MATH 8560: INFORMATION THEORY AND CODING THEORY
SPRING 2014

INSTRUCTOR: Felice Manganiello [manganm@clemson.edu]

OFFICE: Martin O-2
OFFICE HOURS: by appointment (use email)
TIME: TTh 8am-9.15am
ROOM: Martin Hall M203

WEBSITE: http://www.math.clemson.edu/~manganm/teaching/math8560-s14/math8560-s14.html

TEXT BOOK:

Required:

- Ron Roth, *Introduction to Coding Theory*, Cambridge University Press

Recommended references:

- Thomas M. Cover and Joy A. Thomas, *Elements of Information Theory, 2nd edition*, Wiley-Interscience.
- Jack H. van Lint, *Introduction to Coding Theory*, Springer.

PREREQUISITES: Linear Algebra (MATH 3110), basic probability (MATH 4000 or 6000) and some familiarity with the basic concepts of groups, rings and fields (MATH 4120 or 8510).

"WHAT IS THIS COURSE ABOUT?":

- Suppose Alice secretly thinks of a number between 1 and a million. You can ask questions to which Alice can only answer YES or NO. What is the minimal number of questions you need to ask in order to find out this number? What if Alice is allowed to tell one lie? What is a winning strategy in this case?

Information theory and Coding theory provide the answers to this questions respectively. The topics covered in this course underlie the modern digital world, ranging from applications that you encounter in your daily lives such as interactions on social networks, video-streaming on the internet or listening to mp3 music on your portable devices, to sending commands to a space probe.

LEARNING OUTCOMES: At the end of the course you will be able to: compute the entropy of simple channels; understand the effectiveness of codes based on bounds and compute parameters like minimum distance and cardinality of a code; apply basic knowledge on algebra to construct codes; compute the complexity of simple decoding algorithms and apply these algorithms to small examples.

COURSE TOPICS: Topics of the course will be chosen from the following pool

- Entropy and mutual entropy.
- Channel coding.
- Network Coding.
- Linear codes.
- Bounds on codes.
- Reed-Solomon and related codes.
- Cyclic codes.
- List decoding of Reed-Solomon codes.
- MDS codes.
- Low Density Parity Check codes.
- Codes on Graphs.
- Trellis and Convolutional codes.

HOMEWORK: Homework will be assigned, and all must be completed to receive a grade for the course. Late homework will not be accepted.

COURSE PROJECT: There will be a course project. Its modality will be discussed in class at the beginning of the course.

GRADING: The final grade will be calculated as follows:

- Homework 30%,
- Midterm (mid March) 30% and
- Course project 40%.

POLICIES:

- You are expected to come to class regularly. You are also expected to participate in class discussions and ask questions when you are confused. Finally, you are responsible for any material covered in classes you miss.
- Students are responsible to check periodically both the Webpage and the Blackboard page of the course.
- Absent Professor Policy: If the instructor has not arrived within 15 minutes of the scheduled class time, you may assume that class has been canceled.

PLAGIARISM: I encourage you to consult with your colleagues when you are working on homework. However, the work you turn in must be your own. You must cite any material (books and online resources other than the course books and lecture notes) that you used to solve the problem. You can help another student, but you must not show him your homework.

Any breach of this policy will be considered an act of plagiarism, and will be reported.

ACADEMIC INTEGRITY STATEMENT: As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.
See also `http://www.clemson.edu/academics/academic-integrity`.