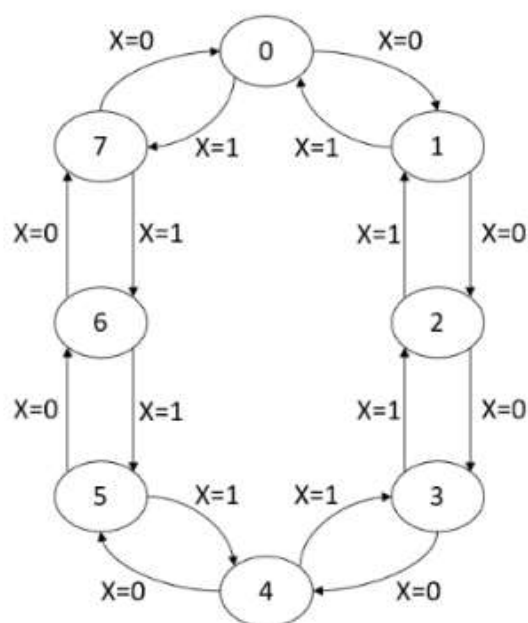


1. 請設計一個 3-bits counter，具有 3 個 D 型正反器 A, B, C，一個輸入 X。(如下圖所示，X=0 時，電路會開始上數，X=1 時，電路會開始下數)。請寫出完整設計過程，包含狀態表、狀態方程式、及電路圖。



狀態表:

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

狀態方程式:

| 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:  $X'AB' + ABC' + XAC + X'A'BC + XA'B'C'$

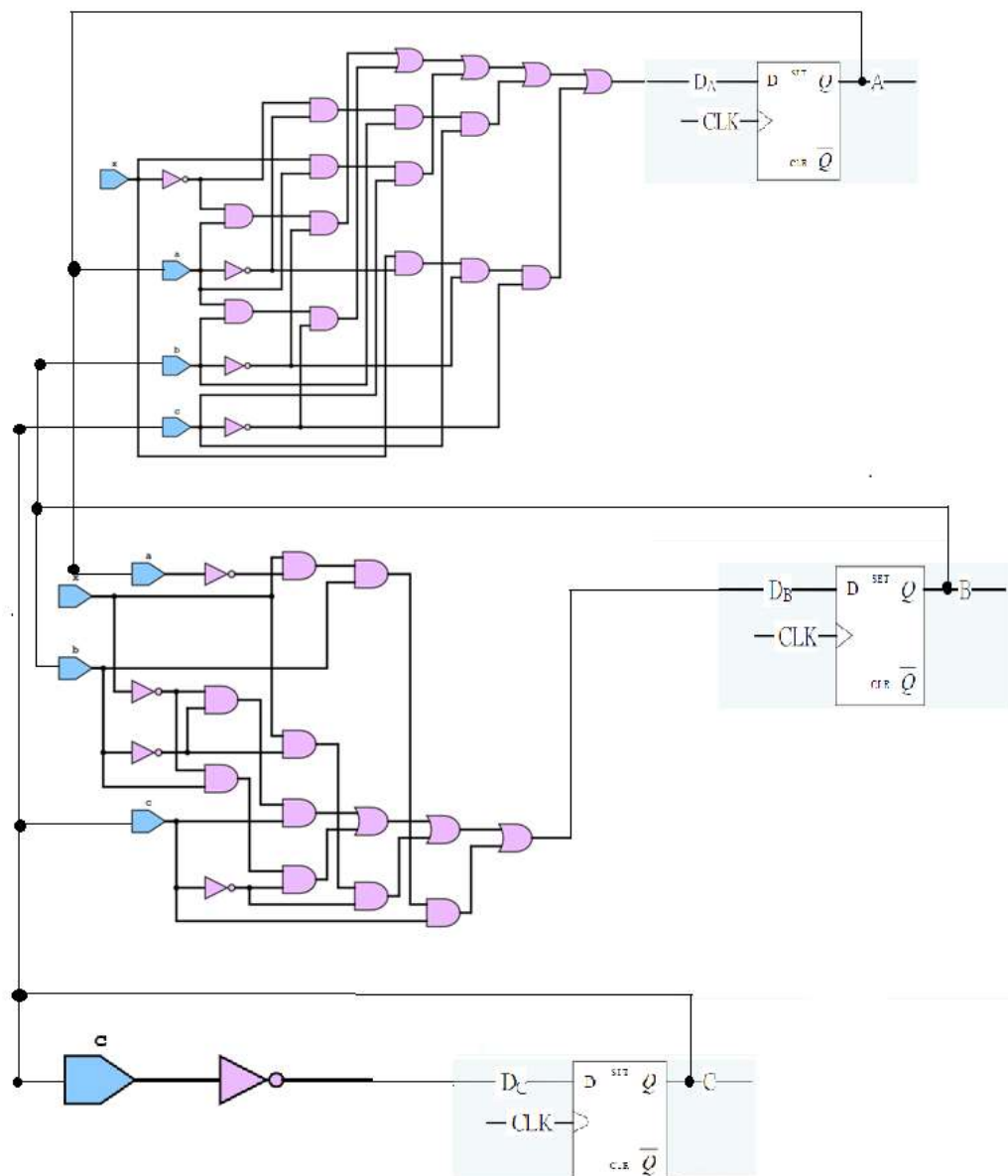
| XA/BC | 0 0 | 0 1 | 1 1 | 1 0 |
|-------|-----|-----|-----|-----|
| 0 0   | 0   | 1   | 0   | 1   |
| 0 1   | 0   | 1   | 0   | 1   |
| 1 1   | 1   | 0   | 0   | 1   |
| 1 0   | 1   | 0   | 1   | 0   |

