

# Syllabus for EE 477, Fall 2009: Universal Schemes in Information Theory

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- Introduction and overview
- Discrete Denoising:
  - Fundamental performance limits
  - Bayes-optimal schemes
  - Universal schemes: construction and performance analysis
- Lossless compression:
  - Fundamental performance limits
  - Lempel-Ziv (LZ) compression
- Lossy compression:
  - Rate distortion theory for stationary sources
  - Universal schemes:
    - \* Yang-Kieffer codes
    - \* Lossy compression via Markov chain Monte Carlo
  - Compression-based denoising:
    - \* Indirect rate distortion theory
    - \* Empirical distribution of rate distortion codes
    - \* Universal denoising via lossy compression
- Sequential decision making:
  - Noise-free case:
    - \* prediction with expert advice
    - \* prediction via compression
    - \* LZ predictor
  - Filtering (sequential estimation):
    - \* compound sequential decision problem
    - \* filtering via prediction
    - \* LZ filter
- Optional Topics [as time permits]:

- Universal schemes for other problems such as channel coding, denoising analogue data, and lossy source coding with side information
- Connections between information theory and estimation; applications to universality issues
- Suggestions and/or requests for specific topics