Optimization Hw2

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Problem 1

Let λ_1 and λ_2 be the dual variables of the first two constraints, repsectively, let θ_i be the dual variable for each x_i sign constraint, and let δ be the dual variable of the equality constraint. The the Langragian is:

$$\begin{gathered} L(x,\lambda,\theta,\delta) = -a_1x_1 - a_2x_2 - a_3x_3 \\ +\lambda_1(b_1x_1 + b_2x_2 + b_3x_3 - e_1) \\ +\lambda_2(-c_1x_1 - c_2x_2 + e_2) \\ -\theta_1x_1 - \theta_2x_2 + \theta_3x_3 + \delta(d_3x_3 - e_3) \end{gathered}$$

Which when reararanged gives:

$$\begin{gathered} L(x,\lambda,\theta,\delta) = (-a_1 + \lambda_1b_1 - c_1\lambda_2 - \theta_1)x_1 \\ +(-a_2 + \lambda_1b_2 - c_2\lambda_2 - \theta_2)x_2 \\ +(-a_3 + \lambda_1b_3 + \theta_3 + \delta d_3)x_3 \\ +(-\lambda_1e_1 + \lambda_2e_2 - \delta e_3) \end{gathered}$$