Seven Segment Display Encoder

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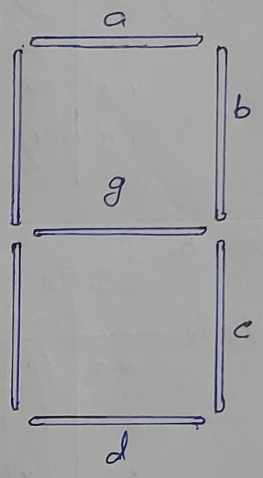
BCSE-II

Hardware Design Lab.

Design a System to Display 0-9 through a 7-Segment L.E.D. Display.

– A 7-segment LED display has 7 outputs or LEDs, which make combinations to display numbers from 0-9.



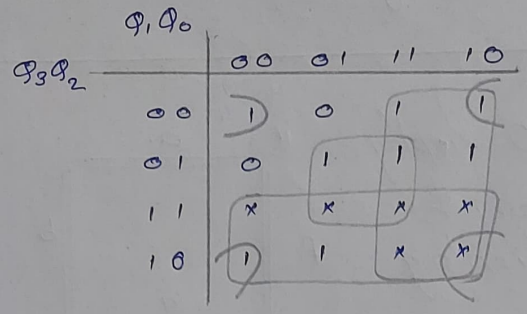
Let the LEDs be numbered from 'a' to 'g' as in the figure. Now, the encoder circuit will have 4 inputs for the decimal number's binary representation and 7 outputs, each corresponding to one of the LEDs.

Truth Table:

Input				Output.						
Q_3	Q_2	Q_1	Q_0	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

Minimization:

