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

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

What Next?

- More depth: Anything in CME!
- Applications:
  CS 231A, CS 221/229, CS 248/348,
  CS 334A

Final Exam

- Cumulative
- Similar format to midterm
- **Two** sheets of notes
- Gates B03

Thanks!

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