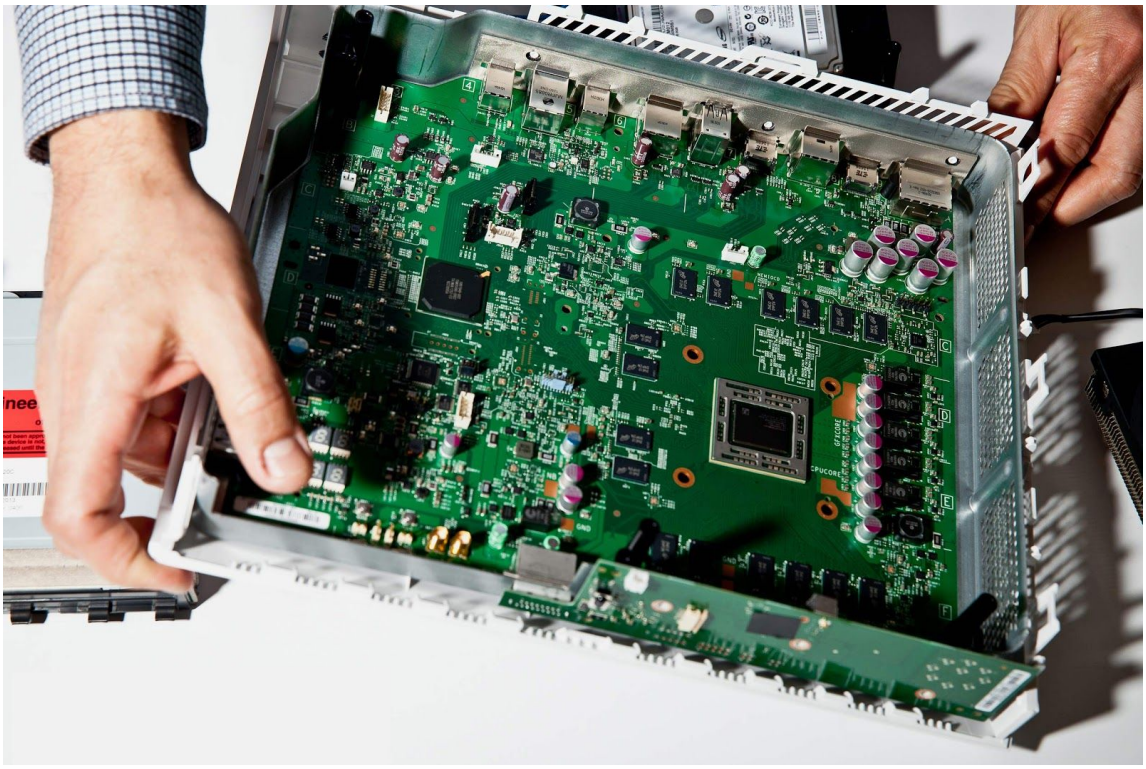

XBOX CONSOLE

Project 1

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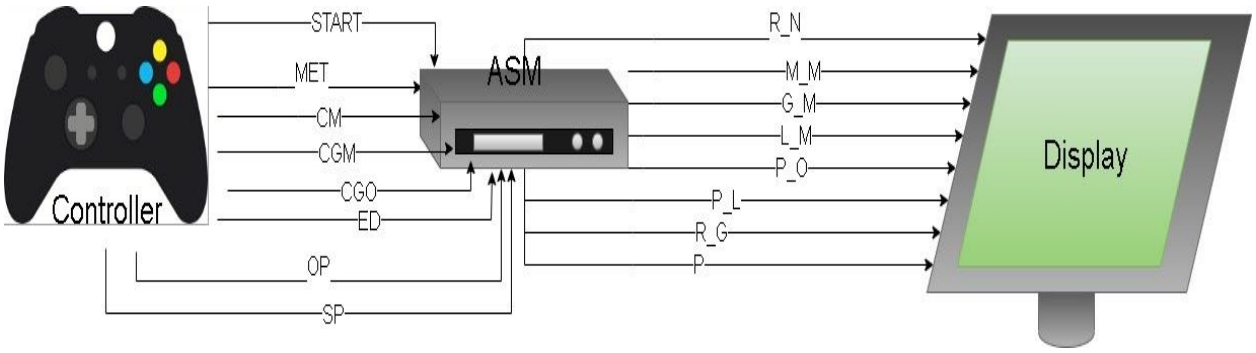
content

THEME OF THE PROJECT

The theme of the project is to make an XBOX console. The device has two main modes of operation: a mode for music and one for games. For music the user can choose any song he wants to listen to. For gaming the user can choose the way he wants to play. It can be played online with friends or locally via game DVDs. The user also has access to options such as switching the console to pause mode or turning off the power.

