

Points missed: _____

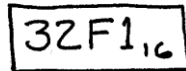
Student's Name: _____

Total score: _____/100 points

East Tennessee State University – Department of Computer and Information Sciences
CSCI 2150 (Tarnoff) – Computer Organization
TEST 1 for Fall Semester, 2008

Read this before starting!

- The total possible score for this test is 100 points.
- This test is *closed book and closed notes*
- *Please turn off all cell phones & pagers during the test.*
- 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.
- Please draw a box around your answers. This is to aid the grader. 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 versus binary, 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."

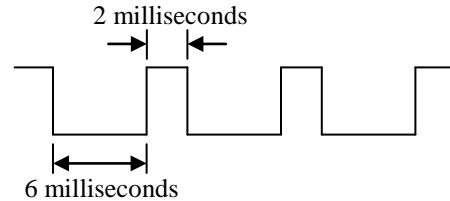
Basic Rules of Boolean Algebra

	OR	AND	XOR
Combined w/0	$A + 0 = A$	$A \cdot 0 = 0$	$A \oplus 0 = A$
Combined w/1	$A + 1 = 1$	$A \cdot 1 = A$	$A \oplus 1 = \bar{A}$
Combined w/self	$A + A = A$	$A \cdot A = A$	$A \oplus A = 0$
Combined w/inverse	$A + \bar{A} = 1$	$A \cdot \bar{A} = 0$	$A \oplus \bar{A} = 1$
Other rules	$A + A \cdot B = A$	$A + \bar{A} \cdot B = A + B$	$(A + B) \cdot (A + C) = A + B \cdot C$
DeMorgan's Th.	$\overline{A \cdot B} = \bar{A} + \bar{B}$		$\overline{A + B} = \bar{A} \cdot \bar{B}$

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

1. For a system to reliably capture the frequency range from 250 Hz to 500 Hz, the system's sampling rate must be greater than _____.
- a.) 250 samples/sec. b.) 500 samples/sec. c.) 750 samples/sec. d.) 1000 samples/sec.

2. What is the frequency of the signal show to the right?
(Note: 1 millisecond = 1×10^{-3} seconds)



3. The duty cycle for the previous problem is:
- a.) 25% b.) 33% c.) 40% c.) 50% d.) 66% e.) 75% f.) 100%
4. True or False: The frequency of a periodic signal can be calculated using only the duty cycle.
5. What is the most negative value that can be stored using 10-bit 2's complement representation?
- a.) -2^{10} b.) $-(2^{10} - 1)$ c.) -2^9 d.) $-(2^9 - 1)$ e.) -2^8 f.) $-(2^8 - 1)$
6. What is the minimum number of bits needed to represent 999_{10} in unsigned binary representation?
- a.) 8 b.) 9 c.) 10 d.) 11 e.) 12 f.) 13
7. Which signed binary representation works for addition of both positive and negative values?
- a.) signed magnitude b.) 2's complement c.) neither
8. How many patterns of ones and zeros does a 6-bit **Gray code sequence** consists of?
9. The IEEE-754 32-bit floating-point value 01000000100101000000000000000000 is _____.
(3 points)
- a.) less than zero b.) between zero and one c.) greater than one

10. Write the complete truth table for a 2-input XOR gate. (3 points)

A	B	X

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

$$\begin{array}{r}
 0 \quad 01110010 \\
 +00010101 \\
 \hline
 10000111
 \end{array}$$

No carry out

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

13. In the boolean expression below, circle the *single* operation that would be performed first.

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

14. Multiply the 16-bit value 0000111011101000_2 by 8. *Leave your answer in 16-bit binary.* (Hint: Remember the shortcut!)

15. Convert $1101000011011111011101111_2$ to hexadecimal.

16. Convert the unsigned binary value 010100_2 to its corresponding 6-bit binary Gray code. (3 points)

Medium-ish Answer (4 points each unless otherwise noted)

17. Convert the 32-bit IEEE 754 floating-point number $00111110110101100000000000000000$ to its binary exponential format, e.g., -1.001010×2^{-12} , (which, by the way, is not the answer).

18. Convert 1011.101_2 to decimal. (You may leave your answer in expanded form if you wish.)

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

20. Prove that $A \oplus \overline{A} = 1$. (Remember that \oplus is the XOR or exclusive-OR) *For full credit, please show all steps in detail.*

Longer Answers (Points vary per problem)

25. 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.) $A \cdot B \cdot (\bar{A} + \bar{B}) = 0$ Answer: _____

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

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

26. 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". (7 points per row)

Decimal	2's complement binary	Signed magnitude binary	Unsigned binary	Unsigned BCD
-112				
	11000110			
			11000110	