

# [CS M51A FALL 15] QUIZ 1

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- The quiz is closed book, and closed notes (30mins).
- Please show all your work and write legibly, otherwise no partial credit will be given.
- This should strictly be your own work; any form of collaboration will be penalized.

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## Quiz Problems (50 points total)

### Problem 1 (10 points)

Find  $x$  and  $y$  such that the following conditions are satisfied and show all the steps of your work.

1. (5 points)  $(818)_9 = (x)_3$

$$8_9 = 22_3$$

$$1_9 = 01_3$$

$$3 \cdot 3 + 2 = 8$$

$$2 \cdot 3 + 1 = 7$$

$$(x)_3 = (220122)_3$$



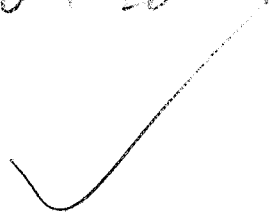
2. (5 points) What is the largest number  $y$  that can be represented with 4 digit-vector in radix 5. Show  $y$  in radix 5 and decimal.

$$y = (4444)_5$$

$$= 4 \cdot 125 + 4 \cdot 25 + 4 \cdot 5 + 4$$

$$= 500 + 100 + 20 + 4$$

$$= 624$$



**Problem 2 (16 points)**

Solve the following problems using the postulates and theorems of Boolean algebra. Do not use a truth table.

1. (8 points) The Boolean function  $f$  is defined as  $f(a, b, c) = ac' + a'b$  and the Boolean function  $g$  is defined as  $g(a, b, c) = ac + b'c + a'b'$ . Show that  $g(a, b, c)' = f(a, b, c)$ .

$$\begin{aligned} g(a, b, c)' &= (ac + b'c + a'b')' \\ &= (ac)'(b'c)''(a'b')' \\ &= (a' + c')(b + c')(a + b) \\ &= (a' + c')(ac' + b) \\ &= (a' + c')ac' + (a' + c')b \\ &= ac' + a'b + bc' \\ &= (a + b)c' + a'b \\ &= bc' + a'b = a'b + ac' = f(a, b, c) \end{aligned}$$

2. (8 points) Simplify the following expression.

$$\begin{aligned}
 &xyzw' + xyz' + xy' + x' \\
 &= xy(zw' + z') + xy' + x' \\
 &= xy((zw)') + (xy)'. \\
 &= (xyzw)'. \\
 &= x' + y' + z' + w'.
 \end{aligned}$$



**Problem 3 (24 points)**

F is a function that accepts inputs  $x \in \{0, 1, 2\}$ ,  $y \in \{1, 2, 3\}$ , and outputs  $z = \max(x^2, y)$ . Suppose you use binary code to encode  $x$ ,  $y$ , and  $z$ .  $x$  is encoded as  $x_1x_0$ ,  $y$  is encoded as  $y_1y_0$ ,  $z$  is encoded as  $z_2z_1z_0$ .

1. (16 points) Fill in the table below.

$x_1$	$x_0$	$y_1$	$y_0$	$z_2$	$z_1$	$z_0$
0	0	0	0	-	-	-
0	0	0	1	0	0	1
0	0	1	0	0	1	0
0	0	1	1	0	1	1
0	1	0	0	-	-	-
0	1	0	1	0	0	1
0	1	1	0	0	1	0
0	1	1	1	0	1	1
1	0	0	0	-	-	-
1	0	0	1	1	0	0
1	0	1	0	1	0	0
1	0	1	1	1	0	0
1	1	0	0	-	-	-
1	1	0	1	-	-	-
1	1	1	0	-	-	-
1	1	1	1	-	-	-



2. (8 points) Fill in the sets in the forms specified below.

$$z_2 = \sum m( M_9 + M_{10} + M_{11} )$$

$$z_1 = \sum m( M_2 + M_3 + M_6 + M_7 )$$

$$z_0 = \prod M( M_2 M_6 M_9 M_{10} M_{11} )$$

$$\text{dc-set of } z_1 = \text{dc}( 0, 4, 8, 12, 13, 14, 15 )$$