BLOCK SCHEME



NOMENCLATURE OF INPUT / OUTPUT VARIABLES

Entries:

Notation	Explanation Notation
START	A successful button must be pressed to turn on the device. 0 = no, 1 = yes
meth METHOD	Every user must choose a way, an activity that he wants to accomplish. For 0 you access music_mode and for 1 you access game_mode.
CM CHOOSE_MUSIC	The user must choose a song. For 1 the music starts, and for 0 it remains in the current state.

CGM CHOSE_GAME_MODE	After choosing to play, the user must choose the way he wants to play. For 0 he chooses to play online with friends, and for 1 he chooses the local mode.
CGO CHOOSE_GAME_ONLINE	To start the online game the user must choose a type of game. 1 = game start, and for 0 it remains in the current state.
ED ENTER_DVD	Local games can only be accessed via DVDs. 1 = insert dvd with game, 0 = stay in the current state.
OP OPTION_POWER	Device operation options. 0 = pause_mode and 1 = switch off the device
SP STOP_PAUSE	For 1 the device exits the pause mode, and for 0 it remains in the current state.

Exits:

Notation	Explanation Notation
R_N RUNNIG	The console has started. Wait! You are about to choose an activity.
M_M MUSIC_MODE	You have chosen to listen to music. Now you can choose a song ...
G_M GAME_MODE	You have chosen to play! Now you can choose a game mode ...
L_M LISTEN_MUSIC	The song you chose to listen to has started.
P_O PLAY_ONLINE	You have selected the option to play online, now you have to choose a type of game.
P_L PLAY_LOCAL	You have chosen the option to play locally, so you need to insert a DVD with the desired game.
R_G RUNNIG_GAME	The game you chose to play has started.
P PAUSE	You have selected the console pause mode. You can deactivate it at any time!

