

Lab A6 Report

TT0L - GROUP 0

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Q1.

a)

J	K	CLK	Q(t)	Q(t+1)
0	0	↑	Q	Q
0	0	↓	Q	Q
0	1	↑	Q	0
0	1	↓	Q	0
1	0	↑	Q	1
1	0	↓	Q	1
1	1	↑	Q	~Q
1	1	↓	Q	~Q

b)

D(Data) Flip-Flop

Truth Table:

D	Q _t	Q(t+1)	J	K
0	0	0	0	X
0	1	0	X	1
1	0	1	1	X
1	1	1	X	0

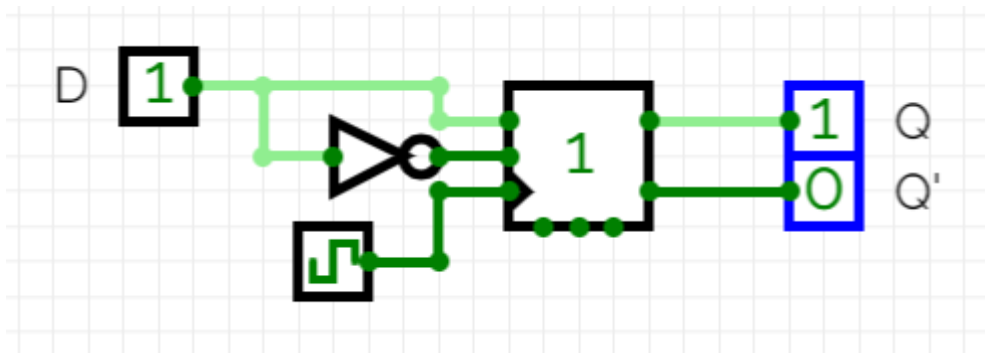
K-Map:

D/Q _t	0	1
0	0	X
1	1	X

$$J = D$$

D/Q _t	0	1
0	X	1
1	X	0

$$K = D'$$



T(Toggle) Flip-Flop

Truth Table:

T	Q _t	Q(t+1)	J	K
0	0	0	0	X
0	1	1	X	0
1	0	1	1	X
1	1	0	X	1

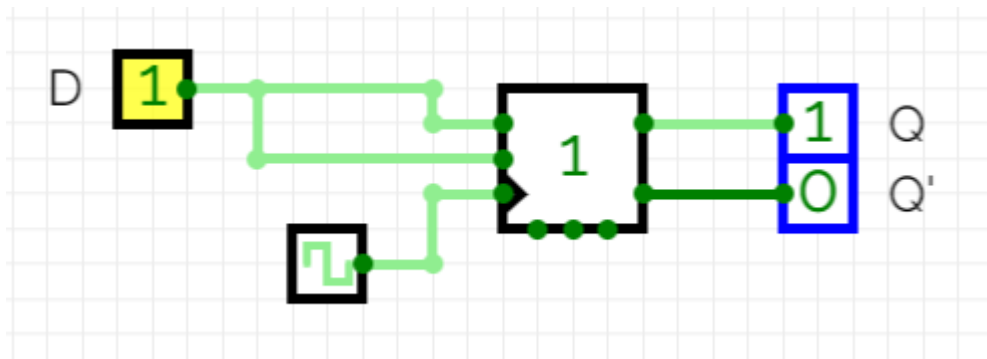
K-Map:

T/Q _t	0	1
0	0	X
1	1	X

$$J = T$$

T/Qt	0	1
0	X	0
1	X	1

$$K = T$$



Q2.

Truth Table:

A	B	At	Bt	JA	KA	JB	KB
0	0	0	1	0	X	1	X
0	1	1	1	1	X	X	0
1	0	0	0	X	1	0	X
1	1	1	0	X	0	X	1

K-map:

A\B	0	1
0	0	1
1	X	X

$$JA = B$$

K-map:

A\B	0	1
0	X	X
1	1	0

$$KA = B'$$

K-map:

