

# Topics in Combinatorics

## Fall 2006

### Syllabus

Instructor: Rudolf Ahlswede

Office Hours: To be announced.

Text: *Lectures on Advances in Combinatorics* by R. Ahlswede and V. Blinovsky.

#### Lectures

Chapter 1: Intersection and diametric problems

- Lecture 1: The Complete Intersection Theorem
- Lecture 2: The diametric problem for vertices in Hamming metric
- Lecture 3: The diametric problem for vertices in Taxi metric
- Lecture 4: The diametric problem for edges in Hamming metric
- Lecture 5: Words with pairwise common letter
- Lecture 6: Pairs of sets with specified distance

Chapter 2: Covering, packing and list codes

- Lecture 7: Covering and packing of hypergraphs
- Lecture 8: Covering of products of graphs and hypergraphs
- Lecture 9: Multiple packing
- Lecture 10: List decoding

Chapter 3: Higher level and dimension constrained extremal problems

- Lecture 11: Higher level extremal problems
- Lecture 12: Properties of binary sequences over reals

Chapter 4: LYM--related AZ identities, antichain splittings and Correlation inequalities

- Lecture 13: LYM-type relations
- Lecture 14: The splitting property
- Lecture 15: Correlation inequalities

Chapter 5: Basic problems from Combinatorial Number Theory

- Lecture 16: A problem from Combinatorial Number Theory

#### Perspectives

Perspective A: Diametric and isoperimetric theorems in sequence spaces

Perspective B: Extremal problems with group structure

Perspective C: Extremal problems under dimension constraints and security of databases

Perspective D: Numbertheoretical density properties

Perspective E: Information Theory as tool for Graph Theory and Number Theory

Perspective F: Network coding

Perspective G: On diagnosability of large multiprocessor networks

Perspective H: Creating order under constraints on mind and matter

Perspective I: The evolution of languages

#### Seminars

Ad Lecture 1

Ad Lecture 2

Ad Lecture 5

Ad Lecture 6

Ad Lecture 8

Ad Lecture 11

Ad Lecture 13

Ad Lecture 14

Ad Lecture 15

Ad Lecture 16