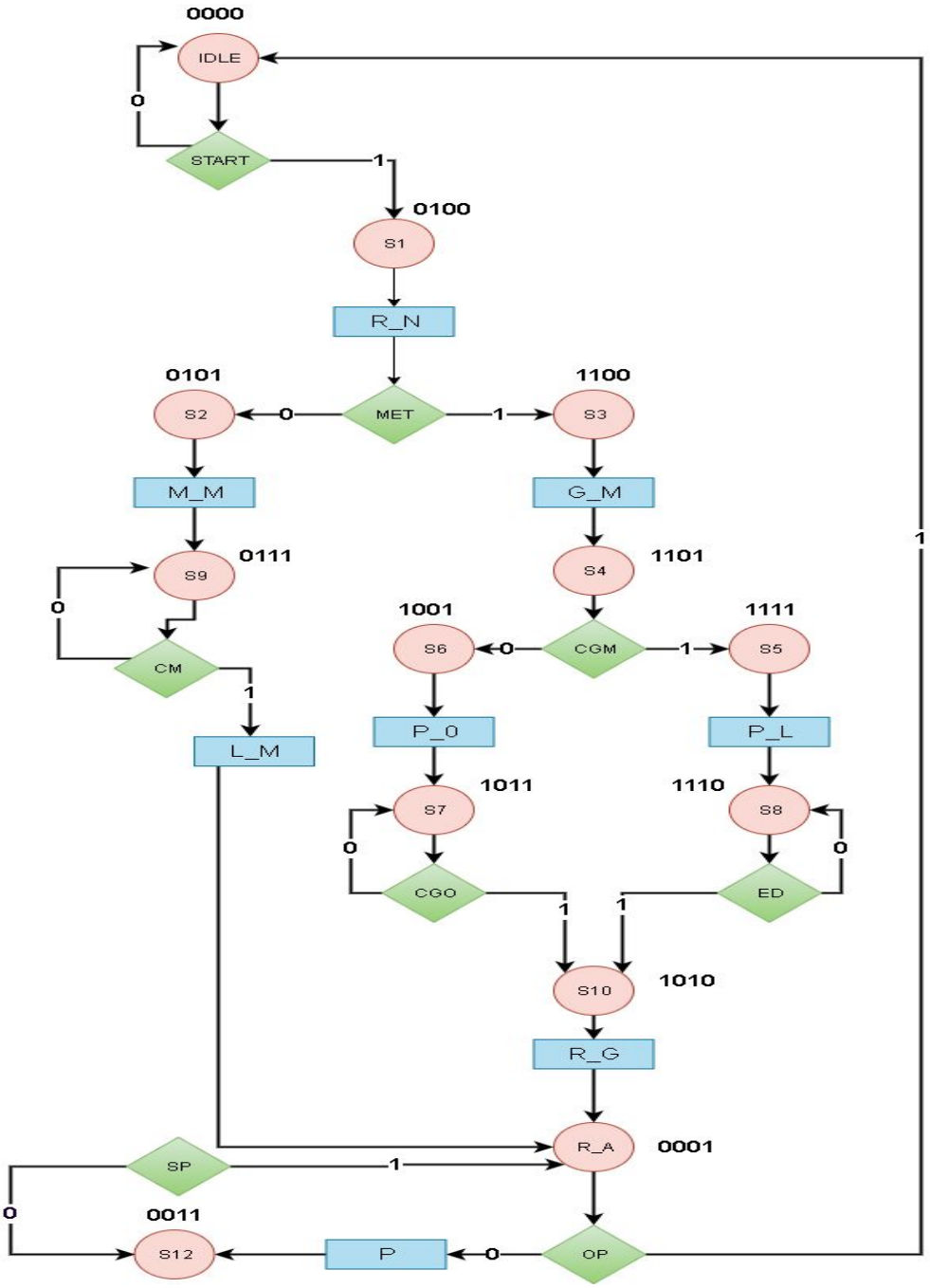
EXPLANATION OF THE FUNCTIONALITY OF THE DEVICE

The XBOX console starts from the state **IDLE** in which it remains as long as the power button is not pressed (variable **START** remains 0) .When **START** becomes 1 the device starts, goes into condition **S1,** and then the user is expected to choose a boot mode. If music mode is selected (**MET = 0)** it goes in the state **S2** where the user is expected to choose a song. Then if he successfully chooses a song, it starts and the console reaches the state **R_A (RUNNING_ACTIVITY).** Also if the user chooses to play at startup, (**MET = 1),** the console reaches an intermediate state **S4** in which the user must choose whether to play online or locally. If he chooses to play online (**CGM = 0),** the device reaches the state **S6** intended for online play, then in the state **S9** where the user will have to decide on a game to start. If he chooses to play locally (**CGM = 1),** the console reaches the state **S5,** of

