Conclusion

CS 205A:
Mathematical Methods for Robotics, Vision, and Graphics

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Course Topics I

1. Numerics
- ► Stability and error analysis
- ► Floating-point representations

2. Linear algebra
- ► Gaussian elimination and LU
- ► Column spaces and QR
- ► Eigenproblems
- ► Applications

3. Root-finding and optimization
- ► Single-variable
- ► Multivariable
- ► Constrained optimization

Course Topics II

- ► Iterative linear solvers: Conjugate gradients and friends

4. Interpolation and quadrature
- ► Approximating integrals
- ► Approximating derivatives

5. Differential equations
- ► ODEs: time-stepping, discretization
- ► PDEs: Poisson equation, heat equation, waves
- ► Techniques: Differencing, applications

Two Roles

- **Client** of numerical methods

- **Designer** of numerical methods

Variational Viewpoint

Minimize objective **subject to** constraints

- $A\vec{x} = \vec{b} \iff \min \|A\vec{x} - \vec{b}\|_2^2$
- $A^\top A\vec{x} = \lambda\vec{x} \iff \min \|A\vec{x}\|_2 \text{ s.t. } \|\vec{x}\|_2 = 1$

What Next?

- **More depth:** Anything in ICME!

- **Applications:**
    - CS 221 - AI
    - CS 223A - Introduction to Robotics
    - CS 229 - Machine Learning
    - CS 231A - Computer Vision
    - CS 248 - Interactive Computer Graphics
    - CS 348A/B/C - Computer Graphics (Geom/Imag/Anim)
    - CS 334A - Convex Optimization I
    - CS 448J
    - . . .

Final Exam

- ▶ Cumulative
- ▶ Similar format to midterm
- ▶ **Two** sheets of notes
- ▶ Gates B01

Thanks!

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