Linear Programming

Lecture 3

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Pitfalls

- Initialization
- Iteration
- Termination
Initialization

We will discuss in more details later on.

Now we assume our problems have *feasible origin* -

\[ x_1 = x_2 = \cdots = x_n = 0 \]

is a feasible solution *iff* all \( b_i \)'s are nonnegative.
Iteration

Fact 1  *If there is no candidate for entering variable then the solution is optimal.*

Fact 2  *If there is no candidate for a leaving variable then the problem is unbounded.*
Degeneracy

Basic solutions with with one or more basic variable at zero are called \textit{degenerate}.

Simplex iterations that do not change solutions are called \textit{degenerate}.
Termination

*Cycling* - if after iterations you arrive at the same dictionary.

**Theorem 3** *If the simplex method fails to terminate then it must cycle.*
Avoiding cycling

- Perturbation method and lexicographic rule.

**Theorem 4** The simplex method terminates as long as leaving variable is selected by the lexicographic rule.

- Smallest subscript rule.

**Theorem 5** The simplex method terminates if entering and leaving variables are selected using the smallest subscript rule.