

The University of Alabama in Huntsville
ECE Department
EE 202 – 02
Fall 2010
Sample Test 1 Solution

1. (1 point) The output of a two input OR gate is 1 if one of the inputs is 1.
2. (1 point) Binary numbers are numbers with a base of 2.
3. (1 point) The standard binary code for alphanumeric codes is ASCII.
4. (1 point) A register is a group of binary cells.
5. (1 point) Boolean algebra is an algebra that deals with binary variables and logic operations.
6. (10 points) Convert (245_7) to decimal:

$$245_7 = 2 \times 7^2 + 4 \times 7^1 + 5 \times 7^0 = 2 \times 49 + 4 \times 7 + 5 \times 1 = 98 + 28 + 5 = 131_{10}$$

7. (5 points) Convert 1011011010010001_2 to hexadecimal

$$1011011010010001_2 = 1011\ 0110\ 1001\ 0001 = B691_{16}$$

8. (5 points) We can perform logical operations on strings of bits by considering each pair of corresponding bits separately (called bitwise operation). Given two eight-bit strings A = 10110001 and B = 10101100, evaluate the eight bit result after an AND operation.

$$\begin{array}{rcl} A = & 10110001 \\ B = & 10101100 \\ A \text{ AND } B = & 10100000 \end{array}$$

9. (20 points) Convert decimal +13 and +85 to binary, using the signed-2's-complement representation and enough digits to accommodate the numbers. Then perform the binary equivalent of $(+13) + (-85)$. Convert the answer back to decimal and verify that it is correct.

$\begin{array}{r} 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \end{array} \begin{array}{r} 85 \\ 42 \\ 21 \\ 10 \\ 5 \\ 2 \\ 1 \\ 0 \\ 0 \end{array} \begin{array}{r} \\ 1 \\ 0 \\ 1 \\ 0 \\ 1 \\ 0 \\ 1 \end{array}$	$\begin{array}{r} 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \end{array} \begin{array}{r} 13 \\ 6 \\ 3 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{array} \begin{array}{r} \\ 1 \\ 0 \\ 1 \\ 1 \\ 1 \end{array}$	$\begin{array}{r} 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \end{array} \begin{array}{r} 43 \\ 21 \\ 10 \\ 5 \\ 2 \\ 1 \\ 0 \\ 0 \\ 0 \end{array} \begin{array}{r} \\ 1 \\ 1 \\ 0 \\ 0 \\ 1 \\ 0 \\ 1 \end{array}$
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$$+13 = 0000\ 1101 \qquad +85 = 0101\ 0101 \qquad -85 = -128 + 43 \qquad -85 = 1010\ 1011$$

$$+13 = 0000\ 1101 \qquad 13-85 = -72$$

$$\begin{array}{r} +13 = 0000\ 1101 \\ +(-85) = 1010\ 1011 \\ \hline \end{array}$$

$$\begin{aligned} 1011\ 1000 &= 1 \times -2^7 + 0 \times 2^6 + 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 0 \times 2^0 \\ &= -128 + 0 + 32 + 16 + 8 + 0 + 0 + 0 \\ &= -72 \checkmark \end{aligned}$$

10. (5 points) Convert $F(A, B, C, D) = \Sigma(0, 1, 2, 4)$ to the other canonical form.

$$F(A, B, C, D) = \Pi(3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15)$$

11. (10 points) Formulate a weighted binary code for the decimal digits, using weights 8-4-2-1

8	4	-2	-1	Digit
0	0	0	0	0
0	1	1	1	1
0	1	1	0	2
0	1	0	1	3
0	1	0	0	4
1	0	1	1	5
1	0	1	0	6
1	0	0	1	7
1	0	0	0	8
1	1	1	1	9

12. (10 points) Reduce $ABCD + A'BD + ABC'D$ to two literals.

$$\begin{aligned}
 ABCD + A'BD + ABC'D &= D(ABC + ABC') + A'BD \\
 &= D(AB(C + C')) + A'BD \\
 &= ABD + A'BD \\
 &= BD(A + A') \\
 &= BD
 \end{aligned}$$

13. (10 points) Find the complement of $(x' + y + z')(x + y')(x + z)$

$$\begin{aligned}
 ((x' + y + z')(x + y')(x + z))' &= (x' + y + z')' + (x + y')' + (x + z)' \\
 &= xy'z + x'y + x'z'
 \end{aligned}$$

14. (20 points) Obtain the truth table of the following function, and express it in sum-of-minterms and product-of-maxterms form:

$$F = (x + y)z + x'y'z + x(y + z')$$

x	y	z	x + y	(x + y)z	x'y'z	y + z'	x(y + z')	(x + y)z + x'y'z + x(y + z')
0	0	0	0	0	0	1	0	0
0	0	1	0	0	1	0	0	1
0	1	0	1	0	0	1	0	0
0	1	1	1	1	0	1	0	1
1	0	0	1	0	0	1	1	1
1	0	1	1	1	0	0	0	1
1	1	0	1	0	0	1	1	1
1	1	1	1	1	0	1	1	1

$$F(x, y, z) = \Sigma(1, 3, 4, 5, 6, 7) = \Pi(0, 2)$$