

Points missed: _____ Student's Name: _____

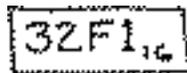
Total score: _____ /100 points

East Tennessee State University
Department of Computer and Information Sciences
CSCI 2150 (Tarnoff) – Computer Organization
TEST 1 for Spring Semester, 2003

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:**



32F1,6

- **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. (A subscript is fine)
- If you perform work on the back of a page or on your scrap paper, 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 plagiarizing, 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' 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. $A \cdot \bar{A} = 0$
	3. $A \cdot 0 = 0$	9. $\overline{\overline{A}} = A$
	4. $A \cdot 1 = A$	10. $A + \overline{AB} = A$
	5. $A + \overline{A} = 1$	11. $A + \overline{AB} = A + B$
	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)

- How many possible combinations of ones and zeros do 5 boolean variables have?
a.) 4 b.) 8 c.) 16 d.) 32 e.) 48 f.) None of the above
- Write the complete truth table for a 2-input NAND gate using the table to the right. \longrightarrow

A	B	X
- What is the largest possible value that can be represented with a 6 bit unsigned binary number?
a.) 32 b.) 31 c.) 127 d.) 64 e.) 63 f.) 255 g.) None of the above
- What is the lowest possible value for a 10-bit binary number in 2's complement representation?
a.) 0 b.) -512 c.) -256 d.) -511 e.) -255 f.) -127 g.) None of the above
- What is the **minimum** number of bits needed to represent 256_{10} in signed magnitude representation?
a.) 6 b.) 7 c.) 8 d.) 9 e.) 10 f.) None of the above
- True or False: The expression $\overline{A} + (\overline{B} \cdot C) + (A \cdot \overline{B} \cdot C)$ is in correct Sum-of-Products form.
- An analogy was made in class between boolean algebra and mathematical algebra. Which boolean operation did not have an equivalent in mathematical algebra? (Don't consider XOR.)
- True or False: The number 111010100000100001 is a valid BCD number.
- In the boolean expression below, circle the first operation to be performed. **Do not simplify!**
 $B + C(E + AD)$

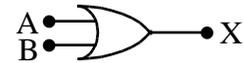
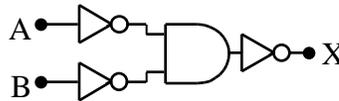
10) How can you tell that an overflow in binary addition has occurred resulting in an incorrect sum?

11) In order to determine whether 10010110 is a negative number, you must be told what representation the number is in (e.g., 2's complement) and what else?

12) Shifting all the bits of a binary value three positions to the left is equivalent to what mathematical operation. Be as specific as you can.

13) What is the purpose behind the use of Binary Coded Decimal (BCD)?

14) True or False: The two circuits to the right are equivalent.

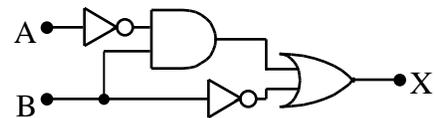


Medium-ish Answer (5 points each)

15) Determine the Sum-of-Products expression for the truth table to the right. **Do not simplify!**

A	B	C	X
0	0	0	0
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

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



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

18) Prove $A + A \cdot B = A$. Be sure to add enough detail to show that you understand the proof.

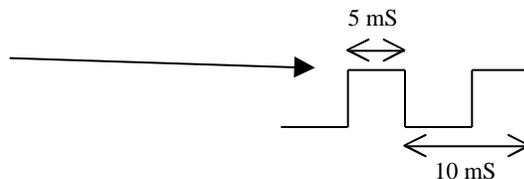
19) Convert 110110010100110110_2 to hexadecimal.

20) Complete the truth table below with the output from the Product-of-Sums equation shown.

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

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

21) What is the duty cycle of this periodic signal?



22) What is the frequency of the signal from problem 20? (Hint: $1 \text{ mS} = 1 \times 10^{-3}$ seconds) Do not bother to calculate the final decimal value. **Just put the values into the proper equation.**

23) Use DeMorgan's Theorem to distribute inverse to individual terms. **Do not simplify!** (6 points)

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

Longer Answers (Points vary per problem)

24) 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. (2 points per cell)

Decimal	2's complement binary	Signed magnitude binary	Unsigned binary
			01010011
		10110000	
-66			

25) 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.) $\overline{B}(A + \overline{A} \cdot B) = \overline{A} \cdot \overline{B}$

Answer: _____

b.) $\overline{((A \cdot B) + (\overline{A} \cdot \overline{B}))} = 1$

Answer: _____

c.) $(A + B)(\overline{B} + \overline{B}) = 1$

Answer: _____