Department of Electrical and Electronic Engineering
Shahjalal University of Science and Technology

EEE 222: Electronic Circuit Simulation Laboratory

EXPERIMENT NO: 08

Name of the Experiment: FAMILIARIZATION WITH BASIC LOGIC GATES AND DIGITAL COUNTERS

OBJECTIVES:

The objectives of this experiment are to-

- Familiarize with the basic concepts of digital logic.
- Study different components for digital simulation.
- Study and simulate the truth table of basic logic gates.
- Simulate the output of digital counters

THEORY:

Digital circuit posses numerous advantages over analog circuit. Digital circuit works on binary logic. Binary logic deals with variables that take on two discrete values. The values the variables take may be called by different names (e.g. *true* and *false*, *yes* and *no* etc.). The most convenient way to represent the values is in terms of bit and assigns them the values 1 and 0. Binary logic is used to describe, in a mathematical manner, the manipulation and processing of binary information.

Binary Logic:

Binary logic consists of binary variables and logical operations. The variables are designated by letters of the alphabet such as *A*, *B*, *C*, *x*, *y*, *z* etc., with each variable having two and only two distinct possible values 1 and 0. There are three logical operations: AND, OR and NOT.

1. **AND:** This operation is represented by a dot or by the absence of an operator. For example, $x \cdot y = z$ or $xy = z$ is read "*x* AND *y* is equal to *z*." The logical operation AND is interpreted to mean that $z=1$ if and only if $x=1$ and $y=1$; otherwise $z=0$. *x*, *y* and *z* are binary variables and can be equal to either 1 or 0 and nothing else.

2. **OR:** This operation is represented by a plus sign. For example, $x+y=z$ is read " *x* OR *y* is equal to *z*," meaning that $z=1$ if $x=1$ or if $y=1$ of if both $x=1$ and $y=1$. If both $x=0$ and $y=0$ then $z=0$.

3. **NOT:** This operation is represented by a prime (sometimes by a bar). For example $x' = z \ (or \ \bar{x} = z)$ is read " x NOT is equal to z," meaning that z is what x not. In other words if $x=1$ then $z=0$ and if $x=0$ then $z=1$.

