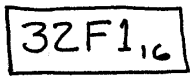
Points missed: _____ Student's Name: _____

Total score: _____ /100 points

East Tennessee State University – Department of Computer and Information Sciences
CSCI 2150 (Tarnoff) – Computer Organization
TEST 1 for Fall Semester, 2004

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. Leave all numeric answers in the form of a formula.
- You may use one sheet of scrap paper that you must turn in with your test.
- 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.
- Statement regarding academic misconduct from Section 5.7 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:	$\overline{(AB)} = (\overline{A} + \overline{B})$	$\overline{(A + B)} = (\overline{A} \cdot \overline{B})$

Short-ish Answer (2 points each unless otherwise noted)

1. Calculate the frequency of a periodic pulse train with a period of 1 millisecond ($1x10^{-3}$ seconds).

2. True or False: A signal's frequency can be calculated from its duty cycle alone.

3. A digital signal with a duty cycle of 100%: (select the ***best*** answer)

   a.) has a constant frequency b.) is not possible c.) is a constant logic 0
   d.) is a constant logic 1 e.) never stops pulsing f.) none of the above

4. For each of the following binary representations, what is the smallest/lowest value that can be represented using 10 bits. (2 points each)

   a.) unsigned binary:

   b.) 2's complement:

   c.) signed magnitude:

5. How many bits does each of the following terms represent? (1 point each)

   a.) nibble _____ b.) byte _____ c.) word _____

6. What is the **minimum** number of bits needed to represent $+255_{10}$ in signed magnitude representation?

7. True or False: The number 01100101011110010111 is a valid BCD number.

8. True or False: The 8-bit value 01101011_2 has the same value in both signed magnitude and 2's complement form.

9. Write the complete truth table for a 2-input NAND gate.

A	B	X

The following two questions are based on the 8-bit binary addition shown below.

```
  1   11101011
 +11110010
 --------
  11011101
```

Carry out

10. True or False: If the addition above is considered 8-bit 2's complement, an overflow has occurred.

11. True or False: If the addition above is considered 8-bit unsigned, an overflow has occurred.

12. True or false: There is an algorithm that allows us to add BCD numbers without converting.

13. How many possible combinations of ones and zeros do 5 boolean variables have?

    a.) 15 b.) 64 c.) 32 d.) 16 e.) 31 f.) None of the above

14. How many positions must the number 000010101_2 be shifted left in order to multiply it by 16?

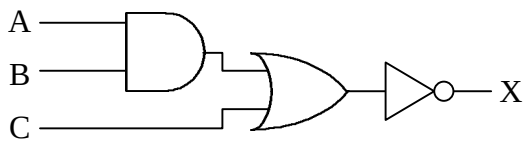
Medium-ish Answer (5 points each)

15. Convert the floating-point number 11000001111010010101000000000000 to its binary exponential format, e.g., 1.1010110×2^{-12}, (which, by the way, is not the answer).

16. Convert 101**.**11 to decimal.

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

18. In the space to the right, create the truth table for the circuit shown below.

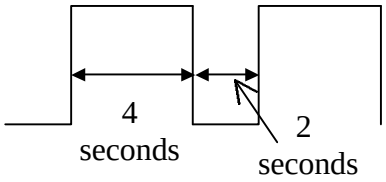


19. Convert 100110101101001001101_2 to hexadecimal.

20. List two benefits of a digital circuit that uses fewer gates.

21. If an 8-bit binary number is used to represent an analog value in the range from -25^{o} to 115^{o}, what does the binary value 01100100_2 represent? (Leave your answer in the form of a fraction.)

22. What is the duty cycle of the signal shown to the right?



Longer Answers (Points vary per problem)

23. Mark each boolean expression as ***true*** or ***false*** depending on whether the right and left sides of the equal sign are equivalent. Show all of your work to receive partial credit for incorrect answers. (3 points each)

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

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

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

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
-34			
			10010110
96			