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First name _____

LARSON—OPER 731—CLASSROOM WORKSHEET 09
Theorem of the Alternatives—Complementary Slackness

We showed that the following system (I.) is *infeasible*:

$$(1) \ x_1 + x_2 \leq 1$$

$$(2) \ x_1 - x_2 \leq -2$$

$$(3) \ -x_1 \leq 0$$

$$(4) \ -x_2 \leq 0.$$

and that the following system (II.) is feasible:

$$y_1 + y_2 - y_3 = 0$$

$$y_1 - y_2 - y_4 = 0$$

$$y_i \geq 0$$

$$y_1 - 2y_2 < 0$$

1. Check. Check that $1 \cdot (1) + 1 \cdot (2) + 2 \cdot (3)$ is a non-negative linear combination of the equations in system (I.) that is inconsistent.

2. Check that there is a feasible solution of (II.) with $y_1 = 1$, $y_2 = 1$ and $y_3 = 2$.

3. What is the *Theorem of the Alternatives*?

4. What is the *Farkas Lemma*?

5. What is the *Weak Duality Theorem*?

6. What is the *Strong Duality Theorem*?

7. What does it mean for a feasible solution x of the primal LP P and a feasible solution y of the dual LP D to be *complementary*? What's an example?

8. What is the *Weak Complementary Slackness Theorem*?

9. What is the *Strong Complementary Slackness Theorem*?