Logical Methods in Combinatorics - שם הקורס

236605 - מספר הקורס

פרופ' מקובסקי	מרצה:
	מתרגל/בודק תרגילים:
Two hours frontal lecture + one hour tirgul	שעות הרצאה:
Sets and Logic (234293)	דרישות קדם:
http://www.cs.technion.ac.il/~janos/COURSES/236605-09. There you find a more detailed description and references.	אתר הקורס: (כתובת האתר)

תאור הקורס

The course deals with the interplay of logic and combinatorics. We study various counting problems and how their solution is affected by an additional assumption on the definability of the property of the counted objects. The following examples are taken from graph theory, but can be generalized to hypergraphs and relational structures. Examples are:

Spectra

A spectrum of a graph property is the set of finite cardinalities in which there exists graphs with this property. The spectrum of connected graphs consists of all natural numbers. The spectrum of Eulerian cliques consists of the odd numbers. What can we say about the spectrum of graph properties definable in First Order Logic, Monadic Second Order Logic or Second Order Logic? This problem is intrinsically connected to the famous open problem P =? NP.

0-1 laws

Let P be a graph property, and denote by pP(n) the percentage of graphs on n labeled vertices having property P. What can we say about the limit of pP(n) when n goes to infinity. If P is definable in First Order Logic, the limit always exists and is either 0 or 1. How can this be generalized?

Recurrence relations for combinatorial counting functions

Let P be a graph property, and denote by nP(n) the number of graphs on n labeled vertices having property P. What can we say about the behaviour of this function. How does it help to know that P is definable in First Order Logic?

Graph polynomials

A common generalization of counting problems are graph polynomials. The most prominent of these are the matching polynomials, the chromatic polynomial and the Tutte polynomial. We shall use logic to develop a general theory of graph polynomials.

For those graduate students who have already taken 236605 before, but on another topic, arrangements will be found to get credit again. A similar course was tought as 236601 in WS 2005/6.

Take home exam or (preferably) final project.