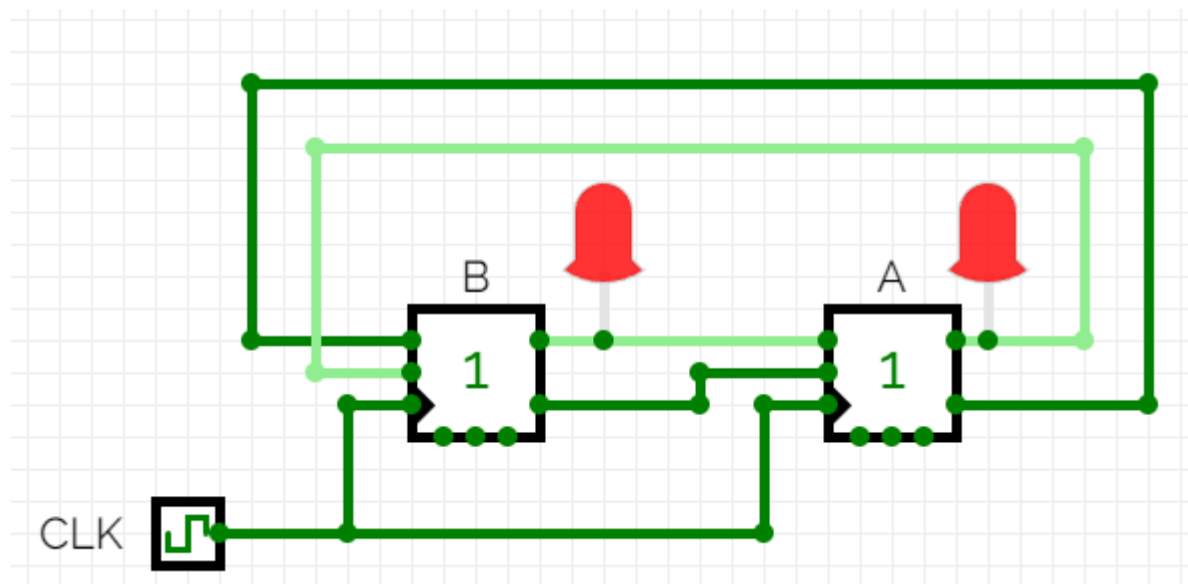
A\B	0	1
0	1	X
1	0	X

$$JB = A'$$

K-map:

