Portland State University   **SySc 510/610 ECE 510/610**
Systems Science Program   **MW 2:00-3:40 PM**
Spring 2004

INFORMATION THEORY II: TOPICS IN LINEAR CODES

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Text: *Information Theory, Inference, and Learning Algorithms*, by David
                   MacKay.

Grading: Homework   40%
               Midterm Exam   30%
               Final Exam   30%

Prerequisites: Information Theory I (SySc 545/645 ECE 563/663) or its equivalent.

This course is designed as a continuation of Information Theory I. While the first course focused on the fundamental mathematics and theory of information, this course will focus on the practical design and implementation of linear codes. Specific topics include: Error-Correcting Codes for Real Channels, Hash Codes, Binary Codes, Low-Density Parity-Check (LDPC) Codes, Turbo Codes, Repeat-Accumulate Codes, and Digital Fountain Codes. The emphasis of these techniques is towards practical solutions to communication and storage problems. Applications include: disk drive encoding, RAID storage technologies, digital signatures and efficient digital broadcast channels.

The general outline of the course is:
- Review of Noisy Channel Coding (MacKay, chpt.s 10 & 11)
  - Channel Coding Theorem
  - Gaussian and Colored Channels
- Preliminary topics for applied coding
  - Hash Codes (MacKay, chpt. 12)
  - Binary Codes (MacKay, chpt. 13)
- Message Passing and Exact Marginalizations (MacKay, chpt.s 16,17, 23-26)
- Sparse Graph Codes
  - LDPC Codes (MacKay, chpt. 47)
  - Turbo Codes (MacKay, chpt. 48)
  - Repeat-Accumulate Codes (MacKay, chpt. 49)
  - Digital Fountain Codes (MacKay, chpt. 50)