Truth table of AND gate

X	Y	Z
0	0	0
0	1	0
1	0	0
1	1	1

Truth table of OR gate

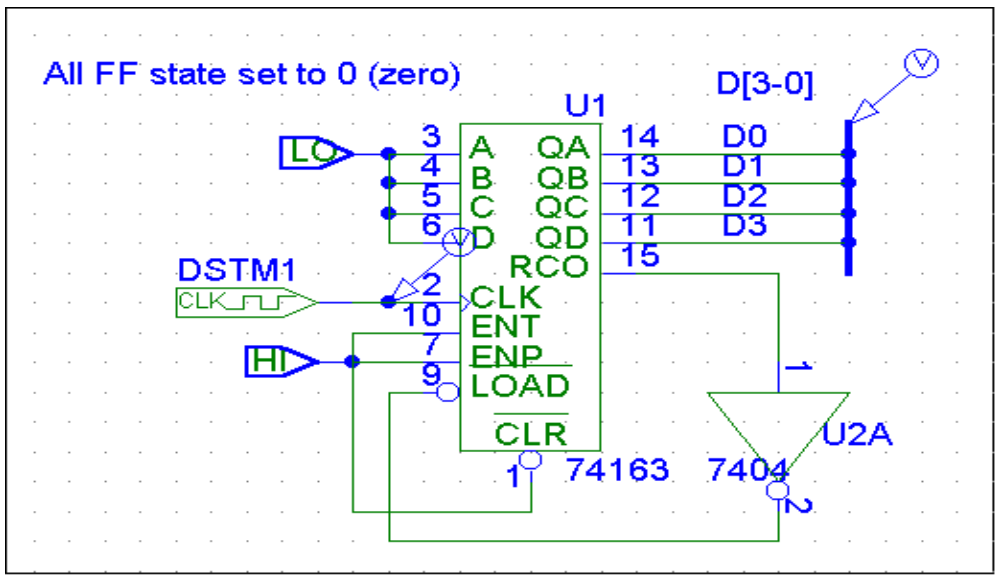
X	Y	Z
0	0	0
0	1	1
1	0	1
1	1	1

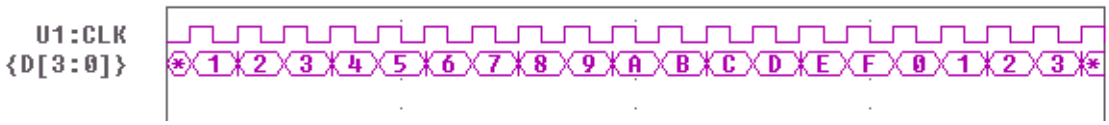
Truth table of NOT gate

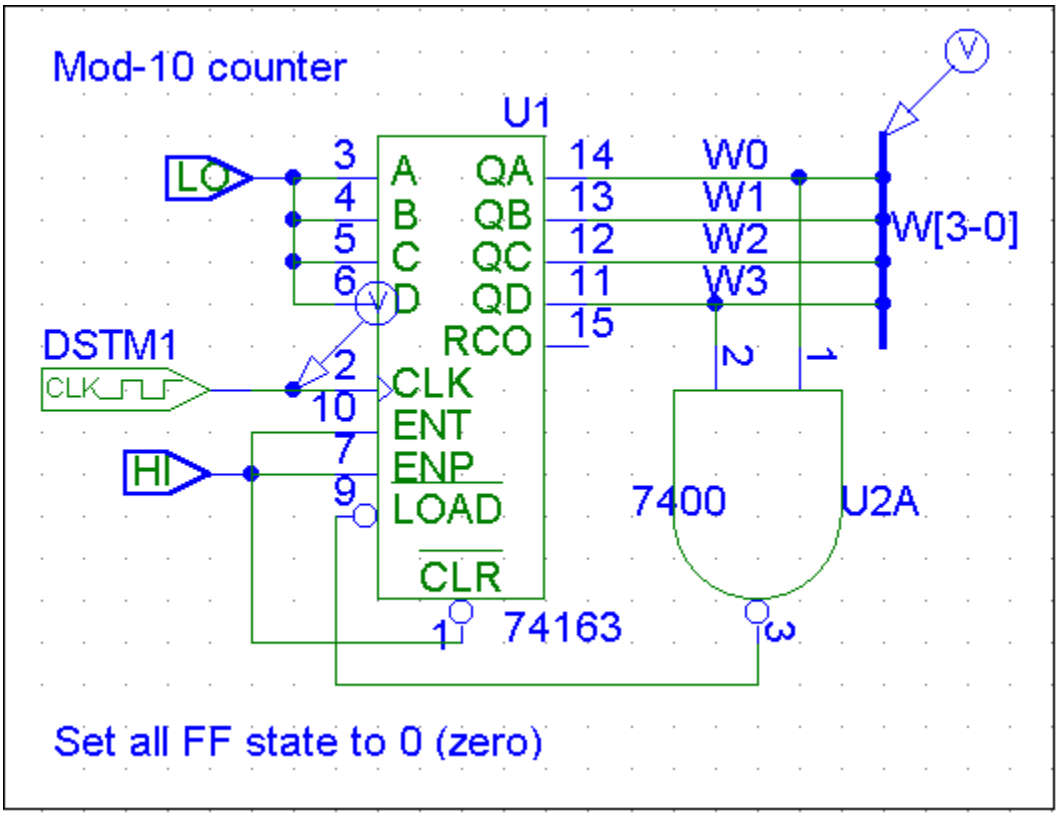
X	Z
0	1
1	0

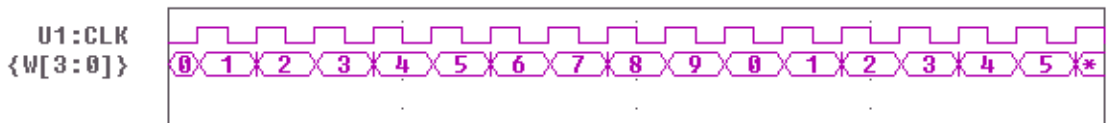
Digital Simulation using PSpice:

For digital simulation we use logic signals/levels as input to logic gates/logic circuits and view the corresponding logic levels at the output. Again it is common for digital signal to appear in parallel say in the group of 4, 8, 16 or 32 (in the form of 2^n where n is the *number* of bit representation).






Mod-10 counter
U1
LO
HI
DSTM1
CLK
3
4
5
6
2
10
7
9
1
A
B
C
D
CLK
ENT
ENP
LOAD
CLR
QA
QB
QC
QD
RCO
14
13
12
11
15
74163
W0
W1
W2
W3
W[3-0]
2
1
3
7400
U2A
Set all FF state to 0 (zero)


U1:CLK
{W[3:0]}
0
1
2
3
4
5
6
7
8
9
0
1
2
3
4
5
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