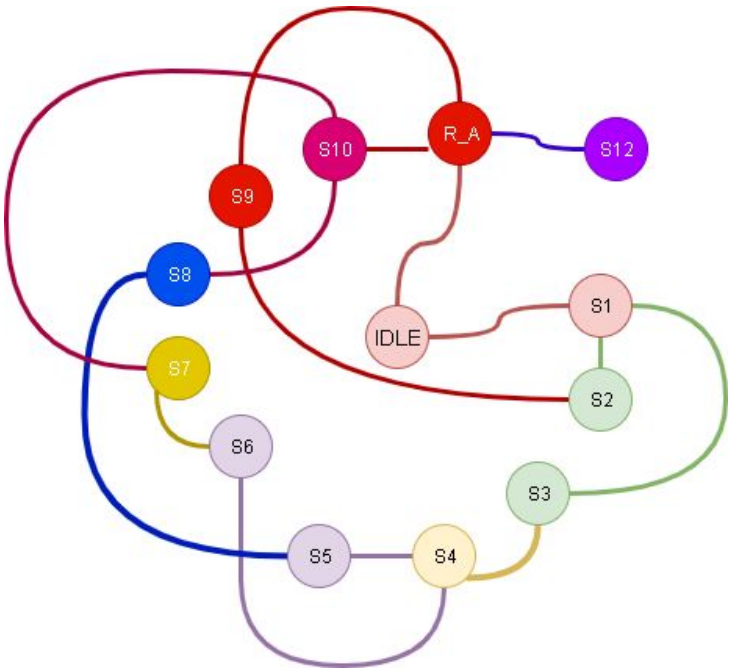
then **S8** and will

wait for a DVD with a game to be inserted. After one of these options has been chosen, the game starts and the console reaches the same state. **R_A.** While the user is listening to music or playing (the console is in **R_A)** it has access to several options. If it wants to rest, the user can choose the pause mode, and the default console enters the pause_mode (**OP = 0),** in which it remains as long as the user does not return and deactivates the option (**SP = 1).** If he wants to turn off the console the user can turn off the power (**OP = 1)** and the console returns to its original state **IDLE.**

ORGANIZATIONAL CHART



GRAPH OF STATES



STATE DIAGRAM

Q3Q2 / Q1Q0	00	01	11	10
00	IDLE	S1	S3	*
01	R_A	S2	S4	S6
11	S12	S9	S5	S7
10	*	*	S8	S10

TABLE OF TRANSITIONS

$Q3$	$Q2$	$Q1$	$Q0$	$Q3_{t+1}$	$Q2_{t+1}$	$Q1_{t+1}$	$Q0_{t+1}$	R_N	M_M	G_M	L_M	P_O	P_L	R_G	P
0	0	0	0	0	standing T	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	! OP	! OP	0	0	0	0	0	0	0	! OP
0	0	1	0	*	*	*	*	*	*	*	*	*	*	*	*
0	0	1	1	0	0	! SP	1	0	0	0	0	0	0	0	0
0	1	0	0	meth	1	0	! MET	1	0	0	0	0	0	0	0
0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0
0	1	1	0	*	*	*	*	*	*	*	*	*	*	*	*
0	1	1	1	0	! CM	! CM	1	0	0	0	CM	0	0	0	0
1	0	0	0	*	*	*	*	*	*	*	*	*	*	*	*
1	0	0	1	1	0	1	1	0	0	0	0	1	0	0	0
1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0
1	0	1	1	1	0	1	! CGO	0	0	0	0	0	0	0	0
1	1	0	0	1	1	0	1	0	0	1	0	0	0	0	0
1	1	0	1	1	CGM	CGM	1	0	0	0	0	0	0	0	0
1	1	1	0	1	! ED	1	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	0	0	0	0	0	0	1	0	0

KARNAUGH DIAGRAMS FOR STATE VARIABLES

Q3Q2 / Q1Q0	00	01	11	10
00	0	MET	1	*
01	0	0	1	1
11	0	0	1	1
10	*	*	1	0

$$Q_3^{t+1} = MET * Q_2 * !Q_0 + Q_3 * Q_0 + Q_3 * Q_2$$

Q3Q2 / Q1Q0	00	01	11	10
00	START	1	1	*
01	0	1	CGM	0
11	0	!CM	1	0
10	*	*	!ED	0

$$Q_2^{t+1} = Q_2 * !Q_1 * !Q_0 + Q_2 * !Q_1 * !Q_3 + Q_3 * Q_2 * Q_1 * Q_0 + START\ !Q_1 * !Q_0 + !ED * !Q_0 * Q_2 + !CM * Q_2 * !Q_3 + CGM * !Q_1 * Q_2$$

Q3Q2 / Q1Q0	00	01	11	10
00	0	0	0	*
01	!OP	1	CGM	1
11	!SP	!CM	1	1
10	*	*	1	0

$$Q_1^{t+1} = Q_0 * Q_3 * !Q_2 + Q_3 * Q_1 * Q_2 + Q_2 * !Q_3 * !Q_1 * Q_0 + !OP * !Q_3 * !Q_1 * Q_0 + !SP * !Q_3 * !Q_2 * Q_1 + !CM * Q_2 * Q_1 + CGM * Q_0 * Q_3$$

