1. 設計一個3-bits counter，具有3個D型正反器A,B,C，一個輸入X

X＝0 時，電路開始上數
X＝1 時，電路開始下數

狀態表:

X	present state			next state		
	A	B	C	A	B	C
0	0	0	0	0	0	1
0	0	0	1	0	1	0
0	0	1	0	0	1	1
0	0	1	1	1	0	0
0	1	0	0	1	0	1
0	1	0	1	1	1	0
0	1	1	0	1	1	1
0	1	1	1	0	0	0
1	0	0	0	1	1	1
1	0	0	1	0	0	0
1	0	1	0	0	0	1
1	0	1	1	0	1	0
1	1	0	0	0	1	1
1	1	0	1	1	0	0
1	1	1	0	1	0	1
1	1	1	1	1	1	0

狀態方程式:

A				
XA/BC	0 0	0 1	1 1	1 0
0 0	0	0	1	0
0 1	1	1	0	1
1 1	0	1	1	1
1 0	1	0	0	0

Da = X`AB` + ABC` + XAC + X`A`BC + XA`B`C`

B				
XA/BC	0 0	0 1	1 1	1 0
0 0	0	1	0	1
0 1	0	1	0	1
1 1	1	0	1	0
1 0	1	0	1	0

Db = X`B`C + X`BC` + XB`C` + XBC = X`(B XOR C) + X(B XNOR C)

C				
XA/BC	0 0	0 1	1 1	1 0
0 0	1	0	0	1
0 1	1	0	0	1
1 1	1	0	0	1
1 0	1	0	0	1

Dc = C`

電路圖:

電路圖:
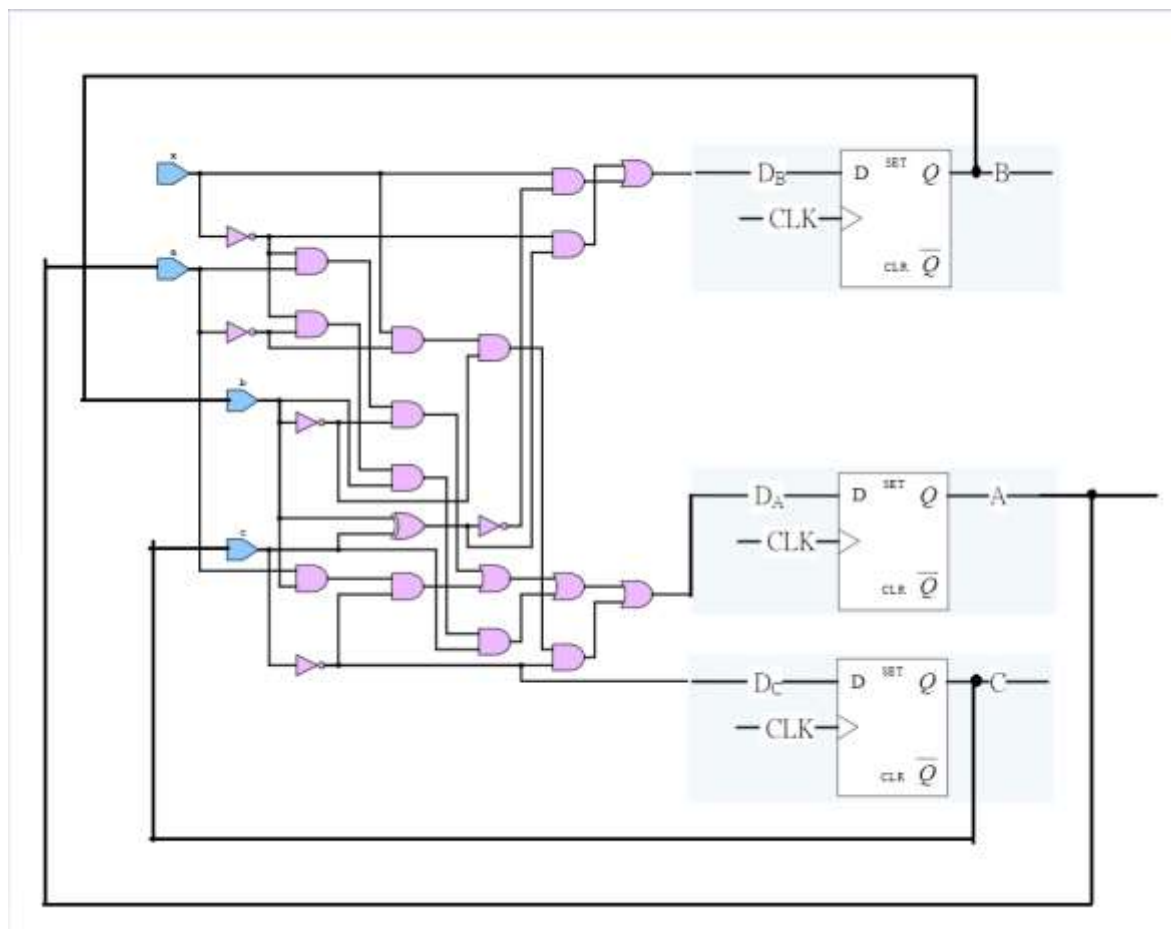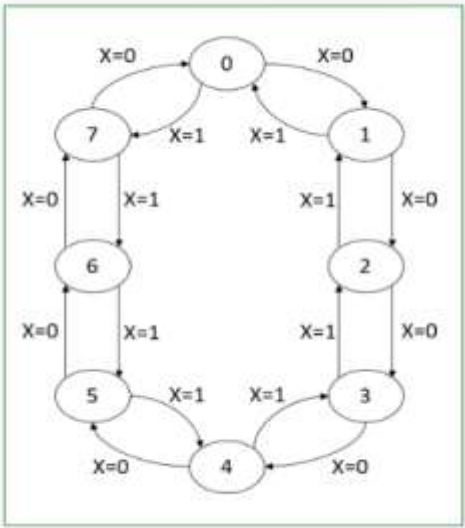
2. 設計一個3-bits counter，具有3個T型正反器A,B,C，一個輸入X

