1074-05-62 **David Galvin*** (dgalvin1@nd.edu), University of Notre Dame, South Bend, IN. *Counting graph homomorphisms.*

A *homomorphism* from graph G to H is an adjacency-preserving map between vertex sets. Homomorphisms can be used to encode numerous graph theory notions, such as independent sets and proper colourings, as well as providing a language in which to discuss statistical physics hard-constraint spin models.

In this talk we address an extremal question for graph homomorphisms: given H, which graph in the class of n-vertex, d-regular graphs admits the most homomorphisms to H? With Tetali, we answered this question for *bipartite* graphs (the answer is the same for each H: a disjoint union of $n/2d$ copies of the complete d-regular bipartite graph). Zhao showed that for many H, including the H that encodes independent sets, this remains the answer for not-necessarily-bipartite graphs. In general, however, the answer turns out to depend on H.

We present a hopeful conjecture, and survey all that we know. (Received August 07, 2011)