

## Exercise 9.1

## Exercise 9.2

- (a) No, the statement is not correct. A language can be in both P and NP because P represents problems solvable in polynomial time, while NP represents problems verifiable in polynomial time. Being verifiable in polynomial time does not preclude a problem from also being solvable in polynomial time, thus allowing a language to belong to both classes.
- (b) The statement is not necessarily true. If  $X$  is an NP-complete problem and  $Y$  is a problem with  $X \leq Y$  (meaning  $Y$  is polynomial-time reducible to  $X$ ), it does not automatically imply that  $Y$  is NP-complete. The NP-completeness of a problem is not preserved under polynomial-time reductions in the general case.

## Exercise 9.3

I cannot prove that all languages in NP are decidable because it is not true. In fact, the question of whether P (class of problems decidable in polynomial time) is equal to NP is an open problem in computer science. If  $P = NP$  were proven, it would imply that all languages in NP are decidable. However, as of now, it remains an unsolved question.