Electronic Quiz Buzzer Circuit using FSM

MINI PROJECT

Abstract-

Quiz competitions are held in various special programs, the process of identifying the candidate who pressed the button is very critical in timing and might differ in milliseconds.

This process is made simpler using this electronic quiz buzzer circuit. The indicator corresponding to the candidate(assume their are three candidates) should be active (led and buzzer on) who has pressed the switch first. After the indication from first switch being pressed(even if pressed momentarily), pressing of another switch does not give any indication.The system is reset for next round when instructor presses the reset/clear button.

The circuit is made using AND gate, OR gate ICs, and a couple of SR type Flipflop , sense the circuit is cost effective.

Fastest Finger First

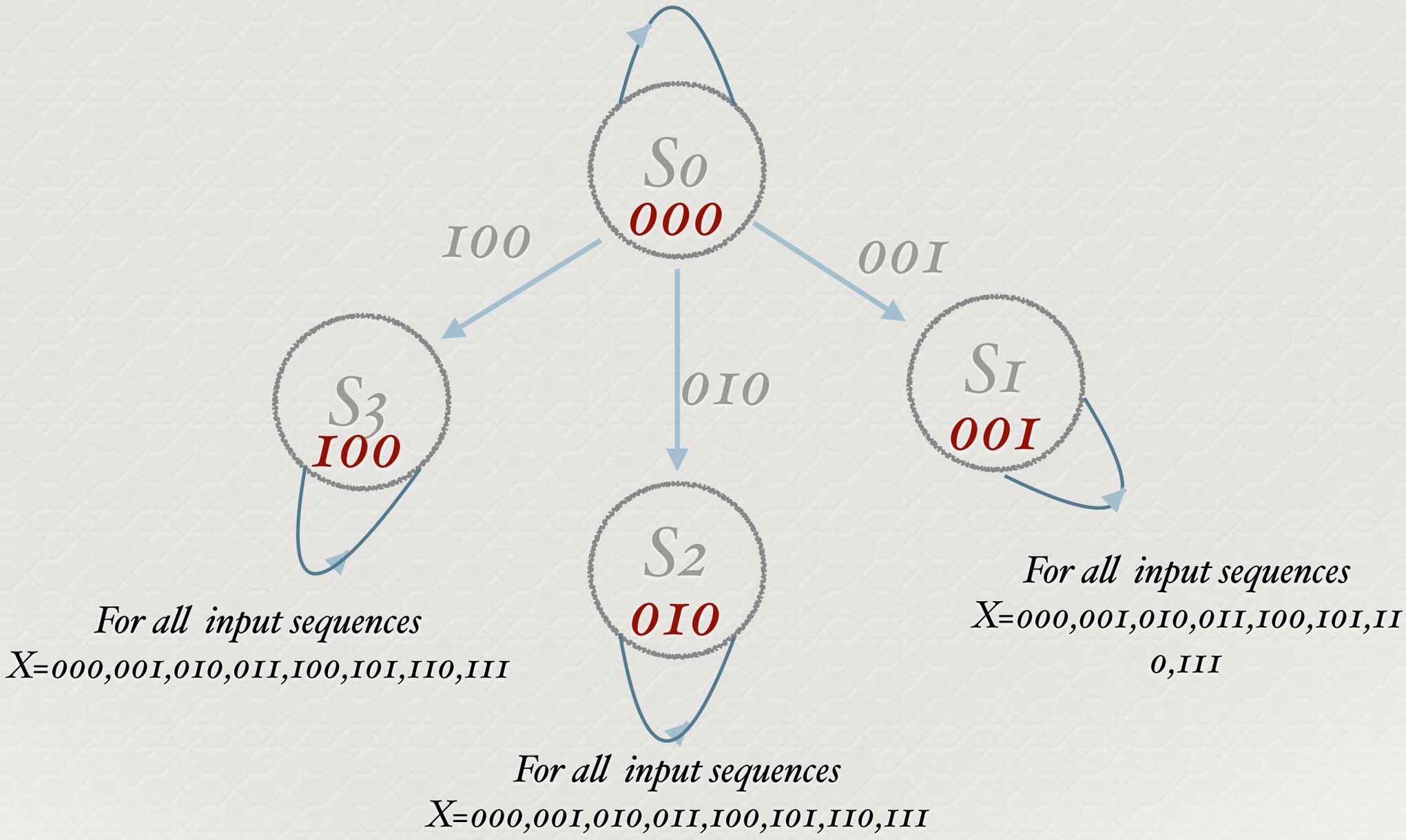
Electronic Quiz Buzzer Circuit

Methodology-

1.The switches for candidates A,B,C are x2, x1, x0 (input) respectively
2. Output is Z2,Z1,Z0
3. If candidate A presses switch first input sequence is 001 , state reached is 01 switching on first led only, producing output as z2=0,z1=0,z0=1. If after this another switch is pressed(high) the output remains unaffected until clear is applied.
4. If candidate B presses switch first input sequence is 010, state reached is 10 switching on first led only. If after this another switch is pressed(high) the output remains unaffected until clear is applied.
