

Karnaugh Maps question

Step 1

2.1. Truth table for all segments:

D_3	D_2	D_1	D_0	S_a	S_b	S_c	S_d	S_e	S_f	S_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	0	1	1
0	0	1	1	1	1	1	0	0	1	1
0	1	0	0	1	0	1	1	0	1	1
0	1	0	1	1	0	1	1	1	1	1
0	1	1	0	1	0	1	1	1	0	1
0	1	1	1	1	0	1	1	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

other inputs - output not specified

Karnaugh maps + minimised Boolean formulas:

S_a $D_{3:2}$ $D_{1:0}$

$D_{3:2}$	00	01	11	10
00	1	0	x	1
01	0	1	x	1
11	1	1	x	x
10	1	1	x	x

$$S_a = D_3 + D_2 D_0 + \bar{D}_2 \bar{D}_0 + D_1$$

S_b $D_{3:2}$ $D_{1:0}$

$D_{3:2}$	00	01	11	10
00	1	1	x	1
01	1	0	x	1
11	1	1	x	x
10	1	0	x	x

$$S_b = \bar{D}_2 + D_1 D_0 + \bar{D}_1 \bar{D}_0$$

S_c $D_{3:2}$ $D_{1:0}$

$D_{3:2}$	00	01	11	10
00	1	1	x	1
01	1	1	x	1
11	1	1	x	x
10	0	1	x	x

$$S_c = D_0 + D_2 + \bar{D}_1$$

S_d $D_{3:2}$ $D_{1:0}$

$D_{3:2}$	00	01	11	10
00	1	0	x	1
01	0	1	x	1
11	1	0	x	x
10	1	1	x	x

$$S_d = D_3 + \bar{D}_2 \bar{D}_0 + D_2 \bar{D}_1 + D_1 \bar{D}_0 + \bar{D}_2 D_1$$

S_e $D_{3:2}$ $D_{1:0}$

$D_{3:2}$	00	01	11	10
00	1	0	x	1
01	0	0	x	0
11	0	0	x	x
10	1	1	x	x

$$S_e = D_1 \bar{D}_0 + \bar{D}_2 \bar{D}_0$$

S_f $D_{3:2}$ $D_{1:0}$

$D_{3:2}$	00	01	11	10
00	1	1	x	1
01	0	1	x	1
11	0	0	x	x
10	0	1	x	x

$$S_f = D_2 \bar{D}_0 + \bar{D}_1 \bar{D}_0 + D_2 \bar{D}_1 + D_3$$

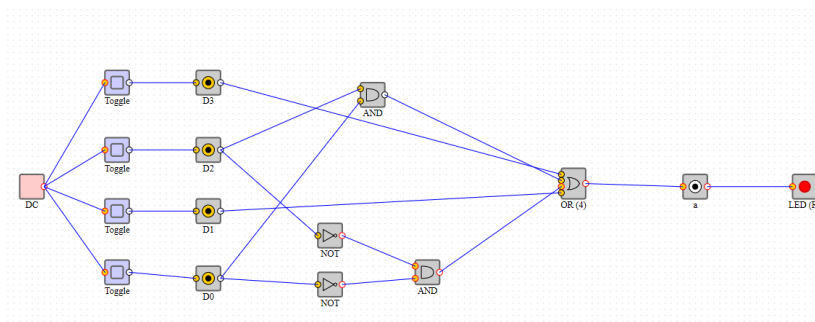
S_g $D_{3:2}$ $D_{1:0}$

$D_{3:2}$	00	01	11	10
00	0	1	x	1
01	0	1	x	1
11	1	0	x	x
10	1	1	x	x

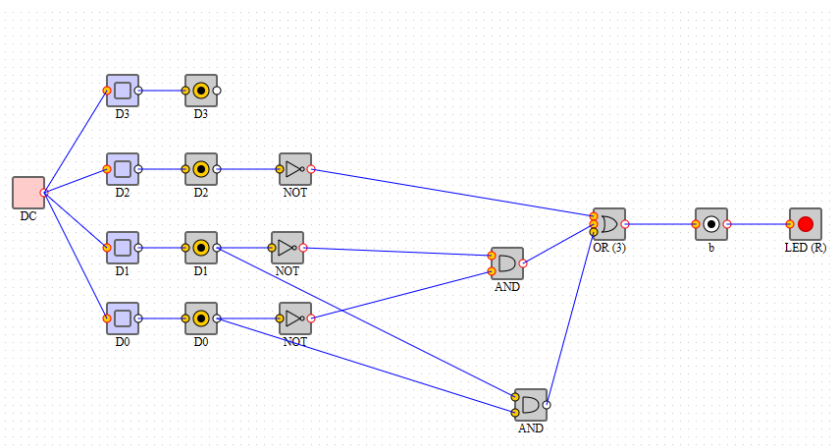
$$S_g = D_1 \bar{D}_0 + D_3 + D_2 \bar{D}_1 + \bar{D}_2 D_1$$

