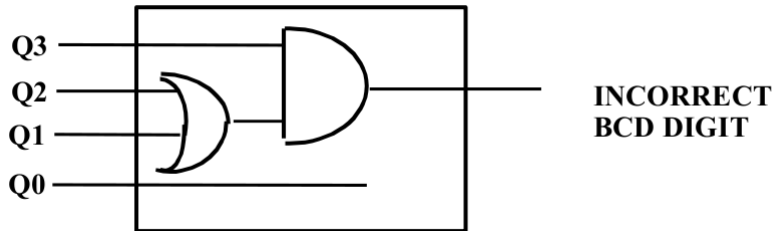


Tutorial 7: Solution

Problem 1

	Q1,Q0			
Q3,Q2	00	01	11	10
00	0	0	0	0
01	0	0	0	0
11	1	1	1	1
10	0	0	1	1

$$\begin{aligned} \text{Bad BCD digit} &= Q3 \cdot Q2 + Q3 \cdot Q1 \\ &= Q3 \cdot (Q2 + Q1) \end{aligned}$$



Problem 2

Sum	10	11	12	13	14	15	16	17	18	19
Bin. Sum	1010	1011	1100	1101	1110	1111	0000	0001	0010	0011
Bin. C.Out	0	0	0	0	0	0	1	1	1	1
BCD Sum	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001
BCD C.Out	1	1	1	1	1	1	1	1	1	1

We need to provide a carry for these cases

	Q1,Q0			
Q3,Q2	00	01	11	10
00	0	0	0	0
01	0	0	0	0
11	1	1	1	1
10	0	0	1	1

$$\begin{aligned} \text{BCD Carry} &= Q3 \cdot Q2 + Q3 \cdot Q1 \\ &= Q3 \cdot (Q2 + Q1) \end{aligned}$$

The Same !!!!!

Problem 3

In order to generate the BCD sum from the binary sum when the sum is larger than 1001 (9) we have to subtract 10. The 4 bit two's-complement of 10 is 6, so we add the binary number 0110 (6) and this works for all numbers between 10 and 19.

