

Ground Rules

- Grading. You will be graded on the correctness as well as clarity of your solutions. You are required to prove any claims that you make. In particular, when you are asked to design an algorithm, you must argue its correctness and running time.
- Collaboration. You are allowed to discuss questions with other people in the class. However, **you must solve and write your answers yourself without any help**. You must also give explicit citations to any sources besides the textbook and class notes, including discussions with classmates. Solutions taken from external sources such as the WWW, even if cited, will receive no credit unless there is significant “value added”. In cases of doubt, you may be asked to explain your answer to the instructor and this will determine your grade.
- Lateness. Please see the class webpage for details on the lateness policy.
- This homework is due in **one week**. Start working early. Plan your work in such a way that you have the opportunity to put some problems on the back burner for a while and revisit them later. Good luck!

Problems

1. (Read-Thrice 3-SAT.)

- (a) Consider the following simpler version of 3-SAT: We are given a 3-CNF formula with the property that each variable appears at most thrice in the formula as itself or its negation (that is, the formula reads each variable at most thrice). An example of such a formula is given below.

$$(U \vee V \vee \overline{W}) \wedge (\overline{U} \vee X \vee \overline{Y}) \wedge (W \vee X \vee Y) \wedge (\overline{U} \vee \overline{X} \vee Z) \wedge (\overline{V} \vee \overline{Z})$$

We are asked to find a satisfying assignment for this formula. Prove that this problem is NP-complete.

- (b) In a further simplification of this problem, we are given a formula in which each variable appears **exactly** three times and each clause contains **exactly** three literals. Prove that such a formula is always satisfiable and give an algorithm for finding a satisfying assignment.

(Hint: Reduce this problem to the bipartite matching problem, matching clauses to literals.)

2. Problem 8.31 in the textbook (p. 520).
3. Problem 8.32 in the textbook (p. 521).