1. (a) Define conjunctive normal forms (CNF), clauses and literals of propositional logic. [6]

   (b) Describe Tseitin's encoding that translates arbitrary propositional formulas to equisatisfiable CNF, with only a linear increase in formula size. What is the price to pay? [6]

   (c) Consider the following two restrictions of CNF:

      i. there is not more than one positive literal in each clause;

      ii. no clause has more than two literals.

   For each of these two restrictions, describe a polynomial-time procedure for deciding satisfiability. [12]

   (d) Show that every CNF can be converted to another CNF which is a conjunction of the two types of formula in the previous part. In other words, in the resulting CNF, all the clauses are either unary, or binary, or have not more than one positive literal. How many additional variables are necessary for the conversion? [6]