Final Exam Outline

This is an outline of the material that you will be responsible for on the final exam. The questions will be similar to the problems in the homework assignments and final exam practice problems.

Reminder: Please check the final exam schedule for the room location and time which may differ from the lecture.

- Basic Classification of PDE’s (Order, Linear vs. Non-linear, Homogeneous vs. Non-Homogeneous)
- First Order Linear PDE’s \( a(x, y)u_x + b(x, y)u_y = 0 \)
  - Solution by Method Characteristics (Geometric Approach)
  - Solution by Change of Coordinates (Algebraic Approach)
- Classification of Linear Second Order PDE’s
  - Elliptic
  - Hyperbolic
  - Parabolic
- Hyperbolic PDE’s
  - Solutions of Initial Value Problems for 1-D Wave Equation on \( \mathbb{R} \)
  - Boundary Value Problems on \( \mathbb{R}_+ \) and \([0, \ell]\)
    * Dirichlet
    * Neumann (just \( \mathbb{R}_+ \))
  - Solutions of Initial Value Problems with a Source Term
- Parabolic PDE’s
  - Solutions of Initial Value Problems for 1-D Diffusion Equation on \( \mathbb{R} \)
  - Boundary Value Problems on \( \mathbb{R}_+ \)
    * Dirichlet
    * Neumann
  - Minimum / Maximum Principle
  - Solutions of Initial Value Problems with a Source Term (Duhamel’s Principle)
- Elliptic PDE’s
  - Solutions of Boundary Value Problems for 2-D Laplace Equation on a Disk
    * Poisson’s Formula (expressed in polar coordinates)
  - Minimum / Maximum Principle
  - Mean Value Theorem for Harmonic Functions