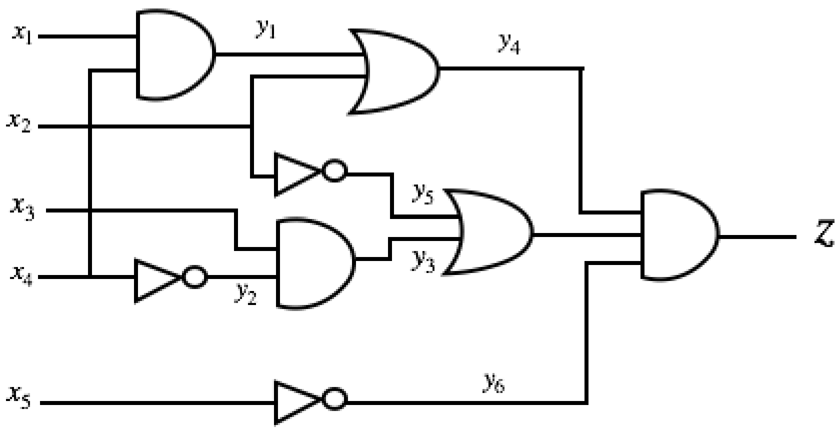
Problem 1. Consider the following Boolean formula

$$((x_1 \wedge \overline{x_2}) \vee (x_1 \wedge x_3)) \wedge (x_2 \wedge \overline{x_3})$$

with assignment to the variables $x_1, x_2 \equiv TRUE, x_3 \equiv FALSE$. Evaluate the formula.

Problem 2. Consider the following Boolean circuit, with the assignment $x_1, x_3, x_5 \equiv TRUE$, $x_2, x_4 \equiv FALSE$. Evaluate the Boolean circuit. Show your work by indicating the truth value produced by each gate.



Problem 3. Suppose you work for this company that evaluates Boolean circuits in exponential time. Since you are very smart, your manager wants you to write some code that will solve these problems in polynomial time. You have no idea of how to solve this in polynomial time. You search on the internet but do not find anything. However, your roommate tells you that he just finished writing a program called, FormulaII, that solves a boolean formula in polynomial time and would let you use it. Now you are in a position to write a program to solve boolean circuits in polynomial time. Write high level pseudo-code.

Problem 4. A Hamiltonian cycle of a graph G = (V,E) is a simple cycle that contains each vertex exactly once. It is an NP-complete problem. Do the following:

(a) Write a decision version of this NP-complete problem.

(b) Show that Hamiltonian cycle is in NP.

Problem 5. A clique in an undirected graph, G = (V,E) is a subset $V' \subseteq V$ of vertices each pair of which is connected by an edge in E. The size of a clique is the number of vertices it contains. It is an NP-complete problem. Do the following:

(a) Write a decision version of this NP-complete problem.

(b) Show that clique is in NP.