Q3Q2 / Q1Q0	00	01	11	10
00	0	!MET	1	*
01	!OP	1	1	1
11	1	1	0	!CGO
10	*	*	0	1

$$Q_0^{t+1} = Q_1 * !Q_3 * + Q_3 * !Q_1 + Q_1 * !Q_0 * !Q_2 + !Q_1 * Q_0 * Q_2 + !OP * Q_0 * !Q_3 + !CGO * Q_3 * !Q_2 + !MET * !Q_1 * Q_2$$

KARNAUGH DIAGRAMS FOR EXITS

Q3Q2 / Q1Q0	00	01	11	10
00	0	1	0	*
01	0	0	0	0
11	0	0	0	0
10	*	*	0	0

R_N = $!Q_3 * Q_2 * !Q_0$

Q3Q2 / Q1Q0	00	01	11	10
00	0	0	0	*
01	0	1	0	0
11	0	0	0	0
10	*	*	0	0

M_M= $!Q_3 * Q_2 * !Q_1 * Q_0$

Q3Q2 / Q1Q0	00	01	11	10
00	0	0	1	*
01	0	0	0	0
11	0	0	0	0
10	*	*	0	0

G_M = $Q_3 * !Q_1 * !Q_0$

Q3Q2 / Q1Q0	00	01	11	10
00	0	0	*	0
01	0	0	1	0
11	0	0	0	0
10	*	*	0	0

P_O = $!Q_1 * Q_3 * Q_2$

Q3Q2 / Q1Q0	00	01	11	10
00	0	0	0	*
01	0	0	0	0
11	0	0	1	0
10	*	*	0	0

P_L = $Q_3 * Q_2 * Q_1 * Q_0$

Q3Q2 / Q1Q0	00	01	11	10
00	0	0	0	*
01	0	0	0	0
11	0	0	0	0
10	*	*	0	1

R_G = $!Q_3 * Q_1 * !Q_0$

Q3Q2 / Q1Q0	00	01	11	10
00	0	0	0	*
01	!OP	0	0	0
11	0	0	0	0
10	*	*	0	0

P = $!OP * !Q_3 * !Q_2 * !Q_1 * Q_0$

TABLE OF TRANSITIONS FOR JK, D TYPE CBB INPUTS

For implementation, 4 bits were used that encode 4 state variables: Q3, Q2, Q1, Q0. The 4 state variables will be implemented using CBBs as follows:

- Q0 using CBB type D and a 16: 1 MUX;
- Q1 using CBB type D and an 8: 1 MUX;
- Q2 using CBB type JK, having J implemented through a 2: 1 MUX and K through a 4: 1 MUX.
- Q3 using CBB type JK, having J implemented with NAND type gates and K with NOR type gates.

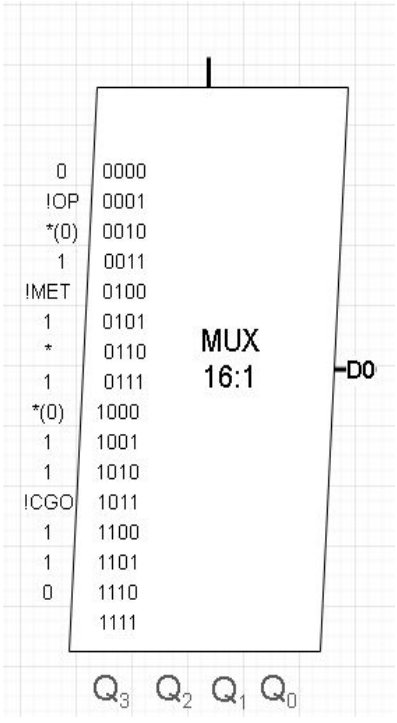
$Q3$	$Q2$	$Q1$	$Q0$	$Q3_{t+1}$	$Q2_{t+1}$	$Q1_{t+1}$	$Q0_{t+1}$	D0	D1	J2	K2	J3	K3
0	0	0	0	0	START	0	0	0	0	START	*	0	*
0	0	0	1	0	0	! OP	! OP	! OP	! OP	0	*	0	*
0	0	1	0	*	*	*	*	*	*	*	*	*	*
0	0	1	1	0	0	! SP	1	1	! SP	0	*	0	*
0	1	0	0	meth	1	0	! MET	! MET	0	*	0	meth	*
0	1	0	1	0	1	1	1	1	1	*	0	0	*
0	1	1	0	*	*	*	*	*	*	*	*	*	*
0	1	1	1	0	! CM	! CM	1	1	! CM	*	CM	0	*
1	0	0	0	*	*	*	*	*	*	*	*	*	*
1	0	0	1	1	0	1	1	1	1	0	*	*	0
1	0	1	0	0	0	0	1	1	0	0	*	*	1
1	0	1	1	1	0	1	! CGO	! CGO	1	0	*	*	0
1	1	0	0	1	1	0	1	1	0	*	0	*	0
1	1	0	1	1	CGM	CGM	1	1	CGM	*	! CGM	*	0
1	1	1	0	1	! ED	1	0	0	1	*	ED	*	0
1	1	1	1	1	1	1	0	0	1	*	0	*	0

