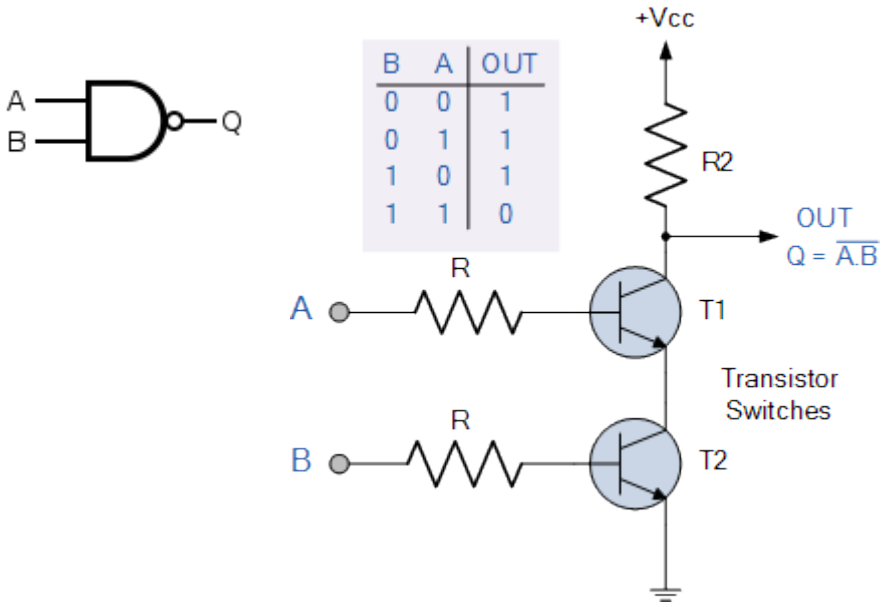
ASSIGNMENT SET - I

A universal gate can be used to implement any Boolean function without the need of any other primitive (Basic) gates such as AND, NOT & OR. The NAND and NOR gates are universal gates. In practice, they are advantageous to use and implement any logic function, since NAND and NOR gates are economical and they are more comfortable to fabricate which includes all basic gates functions used in the integrated circuits (ICs) of digital logic families.

Figure 1[1] shown below, The logical symbol of NAND Gate, Truth Table and The corresponding circuit level diagram used for implementing the NAND gate using Transistor switches.



The objective of the Assignment-I is to implement all the primitive logic functions 1-6 given below using NAND gates only. For the implementation of logic functions 7-18, use the required number of NAND gates which you realised from 1-6.

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

ModelSim could start from the terminal by navigating the installed directory using "cd intelFPGA_lite/18.0/modelsim_ase/linuxaloem/" and executing the command ./vsim . The user has to be careful that, he/she shouldn't close the terminal till he/she have completed his work with modelsim GUI. Verilog HDL code for initiating the NAND Gate in ModelSim is:

nand nand_1 (out, in0, in1);

As the assignment progress, students will have to call/use the essential logical functions that are already implemented by him/her for building other logical functions.

The list of the exercises shown below: are 16 different logical functions. Students are expected to use only Gate-Level Modeling (Structural Modeling) for the implementation of these functions 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

Reference

[1] https://www.electronics-tutorials.ws/logic/logic_5.html