5. If candidate C presses switch first input sequence is 100, state reached is 11 switching on first led only. If after this another switch is pressed(high) the output remains unaffected until clear is applied.

State Diagram

For all other input sequences
X=000,011,101,110,111



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State Table:

Present state	Next state $X_0X_1X_2$ 000	001	010	011	100	101	110	111	Output Z_2,Z_1,Z_0
S0	S0	S1	S2	S0	S3	S0	S0	S0	000
S1	S1	S1	S1	S1	S1	S1	S1	S1	001
S2	S2	S2	S2	S2	S2	S2	S2	S2	010
S3	S3	S3	S3	S3	S3	S3	S3	S3	100

1.Circuit is implemented using D flip flops

2 The number of flipflop = shortest integer function (log2(no. of states))

=SIF(log2(4))=2

3Using Shannons decomposition theorem D0,D1 are evaluated for each case of present state(PS) individually

Ie.Di=Q'1Q'0(F1(Di))+Q'1Q0(F2(Di))+Q1Q'0(F3(Di))+Q1Q0(F4(Di))

PS(Qn)=Q'1Q'0

Input	PS	NS	*D*=Qn=1	
x2x1x0	Qn	Qn+1	D1	D0
000	00	00	0	0
001	00	01	0	1
010	00	10	1	0
011	00	11	0	0
100	00	00	1	1
001	00	00	0	0
010	00	00	0	0
111	00	00	0	0

Kmap for PS(Qn)=Q'1Q'0

x2 \ x1x0	00	01	11	10
0	0	0	0	1
1	1	0	0	0

D_1

$D_1=x'_0(x_1x'_2+x'_1x_2)(Q'_0Q'_1)$

x2 \ x1x0	00	01	11	10
0	0	1	0	0
1	1	0	0	0

D_0

$D_0=x'_1(x'_0x_2+x_0x'_2)(Q'_0Q'_1)$

$PS(Qn)=Q'_1Q_0$

Input(all)	PS	NS		
x2x1x0	Qn	Qn+1	$D_1=0$	$D_0=1$

$D_1=0$

$D_0=(Q'_1Q_0)$

$PS(Qn)=Q_1Q'_0$

Input(all)	PS	NS		
x2x1x0	Qn	Qn+1	D1=1	D0=0

$D_0=0$ $D_1=(Q_1Q'_0)$

$PS(Qn)=Q_1Q_0$

Input(all)	PS	NS		
x2x1x0	Qn	Qn+1	D1=1	D0=1

$D_0=(Q_1Q_0)$ $D_0=(Q_1Q_0)$

Asynchronous clear input is used to clear states at any time by instructor,Combining all the cases and asynchronous clear final D1,D0

$D_1=[Q_1Q'_0+Q_1Q_0+Q'_1Q'_0X'_0(X_1 \text{ xor } X_2)]Clr$

$D_0=[Q'_1Q_0+Q_1Q_0+Q'_1Q'_0X'_1(X_0 \text{ xor } X_2)]Clr$

Output

$Z_0=Q'_1Q_0$

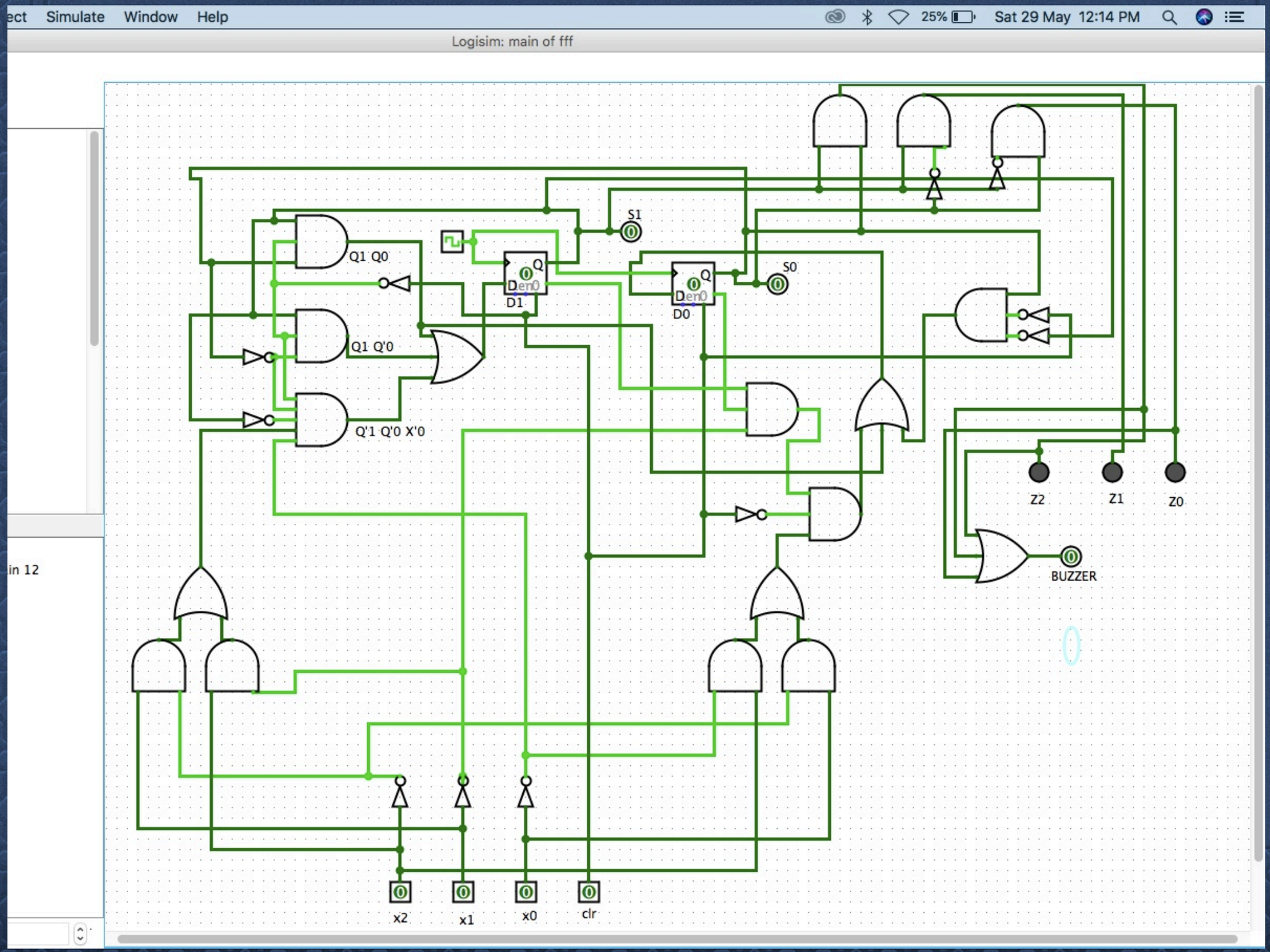
$Z_1=Q_1Q'_0$

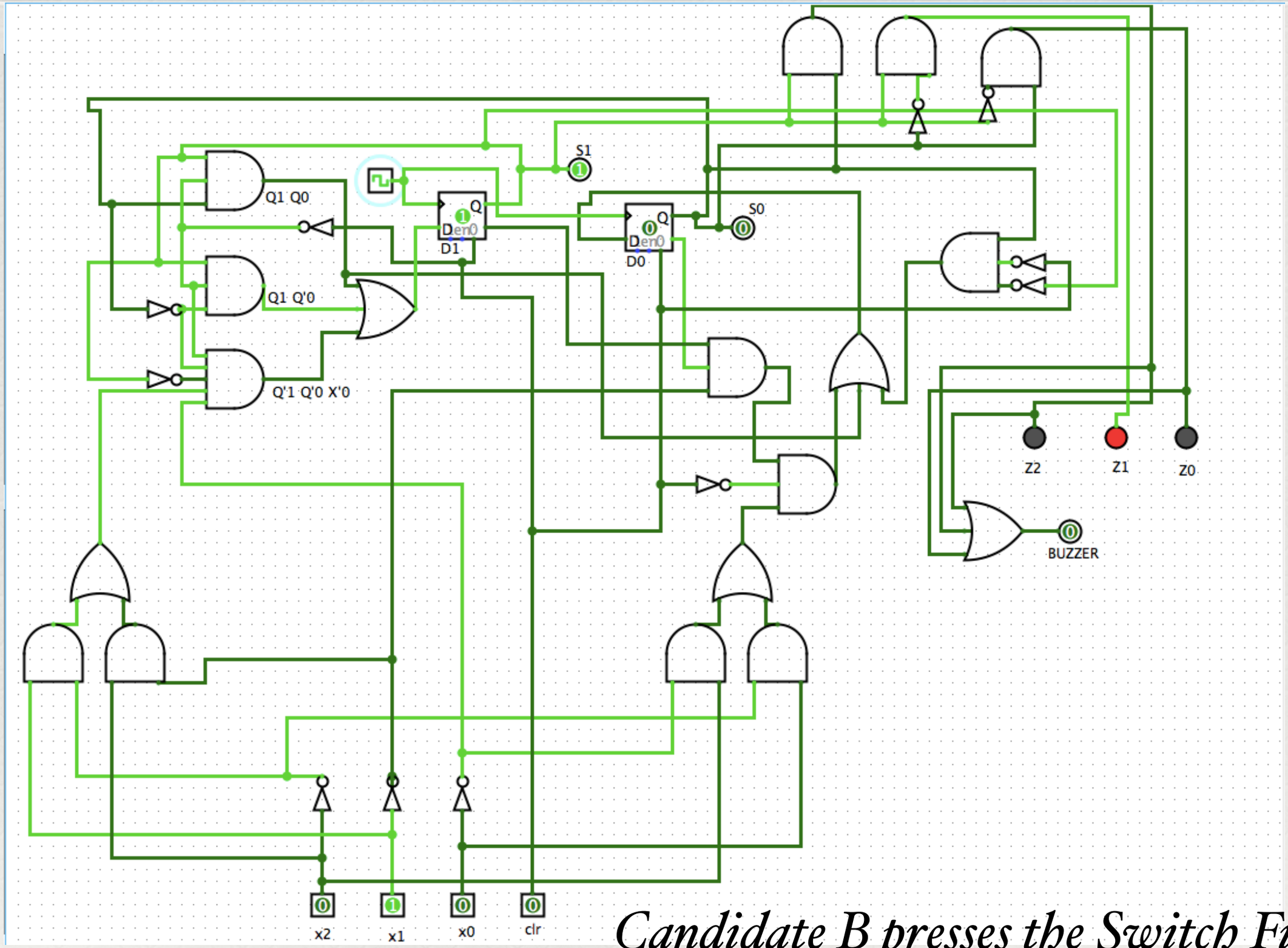
$Z_2=Q_1Q_0$

Buzzer - on when one of the op is on = $Z_0+Z_1+Z_2$

