

# INFEASIBLE PROBLEM EXAMPLE

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# Infeasible Problem Example

$$\begin{array}{llllll} \max & & -x_1 & -x_2 & -x_3 & \\ \text{s.t.} & x_1 & -x_2 & & & \leq 5 \\ & & x_2 & -x_3 & & \leq 4 \\ & -x_1 & & +2x_3 & & \leq -10 \\ & x_1, & x_2, & x_3 & & \geq 0 \end{array}$$

# Initial Primal Dictionary

$x_4$	5	$-x_1$	$+x_2$	
$x_5$	4		$-x_2$	$+x_3$
$x_6$	-10	$+x_1$		$-2x_3$
$z$		$-x_1$	$-x_2$	$-x_3$

Infeasible



Dualize

$y_4$	1	$+y_1$		$-y_3$
$y_5$	1	$-y_1$	$+y_2$	
$y_6$	1		$-y_2$	$+2y_3$
$w$	0	$-5y_1$	$-4y_2$	$+10y_3$

Feasible!

# Dual Simplex Method

$y_4$	1	$+y_1$		$-y_3$
$y_5$	1	$-y_1$	$+y_2$	
$y_6$	1		$-y_2$	$+2y_3$
$w$	0	$-5y_1$	$-4y_2$	$+10y_3$



$y_3$  enters  
 $y_4$  leaves

$y_3$	1	$+y_1$		$-y_4$
$y_5$	1	$-y_1$	$+y_2$	
$y_6$	3	$+2y_1$	$-y_2$	$-2y_4$
$w$	10	$+5y_1$	$-4y_2$	$-10y_4$

$y_1$  enters  
 $y_5$  leaves



$y_3$	2	$-y_5$	$+y_2$	$-y_4$
$y_1$	1	$-y_5$	$+y_2$	
$y_6$	5	$-2y_5$	$+y_2$	$-2y_4$
$w$	15	$-5y_5$	$+y_2$	$-10y_4$

DUAL UNBOUNDED  
= PRIMAL INFEASIBLE

# Initialization Using Dual (Summary)

- ① Change problem objective to  $\sum_{j=1}^n -x_j$
- ② Construct initial primal dictionary  $D_0$
- ③ Convert to dual dictionary.
- ④ Perform optimization phase simplex on dual.
- ⑤ If UNBOUNDED, original primal is INFEASIBLE.
- ⑥ If Optimal Solution found,
  - a) Convert back to primal
  - b) Restore original objective function.