Math 340 HW 1 -1

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1) Three founding fathers of Linear Programming:

- Kantorovich
- Von Neumann
- Dantzig

see article attached

2) Put following linear programming problem in standard inequality form

$$\min \; x_1 - 3x_2$$

subject to $x_1 + x_2 = 2$

$x_1 \geq 3$

x_2 unconstrained

$\Rightarrow \max \; -x_1 + 3x_2 \quad (\min f = -\max(-f))$

s.t. $x_1 + x_2 = 2 \quad (x = a \Leftrightarrow x \leq a \;\&\; -x \geq a)$

$x_1 \geq 3 \quad (x \geq a \Leftrightarrow x - a \geq 0)$

x_2 unconstrained $(x = x^+ - x^-,\; x^+, x^- \geq 0)$

$\Rightarrow \max \; -x_1 + 3x_2$

s.t. $x_1 + x_2 \leq 2$

$-x_1 - x_2 \leq -2$

let $x_1 = x_1' - 3 \Rightarrow x_1' \geq 0$

$x_2^+, x_2^- \geq 0$

replace all other $x_1 = x_1' - 3$, $x_2 = x_2^+ - x_2^-$ $\Rightarrow$

$\max \; -(x_1' - 3) + 3(x_2^+ - x_2^-)$

s.t. $x_1' - 3 + x_2^+ - x_2^- \leq 2$

$-(x_1' - 3) - (x_2^+ - x_2^-) \leq -2$

$x_1', x_2^+, x_2^- \geq 0$

$\Rightarrow$ finally

$\max \; -x_1' + 3x_2^+ - 3x_2^- + 3$ or $\max \; -x_1' + 3x_2^+ - 3x_2^-$ ($\max(f + \text{const}) \Leftrightarrow f$)

$-x_1' - x_2^+ + x_2^- \leq -5$

s.t. $x_1' + x_2^+ - x_2^- \leq 5$

$-x_1' - x_2^+ + x_2^- \leq -5$

$x_1', x_2^+, x_2^- \geq 0$