General rules for solving exercises

- This is a theory course, which means: if an exercise does not explicitly say "you do not need to prove your answer" or "justify intuitively", then a formal proof is always required.

- All exercises and their solutions, no matter whether they are graded or regular/optional ones, are part of the material relevant for the two exams.

- Some of the exercises are marked as "in-class", which means that we do not expect you to solve them before the exercise session. Instead, your teaching assistant will solve them with you in class.

- You are highly encouraged to solve all other exercises (those not marked as "in-class") on your own and to hand in a writeup of your solutions no later than the due date. If you choose to do so, please write the name of your teaching assistant on the front sheet.

The following exercises will be discussed in the exercise class on November 19, 2014. Please hand in your solutions not later than November 18.

Exercise 1: Certificates for Infeasibility of Systems of Linear Equations

(Exercise 6.4 from the lecture notes)
Prove that a system $Ax = b$ of linear equations is unsolvable if and only if there is $y$ with $A^Ty = 0$ and $b^Ty = 1$.

Exercise 2: Equivalence of the Three Farkas Lemmas

(Exercise 6.5 from the lecture notes)

(a) Explain why the $y$ as in Lemma 6.5 indeed certify the nonexistence of a nonnegative solution.

(b) Prove that all of the three variants of the Farkas lemma, I–III, are mutually equivalent. (Or do at least one of the implications.) You may want to look to Exercise 6.2 for inspiration.

Exercise 3: Strong Duality

(Exercise 6.6 from the lecture notes)
Find an example of a specific linear program (P) for each of the cases in Theorem 6.6.