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We characterize properties including p -hyponormality and p -paranormality for composition operators arising from measurable transformations on weighted directed trees, in terms of a test at each node v involving the masses at nodes in a neighborhood of nodes near v . Also constructed are certain graphs \mathcal{E} universal for p -hyponormality in that the neighborhood of any node in any graph yielding a p -hyponormal composition operator is a certain limit of neighborhoods in \mathcal{E} . These results are applied to some examples with particularly regular graph structures. (Received September 14, 2010)