ECE-223, Solution for Assignment #8

Digital Design, M. Mano, 3^{rd} Edition, Chapter 7

7.9) A DRAM chip uses two dimensional address multiplexing. It has 13 common address pins with the row address having 1 bit longer than column address. What is the capacity of the memory?

13+12 = 25 Address lines, => Memory Capacity = 2^{25} words

7.12) A 12-bit Hamming code word containing 8 bits of data and 4 parity bits is read from memory. What was the original 8-bit data word that was written into memory if the 12-bit word read out is as follows:

a) 000011101010
b) 101110000110
c) 101111110100

a)

$C_1(1,3,5,7,9,11) = 0,0,1,1,1,1 = 0$
$C_2(2,3,6,7,10,11) = 0,0,1,1,0,1 = 1$
$C_4(4,5,6,7,12) = 0,1,1,1,0 = 1$
$C_8(8,9,10,11,12) = 0,1,0,1,0 = 0$

⇨ C = 0110
(Data-bits are 3 5 6 7 9 10 11 12)
Error in bit 6 => Corrected 8-bit data = 0 1 0 1 1 0 1 0

b)

$C_1(1,3,5,7,9,11) = 1,1,1,0,0,1 = 0$
$C_2(2,3,6,7,10,11) = 0,1,0,0,1,1 = 1$
$C_4(4,5,6,7,12) = 1,1,0,0,0 = 0$
$C_8(8,9,10,11,12) = 0,0,1,1,0 = 0$

⇨ C = 0010 (Parity bit)
(Data-bits are 3 5 6 7 9 10 11 12)
Error in bit 2 => Corrected 8-bit data = 1 1 0 0 0 1 1 0

c)

⇨ C = 0000
No Error
8-bit Data = 1 1 1 1 0 1 0 0

7.19) Tabulate the truth table for an 8 × 4 ROM that implements the Boolean functions

$A(x, y, z) = \sum (1, 2, 4, 6)$
$B(x, y, z) = \sum (0, 1, 6, 7)$
$C(x, y, z) = \sum (2, 6)$
$D(x, y, z) = \sum (1, 2, 3, 5, 7)$

Inputs			Outputs			
x	y	z	A	B	C	D
0	0	0	0	1	0	0
0	0	1	1	1	0	1
0	1	0	1	0	1	1
0	1	1	0	0	0	1
1	0	0	1	0	0	0
1	0	1	0	0	0	1
1	1	0	1	1	1	0
1	1	1	0	1	0	1

7.22) List the PLA programming table for the BCD to excess-3 code convert whose Boolean function are simplified in Fig. 4-3.

From Fig.4-3

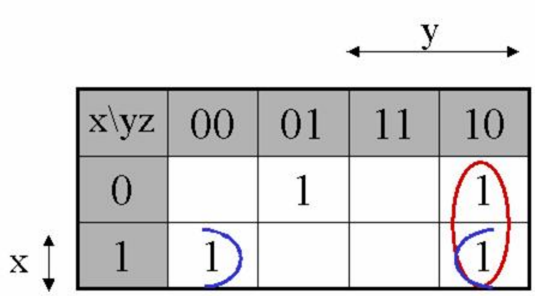
$w = A+BC+BD$, $w' = A'B' + A'C'D'$
$x = B'C + B'D + BC'D'$, $x' = B'C'D' + BC + BD$
$y = CD + C'D'$, $y' = C'D + CD'$
$z = D'$, $z' = D$
use w, x′, y, z (7 terms)

	Product term	Inputs				Outputs			
		A	B	C	D	w	x	y	z
A	1	1	-	-	-	1	-	-	-
BC	2	-	1	1	-	1	1	-	-
BD	3	-	1	-	1	1	1	-	-
B′C′D′	4	-	0	0	0	-	1	-	-
CD	5	-	-	1	1	-	-	1	-
C′D′	6	-	-	0	0	-	-	1	-
D′	7	-	-	-	0	-	-	-	1
						T	C	T	T

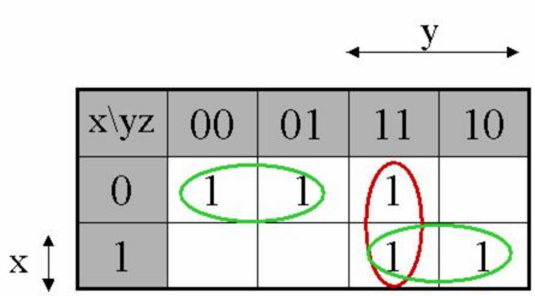
7.23) Repeat problem 7.22 using a PAL.

Product Term	AND Inputs A	B	C	D	Outputs
1	1	-	-	-	w = A+BC+BD
2	-	1	1	-	
3	-	1	-	1	
4	-	0	1	-	x = B′C + B′D + BC′D′
5	-	0	-	1	
6	-	1	0	0	
7	-	-	1	1	y = CD + C′D′
8	-	-	0	0	
9	-	-	-	-	
10	-	-	-	0	z = D′
11	-	-	-	-	
12	-	-	-	-	

7.24) The following is a truth table of a 3-input, 4-output combinational circuit. Tabulate the PAL programming table for the circuit and mark the fuse map in a PAL diagram similar to the one shown in Fig. 7-17.



A = yz’+xz’+x’y’z



B = xy+ yz+ x′y′

x\yz	00	01	11	10
0		1		1
1	1		1	1

C = A + xyz

x\yz	00	01	11	10
0		1	1	1
1		1	1	

D = z + x′y

Product Term	AND Inputs x	y	z	A	Outputs
1	-	1	0	-	A = yz′ + xz′ + x′y′z
2	1	-	0	-	
3	0	0	1	-	
4	0	0	-	-	B = x′y′ + xy + yz
5	1	1	-	-	
6	-	1	1	-	
7	-	-	-	1	C = A + xyz
8	1	1	1	-	
9	-	-	-	-	
10	-	-	1	-	D = z + x′y
11	0	1	-	-	
12	-	-	-	-	