<u>**Logic Design (CS2091D)**</u>

<u>**ASSIGNMENT SET - I**</u>

A universal gate is a gate that can implement any Boolean function without the need of any other logic gate type. The NAND and NOR gates are universal. In practice, this is advantageous since NAND and NOR gates are economical and easier to fabricate and are the basic gates used in all integrated circuits (IC), digital logic families.

We have given the logical symbol of the NAND Gate, Truth Table, and the electronic circuit level diagram used for implementing the NAND gate using Transistor Switches.
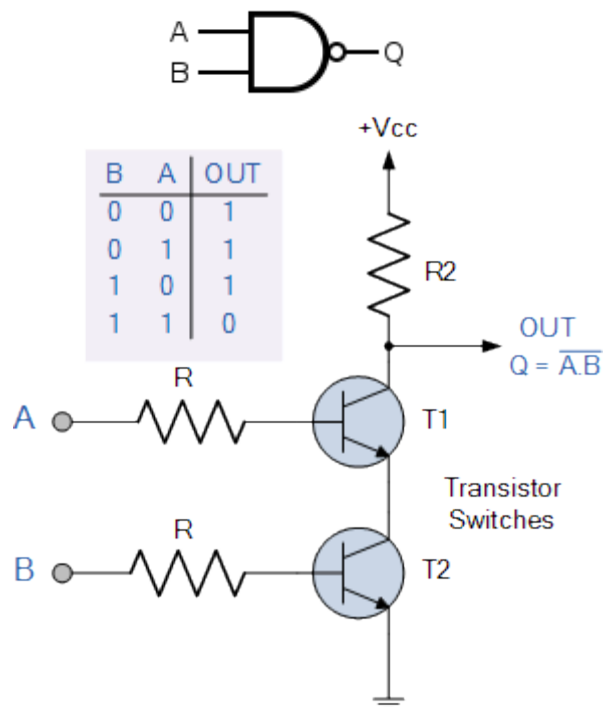
The objective of the first Assignment is to build all 18 logic functions given in page no. 2. The only building blocks you can use are primitive **NAND gates** and the composite gates that you will gradually build on top of them.

The only tool that you need for this project is the ModelSim - Intel FPGA Starter Edition. All the chips should be implemented in the HDL language using Verilog code.

In Linux, ModelSim Could be started from a terminal by navigating the installed directory using "cd intelFPGA_lite/18.0/modelsim_ase/linuxaloem/"& executing command ./vsim. The

user has to be careful that you shouldn't close the terminal till you have completed your work with ModelSim GUI.

Verilog code for initiating the basic NAND Gate in ModelSim is ***nand nand_1 (out, in0, in1);***

As the assignment progress, students have to call/use the basic logical functions that are already implemented by you for building other logical functions.

You are expected to use only **Gate-Level Modeling** (**Structural Modeling**) to implement the following logic circuits in the given order.

1. NOT Gate
2. AND Gate
3. OR Gate
4. NOR Gate
5. XOR Gate
6. XNOR Gate
7. 16-BIT NOT
8. 16-BIT AND
9. 16-BIT OR
10. 16-BIT XOR
11. OR(IN0, IN1,..., IN7)
12. MUX
13. DEMUX
14. 16-BIT MULTIPLEXER
15. 16-BIT / 4-WAY MUX
16. 16-BIT / 8-WAY MUX
17. 4-WAY DEMULTIPLEXER
18. 8-WAY DEMULTIPLEXER