Why Python?

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    - functional languages (like Lisp, Haskell)

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    - functional languages (like Lisp, Haskell)
- ... is used by many industries (Google, etc.).

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- process data (particularly text) and/or crawl the internet.

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- I made a *lot* of assumptions. Do I still have a useful approximation?

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  - Break the text of the file into pieces.
  - Building a dictionary data structure.

Python Code

Input: A file F of emails.
Output: A mapping of words to conditional probabilities.

```
W = open("emails.txt").read().split()
D = {}

for w in W:
    if w not in D:
        D[w] = 1
    else:
        D[w] = D[w] + 1

for w in D:
    D[w] = D[w]/len(W)
```

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Python Solution: 93 lines of code.
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Moral: If you want to know "Is my theory correct?", maybe code-correctness and ease of implementation matter more than speed and maintainability.

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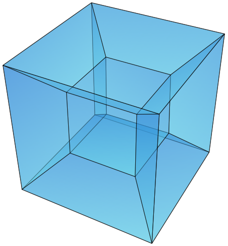
- Let's see an example!

Python, Sage, and Visualization

Common Geometry Problem: Visualizing examples in $\mathbb{R}^3$.
Example: Consider a *hyper-rectangular prism*.



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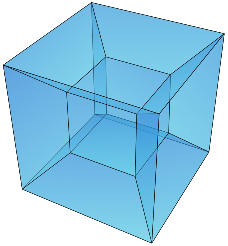

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Research Problem: Investigate geodesics on this space, based on (x, y, z).

Hyper-rectangular Prism

Calculation Problem:

Hyper-rectangular Prism

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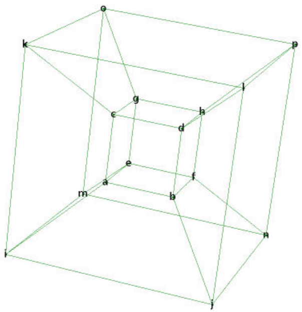
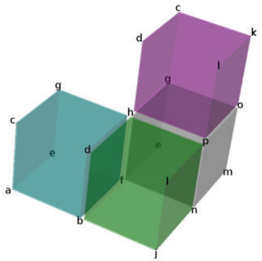
- Easy: How does a geodesic move through **one** cell?





A “tumbling” of the hyper-rectangular prism.

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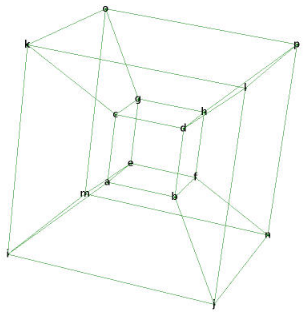

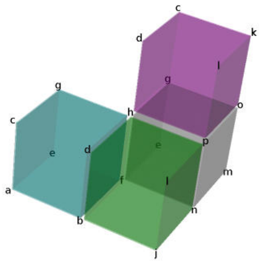

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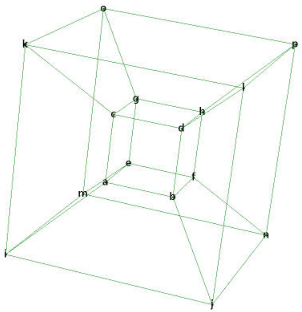

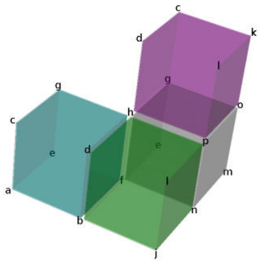

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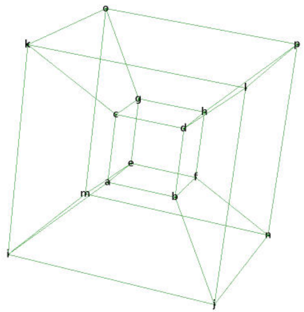

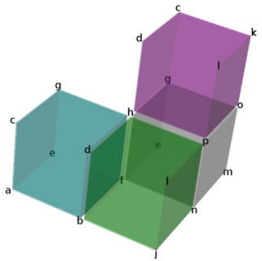

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How can I get all of this in one procedure call?

```
def drawCube( eCube,
              showEdgesTuple=(False,False,False),
              showVertexLabelPred=(lambda vert: True),
              colorCube=False ):
```

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- **Bad Assumption:** If I need a C library, my whole program must be in C.
- Price of this assumption: $\sim$ 3000 lines of hard-to-modify C code. (Replaced by $\sim$ 600 lines of easy Python code.)

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  - Call Python from C/C++
  - Pass data between languages (without writing/parsing text files).

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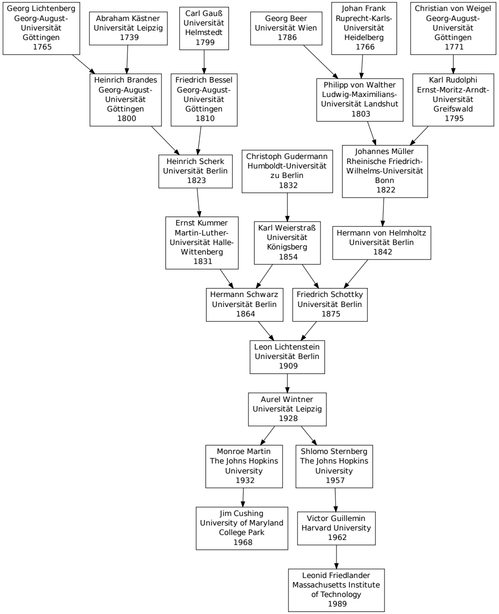
Georg Lichtenberg Georg-August-Universität Göttingen 1765
Abraham Kästner Universität Leipzig 1739
Carl Gauß Universität Helmstedt 1799
Georg Beer Universität Wien 1786
Johan Frank Ruprecht-Karls-Universität Heidelberg 1766
Christian von Weigel Georg-August-Universität Göttingen 1771
Heinrich Brandes Georg-August-Universität Göttingen 1800
Friedrich Bessel Georg-August-Universität Göttingen 1810
Philipp von Walther Ludwig-Maximilians-Universität Landshut 1803
Karl Rudolphi Ernst-Moritz-Arndt-Universität Greifswald 1795
Heinrich Scherk Universität Berlin 1823
Christoph Gudermann Humboldt-Universität zu Berlin 1832
Johannes Müller Rheinische Friedrich-Wilhelms-Universität Bonn 1822
Ernst Kummer Martin-Luther-Universität Halle-Wittenberg 1831
Karl Weierstraß Universität Königsberg 1854
Hermann von Helmholtz Universität Berlin 1842
Hermann Schwarz Universität Berlin 1864
Friedrich Schottky Universität Berlin 1875
Leon Lichtenstein Universität Berlin 1909
Aurel Wintner Universität Leipzig 1928
Monroe Martin The Johns Hopkins University 1932
Shlomo Sternberg The Johns Hopkins University 1957
Jim Cushing University of Maryland College Park 1968
Victor Guillemin Harvard University 1962
Leonid Friedlander Massachusetts Institute of Technology 1989

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Thanks!