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Dependent Edges in Acyclic Orientations of Graphs. Preliminary report.

Given a graph, orient its edges so that there are no directed cycles. (This is always possible.) Call an edge in this new (directed) graph dependent if reversing its direction creates a directed cycle. Over twenty years ago P. Erdös asked whether every graph with girth at least four has an acyclic orientation which contains no dependent edges. Recently the answer was found to be no; we exhibit a counter example. Since there are graphs for which every acyclic orientation has dependent edges, one can ask for the minimum number $(d_{min}(G))$ of dependent edges a given graph G can have, where the minimum is taken over all possible acyclic orientations of the graph. We then consider the ratio $d_{min}(G)/e(G)$, where $e(G)$ is the total number of edges in G. Let $r_{m,k}$ be the supremum of this ratio, taken over all graphs G with chromatic number m and girth k. We give some lower bounds for $r_{m,4}$ for small $m \geq 4$. (Received August 16, 2000)