Steps 2-3

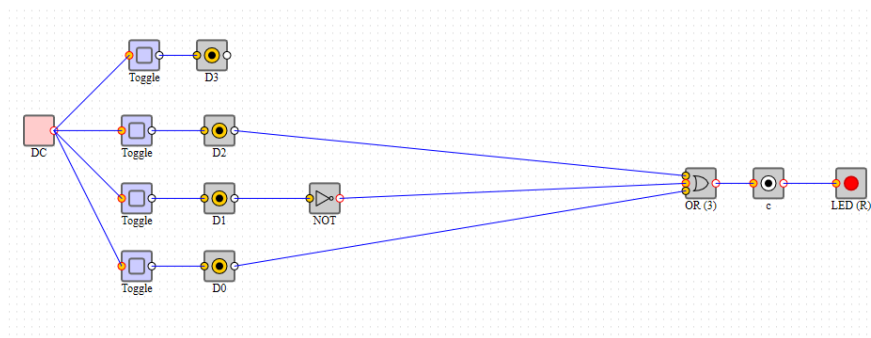
Segment a (as seen in lectures)



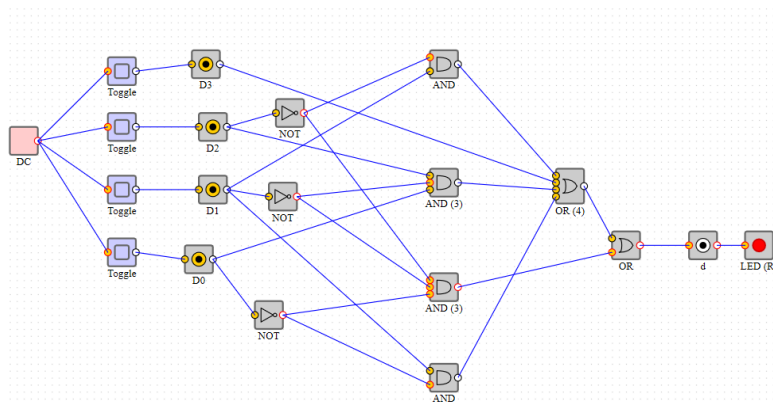
Segment b



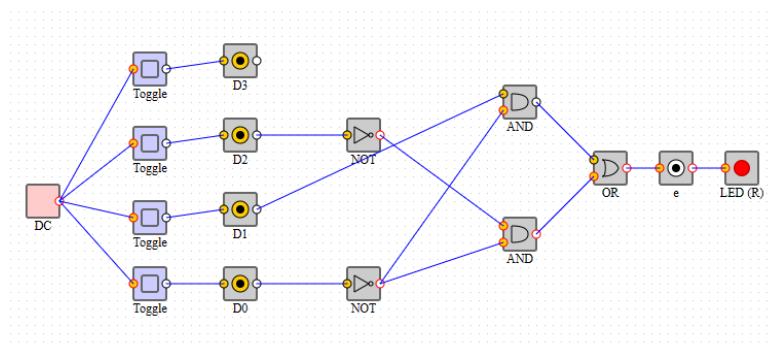
Segment c



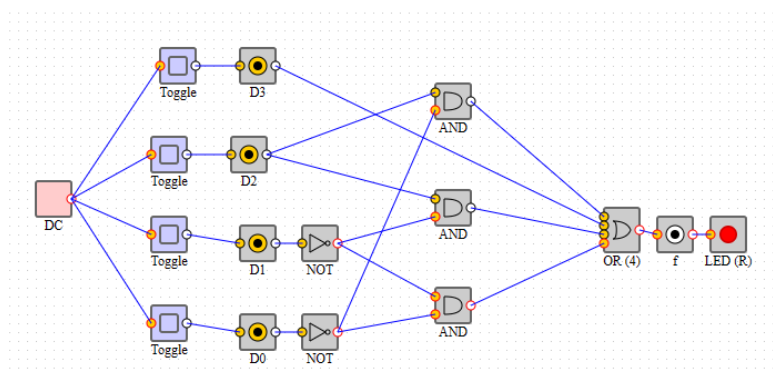
Segment d



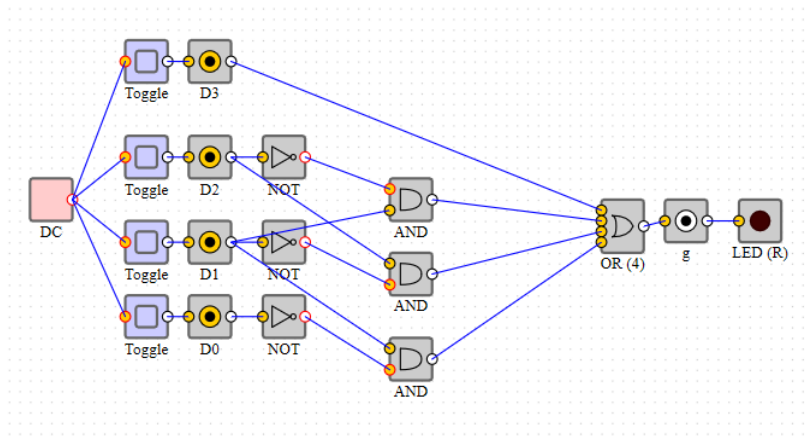
Segment e



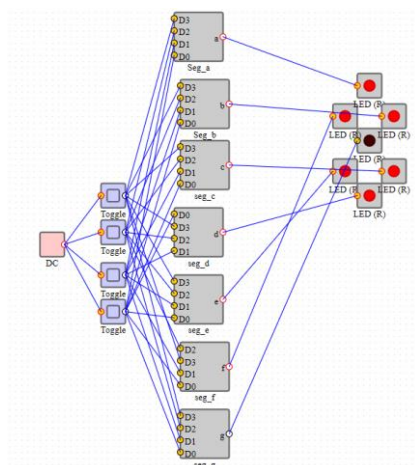
Segment f



Segment g



Full display using 7 LEDs



Full display using 7 segment chip

