1. Design an algorithm to solve the network flow problem on an undirected graph with each edge having capacity one and analyze its time complexity.

2. Design an algorithm to find a matching with maximum size on a tree and analyze its time complexity.

3. Express the problem of finding a maximum independent set $C$ in an undirected graph $G = (V, E)$ so that for each $(v, w)$ in $E$, at most one of $v$ or $w$ is in $C$ as an integer linear programming problem.

4. Given a satisfiable boolean formula in conjunctive normal form that consists of clauses connected by $\land$ in which each clause consists of literals connected by $\lor$ with each literal being a variable or a negated variable, design an algorithm to find a satisfying truth assignment with positive probability.

5. Give an informal description of a nondeterministic Turing machine for the language $L = \{w^c \mid w \in \{0, 1\}^*\}$ for a given constant $c$. 