

Logic Languages

11.7 Explorations

- 11.26 In Section 11.3.1 we translated propositions into *conjunctive normal form*: the AND of a collection of ORs. One can also translate propositions into *disjunctive normal form*: the OR of a collection of ANDs. Does disjunctive normal form have any useful properties? What other normal forms exist in mathematical logic? What are their uses?
- 11.27 With all the different ways to express the same proposition in predicate calculus, is there any useful notion of a “simplest” form? Is it possible, for example, to find, among all equivalent propositions, the one with the smallest number of symbols? How difficult is this task?
- 11.28 *Satisfiability* is the canonical NP-complete problem. Given a formula in propositional logic (no predicates or quantifiers), it asks whether there exists an assignment of truth values to variables that makes the overall proposition true. Can we use Prolog to solve the satisfiability problem? If not, why not? If so, given that it has to take exponential time, how can we hope to solve problems full of predicates and quantifiers quickly?
- 11.29 Suppose we had a form of “constructive negation” in Prolog that allowed us to capture information of the form $\forall X[\neg P(X)]$. What might such a feature look like? What would be its implications for the Prolog search strategy? What portions of predicate calculus (if any) would still be inexpressible?

