Lab 7 Homework

Carefully read each question before answering. Show all work or justify your answers to receive credit. Attach a separate sheet of paper, if necessary, to show all work and calculations.

1. Draw a circuit diagram that shows how you could build a NAND gate with fan-in of four using NAND gates that have a fan-in of two.

2. Draw a circuit diagram that shows how you could build a NAND gate with a fan-in of six using NAND gates that have a fan-in of four.

3. To build an extremely streamlined processor, a circuit designer creates hardware to perform OR and NOT operations, but nothing to do AND operations. Can this processor carry out all possible logical operations? Why or why not?

4. Convert the following expression to a NAND-only circuit using the **double prime method**. (Do not simplify or expand the expression, convert it as-is.)

$$F(A, B, C, D) = B + C(D + A')$$

5. Convert the above expression (from the previous question) to a NAND-only circuit using the **bubble method**. Assume you have access to NAND gates with whatever fan-in is required. (Do not simplify or expand the expression, convert it as-is.)

6. Convert the following expression to a NOR-only circuit using the **double prime method**. (Do not simplify or expand the expression, convert it as-is.)

$$F(A, B, C, D) = A'(C' + DB(A + C))$$

7. Convert the above expression (from the previous question) to a NOR-only circuit using the **bubble method**. Assume you have access to NOR gates with whatever fan-in is required. (Do not simplify or expand the expression, convert it as-is.)

8. Draw the following circuit as a NAND-only circuit. Do not use any inverter bubbles in your circuit diagram; express all inversion operations using NAND-gates. Do not change the fan-in of any of the logic gates.