CS 357

In-class activity: Complexity of Matrix-Matrix Multiplication

Overview

- Big O notation
- Python
- Building models

Recap: Understanding Asymptotic Behavior, $O(\cdot)$ Notation

Demo: Cost of Matrix-Matrix Multiplication

- Can we say anything exact about our results?
- How do we say something exact without having to predict individual values exactly?

$$\mathrm{Time}(n) \approx C \cdot n^3$$

$$\underline{\mathrm{Time}(n) = O(\overset{n^3}{g}(n))}$$

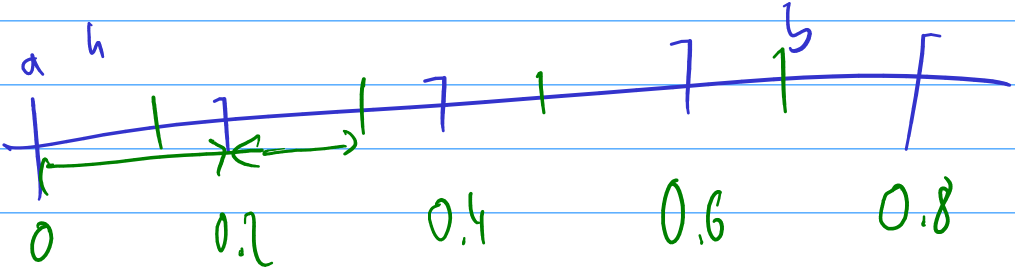
$$\mathrm{Time}(n) \leq \underset{\text{There exists}}{C} \cdot g(n)$$

as soon as $n \geq n_0$

Suppose truth:

$$\mathrm{Time}(n) = \boxed{\underline{5 n^3} +} \underline{200 \cdot n^2}$$

$$\text{Error}(\underset{\uparrow}{h}) = O(\underline{h^3}) \qquad \left(\begin{array}{c} \cancel{h \to \infty} \\ h \to 0 \end{array} \right)$$



Making Predictions with $O(\cdot)$-Notation

- Suppose you know that $\text{Time}(n) = O(n^2)$. And you know that for $n_1 = 1000$, the time taken was 5 seconds. Estimate how much time would be taken for $n_2 = 2000$.

Part 1:
Models, Errors, and Numbers

1 Python, Numpy, and Matplotlib

Programming Language: Python/numpy

- Reasonably readable
- Reasonably beginner-friendly
- Mainstream (top 5 in 'TIOBE Index')
- Free, open-source
- Great tools and libraries (not just) for scientific computing
- Python ~~2~~/3? 3!
- `numpy`: Provides an array datatype
  Will use this and `matplotlib` all the time.
- See class web page for learning materials

- **Demo:** Python
- **Demo:** numpy
- **In-class activity:** Image Processing

2 Making Models with Polynomials