NP?=EXP

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Abstract

We only point out that the work of algorithmic algebra community is not enough, at least so far.

I. PROPOSITION

I_N [SM13], authors presents an algorithm named ANewDsc claiming in *Corollary 27* of efficient computation time. The n in that corollary is the given polynomial's degree. Thus, if the polynomial is given in the form of $567 * x * x * x * x * x * x + 872 * x * x + 12$, then indeed, we have a polynomial time algorithm for the problem at hand. But what if, the polynomial is given like $x^{123456789} + 2 * x^7 - 5$. To the best of our knowledge, we have not devised an algorithm with reasonable time bound.

DEFINITION

$\text{REALROOTCOUNT} = \{ (P, k) \mid \text{polynomial } P \text{ given in the latter (described above) way has at least } k \text{ distinct real roots, } k \text{ is given in unary} \}$

PROPOSITION

$\text{REALROOTCOUNT} \leq_p \text{EXISTENTIALREALTHY}$

where $\text{EXISTENTIALREALTHY}$ is the definitive problem of existential first-order theory. Details can be found in [WikiExistRealThy]

We can use the expressive capability of existential first-order theory to build things up like $y = x * x$, $z = y * y$, $u = z * x + y + y + y + x + x + 1 + 1$, etc. Note that in the REALROOTCOUNT we have the exponentiation symbol, but in the theory considered here, we only have $0, 1, +, *$ and existential quantifier. For large coefficient, we utilize the same idea.

i. Conclusion

We have to ask ourselves whether the question in the title is significant.

REFERENCES

- [SM13] , Michael Sagraloff, Kurt Mehlhorn, Computing Real Roots of Real Polynomials, 2013
- [WikiExistRealThy] , The free encyclopedia, https://en.wikipedia.org/wiki/Existential_theory_of_the_reals

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