10th Problem Set for the MDS Block Course on

High-Dimensional Computational Geometry

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The problems will be discussed in the afternoon session.

Problem 1 length concentration

Determine, theoretically or experimentally, the shape of the distribution of lengths when points $x \in S^2$ are chosen uniformly at random and projected to their first coordinate.

Problem 2 Hausdorff

Let (X, ρ) be a finite metric space and d_H the corresponding Hausdorff metric .

(a) Show that d_H is indeed a metric on 2^X.

(b) Show that, if a set T of transformations from $2^X \to 2^X$ is closed under composition and inversion, then d_H^T is a metric.

(c) Design and analyze an algorithm for computing the Hausdorff distance for convex polytopes in ℓ_2^d.

Problem 3 isometric embedding

Show that any metric space (X, ρ) can be isometrically embedded into $\ell_\infty^{|X|}$.
Hint: If $V = \{p_1, ..., p_n\}$, let $f(u)_i = \rho(u, v_i)$.