North South University

Department of Electrical & Computer Engineering

Lab Report

Experiment No: 04

Experiment Title: Design of a 3-bit Binary Up-Down counter

Course Code: **CSE332L**

Section: **07**

Course Name: **Computer Organization & Architecture Lab**

Lab Group #: 02

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Objective:

① To build and understand the behaviour of an up-down counter.

Equipments List:

- Trainer Board
- IC 7404 (Not Gate), IC 7408 (AND Gate), IC 7432 (OR Gate) IC 7486 (XOR gate), IC 7474 (D-flipflop)
- wires
- Power supply.

Block Diagram:

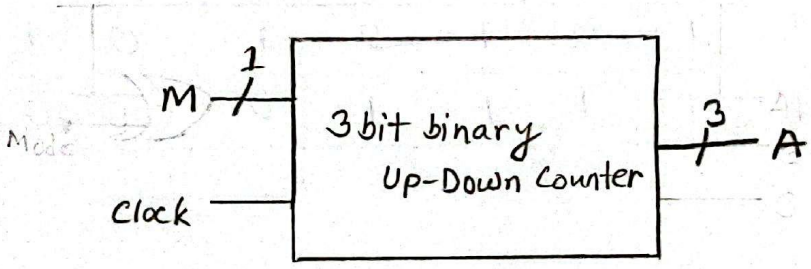

Fig: Block Diagram of 3-bit Up-Down Counter

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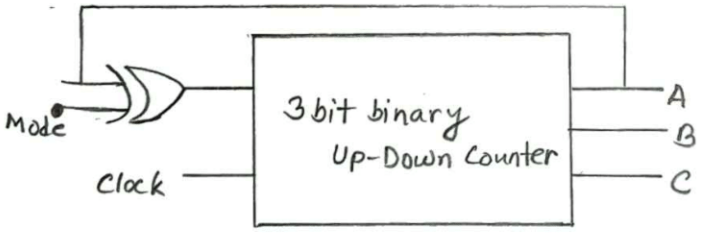


Fig: Block Diagram of 3 bit Up-Down Counter

Truth table :

M	Q_C	Q_B	Q_A	Q_C^+	Q_B^+	Q_A^+	T_C	T_B	T_A
0	0	0	0	0	0	1	0	0	1
0	0	0	1	0	1	0	0	1	1
0	0	1	0	0	1	1	0	0	1
0	0	1	1	1	0	0	1	1	1
0	1	0	0	1	0	1	0	0	1
0	1	0	1	1	1	0	0	1	1
0	1	1	0	1	1	1	0	0	1
0	1	1	1	0	0	0	1	1	1
1	0	0	0	1	1	1	1	1	1
1	0	0	1	0	0	0	0	0	1
1	0	1	0	0	0	1	0	1	1
1	0	1	1	0	1	0	0	0	1
1	1	0	0	0	1	1	1	1	1
1	1	0	1	1	0	0	0	0	1
1	1	1	0	1	0	1	0	1	1
1	1	1	1	1	1	0	0	0	1

K-Map :

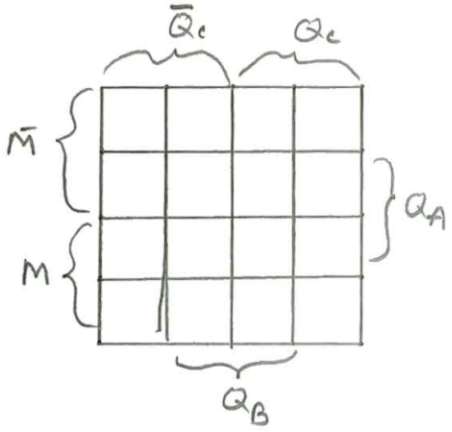
	00	01	11	10
00	0	1	1	0
01	0	1	1	0
11	1	0	0	1
10	1	0	0	1

$T_B = M\bar{Q}_B + \bar{M}Q_B$

$= M \oplus Q_B$

	00	01	11	10
00	0	0	1	0
01	0	0	1	0
11	1	0	0	0
10	1	0	0	0

$T_C = \bar{M}Q_CQ_B + M\bar{Q}_B\bar{Q}_C$



Boolean Expression :

