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Decision versus evaluation in algebraic complexity theory

Two main categories of problems are studied in algebraic complexity theory: evaluation problems and decision problems. A typical example of an evaluation problem is the evaluation of the permanent of a matrix. Such problems can be studied within Valiant's framework.

Deciding whether a multivariate polynomial has a real root is a typical example of a decision problem. This problem is NP-complete in the Blum–Shub–Smale model of computation over the real numbers.

In this talk I will present a transfer theorem which shows that if certain evaluation problems are easy, then other decision problems (including the above-mentioned NP-complete problem) are easy too.

Therefore, to show that that P is different from NP over the set of real numbers, one should first be able show that certain evaluation problems are hard.