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Electronic Notes in DISCRETE MATHEMATICS
Electronic Notes in Discrete Mathematics 63 (2017) 323–332 www.elsevier.com/locate/endm

An Algorithmic Characterization of Splitting Signed Graph

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Abstract

A *signed graph* (also known as *sigraph*) S is a graph G' where every edge y have value $s'(y) \in \{-1, +1\}$ known as its *sign function* and is denoted as $S = (G', s')$. Given a sigraph $S = (V, E, \sigma)$, for every vertex $v \in V(S)$, take a new vertex v'. Join v' to all vertices of S adjacent to v such that, $\sigma_\Lambda(uv') = \sigma(uv)$, $u \in N(v)$. The sigraph $\Lambda(S) = (V_\Lambda, E_\Lambda, \sigma_\Lambda)$ thus produced is called the *splitting sigraph* of S. Here we define an *algorithm* to produce a splitting sigraph and root splitting sigraph from a given sigraph, if it exists, in $O(n^4)$ steps.

Keywords: Algorithm, sigraph, splitting graph, splitting sigraph, root splitting sigraph

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https://doi.org/10.1016/j.endm.2017.11.029

1 Introduction

For definitions and concepts on *sigraphs* refer to Zaslavsky [6]. For *algorithms*, refer to Golumbic [2].

Sampathkumar and Walikar [4] introduces the concept of *splitting graph* $\Lambda(G)$ of a graph G Although, the term splitting graph is well studied in the literature, which has slight variation than the splitting graph of a graph. Sinha and Garg [5] extended the concept of splitting graphs to splitting sigraphs as: For every vertex $v \in V(S)$, create a new vertex v'. Join v' to all vertices of S adjacent to v such that,

$$\sigma_\Lambda(uv') = \sigma(uv),\ u \in N(v).$$

The sigraph so obtained $\Lambda(S) = (V_\Lambda, E_\Lambda, \sigma_\Lambda)$ of a sigraph $S = (V, E, \sigma)$ is called the splitting sigraph (see **Fig 1**) of S. A given sigraph S is a splitting sigraph if it is isomorphic to the splitting sigraph $\Lambda(T)$ of a sigraph T. Here T is called the root splitting sigraph of S.

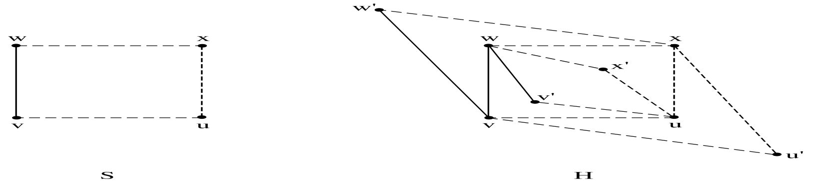

Fig. 1. Showing splitting sigraph $H = \Lambda(S)$ of a sigraph S

2 Numerical Interpretation to obtain splitting signed graph

Consider n to be the number of vertices. An $n \times n$ symmetric adjacency matrix is encoded with respect to given sigraph. Since, for every vertex, another new vertex is created therefore, splitting sigraph will have '2n' number of vertices. Starting from first row, find all non-zero entries in row 1. These non-zero entries denotes the vertex adjacent to vertex 1. Now these entries are also adjacent to to $(n + 1)$ vertex and we update the output matrix. Similarly we calculate for each row till all rows are traversed. Thus, output matrix of order $2n \times 2n$ is created.