Db:  $X'B'C + X'BC' + XB'C' + XA'BC$

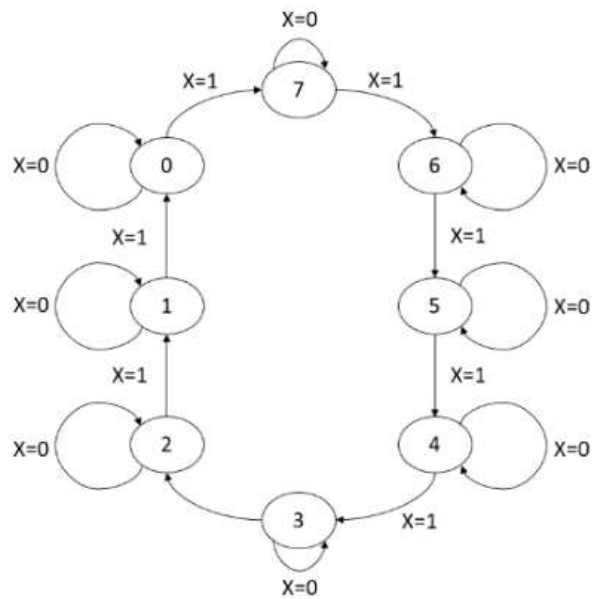
| XA/BC | 0 0 | 0 1 | 1 1 | 1 0 |
|-------|-----|-----|-----|-----|
| 0 0   | 1   | 0   | 0   | 1   |
| 0 1   | 1   | 0   | 0   | 1   |
| 1 1   | 1   | 0   | 0   | 1   |
| 1 0   | 1   | 0   | 0   | 1   |

Dc:  $C'$

電路圖：



2. 請設計一個 3-bits counter，具有 3 個 D 型正反器 A, B, C，一個輸入 X，( 如下圖所示，X=0 時，狀態保持不變，X=1 時，電路會開始下數 )。請寫出完整設計過程，包含狀態表、狀態方程式、及電路圖。



狀態表:

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

Da:  $X'A + AC + AB + XA'B'C'$

| B     |     |     |     |     |
|-------|-----|-----|-----|-----|
| XA/BC | 0 0 | 0 1 | 1 1 | 1 0 |
| 0 0   | 0   | 0   | 1   | 1   |
| 0 1   | 0   | 0   | 1   | 1   |
| 1 1   | 1   | 0   | 1   | 0   |
| 1 0   | 1   | 0   | 1   | 0   |

Db:  $X'B + BC + XB'C'$

| C     |     |     |     |     |
|-------|-----|-----|-----|-----|
| XA/BC | 0 0 | 0 1 | 1 1 | 1 0 |
| 0 0   | 0   | 1   | 1   | 0   |
| 0 1   | 0   | 1   | 1   | 0   |
| 1 1   | 1   | 0   | 0   | 1   |
| 1 0   | 1   | 0   | 0   | 1   |

Dc:  $X'C + XC'$

電路圖：

