Chapter 3 Wrap-up and Section 5.1

Simplex Method and Sets

February 9, 2016

Shipping Example: Three Variables

Suppose that a Michigan fruit farmer has stores in Chicago, IL and Grand Rapids, MI and farms in Holland, MI and Traverse City, MI. The cost of shipping a pound of apples from Holland to Chicago is \$6 and from Holland to Grand Rapids is \$3. The cost of shipping a pound of apples from Traverse City to Chicago is \$9 and from Traverse City to Grand Rapids is \$5.

Suppose that the Chicago store orders 25 pounds of apples, and the Grand Rapids store orders 30 pounds. Suppose further that the Holland farm has 45 pounds of apples and the Traverse City farm has 40 pounds.

What is the cheapest way to supply the orders for apples?

Linear programming for three variables

Suppose you want to compute a linear programming problem with the following constraints:

$$\begin{cases} x + y \leqslant 5 \\ x + y \geqslant 1 \\ x + z \leqslant 5 \\ x + z \geqslant 1 \\ y + z \leqslant 6 \\ y + z \geqslant 1 \end{cases}$$

Find a vertex of the feasible set.

Finding every vertex of the feasible set isn't very efficient.

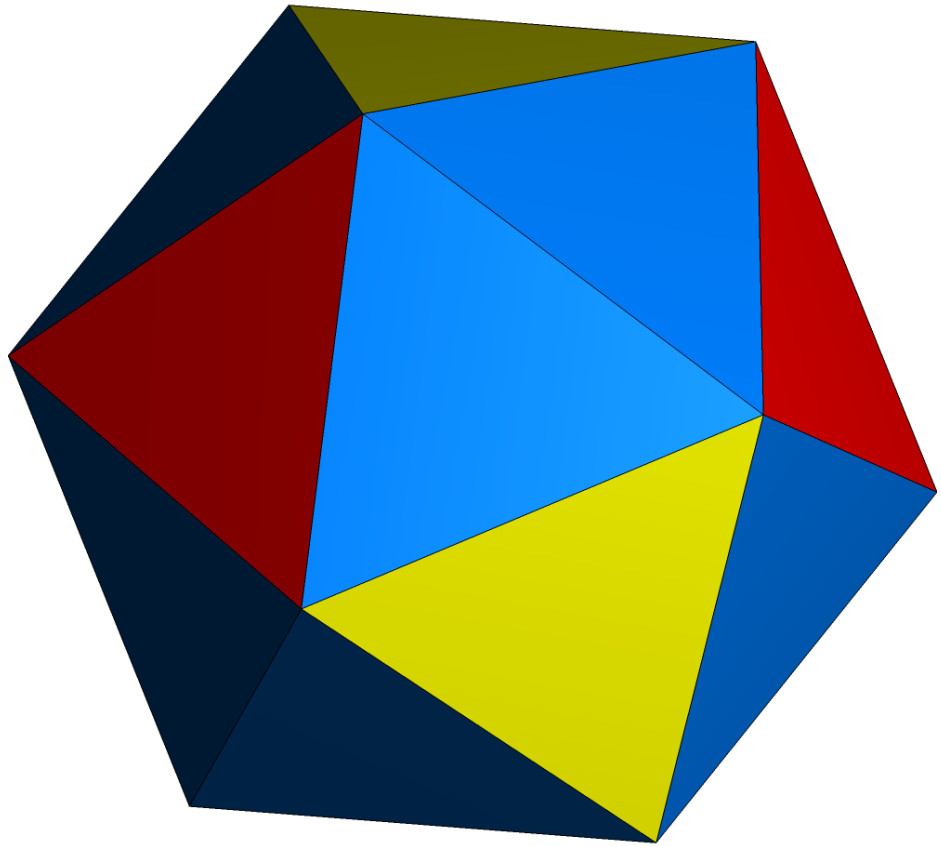

Figure: "Uniform polyhedron-33-s012". Licensed under Public Domain via Wikimedia Commons

