1. If P = NP, is SAT NP-complete?
2. Is SAT known to be NP-complete, or is SAT only conjectured to be NP-complete?
3. Is it known that SAT is not in P?
4. Show that DOUBLE-SATPL is NP-complete. You can appeal to answers to prior exercises without repeating them. (DOUBLE-SATPL is defined in problem set 0911.)
5. The Hitting Set Problem (HSP) is as follows.

**Input.** Positive integers and ; and a list of sets where for .

**Question.** Does there exist a set where and for . That is, must contain at least one member of each set .

* 1. Give a polynomial-time evidence checker for HSP. Be sure that it is correct for every input and that your description is clear and easy to understand.
  2. Give a polynomial-time reduction from the the Vertex Cover Problem (VCP) to HSP. Be sure that the reduction is correct for all possible inputs. Describe the reduction in a clear, readable way. Be sure that I can find your definition of the reduction. Just words describing what the reduction might do are not adequate.
  3. Are the results of parts (a) and (b) of this problem sufficient for you to conclude that HSP is NP-complete? Explain why or why not.
  4. Does there exist a polynomial-time reduction from HSP to VCP? Either argue that there probably is no such reduction or explain why there must exist such a reduction.