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*Sharp Thresholds in Random Constraint Satisfaction Problems*

We consider a wide family of models for random constraint satisfaction problems. This family includes random  $k$ -SAT, random  $k$ -colourability and many other well-studied generalizations. Our goal is to determine precisely which members of this family have sharp thresholds of satisfiability, in the sense (formalized by Friedgut) that the probability of satisfiability drops suddenly from  $1 - o(1)$  to  $o(1)$ . In doing so, we want to understand what sorts of features can cause models to have coarse thresholds rather than sharp ones.

In this talk, I'll report some progress towards this goal. This includes the following:

- (1) A theorem that for any simple connected graph  $H$  (on at least 2 vertices), the property "is homomorphic to  $H$ " has a sharp threshold iff  $H$  has a triangle.
- (2) A characterization of which models from a natural subfamily (the so-called  $(d, k, t)$ -models) have sharp thresholds.
- (3) Some interesting examples of models which have coarse thresholds.

This is joint work with Hamed Hatami.