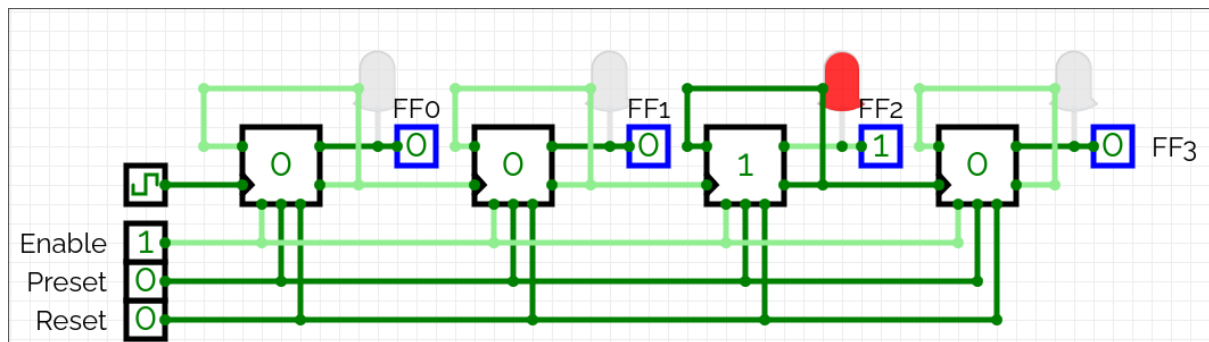
A\B	0	1
0	X	0
1	X	1

$$KB = A$$

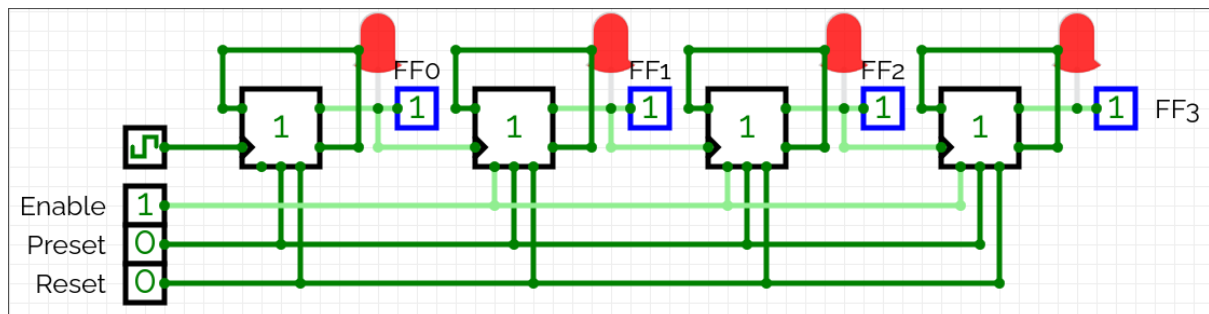


Q3.

