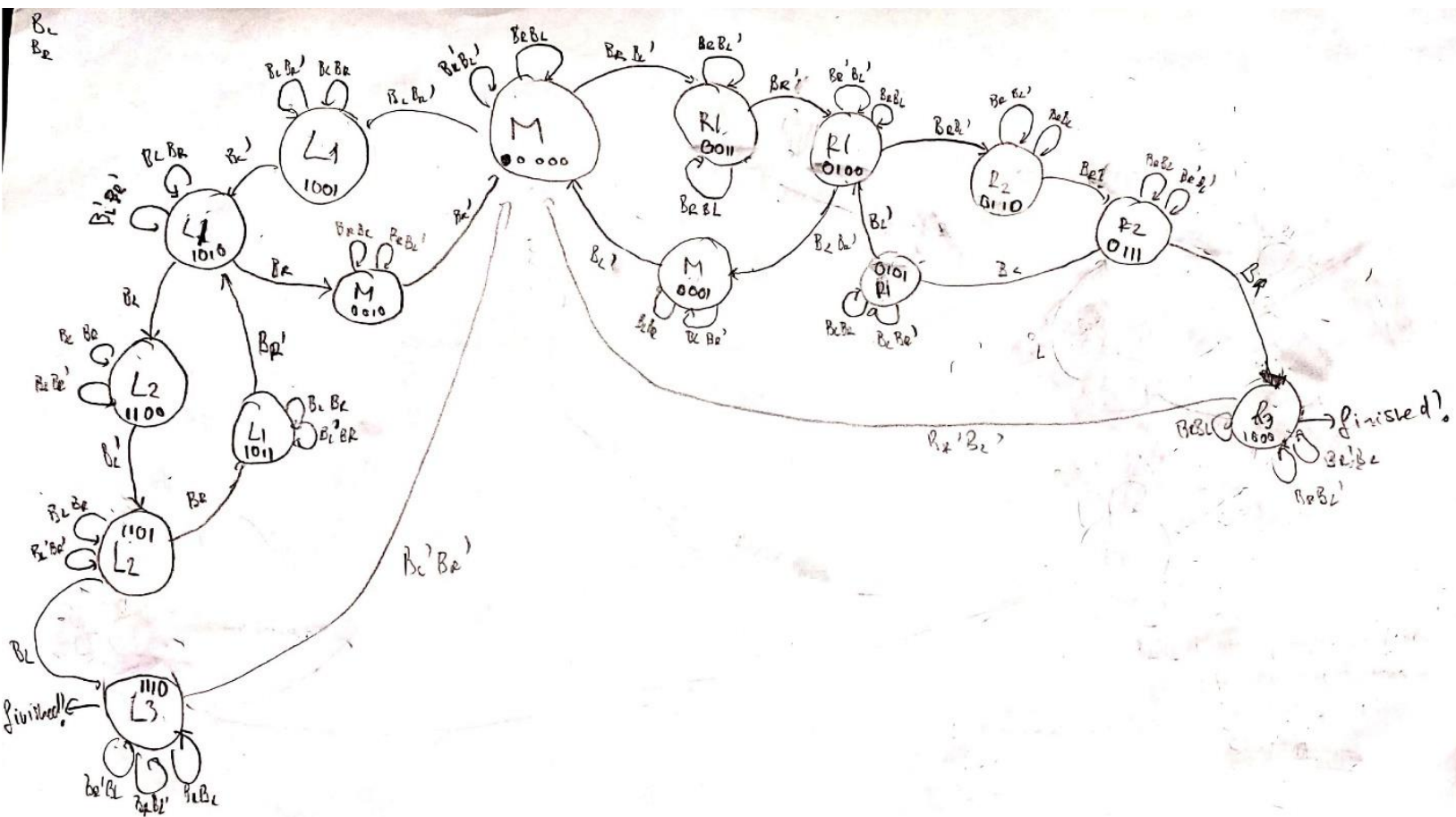


How it works?

When both buttons are pressed or no buttons are pressed the state of the machine will stay the same. When one player holds the button and doesn't release, it will only move for one step. When the rightmost or the leftmost LED is reached it will stay there until both buttons are released after which the middle LED will light up resetting the game.