Q3Q2 / Q1Q0	00	01	11	10
00	0	!MET	1	*
01	!OP	1	1	1
11	1	1	0	!CGO
10	*	*	0	1

$$Q_0^{t+1} = Q_1 * !Q_3 * + Q_3 * !Q_1 + Q_1 * !Q_0 * !Q_2 + !Q_1 * Q_0 * Q_2$$
$$+ !OP * Q_0 * !Q_3 + !CGO * Q_3 * !Q_2 + !MET * !Q_1 * Q_2$$

$$D_0 = Q_0^{t+1}$$

Q3Q2 / Q1Q0	00	01	11	10
00	0	!MET	1	*
01	!OP	1	1	1
11	1	1	0	!CGO
10	*	*	0	1

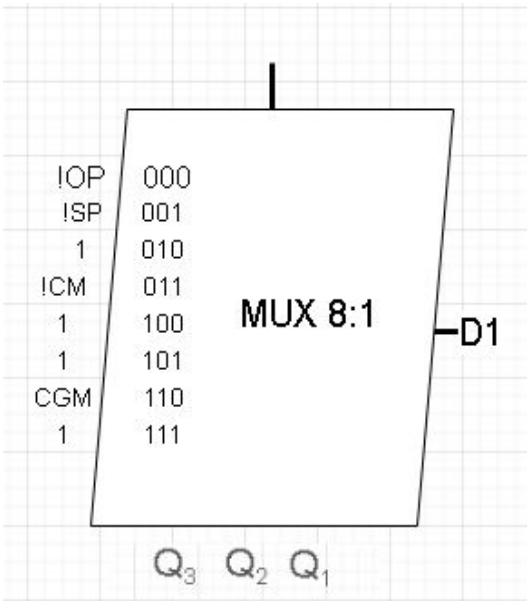


Q3Q2 / Q1Q0	00	01	11	10
00	0	0	0	*
01	!OP	1	CGM	1
11	!SP	!CM	1	1
10	*	*	1	0

$$Q_1^{t+1} = Q_0 * Q_3 * !Q_2 + Q_3 * Q_1 * Q_2 + Q_2 * !Q_3 * !Q_1 * Q_0 + !OP * !Q_3 * !Q_1 * Q_0 + !SP * !Q_3 * !Q_2 * Q_1 + !CM * Q_2 * Q_1 + CGM * Q_0 * Q_3$$

