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Chordality of locally semicomplete and weakly quasi-transitive digraphs

Chordal graphs are important in the structural and algorithmic graph theory. A digraph analogue of Chordal graphs was introduced by Haskin and Rose in 1973 but has not been studied until recently when a characterization of semicomplete chordal digraphs was found by Meister and Telle.

Locally semicomplete digraphs, quasi-transitive digraphs and extended semicomplete digraphs are the most popular generalizations of semicomplete digraphs. We extend the forbidden subdigraph characterization to Locally semicomplete chordal digraphs. We introduce weakly quasi-transitive digraphs, which contains quasi-transitive digraphs, symmetric digraphs, and extended semicomplete digraphs, but is incomparable to locally semicomplete digraphs. We show that weakly quasi-transitive digraphs can be recursively constructed by substitutions from transitive oriented graphs, semicomplete digraphs, and symmetric digraphs. This recursive construction demonstrates the naturalness of the new digraph class. As a by-product, we prove that semicomplete chordal digraphs and weakly quasi-transitive chordal digraphs have the same forbidden subdigraphs.