** PROJECT SUGGESTIONS **

The first project is due Wednesday April 5 (no class Monday April 3 after spring break. Mr. Cho may have office hours that day).
Many projects will move to 2 or 3 space dimensions or nonlinear problems like conservative laws, starting in 1 space dimension.

(Area 1) Numerical methods for initial-value problems
(Area 2) Direct and iterative methods for large systems Ax=b

In area 1, the first questions will be similar to the recent homework, but in more dimensions. Implicit methods may need an idea from area 2. Shocks and fans in 2D would be extremely interesting. (Even in 1D, how well does a difference method show the fan+ shock solution when $u(x,0)=\delta(x)$?)

In area 2, experiments are badly needed on reordering the linear system to reduce fill-in, which is counted by nnz(L) and nnz(U). Compare minimum degree software, estimate or prove on estimate for fill-in and flop count as N increases (dimensions 2 and 3). Last year's final project on multi-grid by Joseph Kovac is on the ocw.mit.edu page for 18.086. That would have ideas for this year's first project (not as extensive of a final project). How is multi-grid affected by a first-difference matrix which might be one-sided, or centered and anti-symmetric, coming from implicit convection-diffusion? Does multi-grid break down when convection dominates diffusion? Also experiments on Incomplete LU using luinc and cholinc with different tolerances. Good preconditioner for iterative methods? Dependence on the choice of tolerance?