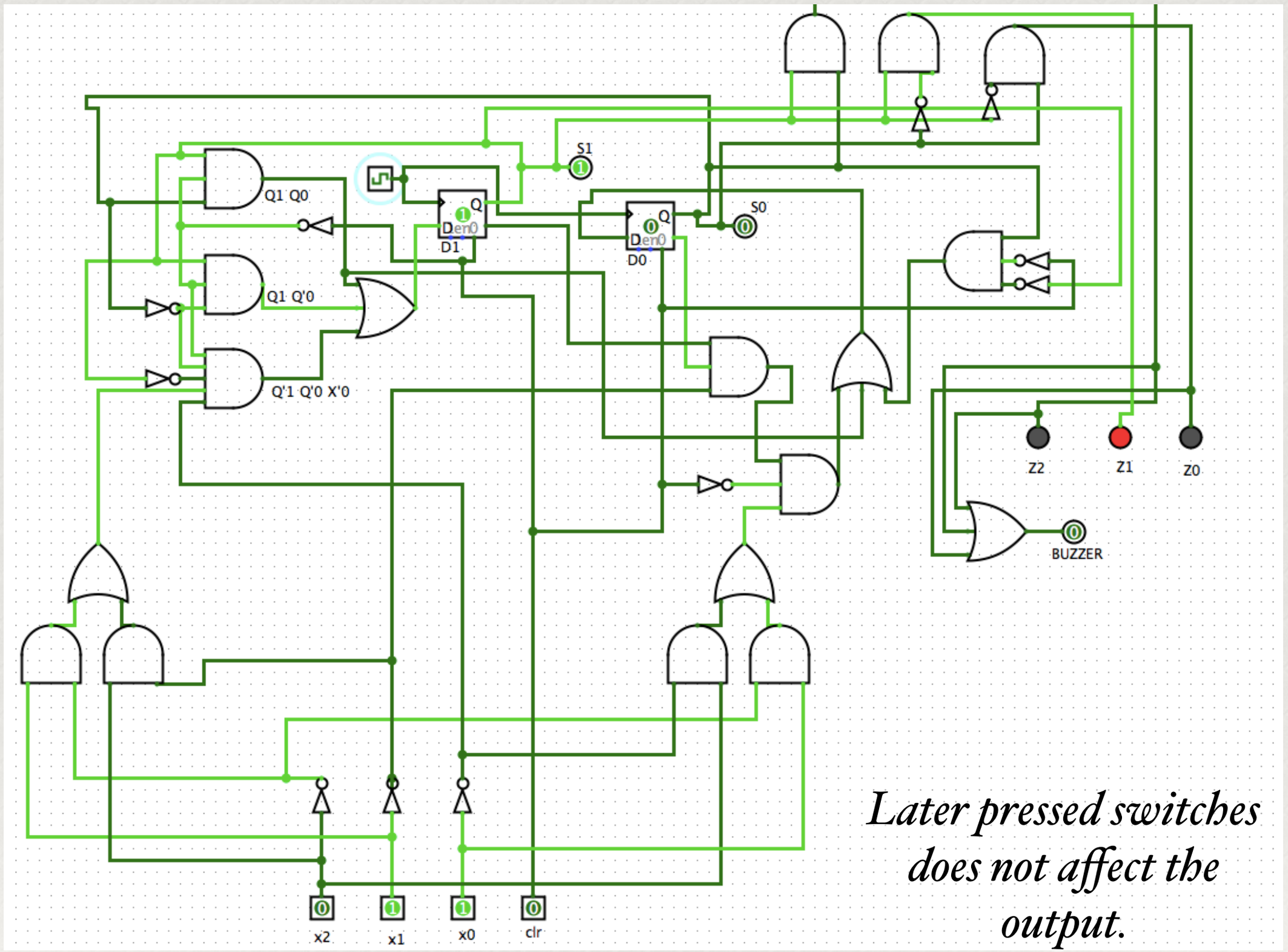
Electronic buzzer circuit using Logisim

Simulation snapshots

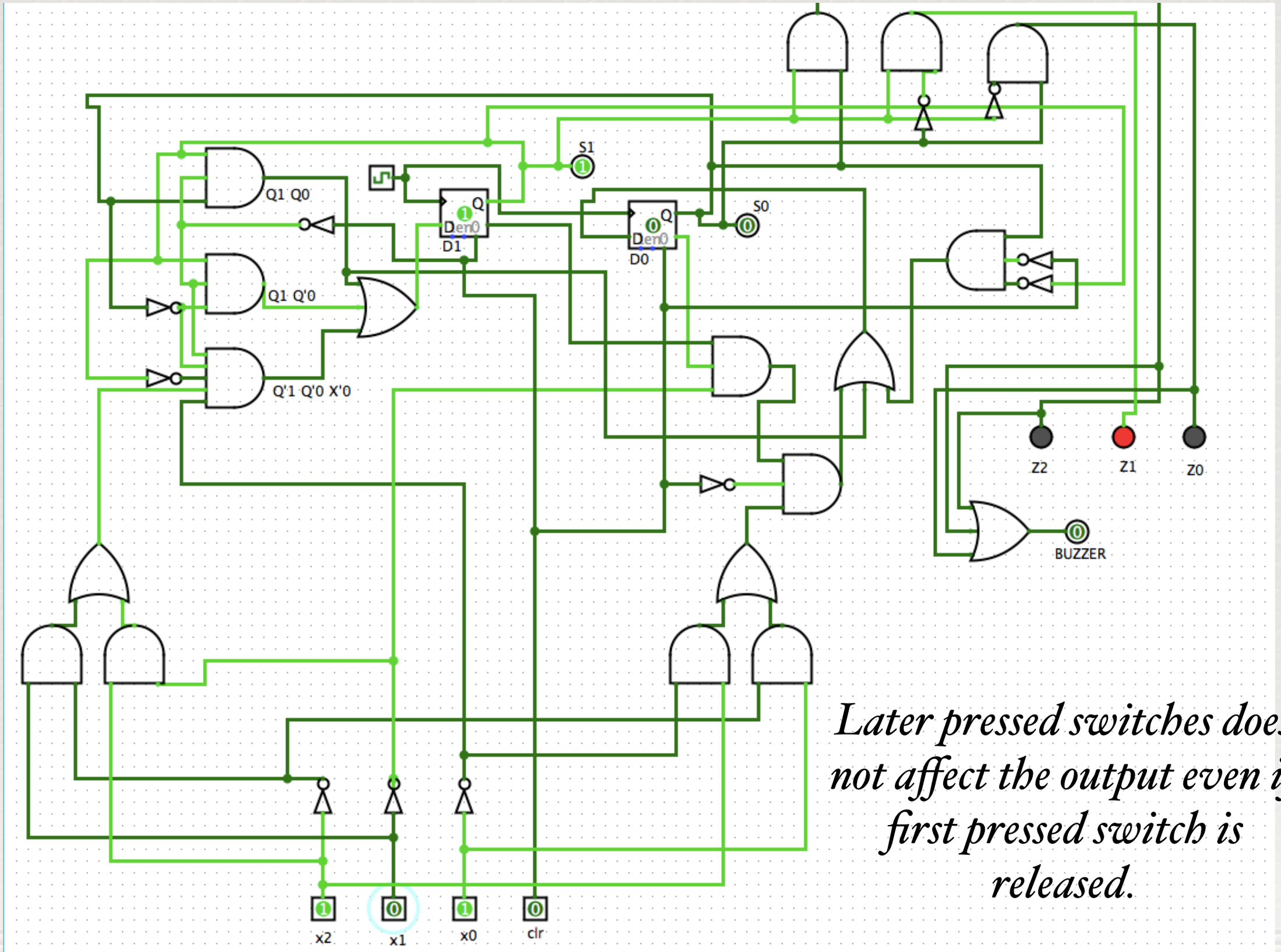




