Introduction

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Parts of the course materials are courtesy of Prof. Roger Jang

Scientific Computing

- We have learned many concepts and theorems in Linear Algebra and other Math courses
  - Rank, null space…
  - Linear transformation
  - Eigenvalues
  - Gauss elimination
  - QR decomposition
  - …
- But where are their applications?
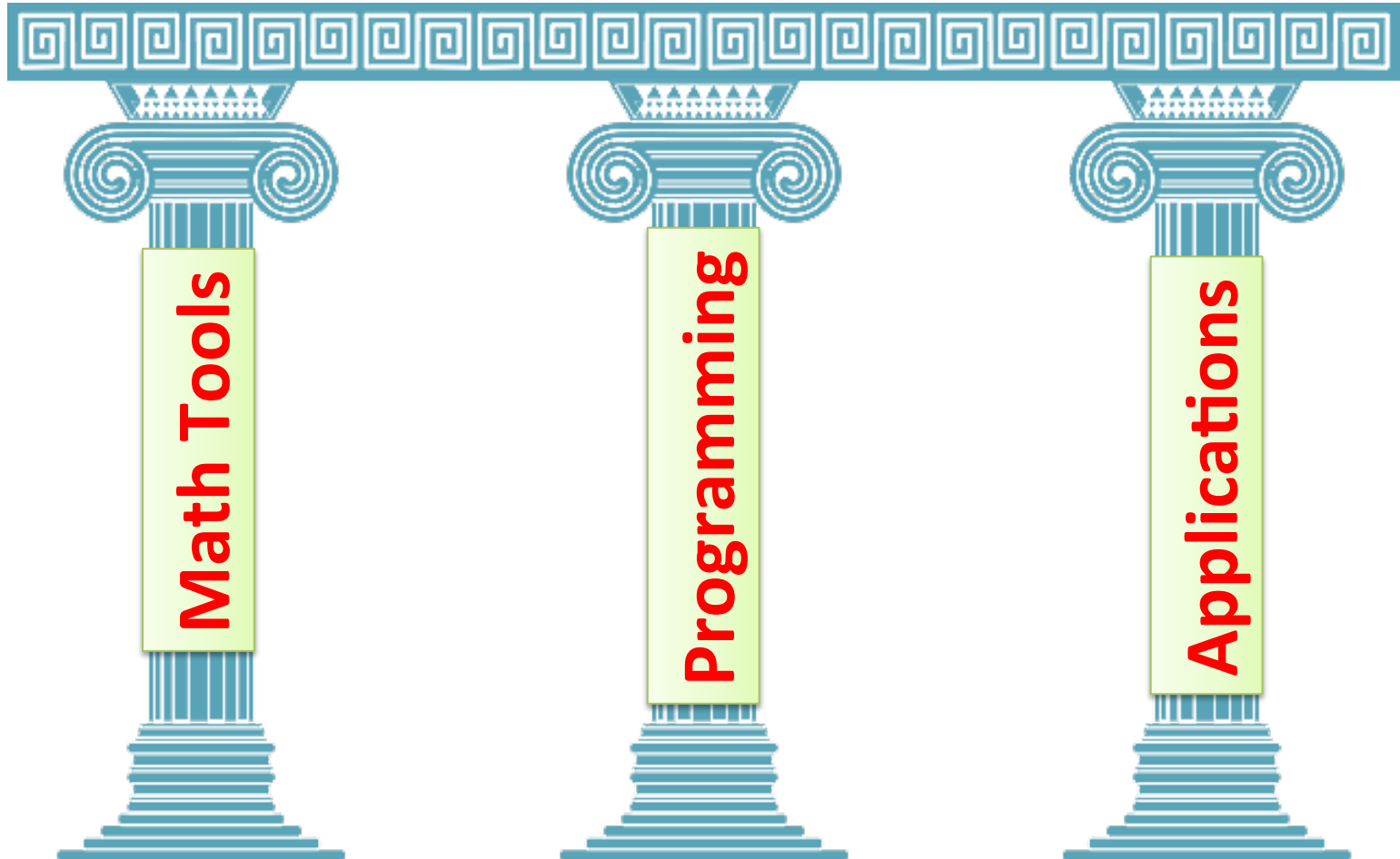- More importantly, how do we write code to solve the real problems!

Approach of This Course

- Application orientated!

- We focus on
  - Problem solving
  - Hands-on coding
  - Data/approach visualization
  - Real-world applications

- We will learn how to write programs solving real-life problems

Three Pillars of This Course

Math Tools

Programming

Applications

Math Tools

- Least-squares estimate
- Approximation
- Interpolation
- PDF modeling
- Data clustering
- Pattern recognition
- Dynamic programming
- Numerical optimization
- ……

Programming

- Symbolic computing

- Numerical computing

- Matrix computation

- Programming paradigms

- Animation and visualization

- Audio and image processing

- …

Applications

- Personal financial computing
  - Loan and mortgage
  - Insurance
- Least-square estimate
  - Data fitting
- Data clustering
  - Image data compression
  - Object identification
- Classification
  - Texts, audio, images…

- Principal component analysis
  - Dimensionality reduction
  - Data fitting
- Page rank
  - Google's page rank
  - Team ranking
- Dynamic programming
  - Object tracking
- Fractals
- …….

Prerequisites

- STEM (science, technology, engineering, and mathematics) students
  - Calculus: must
  - Linear algebra: must
  - Probability: better to have taken it already
- Non-STEM students
  - Please talk to me before taking the course

Course Format

- Time: Tuesdays 1:20 – 2:10 p.m. and Fridays 1:20 – 3:10 p.m.
- Location: EECS 323, MAC Lab
- Office hour: Tuesdays 2:10 – 3:00 p.m., Delta 643
- TA:
  - Mu-Che Lee (morton7932 AT gmail.com)
  - Daniel Huang (buzzfirefox AT gmail.com)
  - Meng-Chen Tsai (tony830705 AT gmail.com)
- Labs (weekly assignment demo): Tuesdays 7:00 – 9:00 p.m., EECS 323
- Website: http://nmsl.cs.nthu.edu.tw/index.php/courses

Tentative Plan and Textbooks

- Mathematics typesetting with Latex (3 weeks)
  - "More Math Into Latex", G. Gratzer, 4th Ed., Springer, available online at NTHU's Library at http://link.springer.com/book/10.1007%2F978-0-387-68852-7
- Symbolic computing with SageMath (3 weeks)
  - "Sage for Undergraduates", G. Bard, American Mathematical Society, online version at http://www.gregorybard.com/books.html
- Numerical computing and visualization with Matlab (10 weeks)
  - "Experiments with Matlab", C. Moler, available online at http://www.mathworks.com/moler/exm/index.html
  - "Numerical Computing with Matlab", C. Moler, available online at http://www.mathworks.com/moler/index_ncm.html

Grading

- Weekly assignments (40% + 5% Bonus): 15 times, 3% each
  - Assignments are given on the last slide of each topic
  - Students turn in their assignments during weekly labs
  - TAs grade assignments during labs
  - Scores will be announced online in real-time
- Midterm (25%) on Latex and SageMath
- Final Exam (35%) on Matlab
- I have never done curving for several years, and I intent to keep it in this way

Questions?