Quiz Problems (50 points total)

Problem 1 (15 points)

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

1. (5 points) $(3)_{10} \times (724)_9 = (x)_3$
2. (5 points) $(654)_{11} = (y)_5$
3. (5 points) $(33653337357)_8 = (z)_{16}$

1
$$7 = 2 \times 3 + 1$$
$$2 = 0 \times 3 + 2$$
$$4 = 1 \times 3 + 1$$

$$724_9 = 210211_3$$

$$3_{10} \times 210211_3 = 2102110_3 \qquad \underline{x = 2102110}$$

2 $\quad 654_{11} = 6 \times 11^2 + 5 \times 11 + 4 \times 1$

$$
\Rightarrow \quad
\begin{array}{r}
6 \\
6 6 6 \\
5 5 \\
+ 4 \\
\hline
7 8 5_{10}
\end{array}
$$

$5 \underline{/ 785}$
$5 \underline{/ 157} \cdots 0$
$5 \underline{/ 31} \cdots 2$
$5 \underline{/ 6} \cdots 1$
$ 1 \cdots 1$

$11120_5 \qquad \underline{y = 11120}$

$625 + 125 + 25 + 2 \times 5$
$= 750 + 35 = 785$

3 $\quad 33653337357_8 = \boxed{011} \boxed{101} \, 110 \, 101 \, 011 \, 011 \, 110 \, 111 \, 110 \, 111_2$

$$= \quad D \quad E \quad A \quad D \quad B \quad E \quad E \quad F_{16}$$

2

Problem 2 (20 points)

Given the function F defined as

$$F(a, b, c) = a'bc + ab'c + abc' + abc$$

1. **(5 points)** Draw a truth table for the function F.

2. **(5 points)** Represent the function $F(a, b, c)$ using minterm and maxterm notations.

3. **(5 points)** Obtain the minimal sum of products form (SOP) for the function $F(a, b, c)$ by **only** using Boolean algebra postulates and theorems. Do not use a truth table. *(Hint: the minimal SOP of $\overline{F}$ has three product terms.)*

4. **(5 points)** Draw a diagram for the gate network that implements the minimal SOP of $F(a, b, c)$ using AND, OR, or NOT gates.
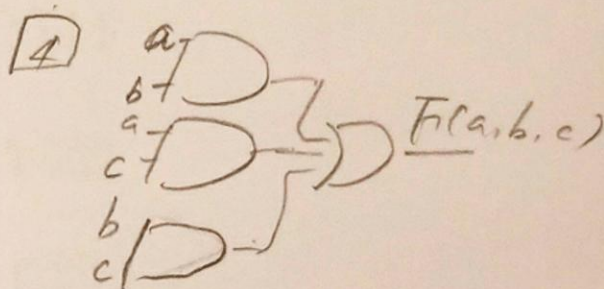
1.

a	b	c	$F(a, b, c)$
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

4.

or

2.
$$F(a, b, c) = m_3 + m_5 + m_6 + m_7$$
$$= \Sigma m(3, 5, 6, 7)$$
$$= \Pi M(0, 1, 2, 4)$$

3.
$$F(a, b, c) = a'bc + ab'c + abc' + abc$$
$$= a'bc + ab'c + abc' + (abc + abc)$$
$$= a'bc + ab'c + ab(c' + c) + abc$$
$$= a'bc + ab'c + ab + abc$$
$$= bc + ac + ab$$
$$= ab + c(a + b)$$

3
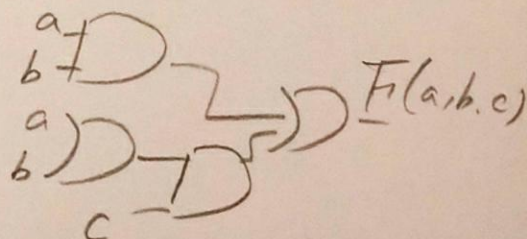
Problem 3 (15 points)

For the integer with decimal representation 1234,

- (5 points) Give the corresponding bit-vectors for the BCD code
- (5 points) Give the corresponding bit-vectors for the Excess-3 code.
- (5 points) From the Excess-3 code, invert every bit of the bit vectors. What is the number in decimal representation?

BCD $\left(\begin{array}{cccc} 0001 & 0010 & 0011 & 0100 \end{array}\right)$

EXCESS$_3$ 0100   0101   0110   0111

Inverted
EXCESS$_3$ 1011   1010   1001   1000

BCD   1000   0111   0110   0101

         8   7   6   5

$\therefore$ 8765