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An Alterative Set of Constraints - The Theorems of the Alternative

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A typical Theorem of the Alternative shows that corresponding to any given system of linear constraints, system I, there is another associated system of linear constraints, system II, based on the same data, satisfying the property that one of the systems among I and II is feasible if and only if the other is infeasible. These theorems have direct applications in the derivations of optimality conditions. This project explores the Theorems of the Alternative as they are found in linear programming, projection theory, and linear complementarity. Farkas' Theorem, Gordan's Theorem, and Tucker's Theorem are considered in particular. In addition, this project investigates Pye and Webster's claim (1989) that each theorem can be easily proven using the geometric form of Gordan's Theorem of the Alternative with the proper subspaces.