X = 0 時，電路開始上數
X = 1 時，電路開始下數

狀態表:

Present State				Next State				Flip-Flop Inputs		
A	B	C	X	A	B	C		T_A	T_B	T_C
0	0	0	0	0	0	1		0	0	1
0	0	0	1	1	1	1		1	1	1
0	0	1	0	0	1	0		0	1	1
0	0	1	1	0	0	0		0	0	1
0	1	0	0	0	1	1		0	0	1
0	1	0	1	0	0	1		0	1	1
0	1	1	0	1	0	0		1	1	1
0	1	1	1	0	1	0		0	0	1
1	0	0	0	1	0	1		0	0	1
1	0	0	1	0	1	1		1	1	1
1	0	1	0	1	1	0		0	1	1
1	0	1	1	1	0	0		0	0	1
1	1	0	0	1	1	1		0	0	1
1	1	0	1	1	0	1		0	1	1
1	1	1	0	0	0	0		1	1	1
1	1	1	1	1	1	0		0	0	1

狀態方程式:

T$_A$				
AB/CX	0 0	0 1	1 1	1 0
0 0	0	1	0	0
0 1	0	0	0	1
1 1	0	0	0	1
1 0	0	1	0	0

T$_A$ = B'C'X + BCX'

T$_B$				
AB/CX	0 0	0 1	1 1	1 0
0 0	0	1	0	1
0 1	0	1	0	1
1 1	0	1	0	1
1 0	0	1	0	1

T$_B$ = C`X + CX` = C^X

T$_C$				
AB/CX	0 0	0 1	1 1	1 0
0 0	1	1	1	1
0 1	1	1	1	1
1 1	1	1	1	1
1 0	1	1	1	1

T$_C$ = 1

電路圖: