Greedy algorithms, independent sets and local limits

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The greedy algorithm for finding a maximal independent set in a graph G on vertices $V = \{v_1, ..., v_n\}$ can be described as follows. Let σ be a permutation of $[n]$ chosen uniformly at random. Starting from an empty set R, at step i add $v_{\sigma(i)}$ to the set R if and only if $R \cup \{v_{\sigma(i)}\}$ is an independent set in G. This very natural algorithm has been studied extensively in various instantiations and disguises in combinatorics, probability, computer science - and even in chemistry.

In this talk we will focus on the behaviour of this algorithm on sequences of (random or deterministic) graphs that are locally tree-like. We introduce a general framework for studying the asymptotics of the size of the independent set R. This framework applies various tools, such as local limits and differential equations, and allows us both to prove new results, for example on Galton-Watson trees, and give simple proofs for known ones.

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