

Consider the following constrained minimization problem and the KKT necessary conditions for a minimum.

$$\text{Min}_{\mathbf{x}} f(\mathbf{x})$$

Subject to

$$\mathbf{h}(\mathbf{x}) = \mathbf{0}$$

$$\mathbf{g}(\mathbf{x}) \leq \mathbf{0}$$

$$\nabla_{\mathbf{x}} f(\mathbf{x}^*) + \nabla_{\mathbf{x}} \mathbf{h}(\mathbf{x}^*) \boldsymbol{\lambda}^T + \nabla_{\mathbf{x}} \mathbf{g}(\mathbf{x}^*) \boldsymbol{\mu}^T = \mathbf{0}$$

$$\mathbf{h}(\mathbf{x}^*) = \mathbf{0}; \quad g_k(\mathbf{x}^*) \leq 0$$

$$\mu_k g_k(\mathbf{x}^*) = 0; \quad \mu_k \geq 0; \quad k = 1, 2, \dots, p$$

Variables: $n+m+p$

Equations: $n+m+p$

Number of inequalities: $2p$

Explain in your own words, **without referring to notes or any other material online**, why Lagrange multipliers corresponding to inequality constraints should be non-negative.