On the optimality criteria of tree decompositions

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Tree decomposition is an important tool used in algorithmic and structural graph theory. Intuitively, a tree decomposition represents the vertices of a graph G as subtrees of some tree T, in such a way that vertices in G are adjacent only when the corresponding subtrees intersect. On the other hand — vertices of T may be viewed as collections of subtrees (and corresponding vertices of G) and thus they are called *bags*.

Given graph G a natural question is how to optimally choose a tree T with the particular decomposition. The standard approach is to have the largest bag as small as possible, which leads to the notion of *tree-width*. Recently, another optimization criteria were considered (eg. *tree independence number*, where the largest size of the maximum independent set of the subgraph of G induced by any bag is optimized).

We discuss some of these criteria, in particular we show the connection between *tree domination number* and a *hypertree-width* (the standard measure of tree decomposition of hypergraphs).