

PRAGMATIC 2011

The thirteenth edition of the PRAGMATIC Summer School took place in Catania between June 20 and July 9, 2011. The lecturers were Mats Boij (Royal Institute of Technology, Stockholm) and Ralf Fröberg (Stockholm University), assisted by Alexander Engström (UC, Berkeley). The school was attended by 24 students from Germany, France, India, Iran, Italy, Poland, Romania, Sweden, and Vietnam.

The theme of research was Graded algebras and modules, properties and invariants. The first set of lectures (covered by Boij) were devoted to the study of Hilbert functions and Betti numbers up to scalar multiples, the second (covered by Fröberg) were devoted to homology of semigroup rings and monomial rings, and their connection to combinatorics.

During the first week, the lecturers presented the state of the art of their subjects, and gave lots of open problems. By the end of the week, students were grouped into working teams and have made their personal choice of problem to work on. During the remaining time of the school, each team worked under guidance of the lecturers and the assistant, and some more lectures were given, on request. In the last day, each team presented to the entire audience their progress on the chosen problem.

The present volume of *Le Matematiche* contains eleven of the papers that have materialized since the end of the school. Some more will appear elsewhere.

Mats Boij
Ralf Fröberg