AM 205 Final Projects, Fall 2025

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Deadline. 5pm, Tue 9 December, uploaded as a pdf file on Gradescope under either author's name. Later submissions will lose 20% per day.

Teams. Students should normally work in pairs. Solo projects are permitted, but ≥ 3 authors are not.

Project proposal. By Friday 7 November at 5:00 pm, please upload to Gradescope a page indicating the proposed authors, tentative title, topic, and most relevant chapter of Heath (see below) for your project. This will count for 1% of the course grade and will be marked by completion — i.e., you get the 1% if you upload a valid proposal, regardless of the content. We will aim to give you feedback quickly afterwards, and you are free to contact me at any time in advance for advice and feedback.

Scale. Maximum 10 pages including figures and references, with 1 inch or larger margins. We recommend a 12pt font, or double spacing if you use a 10pt or 11pt font. There may be an appendix beyond the 10 pages, typically for program listings, but this will be looked at more superficially.

Academic integrity. All projects must be the work of your team and nobody else. You may discuss matters with other people, but the coding and writing must be your own. Any figures or text taken from other sources, including the web, must be explicitly referenced. Any use of AI tools must be explicitly and fully described. We repeat this (not least since it differs from the AI policy for the rest of the course): *Any use of AI tools must be explicitly and fully described.* If it is clear that parts of your project have been produced by AI and you don't explain this fully, you will lose points.

Page zero. Begin your writeup with a page with four short declarations:

1. *Textbook Chapter* should state which chapter of Heath's textbook your work is close to. To remind you, these are

1. Scientific computing
2. Systems of linear equations
3. Linear least-squares
4. Eigenvalue problems
5. Nonlinear equations
6. Optimization
7. Interpolation
8. Numerical integration and differentiation
9. Initial value problems for ODEs
10. Boundary value problems for ODEs

Later chapters in the book might also be used if you wish. The point is not that you must confine your attention to one chapter, not at all, but that you should be sure that your work is at least rooted in one of the topics of this course.

2. *Contributions of the Authors* should summarize how the two of you contributed (e.g. tell us if one did most of the programming and the other did most of the writing).

3. *Use of AI Tools* must describe fully what AI tools you used and for what purpose (e.g. help with writing, coding, research).

4. *Other Sources* should list people you discussed the work with or who otherwise helped you along the way. Of course in addition to these items, the project still needs to cite sources in the usual manner within the text and in a bibliography at the end.

Topics

(1) AM205 is a course in scientific computing, not machine learning. There are important overlaps of these fields, but to keep things clear and simple, the rule is that AM205 projects should not involve machine learning.

(2) Every project must involve significant computing. Laptops and desktops are fine — we do do not expect high-performance work — but computing must be a significant part of what you do.

(3) A good formula for a project is to explore some aspect of an algorithm in some detail. For example you might pick a topic mentioned perhaps only superficially in lectures (numerical instability of Gaussian elimination, iterative linear algebra, randomized linear algebra, algorithms for linear programming, Google PageRank, Gauss quadrature, Chebyshev expansions, Chebfun vs. Matlab `roots`, pseudospectra, LAPACK, eigenvalues of random matrices, BFGS iteration, numerical solution of chaotic ODEs, spectral methods for ODE BVPs, ...) and explore it. There are numerous further possibilities, for which you can find ideas in almost any section of the textbook.

(4) Alternatively, you may prefer to pursue an application. That is fine, so long as there is significant emphasis on scientific computing. Of course, every AM205 project must be written for AM205; it is not appropriate to recycle a project you have used in another context.

(5) Most important: pick a subject you're excited by!

Novelty. The final projects are not expected to contain original research. But they must certainly represent an original exploration of whatever subject is being considered. Any links to existing literature must be fully explained.

Advice. By all means talk with the teaching staff during office hours or otherwise to focus your project. You are also always welcome to speak with me during office hours or make an appointment by email.

Grading. Projects will be marked by me with input also from the TFs. Among the aspects of your writeup that will count towards the grade are clarity and correctness of writing, correctness of mathematics and of coding, clarity of scientific context, imaginativeness of presentation, clarity and attractiveness of figures, and appropriateness and correctness of references. To repeat: clarity and correctness count. If your list of references is full of lower-case letters that should have been capitalized (a common error when people produce a document in BibTeX and fail to read it), for example, this will hurt you.

It's always a good idea to look over your figures. Are they labeled clearly and in a large enough font? Does the caption indicate clearly what point is being made? In life as in AM205, many readers may look at your figures more carefully than at your text. Likewise people are sure to look at your introduction and conclusion.

In reading a project report, we want to have a sense that the authors have engaged intelligently with their material. Clear presentation of focused ideas is always good. Mechanical "boilerplate" text of the sort one feels one might find anywhere is less appealing.