Extremal combinatorics in random sets

Abstract:
Extremal problems are widely studied in discrete mathematics. Given a finite set *X* and a family *F* of subsets of *X* an extremal result asserts that any sufficiently large (or dense) subset *Y* of *X* must contain an element from F. For example, if *X* consists of the first n integers and F contains all k-term arithmetic progressions in *X*, then Szemeredi's celebrated theorem asserts that every subset *Y* of *X* of positive density contains a k-term arithmetic progression. Other results which naturally fit this setup are e.g. Turan's theorem from graph theory and an extremal version of Schur's theorem on sum-free sets.

We study thresholds for extremal properties of random discrete structures. In particular, we determine the threshold for Szemeredi's theorem on arithmetic progressions in random subsets of the integers and its multidimensional extensions and we determine the threshold for Turan-type problems for random graphs and hypergraphs. Similar results were obtained by Conlon and Gowers.

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