Mark Bellingham – 140320986G4Z1002 CSF Assignment

Truth table for 4 inputs and 7 outputs. The output values in the bottom 6 rows (decimal input values 10 – 15) are marked 'd' because it does not matter what the output is for these inputs.

z	y	x	w	a	b	c	d	e	f	g
0	0	0	0	1	1	1	1	1	1	0
0	0	0	1	0	1	1	0	0	0	0
0	0	1	0	1	1	0	1	1	0	1
0	0	1	1	1	1	1	1	0	0	1
0	1	0	0	0	1	1	0	0	1	1
0	1	0	1	1	0	1	1	0	1	1
0	1	1	0	1	0	1	1	1	1	1
0	1	1	1	1	1	1	0	0	0	0
1	0	0	0	1	1	1	1	1	1	1
1	0	0	1	1	1	1	1	0	1	1
1	0	1	0	d	d	d	d	d	d	d
1	0	1	1	d	d	d	d	d	d	d
1	1	0	0	d	d	d	d	d	d	d
1	1	0	1	d	d	d	d	d	d	d
1	1	1	0	d	d	d	d	d	d	d
1	1	1	1	d	d	d	d	d	d	d

Karnaugh maps for each of the outputs:

$a = x + z + y.w + \overline{w}.\overline{y}$

$b = \overline{z}.\overline{y} + \overline{x}.\overline{w} + z + x.w$

$c = \overline{x} + w + y$

$$d=z+x.\overline{w}+\overline{z}.\overline{y}.x+\overline{y}.\overline{w}+\overline{x}.w.y$$

e		xw			
		0 0	0 1	1 1	1 0
z	0 0	1			1
y	0 1				1
	1 1	d	d	d	d

$$e=\overline{y}.\overline{w}+z.\overline{x}.\overline{w}+x.\overline{w}$$

f		xw			
		0 0	0 1	1 1	1 0
z	0 0	1			
y	0 1	1	1		1
	1 1	d	d	d	d

$$f=z+\overline{x}.\overline{w}+y.\overline{w}+\overline{x}.y$$

g		xw			
		0 0	0 1	1 1	1 0
z	0 0			1	1
y	0 1	1	1		1
	1 1	d	d	d	d
	1 0	1	1	d	d

$$g=z+\overline{x}.y+\overline{z}.\overline{y}.x+x.\overline{w}$$

AND gates which are repeated and can therefore be reused in the circuit:

$\overline{w}.\overline{y}$	$x.\overline{w}$	$\overline{z}.\overline{y}.x$	$\overline{x}.y$
a, d, e	d, e, g	d, g	f, g

Screen-prints of the circuit showing each of the 10 decimal digits on the 7-segment display for the relevant binary input.