

Math 762 Homework Assignment, Due Thursday, April 12

1. Let X be a closed convex set in \mathbb{E}^d , and let p be in $\mathbb{E}^d - X$. Show the following:
 - a. There is a nearest point q_1 to p in X .
 - b. The half space $H = \{q \in \mathbb{E}^d \mid (p - q) \cdot (p - q_1) \geq (p - q_1)^2\}$ contains X but not p .
 - c. If X is a closed convex cone, with cone point at the origin 0 , say, then 0 is in the boundary of H as defined in part b.) above. This means that $p \cdot (p - q_1) = (p - q_1)^2$. A cone from the origin is a set consisting of rays (positive scalar multiples of a vector) from the origin.
2. Calculate the dimension of the set of resolvable forces for the bar framework whose vertices are the vertices of a convex polygon in the plane, and whose bars are the edges of the polygon.
3. Let G be graph of the regular octahedron. This is the complete graph on 6 vertices with 3 disjoint pairs of vertices that do not have edges between them. Consider a straight line embedding of G in the plane, $G(p)$. One triangle of G must bound all the rest of the embedding of G .
 - a. Show that considering G as a bar graph, $G(p)$ must have a non-zero equilibrium stress.
 - b. Is it always true that the stress from part a.) must be of one sign on the outside triangle, and another sign on the rest of the members of G ?