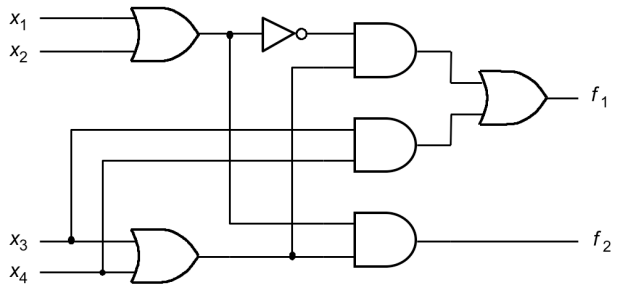
Boise State University
Department of Electrical and Computer Engineering
EE 230 Digital Systems
Test 1, Day: February 20, 2007, Location: ET 103, Time: 10:40am to 11:55am

Name: _____

Instructions: *Show all steps and logic circuits for full or partial credits. It is very important that you write clearly, so that your test can be graded appropriately and fairly. This is a closed book and closed notes test. A Boolean algebraic basic rules table has been provided.* ***ABSOLUTELY NO calculator.***

1. (35 points) Determine the truth table of the following logic circuit (4 inputs and 2 outputs). Re-implement this logic circuit using just NAND gates. Can you re-design the given circuit to one that is more cost-effective? Assuming the input variables are available in both un-complemented and complemented forms.



2. (35 points) Design the simplest circuit that has three inputs, x_1, x_2, and x_3, where x_1 is MSB and x_3 is LSB. The output must have the value of 1 when at least two of the inputs are equal to 1.

a. the truth table,
b. the simplest logic equation,
c. build the circuit using NOT, AND, and OR gates,
d. build the circuit using just NOR gates, and
e. calculate the cost of your circuit in (c) and (d) assuming that the input variables are available in both un-complemented and complemented forms.

3. (15 points) Convert these decimal numbers 35 and -77 into signed 8-bit numbers in the following representations.
a. Sign and magnitude
b. 1's complement
c. 2's complement

4. (15 points) Convert these binary numbers[1] $(1011010001)_2$ and $(1001011101)_2$ into the following representations.
a. Octal
b. Hexadecimal
c. Decimal

[1] Just binary numbers. Not sign-magnitude, 1's complement, or 2's complement.