Abstract

A Hermitian adjacency matrix for Signed Directed Graphs

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The field of signed directed graphs, which is a natural marriage of the well-known fields concerning signed graphs and directed graphs, has thus far received little attention. To characterize such signed directed graphs, we formulate a Hermitian adjacency matrix, whose entries are the unit Eisenstein integers $\exp(k\pi i/3)$, $k \in \mathbb{Z}_6$.

Our main interest is spectral characterization. To this end, we provide a full classification of all signed digraphs with rank at most 3, and an extensive review of signed digraphs with at most 2 non-negative eigenvalues. We show that non-empty signed directed graphs whose spectra occur uniquely, up to isomorphism, do not exist, but we use the provided classification to provide several infinite families whose spectra occur uniquely up to (diagonal) switching equivalence.

Based on joint work with Edwin van Dam.