1090-15-267 **Lek-Heng Lim*** (lekheng@galton.uchicago.edu), University of Chicago, Department of Statistics, Chicago, IL 60637, and **Ke Ye** (kye@math.uchicago.edu), University of Chicago, Department of Mathematics, Chicago, IL 60637. *Complexity and Symmetry.*

The p-norm of a matrix can be computed in polynomial time when $p = 1, 2, \infty$, but is NP-hard for all other values of p. The rank of a nonnegative matrix can be computed in polynomial time but its nonnegative rank is NP-hard. Deciding if a symmetric matrix is positive semidefinite can be done in polynomial time but deciding if it is copositive or completely positive are both NP-hard. The determinant of matrix can be computed in polynomial time but the permanent is #P-hard. In this talk we attempt to provide an explanation for such dichotomies from the point of view of invariant theory. We shall argue that in numerical linear algebra, quantities that can be readily computed or properties that can be easily checked are often the ones preserved by a relatively large submonoid of the group that acts naturally on the space of matrices. (Received March 03, 2013)