$T_B = M \oplus Q_B$

$T_C = \bar{M}Q_CQ_B + M\bar{Q}_B\bar{Q}_C$

Circuit Diagram:

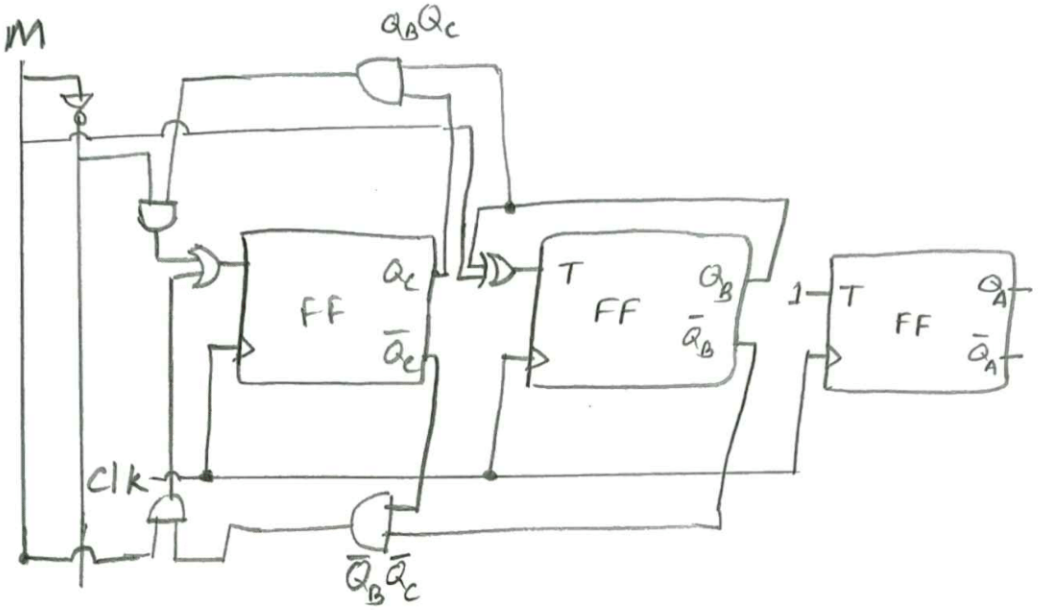
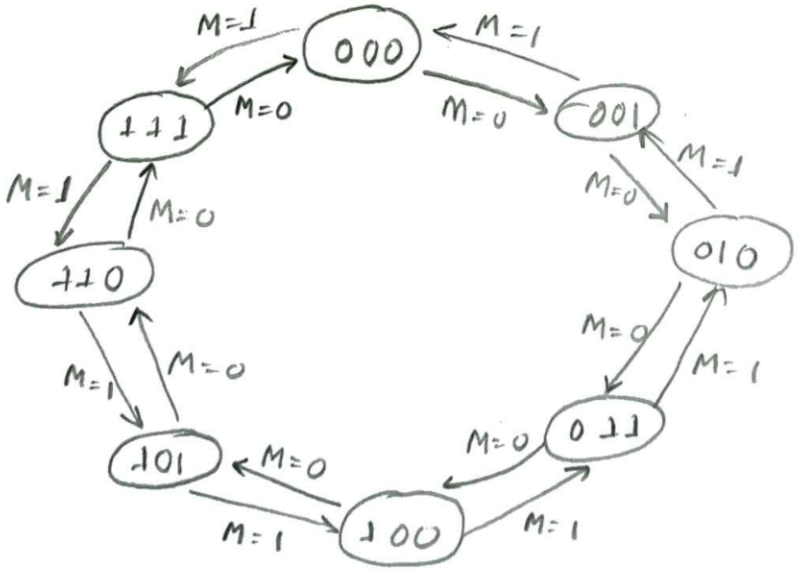


Fig: 3-bit up-down counter

State Diagram:



Mode, M=0 ; ↑ up count

Mode, M=1 ; ↓ down count