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On semiregular digraphs of the congruence $x^k \equiv y \pmod{n}$

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Abstract: We assign to each pair of positive integers n and $k \geq 2$ a digraph $G(n, k)$ whose set of vertices is $H = \{0, 1, \dots, n - 1\}$ and for which there is a directed edge from $a \in H$ to $b \in H$ if $a^k \equiv b \pmod{n}$. The digraph $G(n, k)$ is semiregular if there exists a positive integer d such that each vertex of the digraph has indegree d or 0. Generalizing earlier results of the authors for the case in which $k = 2$, we characterize all semiregular digraphs $G(n, k)$ when $k \geq 2$ is arbitrary.

Keywords: Chinese remainder theorem, congruence, group theory, dynamical system, regular and semiregular digraphs

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