ALGEBRAIC TECHNIQUES IN PARAMETERIZED GRAPH ALGORITHMS

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For a number of algorithmic graph problems that are NP-hard, it is possible to get considerable speed-ups by phrasing the task as a kind of counting problem and then using algebraic techniques. We will see a number of such examples, including:

- Hamiltonian cycle in $2^n poly(n)$ time using inclusion-exclusion principle,

- Vertex coloring in time $2^n poly(n)$ time using cover product or fast subset convolution,

- Finding a k-vertex path in $2^k poly(n)$ time using polynomials over a finite field.

The material will be mostly based on Chapter 11 of the textbook Parameterized Algorithms by Cygan, Fomin, Kowalik, Lokshtanov, Marx, Pilipczuk, Pilipczuk, Saurabh.