Project Description
Winter 2011

1 Description

The goal of this project is for you to explore a research area in multiuser information theory and communications. A sample list of topics are included at the end of this paper, but these topics by no means are exhaustive. You can also propose your own topic. The topic that you choose should be

(i)   related to the materials in this course, and
(ii) related to your field of specialty and interest.

You are encouraged to explore applications of ideas introduced in class to modern communications, networks, as well as information theory.

Format

The project can take one of several formats as follows.

- *A comprehensive literature review of a topic:* This review should identify key journal papers in the chosen topic, discuss the connections among these papers, present a coherent view of the problems, the approaches to solving them and the results in these papers. Identify open problems in the chosen topic.

- *An in-depth analysis of some papers:* The analysis should focus on at least 2 key journal papers, make the connection and reproduce the results in these papers. Identify possible extensions to these papers.

- *A new problem formulation and some initial results:* This project includes a formulation of a new problem with some initial analysis or simulation results.

In all cases, you are required to have a reference list of *4-6 key journal papers*. Conference papers, books or book chapters can be included but are extra to this requirement.

Grading scheme

The project grade will consists of the following components:

(i)   Technical content   40%
(ii) Comprehension   30%
(iii) Novelty   20%
(iv) Report presentation   10%

The technical content part measures the technical depth (not breadth) of topics discussed in the report. It is better to discuss a topic deeply rather than having a superfluous collection of related topics. The comprehension part measures your level of understanding, which is reflected through discussion, coherency of the discussion and ability to make connections among different analyses and results. Novelty will be measured through identifying open problems and proposing an initial solution. Report presentation includes clarity, organization and the English usage in your report.

2   Time line

- Project proposal (1 page): **February 16**

- Presentation (30 minutes): **April 4 and 6**

- Project report: **April 8**

Proposal

Your proposal should outline the topic and the approach to your project and include a list of references. We will provide feedback on your proposal.

Report

Please keep the length of your report within this guideline: 20-30 pages in 1.5 line spacing, 11pt font plus figures. A longer report doesn't mean a better one. Work on the quality.

3   Sample list of topics

1. Network coding in wireless communications

2. Cost of coordination in cooperative communications

3. MIMO multiple access, broadcast and interference channels

4. Interference alignment and applications

5. Coding for relay channels and networks

6. Capacity and coding techniques for cognitive channels

7. Cooperative throughput and diversity

8. Multiuser channels with feedback

9. Capacity bounds for the broadcast or interference channel

10. Energy-efficient coding schemes

11. Half-duplex cooperative coding techniques

12. Distributed coding for multicast/video networks