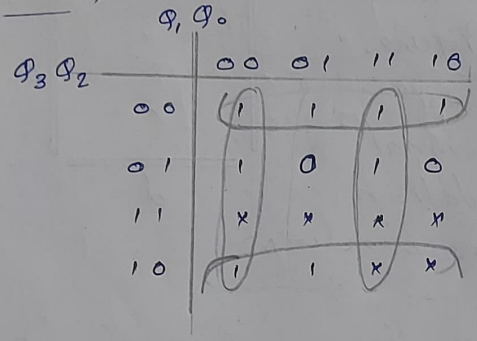
For a,



Q_3Q_2 \ Q_1Q_0	00	01	11	10
00	1	0	1	1
01	0	1	1	1
11	x	x	x	x
10	1	1	x	x

$$a = \bar{Q}_2\bar{Q}_0 + Q_1 + Q_3 + Q_2Q_0$$

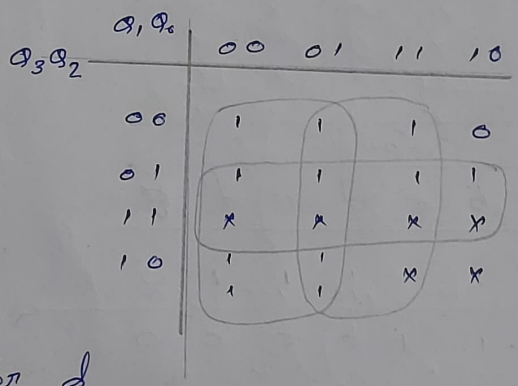
For b,



Q_3Q_2 \ Q_1Q_0	00	01	11	10
00	1	1	1	1
01	1	0	1	0
11	x	x	x	x
10	1	1	x	x

$$b = \bar{Q}_2 + \bar{Q}_1\bar{Q}_0 + Q_1Q_0$$

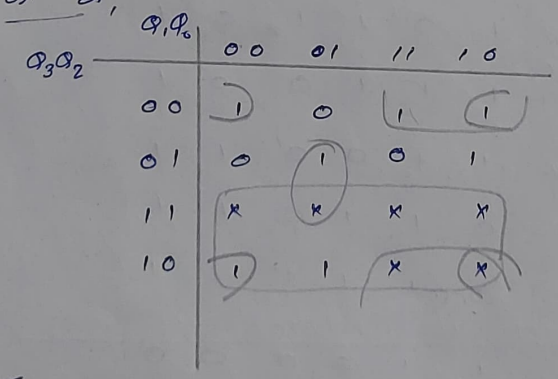
For c,



Q_3Q_2 \ Q_1Q_0	00	01	11	10
00	1	1	1	0
01	1	1	1	1
11	x	x	x	x
10	1	1	x	x

$$c = \bar{Q}_1 + Q_0 + Q_2$$

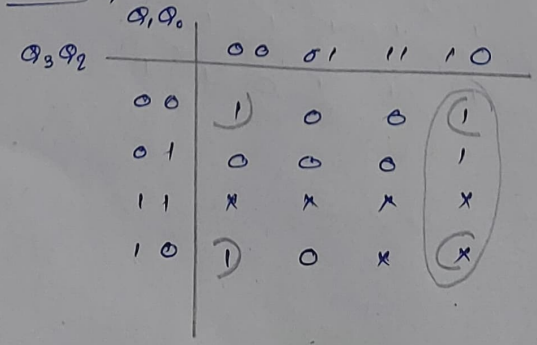
For d,



Q_3Q_2 \ Q_1Q_0	00	01	11	10
00	1	0	1	1
01	0	1	0	1
11	x	x	x	x
10	1	1	x	x

$$d = \bar{Q}_2\bar{Q}_0 + \bar{Q}_2Q_1 + Q_1\bar{Q}_0 + Q_2\bar{Q}_1Q_0 + Q_3$$

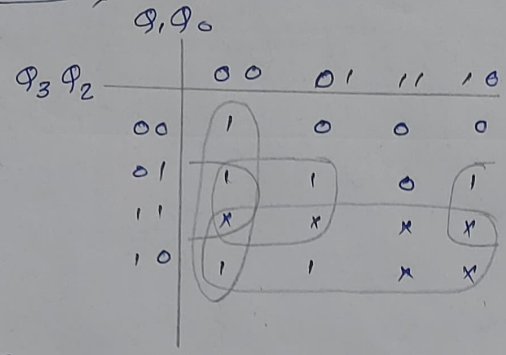
For e,



Q_3Q_2 \ Q_1Q_0	00	01	11	10
00	1	0	0	1
01	0	0	0	1
11	x	x	x	x
10	1	0	x	x

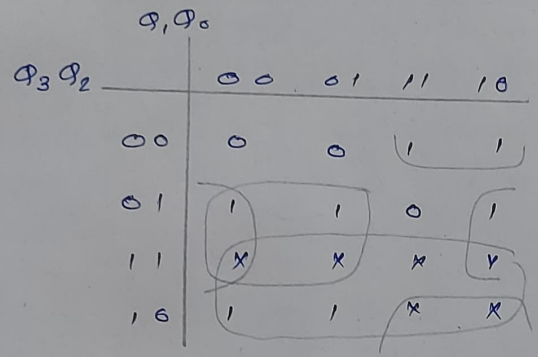
$$e = \bar{Q}_2\bar{Q}_0 + Q_1\bar{Q}_0$$

For f:



$$f = Q_3 + Q_2\bar{Q}_0 + Q_2\bar{Q}_1 + \bar{Q}_1\bar{Q}_0$$

For g,



$$g = Q_3 + Q_2\bar{Q}_0 + Q_2\bar{Q}_1 + \bar{Q}_2Q_1$$

Expressions:

