Review for the Final Exam

The final exam will be comprehensive, which means that you will be responsible for all of the material already covered on the two midterms. In addition, you will be responsible for the material we covered in chapters 10, 11, and 12.

Here is a list of new topics you should review for the final.

- Using separation of variables and Fourier series to solve PDEs on a rectangular domain.

- Solving PDEs on a disk with a spectral method.

- The free-space Green's function for the Laplacian

- The complex Fourier transform

- Convergence theorems for the complex Fourier transform (statements, not proofs)

- Properties of Sturm-Liouville operators

Sample Questions

1. Consider the functions $f(x) = e^x$ and $g(x) = e^x + e^{-x}$ on the interval [-1,1]. If we form periodic extensions of these functions from the interval [-1,1] to the entire real line and then compute complex Fourier coefficients for the periodic extensions, which of the series will converge more rapidly to the periodic extensions? Why?

2. Solve the Laplace equation

$$- \frac{\partial^2 u(x,y)}{\partial x^2} - \frac{\partial^2 u(x,y)}{\partial y^2} = 0$$

on a square region of side one with boundary conditions $u(x,1) = u(0,y) = u(1,y) = 0$ and $u(x,0) = x\,(1 - x)$.