EECE256 Assignment 7

1. How many address lines and data lines are needed for the following memory?

	Address	Data
a) 16K x 8	14	8
b) 256K x 64	18	64
c) 2G x 16	31	16
d) 20 x 4	5	4

2. Show the Parity bits for a 16-bit and 32-bit number. What is the parity value for the 8-bit binary number 10110101? Place the bits into the appropriate places in the parity+data word.

$P_1P_2D_{15}P_4D_{14}D_{13}D_{12}P_8D_{11}D_{10}D_9D_8D_7D_6\ D_5P_{16}\ D_4\ D_3\ D_2\ D_1\ D_0$

$P_1P_2D_{31}P_4D_{30}D_{29}D_{28}P_8D_{27}D_{26}D_{25}D_{24}D_{23}D_{22}D_{21}P_{16}\ D_{20}\ D_{19}\ D_{18}\ D_{17}\ D_{16}\ D_{15}D_{14}D_{13}D_{12}D_{11}D_{10}D_9D_8D_7D_6\ P_{32}D_5\ D_4\ D_3\ D_2\ D_1\ D_0$

$P_1\ P_2\ 1\ P_4\ 011\ P_8 0101$

P_1 = XOR (3,5,7,9,11) = 1

P_2 = XOR (3,6,7,10,11) = 1

P_3 = XOR (5,6,7,12) = 1

P_4 = XOR (9,10,11,12) = 0

111101100101

3. Create the truth table for a ROM that implements the Boolean functions:

A(x,y,z) = ∑(0,3,6)

B(x,y,z) = ∑(1,2,3,6)

C(x,y,z) = ∑(1,5)

D(x,y,z) = ∑(0,1,5,6,7)

How big should the ROM be? What is the memory content at addresses 0 and 5?

X	Y	Z	A	B	C	D
0	0	0	1	1	0	1
0	0	1	0	1	1	1
0	1	0	0	1	0	0
0	1	1	1	0	0	0
1	0	0	0	0	0	0
1	0	1	0	0	1	1
1	1	0	1	1	0	1
1	1	1	0	0	0	1

Address 0 = 1101

Address 5 = 0011

4. Derive the PLA programming table for a combinational circuit that squares a 4-bit number, and minimize the number of product terms. What is the width of the output?

wxyz	$wxyz^2$		$S_7 S_6 S_5 S_4$	$S_3 S_2 S_1 S_0$
0000	0	=	0000	0000
0001	1	=	0000	0001
0010	4	=	0000	0100
0011	9	=	0000	1001
0100	16	=	0001	0000
0101	25	=	0001	1001
0110	36	=	0010	0100
01Φ1	49	=	0011	0001
1000	64	=	0100	0000
1001	81	=	0101	0001
1010	100	=	0110	0100
1011	121	=	0111	1001
1100	144	=	1001	0000
1101	169	=	1010	1001
1110	196	=	1100	0100
1111	225	=	1110	0001

$S_0 = Z$, $S_1 = 0$

$S_2 = \Sigma(2,6,10,14)$

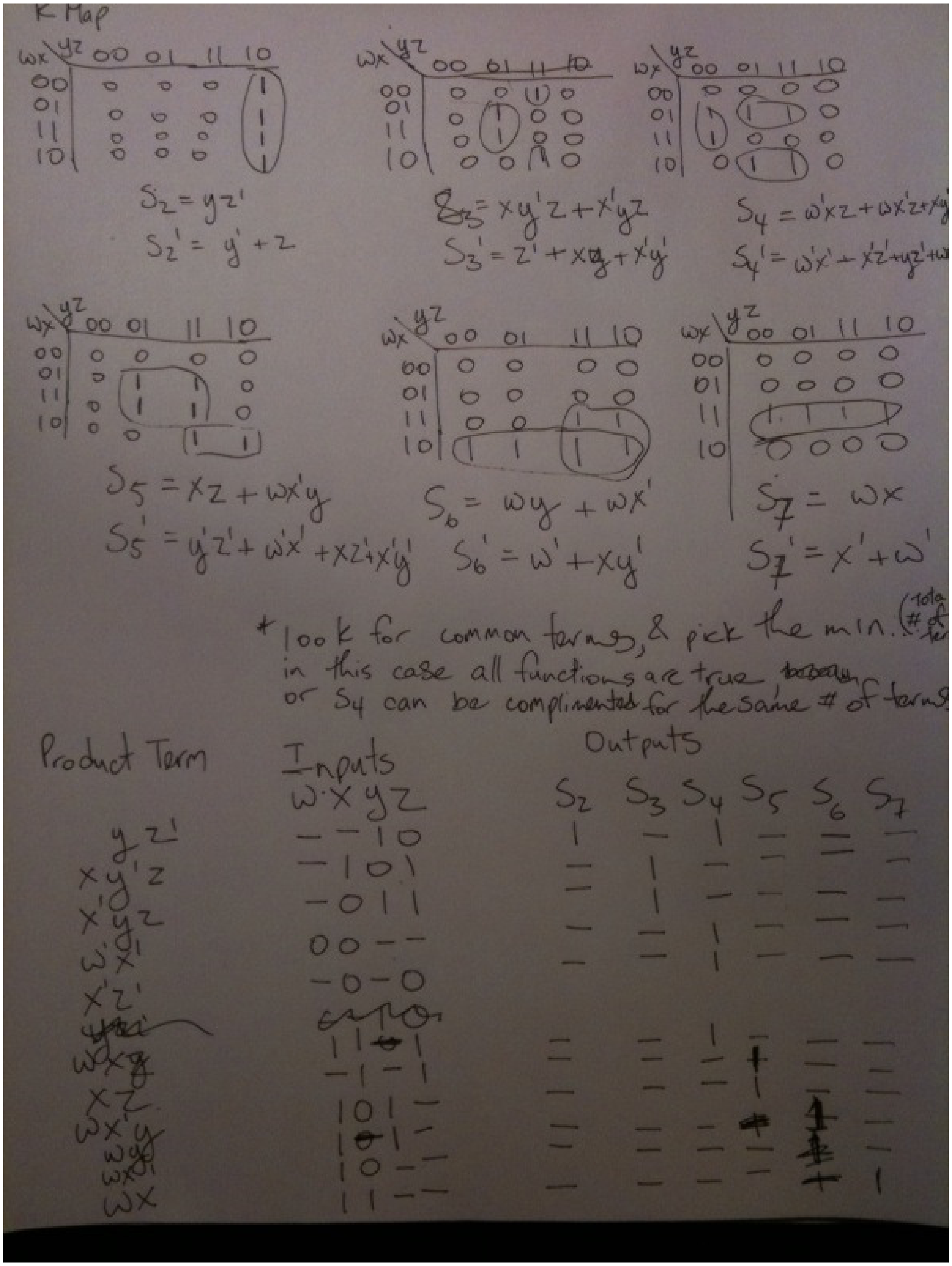
$S_3 = \Sigma(3,5,11,13)$

$S_4 = \Sigma(4,5,7,9,11,12)$

$S_5 = \Sigma(6,7,10,11,13,15)$

$S_6 = \Sigma(8,9,10,11,14,15)$

$S_7 = \Sigma(12,13,14,15)$



It was possible to implement the square function with a PAL, but not very easy. Think of how easy this is to implement using a ROM. Selection of appropriate device types is important!