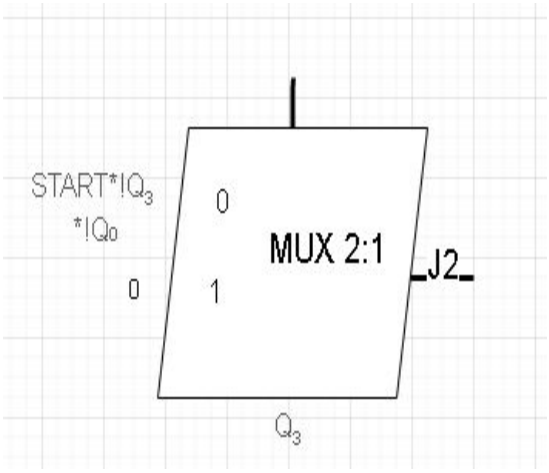
$$D_1 = Q_1^{t+1}$$

Q3Q2 / Q1Q0	00	01	11	10
00	0	0	0	*
01	!OP	1	CGM	1
11	!SP	!CM	1	1
10	*	*	1	0



Q3Q2 / Q1Q0	00	01	11	10
00	START	*	*	*
01	0	*	*	0
11	0	*	*	0
10	*	*	*	0

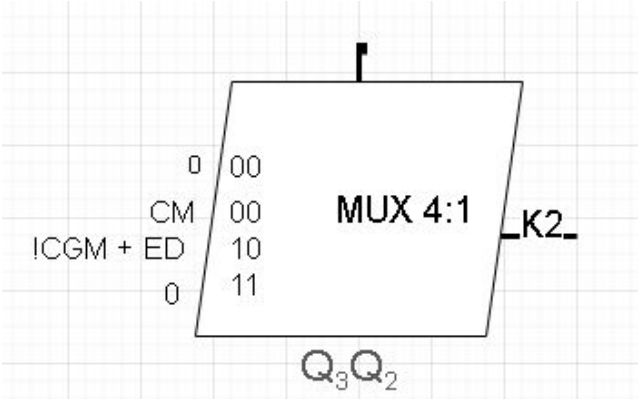
$J_2 = START * Q_0 * Q_0$



Q3Q2 / Q1Q0	00	01	11	10
00	*	0	0	*
01	*	0	!CGM	*
11	*	CM	0	*
10	*	*	ED	*

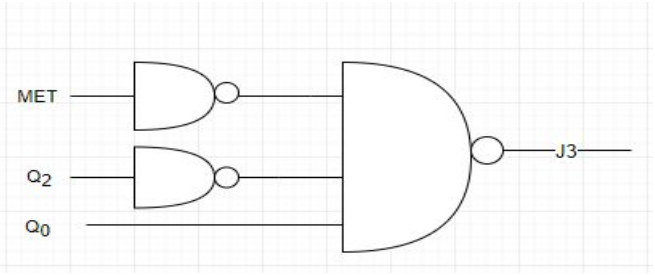
$K_2 = ED * Q_1 * !Q_0 + CM * Q_1 * Q_3 + !CGM * Q_3 * !Q_1 * Q_0$

Q3Q2 / Q1Q0	00	01	11	10
00	*	0	0	*
01	*	0	!CGM	*
11	*	CM	0	*
10	*	*	ED	*



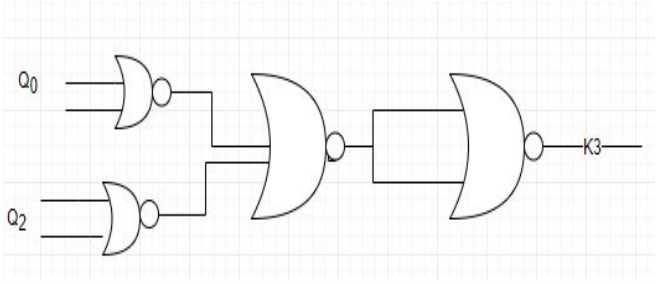
Q3Q2 / Q1Q0	00	01	11	10
00	0	MET	*	*
01	0	0	*	*
11	0	0	*	*
10	*	*	*	*

