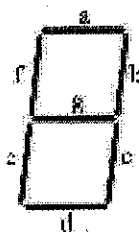UNIVERSITY OF MINNESOTA DULUTH

Draw the logic of one 7-segment display from binary coded decimal format (Conversion from 4 bit input [X,Y,Z,W] to 7 output bits [a,b,c,d,e,f,g] assuming each of the segment is illuminated upon 0 in output) using the given truth table. Write equations of Boolean Expressions and draw logic circuit over Logism, attach screenshot with this worksheet.

$$a = \Sigma(0,2,3,5,7,8,9)$$
$$b = \Sigma(0,1,2,3,4,7,8,9)$$
$$c = \Sigma(0,1,3,4,5,6,7,8,9)$$
$$d = \Sigma(0,2,3,5,6,8)$$
$$e = \Sigma(0,2,6,8)$$
$$f = \Sigma(0,4,5,6,8,9)$$
$$g = \Sigma(2,3,4,5,6,8,9)$$

$$a = X + Z + YW + Y\overline{W}$$
$$b = \overline{Y} + \overline{Z}\overline{W} + ZW$$
$$c = Y + \overline{Z} + W$$
$$d = \overline{Y}\,\overline{W} + Z\overline{W} + Y\overline{Z}W + \overline{Y}Z + X$$
$$e = \overline{Y}\,\overline{W} + Z\overline{W}$$
$$f = X + \overline{Z}\overline{W} + Y\overline{Z} + Y\overline{W}$$
$$g = X + Y\overline{Z} + \overline{Y}Z + Z\overline{W}$$

Truth Table:

Digit	X	Y	Z	W	a	b	c	d	e	f	g
0	0	0	0	0	0	0	0	0	0	0	1
1	0	0	0	1	1	0	0	1	1	1	1
2	0	0	1	0	0	0	1	0	0	1	0
3	0	0	1	1	0	0	0	0	1	1	0
4	0	1	0	0	1	0	0	1	1	0	0
5	0	1	0	1	0	1	0	0	1	0	0
6	0	1	1	0	0	1	1	0	0	0	0
7	0	1	1	1	0	0	0	1	1	1	1
8	1	0	0	0	0	0	0	0	0	0	0
9	1	0	0	1	0	0	0	1	1	0	0

a)

	$\bar{Z}\bar{W}$	$\bar{Z}W$	ZW	$Z\bar{W}$
$\bar{X}Y$	1		1	1
$\bar{X}\bar{Y}$		1		
XY	X	X	X	X
$X\bar{Y}$	1		X	X

$$X + Z + Yw + \bar{Y}w$$

b)

	$\bar{Z}\bar{W}$	$\bar{Z}W$	ZW	$Z\bar{W}$
XY	1		1	1
$\bar{X}Y$	1		1	
XY	X	X	X	X
$X\bar{Y}$	1	1	X	X

$$\bar{Y} + \bar{Z}w + Zw$$

c)

	$\bar{Z}\bar{W}$	$\bar{Z}W$	ZW	$Z\bar{W}$
XY	1	1	1	
$\bar{X}Y$			1	1
$X\bar{Y}$	X	X		X
$X\bar{Y}$	1	1	X	

$$Y + \bar{Z} + w$$

d)

	$\bar{Z}\bar{W}$	$\bar{Z}W$	ZW	$Z\bar{W}$
$\bar{X}Y$	1		1	
$\bar{X}Y$		1		
XY	X	X	X	X
$X\bar{Y}$	1	1	X	X

$$\bar{Y}w + Z\bar{w} + Y\bar{Z}w + \bar{Y}Z + X$$

e)

	$\bar{Z}\bar{W}$	$\bar{Z}W$	ZW	$Z\bar{W}$
XY	1			1
$\bar{X}Y$				1
XY	X	X	X	X
$X\bar{Y}$	1			X

$$Yw + Zw$$

f)

	$\bar{Z}\bar{W}$	$\bar{Z}W$	ZW	$Z\bar{W}$
XY	1			
XY		1		1
XY	X	X	X	X
$X\bar{Y}$	1	1	X	X

$$X + \bar{Z}w + Y\bar{Z} + Y\bar{w}$$

g)

	$\bar{Z}\bar{W}$	$\bar{Z}W$	ZW	$Z\bar{W}$
XY			1	1
$\bar{X}Y$	1	1		1
XY	X	X	X	X
$X\bar{Y}$	1	1		X

$$w\bar{Z} + Y\bar{Z} + \bar{Y}Z + Zw + X$$