L8 Practice answers:

1. Excess-3 to BCD converter

	Excess-3 input				BCD output			
Decimal	**A**	**B**	**C**	**D**	**Y3**	**Y2**	**Y1**	**Y0**
invalid	0	0	0	0	**X**	**X**	**X**	**X**
invalid	0	0	0	1	**X**	**X**	**X**	**X**
invalid	0	0	1	0	**X**	**X**	**X**	**X**
0	0	0	1	1	**0**	**0**	**0**	**0**
1	0	1	0	0	**0**	**0**	**0**	**1**
2	0	1	0	1	**0**	**0**	**1**	**0**
3	0	1	1	0	**0**	**0**	**1**	**1**
4	0	1	1	1	**0**	**1**	**0**	**0**
5	1	0	0	0	**0**	**1**	**0**	**1**
6	1	0	0	1	**0**	**1**	**1**	**0**
7	1	0	1	0	**0**	**1**	**1**	**1**
8	1	0	1	1	**1**	**0**	**0**	**0**
9	1	1	0	0	**1**	**0**	**0**	**1**
invalid	1	1	0	1	**X**	**X**	**X**	**X**
invalid	1	1	1	0	**X**	**X**	**X**	**X**
invalid	1	1	1	1	**X**	**X**	**X**	**X**

By observation, **Y0 = D'**

Y1

AB \ CD	00	01	11	10
00	**X**	**X**	**0**	**X**
01	**0**	**1**	**0**	**1**
11	**0**	**X**	**X**	**X**
10	**0**	**1**	**0**	**1**

Y1 = C'D + CD'

Y2

AB \ CD	00	01	11	10
00	**X**	**X**	**0**	**X**
01	**0**	**0**	**1**	**0**
11	**0**	**X**	**X**	**X**
10	**1**	**1**	**0**	**1**

Y2 = B'C' + B'D' + BCD

Y3

AB \ CD	00	01	11	10
00	**X**	**X**	**0**	**X**
01	**0**	**0**	**0**	**0**
11	**1**	**X**	**X**	**X**
10	**0**	**0**	**1**	**0**

Y3 = AB + ACD

2.

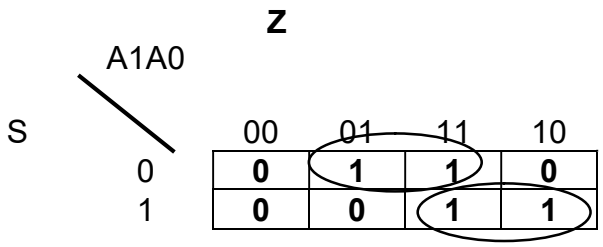
A3	A2	A1	A0	Z
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**1**
0	1	0	0	**1**
0	1	0	1	**1**
0	1	1	0	**1**
0	1	1	1	**1**
1	0	0	0	**0**
1	0	0	1	**0**
1	0	1	0	**0**
1	0	1	1	**0**
1	1	0	0	**0**
1	1	0	1	**0**
1	1	1	0	**0**
1	1	1	1	**0**

Z

A3A2 \ A1A0	00	01	11	10
00	**0**	**0**	**1**	**0**
01	**1**	**1**	**1**	**1**
11	**0**	**0**	**0**	**0**
10	**0**	**0**	**0**	**0**

Z = A3’ A2 + A3’ A1 A0

3.



Z = S' ● A0 + S ● A1

4. From Q3,

Z = S' ● A0 + S ● A1

An enable input EN can be added to the circuit using an AND gate:

Modified_Z = EN ● (S' ● A0 + S ● A1)

i.e. Modified_Z = (EN) AND (Original_Z)

if (EN = 0)
Modified_Z = 0
else
Modified_Z behaves the same as Original_Z in Q3