Points missed: _____ Student's Name: _____

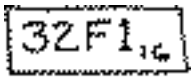
Total score: _____ /100 points

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

Section 002

Read this before starting!

- The total possible score for this test is 100 points.
- This test is closed book and closed notes
- 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:

ETSU Policy No. 3.13, October 1, 1979:

"All students in attendance at East Tennessee State University are expected to be honorable."

"Academic misconduct will be subject to disciplinary action. Any act of dishonesty in academic work constitutes academic misconduct. This includes plagiarism, the changing or 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" for 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 (3 points each)

1.) In a 3-variable Karnaugh map, how many variables does a product have if its rectangle contains 4 cells?

2.) True or False: The number 1110101100001000010 is a valid BCD number.

3.) True or False: The number 10010101 has the same value in BCD as it does in unsigned binary.

4.) What is the **minimum** number of bits needed to represent 64 in unsigned binary representation?

a.) 4 b.) 5 c.) 6 d.) 7 e.) 8 f.) None of the above

5.) True or False: If all of the gates in a P.O.S. circuit are replaced with NAND gates, the resulting circuit has the same truth table.

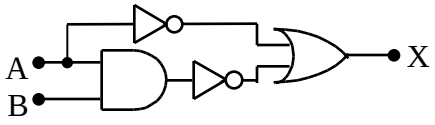
6.) Which of the following is the lowest possible value for a 10-bit 2's complement binary number?

a.) 0 b.) -128 c.) -127 d.) -1024 e.) -512 f.) None of the above

7.) If you could only use one gate to create an entire digital system, which gate would be the best?

Medium-ish Answer (5 points each)

8.) Write the Boolean expression represented by the circuit:



9.) Draw the circuit represented by the Boolean expression $\overline{AC} \cdot (B + A)$.

10.) Convert 1110110010110001010_2 to hexadecimal.

11.) Convert the phone number 439-6404 to BCD.

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

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

13.) Determine the standard Sum-of-Products expression for the truth table to the right. Do not simplify.

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

14.) Determine the standard Product-of-Sums expression for the truth table in the previous question. Do not simplify.

Longer Answers (Points vary per problem)

15.) Fill in the blank cells of the table below with the correct numeric format. For the cells representing binary values, assume 8-bit values. If a value for a cell is invalid or cannot be represented in that format, write "N/A". Use the back of the previous sheet to do your work. (2 points per cell)

Decimal	2's complement binary	Signed magnitude binary	Unsigned binary
-24			
			01010010
			10110001

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

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

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

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

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

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

18.) Apply DeMorgan's Theorem to reduce the following expression to SOP form. (5 points)

$$\overline{A\_C + B}$$

19.) Derive the minimum SOP expression from the Karnaugh map below. (6 points)

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