My favorite theorems

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One of the recurring themes of this blog will be descriptions of my favorite theorems of the 21st century. I will begin with a special category, *Between the Centuries*, devoted to theorems that were proved in the late 20th century but published in the early 21st century. After that, I will proceed year by year—starting with 2001, then 2002, and so on.

For each year, I will select my favorite theorem in the following subject areas:

- Number Theory
- Combinatorics
- Analysis
- Algebra
- Geometry and Topology
- Probability and Statistics
- Algorithms and Complexity

In addition, I will choose a single *favorite theorem of the year* across all of mathematics.

This post will serve as a central index for the series, collecting links to all of my selected theorems in one place as the project develops.

Between the Centuries

Number Theory: The Modularity Theorem

Combinatorics: Cycle decompositions of complete graphs

Analysis: On the zero set of linear recurrences

Algebra: All braid groups are linear

Geomerty and Topology: The proof of Kepler’s conjecture

Probability and Statistics: The intersection exponent for planar random walks

Algorithms and Complexity: The impossibility to beat random assignment in k-SAT

Overall in mathematics: The proof of Kepler’s conjecture

Theorems of the year 2001

Number Theory: On the sets of simple sums and products of integers

Combinatorics: The Graph Minors Theorem

Analysis: The hot spot conjecture for lip domains

Algebra: Positive noncommutative polynomials are sums of squares

Geomerty and Topology: On upper bounds for sphere packings

Probability and Statistics: On the cover times for simple random walk

Algorithms and Complexity: Efficient approximation of the permanent

Overall in mathematics: The Graph Minors Theorem

Theorems of the year 2002

Number Theory: The proof of Catalan’s conjecture

Combinatorics: The strong perfect graph theorem

Analysis: Large Euclidean pieces of finite metrics

Algebra: Groups of non-uniform exponential growth

Geomerty and Topology: Efficient Steiner symmetrizations

Probability and Statistics: The growth of diffusion in the 2D ASEP

Algorithms and Complexity: On the Frobenius Coin Problem

Overall in mathematics: The strong perfect graph theorem

Theorems of the year 2003

Number Theory: Perfect powers in the Fibonacci sequence

Combinatorics: A proof of the Stanley–Wilf conjecture

Analysis: On De Giorgi’s conjecture in dimensions up to 8

Algebra: Parametrization of quintic rings

Geomerty and Topology: A proof of the Poincaré conjecture

Probability and Statistics: On the monotonicity of Shannon entropy

Algorithms and Complexity: Primality testing is in P

Overall in mathematics: A proof of the Poincaré conjecture

Theorems of the year 2004

Number Theory: Arbitrarily long arithmetic progressions in primes

Combinatorics: Ford’s multiplication table theorem

Analysis: The Newtonian 4-body problem

Algebra: Counting low-degree number fields

Geomerty and Topology: The Calabi–Yau conjectures for minimal surfaces

Probability and Statistics: The probability of singularity

Algorithms and Complexity: The sparsest cut problem

Overall in mathematics: Arbitrarily long arithmetic progressions in primes

Theorems of the year 2005

Number Theory: Small gaps between primes

Combinatorics: An effective multidimensional Szemerédi theorem

Analysis: The Ten Martini Problem

Algebra: Growth in finite simple groups

Geomerty and Topology: Almost balls have almost minimal perimeter

Probability and Statistics: Majority is stablest

Algorithms and Complexity: Undirected connectivity in logarithmic space

Overall in mathematics: Undirected connectivity in logarithmic space

Theorems of the year 2006

Number Theory: Counting arithmetic progressions of primes

Combinatorics: Conlon’s bound for Ramsey numbers

Analysis: Julia Sets with Positive Area

Algebra: Uniform Exponential Growth in Linear Groups

Geomerty and Topology: Kissing Numbers: From Pairs to Triples