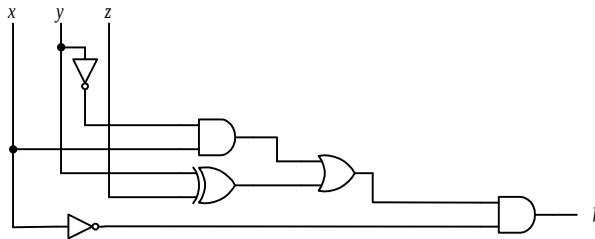


CS/EE 120A

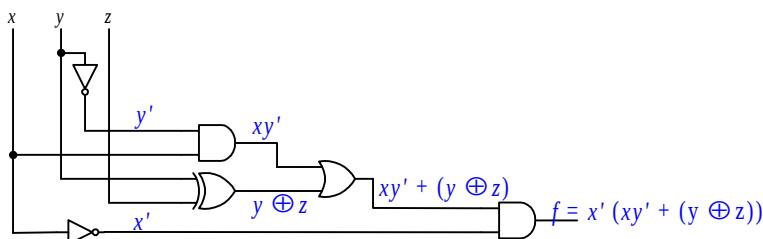
Homework #2 Given 2/15/01. Due 2/22/01

1. Derive the Boolean function that describes the following circuit:

(4 points)



Answer



$$f = x'(xy' + (y \oplus z))$$

4 points for equation

2. Synthesize (construct) a 3-bit comparator circuit that outputs a 1 if the number is greater than or equal to 5, and 0 otherwise. In other words, a circuit that outputs a 0 if the input is a number between 0 and 4, and outputs a 1 if the input is a number between 5 and 7. Use K-map to simplify your circuit. (6 points)

Answer

The truth table is as follows:

x_2	x_1	x_0	f
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

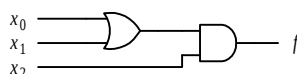
2 points for truth table

From the truth table we get the following function

$$\begin{aligned} f &= x_2x_1'x_0 + x_2x_1x_0' + x_2x_1x_0 \\ &= x_2x_1 + x_2x_0 \\ &= x_2(x_0 + x_1) \end{aligned}$$

2 points for equation

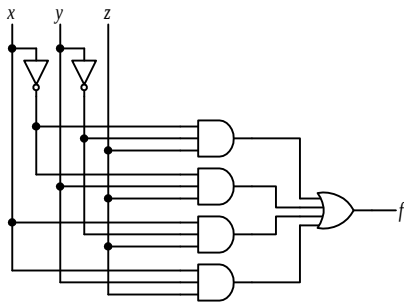
from which we can derive the following circuit



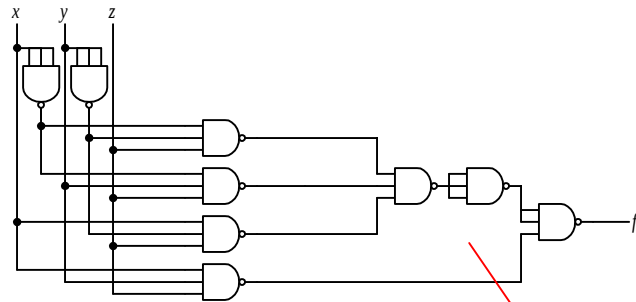
2 points for circuit

3. Convert the following circuit to use only 3-input NAND gates

(6 points)



Answer



2 points for
these NAND
gates

2 points for
these NAND
gates

2 points for changing
the 4 input OR gate to
3 input NAND gates.