Teaching Commutative Algebra and Algebraic Geometry using Computer Algebra Systems

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Abstract

In teaching a mathematics course in commutative algebra and algebraic geometry, we would like students also be able to use a computer algebra system to solve real problems that they might encounter in the future, whether in their own research or in industry. The purpose of this talk is to firstly describe how we use computer algebra in the course MATH 441 Commutative Algebra and Algebraic Geometry at Simon Fraser University and secondly to provide a list of applications problems that we have found to be suitable for such a course. In the talk we describe the content and scope of the course and then present three applications using Gröbner bases, explaining why they are good applications. The applications are (i) to packing problems, (ii) proving theorems in geometry and (iii) using the Nullstellensatz to disprove graph colorability.