

Test 1

50 minutes

All problems worth 10 points.

1. Convert the decimal number 311 to binary. Show your work.
2. Show the decimal equivalent of each of the numbers if they are interpreted as (six answers)

0 1 1 0 0 1 1 1

1 0 0 1 0 1 0 1

- a) Unsigned binary
- b) Signed binary
- c) BCD (8421 code)

3. Add the two pairs of positive binary numbers. (Be sure to show the carry as you add.)

0 1 0 1 1
1 0 1 1 0

0 1 0 1 0
0 1 0 0 1

Show both operands and the result of each addition in decimal as well as binary, indicating when there is overflow.

4. Complete the truth table for a system with 4 inputs, a, b, c, and d and one output, f. The first three inputs (a, b, c) represent a binary number, n, in the range 0 to 7; however, the input 0 never occurs. The last input (d) specifies which of two computations is made.

d = 0: f is 1 iff n is a multiple of 3

d = 1: f is 1 iff n is a multiple of 2

5. Use a truth table to show if $g_1 = g_2$, where

$$g_1 = x' z' + y z$$

$$g_2 = (x' + z)(y + z')$$

6. Reduce the expression below (using the algebraic properties) to a sum of products expression with 2 terms and 4 literals. Show each step.

$$a' b' c' + a' b' c + a b c + a b' c$$

7. Reduce the expression below (using the algebraic properties) to a sum of products expression with 3 terms and 5 literals. Show each step.

$$x' y' z' + x' y' z + x' y z + x y' z + x y z + x y z$$

8. Map the following function, circling each of the terms.

$$f = a' b' c' + a' b + a b d + a b' c' d'$$

9. Consider the following function

$$g = a b + b c' + a c'$$

All inputs are available both uncomplemented and complemented.

- a) Show a block diagram for a two-level AND-OR implementation.
- b) Show a block diagram for an implementation that uses only two-input AND and OR gates.

10. For the following truth table

x	y	z	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

- a) Write a sum of minterms function in numeric form (for example, $\sum m(0, \dots)$)
- b) Write a sum of minterms function in algebraic form (for example, $x' y + \dots$)
- c) Find a minimum sum of products expression (2 terms, 4 literals)