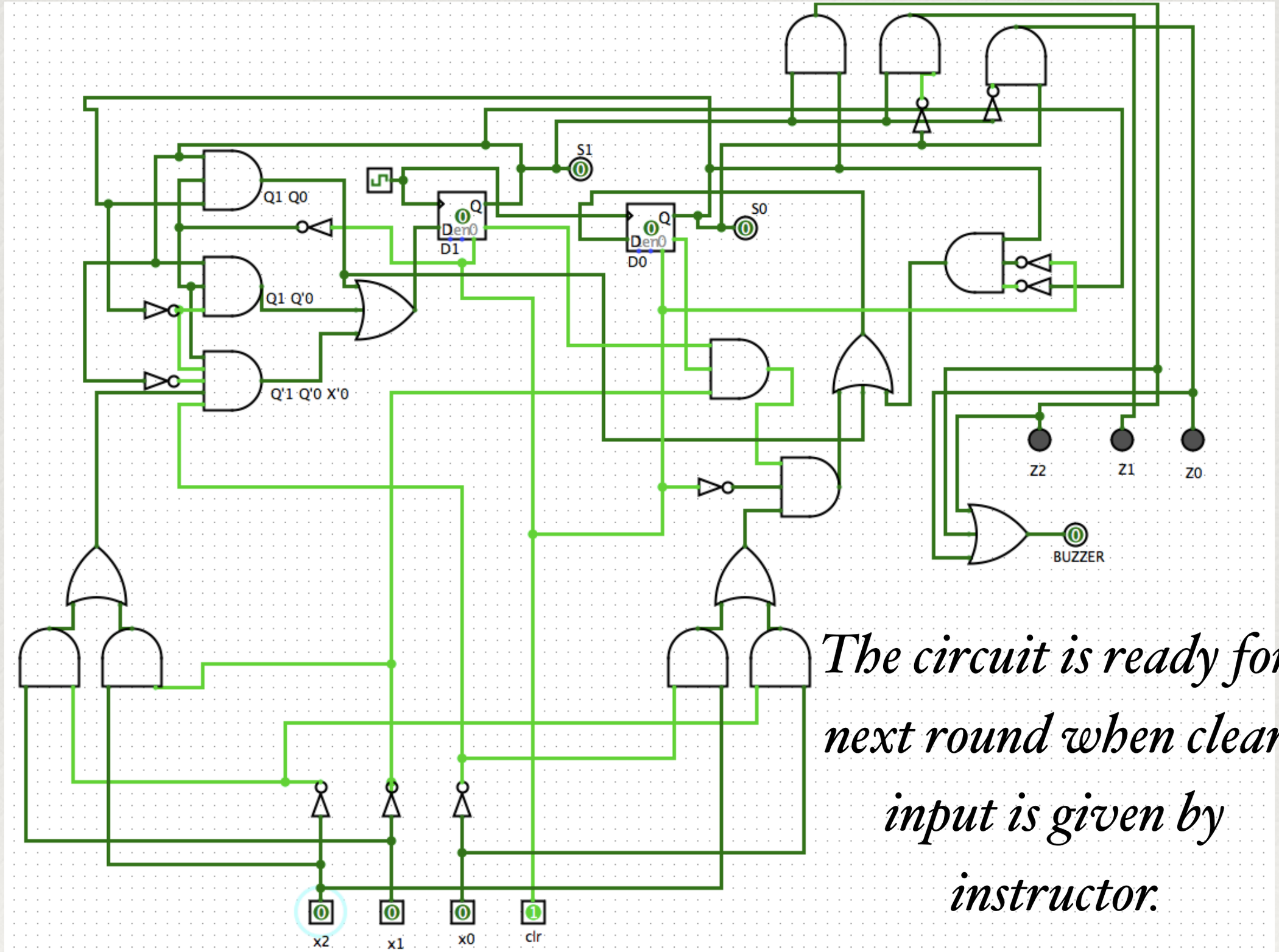
Candidate B presses the Switch First.



Later pressed switches does not affect the output.



Later pressed switches does not affect the output even if first pressed switch is released.



The circuit is ready for next round when clear input is given by instructor.