Technion-Israel Institute of Technology

Computer Science Department

Center for Graphics and Geometric Computing

CGGC Seminar – PhD Talk

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Improving the Upper Bound on the Number of Polycubes

A *d*-dimensional polycube is a facet-connected set of cells (cubes) on the *d*-dimensional cubical lattice. Let *Ad*(*n*) denote the number of *d*-dimensional polycubes (distinct up to translations) with *n* cubes, and *λd* denote the limit of the ratio $Ad(n+1)/Ad(n)$ as *n* approaches infinity. The exact value of λd is still unknown rigorously for $d \geq 2$; the asymptotics of *λd*, as *d* approaches infinity, also remained elusive as of today.

In this talk, I will show how we revisit and extend the approach presented by Klarner and Rivest in 1973 to bound *A2*(*n*) (the number of polyominoes with *n* squares) from above. Our contributions are:

- Using available computing power, we prove that $λ2 \leq 4.5252$. This is the first improvement of the upper bound on *λ2* in almost half a century;

- We prove that $λd \leq (2d−2)e+o(1)$ for any value of $d \geq 2$, using a novel construction of a rational generating function which dominates that of the sequence (*Ad*(*n*));

- For the case of d = 3, this provides a subtantial improvement of the upper bound on *λ3* from 12.2071 to 9.8073;

- We implement an iterative process in three dimensions, which improves further the upper bound on *λ3* to 9.3835;

This work was done jointly with Prof. Gill Barequet (Technion, Haifa).

The lecture will be held on Wednesday, 12.09.2018, at 13:30, Taub 401

הזמנה זו מהווה אישור כניסה עם רכב לטכניון