1032-55-203 **Yuan Yao*** (yuany@math.stanford.edu), Department of Mathematics, Stanford University, Stanford, CA 94305-2125, and **Lek-Heng Lim** (lekheng@math.stanford.edu), Department of Mathematics, University of California at Berkeley, Berkeley, CA 94720. *Hodge Theory and Rank Aggregation.* Preliminary report.

We report an application of a discrete version of Hodge Decomposition Theorem to the rank aggregation problem. Rank aggregation is to find a mapping from a set of partial orders to a single partial order on a set of alternatives. It has received extensive studies from Economics (Social Choice Theory), Computer Science and Statistics. Here we consider the partial orders induced from some real score functions (or utility functions), called as cardinal rankings. To apply the Hodge Theory in this setting, we construct the simplicial complex formed by the alternatives. We may recast cardinal rankings as 0-dim differential forms defined on 0-simplices, and pairwise rankings as 1-dim differential forms defined on 1-simplices. Then Hodge Theory leads to an orthogonal decomposition of the space of pairwise rankings into three component: a *consistent* component and an *inconsistent* component — with a further decomposition of the consistent component into a *global* (consistent acyclic) component and a *harmonic* (consistent cyclic) component. This decomposition shows that consistency of pairwise rankings depends on the topology of the simplicial complex formed by the alternatives to be ranked. (Received August 21, 2007)