Brock University
Department of Computer Science
COSC 5P01 – Coding Theory
Winter 2020

Instructor:

Sheridan Houghten, J313

Course Description:

This course examines concepts, problems and applications of error-correcting codes.

Textbook:

There is no required textbook for this course. We will use material from various books and other sources. The following books will be on reserve in the library:

- Introduction to the Theory of Error-Correcting Codes, Vera Pless, Wiley & Sons (several editions exist).
- Introduction to Coding Theory, Ron M. Roth, Cambridge University Press, 2006.
- Fundamentals of Error-Correcting Codes, W.Cary Huffman and Vera Pless, Cambridge University Press, 2003.

Note that a number of relevant electronic resources are also available from the library.

Mark Distribution:

- Assignments: 30 %
- Class Presentation: 15%
- Paper: 15%
- Class Participation: 5%
- Exam (Oral): 35%

Tentative Outline:

- Introduction: communication, redundancy, codes, distance, encoding/decoding
- Distance metrics: Hamming, edit, insertion-deletion, etc.
- Linear codes: generator matrices, weight, syndrome decoding, sphere packing bound, dual codes, families of linear codes and their constructions.
- Non-linear codes: bounds, optimal codes, constructions to improve bounds, families and examples of non-linear codes.
- Searches for codes, including how equivalence can be used.
- Optional topics: exact topics and depth will be chosen according to student interest, but some of the following will be included: cyclic codes, BCH codes, LDPC codes, applications to bioinformatics, applications to complexity theory.

Important Dates:

- Last date for withdrawal without academic penalty: Friday, 6th March, 2020.

Course Policies:

Illness: If you miss an assignment or other piece of work due to illness, you must submit a student medical certificate (http://www.cosc.brocku.ca/forms/medical) *within 3 days of the illness*, at the main office in the Computer Science department.

Plagiarism: The department views plagiarism as a serious issue. Students may visit http://www.cosc.brocku.ca/about/policies/plagiarism to view the department's policies on plagiarism. Plagiarism detection software may be used in this course.

Assignments:

- Assignments must be completed individually.
- Due dates for assignments will be printed on the assignment text. No late assignments will be accepted except in the case of extreme circumstances; see above course policy concerning illness.
- *Assignments must be submitted both as hard copies AND electronically.*
- Hard copies of all assignments must be submitted directly to the instructor in an envelope with an attached, signed cover page. To generate the cover page, visit http://www.cosc.brocku.ca/forms/cover.
- Instructions on electronic submission will be provided on the assignment text.

Class Presentations: All students will choose one advanced topic to teach to their fellow students. The student should plan to use an entire class (60-75 minutes) to teach this topic. The topic is to be chosen in consultation with the instructor. The class presentation schedule will be determined by the instructor according to topic.

Paper: All students will also submit a paper on the same topic as their class presentation.

Participation: Questions and discussion are encouraged in class. Students will receive the full 5% class participation marks if they attend *all* presentations by fellow students.

Exam: The exam will cover all class material *including presentations by students*. It will be an oral exam to be booked on an individual basis, either on the last day of class or after classes are finished.