# Assignment - 1

TT0L - GROUP 0

| | |
|---|---|
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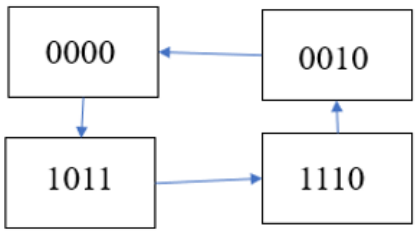
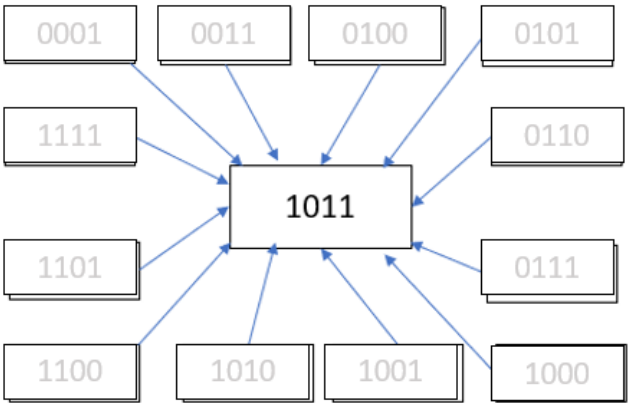
Ques No:5, Input=0, 0->11->14->2(repeat), all undesired state go to 11,
Ques No:5, Input=1, 2->8->6->13(repeat), all undesired state go to 8,
T Flip Flop

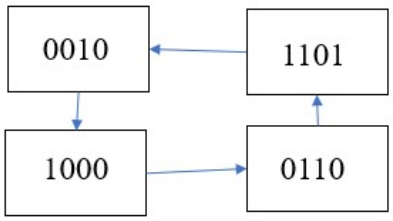
**State Transition Diagram:**

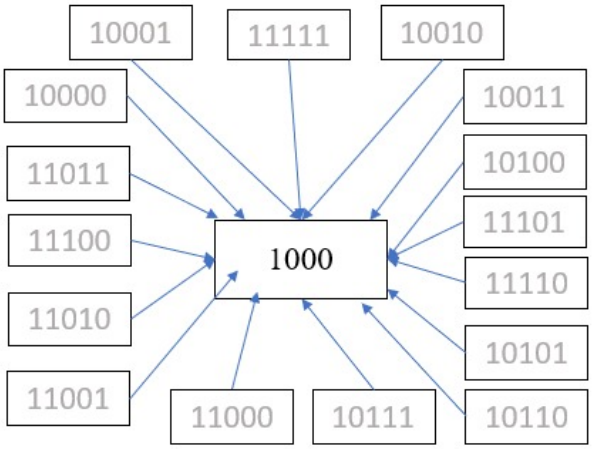
Input = 0




Input = 1



## State Transition Table:

| Input | Present State | | | | Next State | | | | FF3 | FF2 | FF1 | FF0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $D$ | $C$ | $B$ | $A$ | $D^+$ | $C^+$ | $B^+$ | $A^+$ | $T_D$ | $T_C$ | $T_B$ | $T_A$ |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 |
| 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |

| Input | Present State | | | | Next State | | | | FF3 | FF2 | FF1 | FF0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $D$ | $C$ | $B$ | $A$ | $D^+$ | $C^+$ | $B^+$ | $A^+$ | $T_D$ | $T_C$ | $T_B$ | $T_A$ |
| 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |

## K-map:

| **IDC/BA** | **00** | **01** | **11** | **10** |
|---|---|---|---|---|
| **000** | 1 | 1 | 1 | 0 |
| **001** | 1 | 1 | 1 | 1 |
| **011** | 0 | 0 | 0 | 1 |
| **010** | 0 | 0 | 0 | 0 |
| **100** | 1 | 1 | 1 | 1 |
| **101** | 1 | 1 | 1 | 1 |
| **111** | 0 | 1 | 0 | 0 |
| **110** | 1 | 0 | 0 | 0 |

$$T_D = (\overline{B} \cdot \overline{D}) + (A \cdot \overline{D}) + (I \cdot \overline{D}) + (\overline{A} \cdot B \cdot C \cdot \overline{I}) + (\overline{A} \cdot \overline{B} \cdot \overline{C} \cdot I) + (A \cdot \overline{B} \cdot C \cdot I)$$

| **IDC/BA** | **00** | **01** | **11** | **10** |
|---|---|---|---|---|
| **000** | 0 | 0 | 0 | 0 |
| **001** | 1 | 1 | 1 | 1 |
| **011** | 1 | 1 | 1 | 1 |
| **010** | 0 | 0 | 1 | 0 |
| **100** | 0 | 0 | 0 | 0 |
| **101** | 1 | 1 | 1 | 0 |
| **111** | 1 | 1 | 1 | 1 |
| **110** | 1 | 0 | 0 | 0 |

$$T_C = (C \cdot \overline{I}) + (\overline{B} \cdot C) + (A \cdot C) + (C \cdot D) + (A \cdot B \cdot D \cdot \overline{I}) + (\overline{A} \cdot \overline{B} \cdot D \cdot I)$$

| **IDC/BA** | **00** | **01** | **11** | **10** |
|---|---|---|---|---|
| **000** | 1 | 1 | 0 | 1 |
| **001** | 1 | 1 | 0 | 0 |
| **011** | 1 | 1 | 0 | 0 |
| **010** | 1 | 1 | 0 | 0 |
| **100** | 0 | 0 | 1 | 1 |
| **101** | 0 | 0 | 1 | 1 |
| **111** | 0 | 1 | 1 | 1 |
| **110** | 1 | 0 | 1 | 1 |

$$T_B = (\overline{B \oplus I}) + (\overline{A} \cdot \overline{C} \cdot \overline{D} \cdot \overline{I}) + (\overline{A} \cdot \overline{B} \cdot \overline{C} \cdot D) + (A \cdot \overline{B} \cdot C \cdot D)$$

| IDC/BA | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| **000** | 1 | 0 | 0 | 0 |
| **001** | 1 | 0 | 0 | 1 |
| **011** | 1 | 0 | 0 | 0 |
| **010** | 1 | 0 | 1 | 1 |
| **100** | 0 | 1 | 1 | 0 |
| **101** | 0 | 1 | 1 | 1 |
| **111** | 0 | 1 | 1 | 0 |
| **110** | 0 | 1 | 1 | 0 |

$$T_A = (A \cdot I) + (\overline{A} \cdot \overline{B} \cdot \overline{I}) + (\overline{A} \cdot B \cdot C \cdot \overline{D}) + (B \cdot \overline{C} \cdot D \cdot \overline{I})$$

## Circuit: