

# Homework 7

---

**Due** Nov 6 by 8am      **Points** 20      **Submitting** a file upload      **File Types** pdf  
**Available** Oct 30 at 8am - Nov 6 at 8am

---

This assignment was locked Nov 6 at 8am.

## Suggested reading

### Chapter 7.1 and 7.4

#### Practice problems *(do not turn in)*

1. **[DPV] Problem 7.1** (Can you use the dual LP to prove it's optimal?)
2. **[DPV] Problem 7.4** (LP for Duff beer)
3. **[DPV] Problem 7.5** (LP for canine products)
4. **[DPV] Problem 7.6** (Give an example of an LP with unbounded feasible region but bounded optimum.)
5. **[DPV] Problem 7.11** (dual to the example)
6. **[DPV] Problem 7.12** (prove that point (1.5, 0.5, 0) is optimal)

#### Graded problem

(a) Some problems are formulated very closely to well known **NP-hard** problems, but they turn out to be in **P**. Here is an example.

**AllorNothing3SAT** takes as input a boolean formula in CNF such that all clauses have three literals, and returns an assignment of the variables such that each clause has all TRUE literals or all FALSE literals, if such assignment exists. Design an efficient algorithm to solve **AllorNothing3SAT**.

*Hint: read the book! And remember that 2-SAT is in the class P.*

(b) Now consider a new variant of 3-SAT, we will call the **3-at most-3-SAT**:

**Input:** A boolean formula in CNF such that all clauses have at most three literals, and every variable appears in at most three clauses.

**Output:** An assignment of the variables such that the boolean formula returns True, or report NO if such assignment does not exist.

Prove that the **3-at most-3-SAT** problem is NP-complete.

*Hint: read the book again!*