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Algebraic Combinatorics

Lectures at a Summer School
in Nordfjordeid, Norway, June 2003

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Preface

Each year since 1996 the universities of Bergen, Oslo and Trondheim have organized summer schools in Nordfjordeid in various topics in algebra and related fields. Nordfjordeid is the birthplace of Sophus Lie, and is a village on the western coast of Norway situated among fjords and mountains, with spectacular scenery wherever you go. As such it is a welcome place for both Norwegian and international participants and lecturers. The theme for the summer school in 2003 was Algebraic Combinatorics. The organizing committee consisted of Gunnar Fløystad and Stein Arild Strømme (Bergen), Geir Ellingsrud and Kristian Ranestad (Oslo), and Alexej Rudakov and Sverre Smalø (Trondheim). The summer school was partly financed by NorFa-Nordisk Forskerutdanningsakademi.

With combinatorics reaching into and playing an important part of ever more areas in mathematics, in particular algebra, algebraic combinatorics was a timely theme. The fist lecture series "Hyperplane arrangements" was given by Peter Orlik. He came as a refugee to Norway, eighteen years old, after the insurrection in Hungary in 1956. Despite now having lived more than four decades in the United States, he impressed us by speaking fluent Norwegian without a trace of accent. The second lecture series "Discrete Morse theory and free resolutions" was given by Volkmar Welker. These two topics originate back in the second half of the nineteenth century with simple problems on arrangements of lines in the plane and Hilberts syzygy theorem. Although both are classical themes around which mathematics has centered since, there has in recent years been an influx of completely new insights and ideas, and interest in these fields has surged. An attractive feature of both topics is that they relate heavily both to combinatorics, algebra, and topology and, in the case of arrangements, even to analysis, thus giving a rich taste of mathematics. The third lecture series was "Cluster algebras" by Sergei Fomin. This is a recent topic, of this millennium. It has quickly attracted attention due to it giving new insights into classical mathematics as well as giving us fascinating new algebraic structures to study, relating to combinatorics and discrete

geometry. This lecture series is however published elsewhere and so is not included here.

But we are pleased to present the first two lecture series in this volume, the topics of which are so natural, classical and inexhaustible that mathematicians will certainly center around them for years to come.

November 2006, *Gunnar Fløystad*

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