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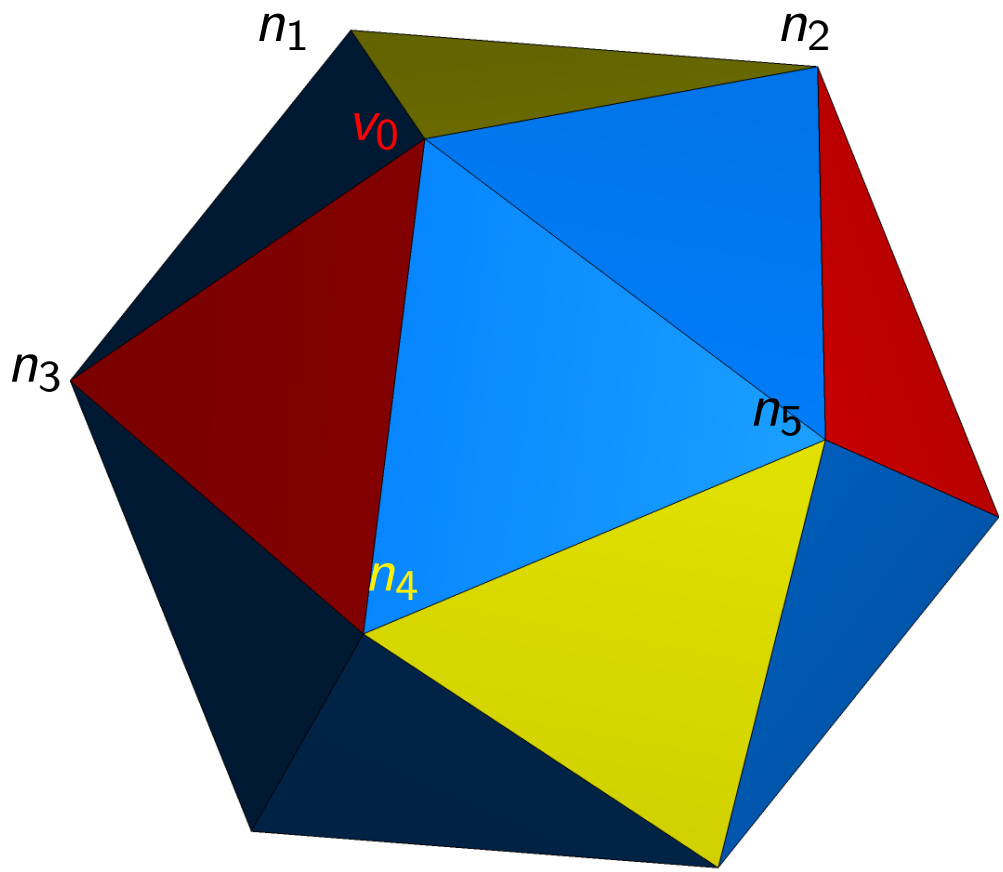

Figure: "Uniform polyhedron-33-s012". Licensed under Public Domain via Wikimedia Commons

Skeleton of a feasible set

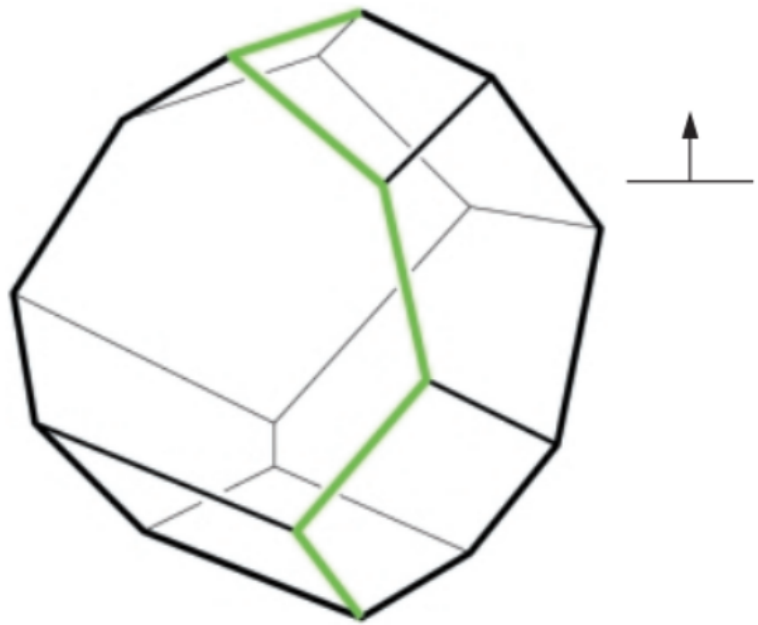

FIGURE 4

A possible path "to the top" taken by a simplex algorithm.

Sets

Definition

A **set** is any collection of objects.

The objects belonging to a set are its **elements**. We use brackets to denote a set: $\{STUFF\}$.

- The set of odd numbers between 1 and 7: $\{1, 3, 5, 7\}$.
- The set of cats in my home: {Abby and Linus}
- The set that has no elements
- The set possible outcomes when tossing a coin twice: $\{HH, HT, TH, TT\}$
- The set of two letter words using the letters A and B: $\{AA, AB, BA, BB\}$

Key Property

IMPORTANT

A set does not see any distinction between its elements. No one element is better (or bigger).

The elements of a set are **not ordered**.