + A \cdot B) = A \cdot \overline{B}$ Answer: _____

b.) $(\overline{A} + B)(A + \overline{B}) = 1$ Answer: _____

c.) $\overline{B} + \overline{(AB)} + \overline{C} = \overline{A} + \overline{B} + \overline{C}$ Answer: _____

23.) Derive the minimum SOP expression from the Karnaugh map below. (8 points)

AB \ *CD*	00	01	11	10
00	1	0	0	0
01	0	0	0	1
11	0	0	0	1
10	1	1	1	1