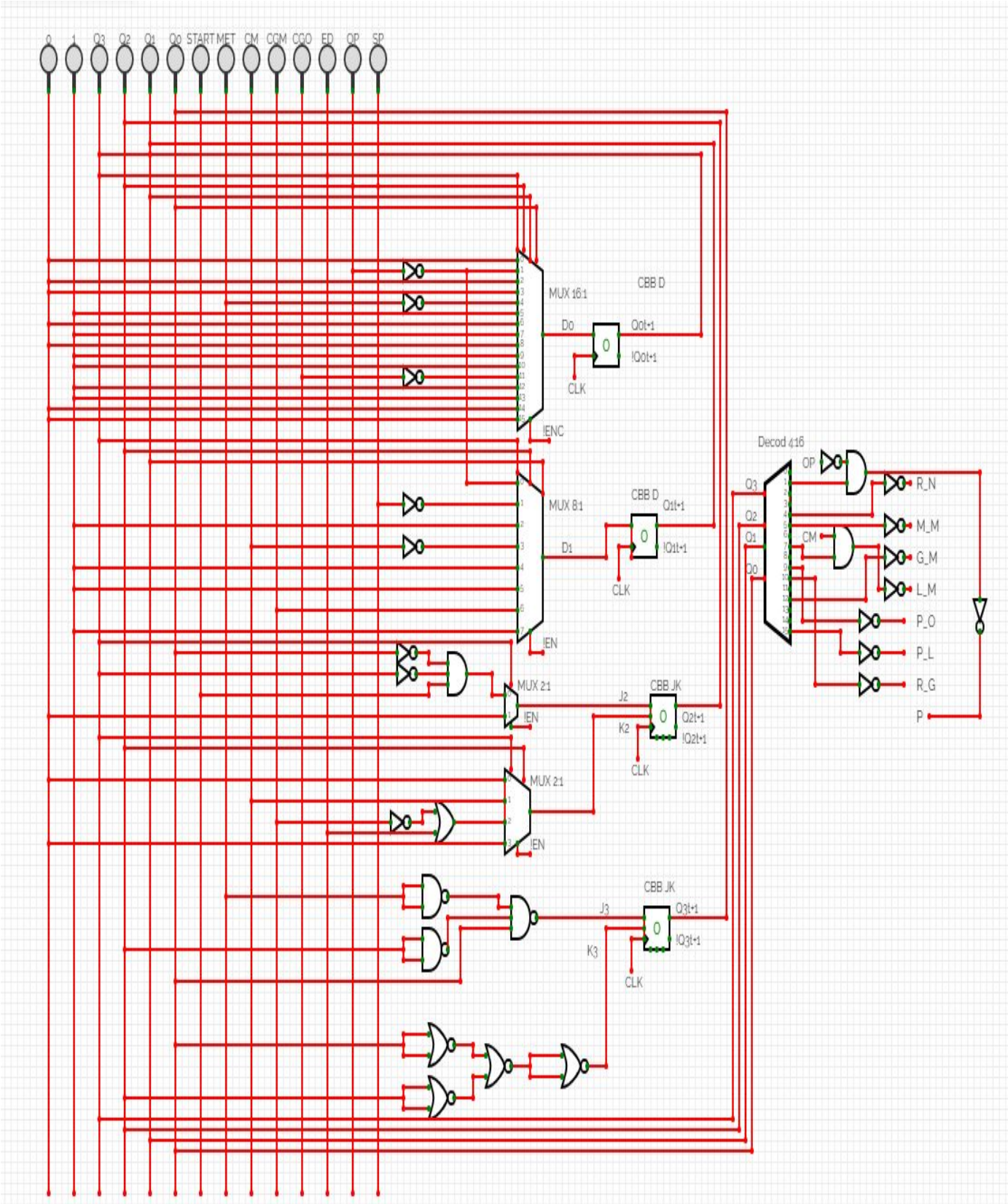
$J_3 = MET * !Q_0 * Q_2$



Q3Q2 / Q1Q0	00	01	11	10
00	*	*	0	*
01	*	*	0	0
11	*	*	0	0
10	*	*	0	1

$K_3 = !Q_0 * !Q_2$




0
1
Q3
Q2
Q1
Q0
START
MET
CM
CGM
CGO
ED
OP
SP
MUX 16:1
CBB D
D0
Qot+1
!Qot+1
CLK
!ENC
MUX 8:1
CBB D
Q1t+1
D1
!Q1t+1
CLK
!EN
MUX 2:1
CBB JK
J2
Q2t+1
K2
!Q2t+1
CLK
!EN
MUX 2:1
CBB JK
J3
Q3t+1
K3
!Q3t+1
CLK
Decod 4:16
OP
CM
R_N
M_M
G_M
L_M
P_O
P_L
R_G
P