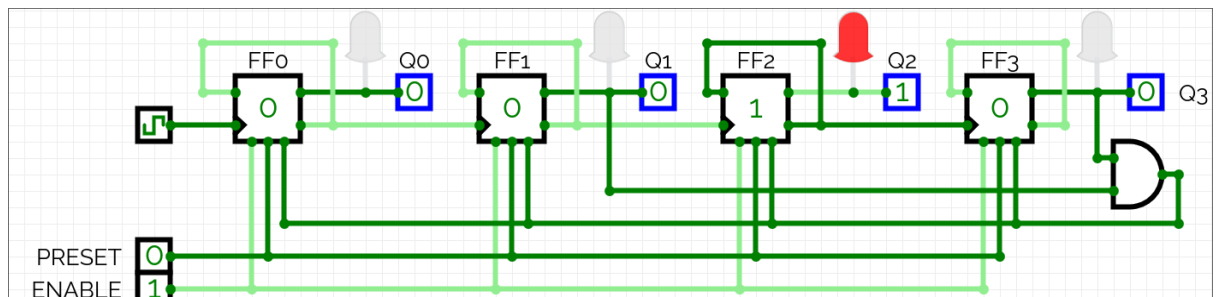
4 bit binary asynchronous UP counter



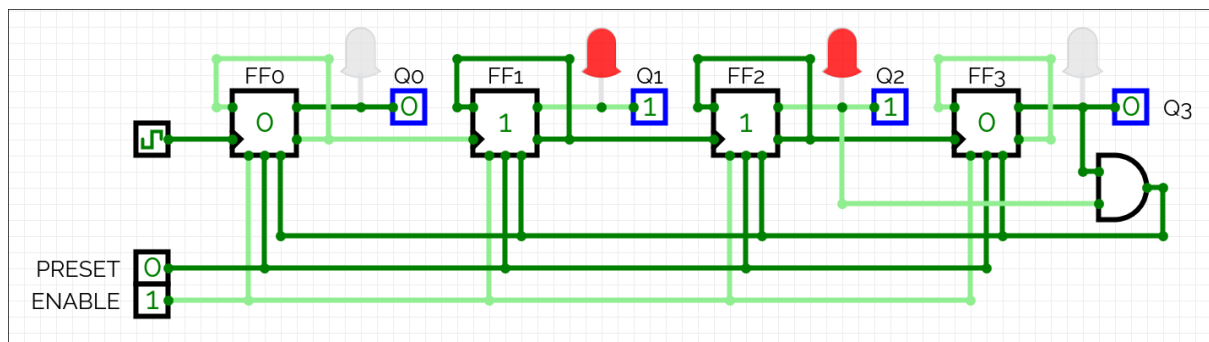
4 bit binary asynchronous DOWN counter



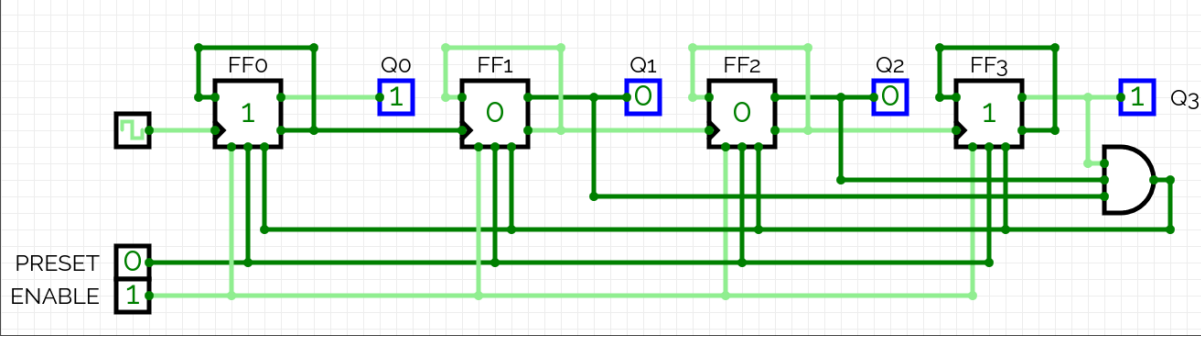
Asynchronous BCD Counter



Asynchronous MOD-12 Counter



Ripple divide by 14 Counter



Q4. Design and Construct a parallel counter that has the following sequence. If the input (UP)/(DOWN)' = 1, it will count up, 000-010-100-110 and then recycle to 000. If the input (UP)/(DOWN)' = 0, it will count down, 110-100-010-000 and then recycle to 110. Undesired states are don't care states.

I. Use T flip-flops for the design.

UP/D OWN	A	B	C	A^+	B^+	C^+	T_A	T_B	T_C
0	0	0	0	1	1	0	1	1	0
0	0	0	1	X	X	X	X	X	X
0	0	1	0	0	0	0	0	1	0
0	0	1	1	X	X	X	X	X	X
0	1	0	0	0	1	0	1	1	0
0	1	0	1	X	X	X	X	X	X
0	1	1	0	1	0	0	0	1	0
0	1	1	1	X	X	X	X	X	X
1	0	0	0	0	1	0	0	1	0
1	0	0	1	X	X	X	X	X	X
1	0	1	0	1	0	0	1	1	0
1	0	1	1	X	X	X	X	X	X
1	1	0	0	1	1	0	0	1	0
1	1	0	1	X	X	X	X	X	X
1	1	1	0	0	0	0	1	1	0
1	1	1	1	X	X	X	X	X	X

II. Use D flip-flops for the design.

UP/D OWN	A	B	C	A^+	B^+	C^+	D_A	D_B	D_C
0	0	0	0	1	1	0	1	1	0
0	0	0	1	X	X	X	X	X	X
0	0	1	0	0	0	0	0	0	0
0	0	1	1	X	X	X	X	X	X
0	1	0	0	0	1	0	0	1	0
0	1	0	1	X	X	X	X	X	X
0	1	1	0	1	0	0	1	0	0
0	1	1	1	X	X	X	X	X	X
1	0	0	0	0	1	0	0	1	0
1	0	0	1	X	X	X	X	X	X
1	0	1	0	1	0	0	1	0	0
1	0	1	1	X	X	X	X	X	X
1	1	0	0	1	1	0	1	1	0
1	1	0	1	X	X	X	X	X	X
1	1	1	0	0	0	0	0	0	0
1	1	1	1	X	X	X	X	X	X

UA/BC	00	01	11	10
00	1	X	X	0
01	0	X	X	1
11	1	X	X	0
10	0	X	X	1

$$D_A = (\bar{U} \cdot \bar{A} \cdot \bar{B}) + (\bar{U} \cdot A \cdot B) + (U \cdot \bar{A} \cdot B) + (U \cdot A \cdot \bar{B})$$

$$= \bar{U}(\bar{A} \cdot \bar{B} + A \cdot B) + U(A \cdot \bar{B} + \bar{A} \cdot B)$$

$$= \bar{U}(\overline{A \oplus B}) + U(A \oplus B)$$

$$= \overline{U \oplus (A \oplus B)}$$

UA/BC	00	01	11	10
00	1	X	X	0
01	1	X	X	0
11	1	X	X	0
10	1	X	X	0

$$D_B = \overline{B}$$

UA/BC	00	01	11	10
00	0	X	X	0
01	0	X	X	0
11	0	X	X	0
10	0	X	X	0

$$\overline{D_c = 0}$$