State diagram



Truth table

[illegible]

Boolean expressions for this truth table

$$\underline{Q_0} = S_0'S_1'S_2'S_3'B_LB_R' + S_0'S_1'S_2'S_3'B_L'B_R + S_0'S_1'S_2'S_3'(B_LB_R + B_L'B_R + B_LB_R') + S_0'S_1'S_2'S_3'(B_LB_R + B_L'B_R + B_LB_R') + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3'$$

$$= S_0'S_1'S_2'S_3'B_LB_R' + S_0'S_1'S_2'S_3'B_L'B_R + S_0'S_1'S_2'S_3'B_LB_R + S_0'S_1'S_2'S_3'B_L'B_R + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3'$$

$$\underline{Q_1} = S_0'S_1'S_2'S_3'(B_LB_R' + B_L'B_R) + S_0'S_1'S_2'S_3'(B_LB_R' + B_L'B_R + B_L'B_R) + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3'(B_LB_R' + B_L'B_R + B_L'B_R) + S_0'S_1'S_2'S_3'(B_LB_R' + B_L'B_R + B_L'B_R)$$

$$= S_0'S_1'S_2'S_3'B_LB_R' + S_0'S_1'S_2'S_3'B_L'B_R + S_0'S_1'S_2'S_3'B_LB_R + S_0'S_1'S_2'S_3'B_L'B_R + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3'$$

$$\underline{Q_2} = S_0'S_1'S_2'S_3'(B_LB_R' + B_L'B_R) + S_0'S_1'S_2'S_3'(B_LB_R' + B_L'B_R + B_L'B_R) + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3'(B_LB_R' + B_L'B_R + B_L'B_R) + S_0'S_1'S_2'S_3'(B_LB_R' + B_L'B_R + B_L'B_R)$$

$$= S_0'S_1'S_2'S_3'B_LB_R' + S_0'S_1'S_2'S_3'B_L'B_R + S_0'S_1'S_2'S_3'B_LB_R + S_0'S_1'S_2'S_3'B_L'B_R + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3'$$

$$\underline{Q_3} = S_0'S_1'S_2'S_3'(B_LB_R' + B_L'B_R) + S_0'S_1'S_2'S_3'(B_LB_R' + B_L'B_R + B_L'B_R) + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3'(B_LB_R' + B_L'B_R + B_L'B_R) + S_0'S_1'S_2'S_3'(B_LB_R' + B_L'B_R + B_L'B_R)$$

$$= S_0'S_1'S_2'S_3'B_LB_R' + S_0'S_1'S_2'S_3'B_L'B_R + S_0'S_1'S_2'S_3'B_LB_R + S_0'S_1'S_2'S_3'B_L'B_R + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3'$$

$$\underline{L_1} = S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3'$$

$$= S_0'S_1'S_3' + S_0'S_2'S_3' + S_0'S_1'S_2'$$

$$\underline{L_2} = S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3'$$

$$= S_0'S_1'S_2' + S_1'S_2'S_3' + S_0'S_1'S_2'S_3'$$

$$\underline{L_3} = S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3' + S_0'S_1'S_2'S_3'$$

$$= S_0'S_1'S_2'S_3' + S_1'S_2' + S_0'S_2'S_3'$$

Truth table for LEDs

I will use L_1, L_2 and L_3 outputs to light up 7 LEDs

L_1	L_2	L_3	L_1	L_2	L_3	L_4	L_5	L_6	L_7
0	0	0	0	0	0	1	0	0	0
0	0	1	0	0	0	0	1	0	0
0	1	0	0	0	0	0	0	1	0
0	1	1	0	0	0	0	0	0	1
1	0	0	0	0	1	0	0	0	0
1	0	1	0	1	0	0	0	0	0
1	1	0	1	0	0	0	0	0	0

1 1 1 not used

$$\begin{aligned} \Rightarrow L_1 &= L_1 L_2 L_3' \\ L_2 &= L_1 L_3 L_2' \\ L_3 &= L_1 L_2' L_3' \\ L_4 &= L_1 L_2 L_3' \\ L_5 &= L_1' L_2' L_3 \\ L_6 &= L_1' L_2 L_3' \\ L_7 &= L_1' L_2 L_3 \end{aligned}$$