Module 2 :: Logic Gates and Implementation

Practice Problems

1. NAND is a universal gate in the sense that any logic function can be realized using NAND gates only. Implement 2-input AND, 2-input OR, and NOT gates using only 2-input NAND gates.
2. NOR is a universal gate in the sense that any logic function can be realized using NOR gates only. Implement 2-input AND, 2-input OR, and NOT gates using only 2-input NOR gates.
3. Implement a 2-input exclusive-OR gate using:
    a) AND, OR and NOT gates
    b) NAND gates only
4. Implement the following:
    a) A 3-input NAND gate using 2-input NAND gates only
    b) A 4-input NAND gate using 2-input NAND gates only
    c) A 5-input exclusive-OR gate using 2-input exclusive-OR gates only
    d) A 4-input NAND gate using CMOS
    e) A 4-input NOR gate using CMOS
    f) The function F = (A .B+ B.C + C.A)' using CMOS
    g) A 2-to-1 multiplexer using AND, OR and NOT gates only
5. A BCD number appears in four input lines of a circuit. Implement the circuit using AND, OR and NOT gates only such that the output is 1 whenever one of the following inputs are applied: 0, 2, 3, 5 or 8.
6. Design a circuit that takes a 4-bit BCD data as input and produces a 3-bit output that is the modulo-7 of the input decimal digit.
7. Implement the following functions using CMOS:
    a) (A + B.C.D)'
    b) (A . (B + C.D))'
    c) A + B + C