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Valuations and Ideal Membership

The classical theory of Gröbner bases provides a deterministic technique for solving the ideal membership problem in polynomial rings. Ever since the original algorithms were developed by Bruno Buchberger in the 1960s through the use of monomial orders, many variations and generalizations have been considered. In particular, Moss Sweedler formed a general framework in the 1980s in which monomial orders were replaced by valuations. Although this work was primarily theoretical, explicit valuations to be used in this framework have been recently constructed. After providing a brief introduction to Gröbner bases, I will discuss the behavior of specific examples of valuations as well as present some of the open problems currently faced.