

CS 315 Test 1 Answers  
 Spring 2009  
 Instructor: Dr. Henry Hexmoor  
 Southern Illinois University

1. What is the decimal equivalent of the largest binary integer that can be obtained with 16 bits (10 points)

$2^{16}-1 = 65,535$

2. Convert decimal number 1492 to binary and then to hexadecimal. (10 points)

$1492/2 = 746$  with remainder 0,

$746/2 = 373$  with remainder 0,

$373/2 = 186$  with remainder 1,

$186/2 = 93$  with remainder 0,

$93/2 = 46$  with remainder 1,

$46/2 = 23$  with remainder 0,

$23/2 = 11$  with remainder 1,

$11/2 = 5$  with remainder 1,

$5/2 = 2$  with remainder 1,

$2/2 = 1$  with remainder 0,

$1/2 = 0$  with remainder 1,

$1492_{10} = 101\ 1101\ 0100_2 = 5d4_{16}$

3. Show the truth table of all possible input values for the following logic circuit. (15 points)

A B C AB C' BC AB+C' +BC

0 0 0 0 1 0 1

0 0 1 0 0 0 0

0 1 0 0 1 0 1

0 1 1 0 0 1 1

1 0 0 0 1 0 1

1 0 1 0 0 0 0

1 1 0 1 1 0 1

1 1 1 1 0 1 1

4. What does the following circuit implement using four NAND gates? (15 points)

Majority function

5. Write the complete addition table for base 8. (15 points)

	+	0	1	2	3	4	5	6	7
0	0	1	2	3	4	5	6	7	
1	1	2	3	4	5	6	7	10	
2	2	3	4	5	6	7	10	11	
3	3	4	5	6	7	10	11	12	
4	4	5	6	7	10	11	12	13	
5	5	6	7	10	11	12	13	14	
6	6	7	10	11	12	13	14	15	
7	7	10	11	12	13	14	15	16	

6. How many OR gates are needed for a 16-4 encoder? Draw the circuit. (10 points)

4 “8 input” OR gates

$$Y_0 = D_1 + D_3 + D_5 + D_7 + D_9 + D_{11} + D_{13} + D_{15}$$

$$Y_1 = D_2 + D_3 + D_6 + D_7 + D_{10} + D_{11} + D_{15} + D_{17}$$

$$Y_2 = D_4 + D_5 + D_6 + D_7 + D_{12} + D_{13} + D_{14} + D_{15}$$

$$Y_3 = D_8 + D_9 + D_{10} + D_{11} + D_{12} + D_{13} + D_{14} + D_{15}$$

$D_x$  is a binary bit string representation of  $x$ .  $x$  is selected for an output  $i$  ( $Y_i$ ) if the  $i$ th bit of  $x$  is 1.

7. What is the difference between a shifter and a rotator? (10 points)

Rotator does not drop a bit during shifting.

8. Multiply the following numbers without converting to decimal:  $(34)_8 \times (12)_8$  and. (15 points)

$$\begin{array}{r} 34 \\ \times 12 \\ \hline 70 \\ 340 \\ \hline 430_8 \end{array}$$