Lab 1

Priority Encoder

Input								Binary Output		
D7	D6	D5	D4	D3	D2	D1	D0	Q2	Q1	Q0
0	0	0	0	0	0	0	1	1	1	1
0	0	0	0	0	0	1	x	1	1	0
0	0	0	0	0	1	x	x	1	0	1
0	0	0	0	1	x	x	x	1	0	0
0	0	0	1	x	x	x	x	0	1	1
0	0	1	x	x	x	x	x	0	1	0
0	1	x	x	x	x	x	x	0	0	1
1	x	x	x	x	x	x	x	0	0	0

The output counts how many zeros are there in the input

$$Q_0 = \sum(1,2,4,6)$$
$$Q_0 = (\overline{D}_7\overline{D}_6\overline{D}_5\overline{D}_4\overline{D}_3\overline{D}_2\overline{D}_1D_0 + \overline{D}_7\overline{D}_6\overline{D}_5\overline{D}_4\overline{D}_3D_2 + \overline{D}_7\overline{D}_6\overline{D}_5D_4 + \overline{D}_7D_6)$$
$$Q_0 = (\overline{D}_7\overline{D}_5\overline{D}_3\overline{D}_1D_0 + \overline{D}_7\overline{D}_5\overline{D}_3D_2 + \overline{D}_7\overline{D}_5D_4 + \overline{D}_7D_6)$$
$$Q_0 = (\overline{D}_7(\overline{D}_5(\overline{D}_3\overline{D}_1D_0 + \overline{D}_3D_2 + D_4) + D_6))$$

Similarly:

$$Q_1 = \sum(0,1,4,5)$$
$$Q_1 = (\overline{D}_7\overline{D}_6\overline{D}_5\overline{D}_4\overline{D}_3\overline{D}_2\overline{D}_1D_0 + \overline{D}_7\overline{D}_6\overline{D}_5\overline{D}_4\overline{D}_3\overline{D}_2D_1 + \overline{D}_7\overline{D}_6\overline{D}_5D_4 + \overline{D}_7\overline{D}_6D_5)$$
$$Q_1 = (\overline{D}_7\overline{D}_6\overline{D}_3\overline{D}_2D_0 + \overline{D}_7\overline{D}_6\overline{D}_3\overline{D}_2D_1 + \overline{D}_7\overline{D}_6D_4 + \overline{D}_7\overline{D}_6D_5)$$
$$Q_1 = (\overline{D}_7(\overline{D}_6(\overline{D}_3\overline{D}_2(D_0 + D_1) + D_4 + D_5)))$$

And

$$Q_1 = \sum(0, 1, 2, 3)$$
$$Q_1 = (\overline{D}_7\overline{D}_6\overline{D}_5\overline{D}_4\overline{D}_3\overline{D}_2\overline{D}_1D_0 + \overline{D}_7\overline{D}_6\overline{D}_5\overline{D}_4\overline{D}_3\overline{D}_2D_1 + \overline{D}_7\overline{D}_6\overline{D}_5\overline{D}_4\overline{D}_3D_2 + \overline{D}_7\overline{D}_6\overline{D}_5\overline{D}_4D_3)$$
$$Q_1 = (\overline{D}_7\overline{D}_6\overline{D}_5\overline{D}_4D_0 + \overline{D}_7\overline{D}_6\overline{D}_5\overline{D}_4D_1 + \overline{D}_7\overline{D}_6\overline{D}_5\overline{D}_4D_2 + \overline{D}_7\overline{D}_6\overline{D}_5\overline{D}_4D_3)$$
$$Q_1 = (\overline{D}_7\overline{D}_6\overline{D}_5\overline{D}_4(D_0 + D_1 + D_2 + D_3))$$

Test Bench