$$a = Q_3 + Q_1 + \bar{Q}_2\bar{Q}_0 + Q_2Q_0$$

$$b = \bar{Q}_2 + \bar{Q}_1\bar{Q}_0 + Q_1Q_0$$

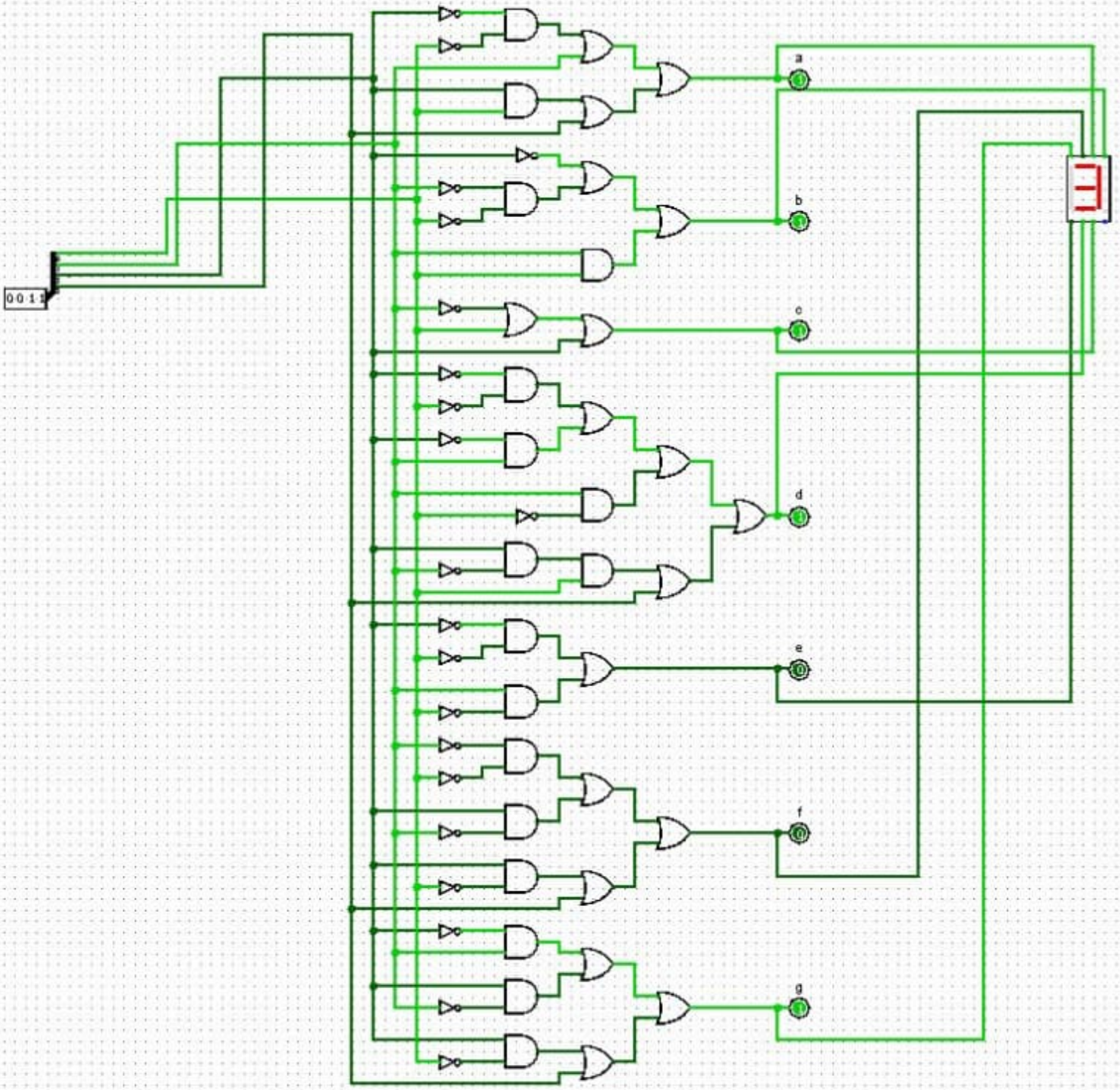
$$c = \bar{Q}_1 + Q_0 + Q_2$$

$$d = Q_3 + \bar{Q}_2\bar{Q}_0 + \bar{Q}_2Q_1 + Q_1\bar{Q}_0 + Q_2\bar{Q}_1Q_0$$

$$e = \bar{Q}_2\bar{Q}_0 + Q_1\bar{Q}_0$$

$$f = Q_3 + Q_2\bar{Q}_0 + Q_2\bar{Q}_1 + \bar{Q}_1\bar{Q}_0$$

$$g = Q_3 + Q_2\bar{Q}_0 + Q_2\bar{Q}_1 + \bar{Q}_2Q_1$$


0011
a
b
c
d
e
f
g