Formulas for the number spanning trees of K_n ($K_{n,m}$) -complement of a bipartite graph

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Abstract

Let G be a subgraph of the complete graph K_n (the complete bipartite graph $K_{n,m}$). The K_n-complement ($K_{n,m}$-complement) of G, denoted by $K_n - G$ ($K_{n,m} - G$), is the graph resulting by removing the edges of G from K_n ($K_{n,m}$). In this paper we examine the problem of calculating the number of spanning trees of $K_n - G$ ($K_{n,m} - G$) for a bipartite graph G in a very straightforward manner and derive formulas for their number of spanning trees of K_n-complements ($K_{n,m}$-complements) of various important classes of bipartite graphs including matchings, paths, cycles, stars and complete bipartite graphs, which generalize previous results and extend the family of graphs of the form $K_n - G$ ($K_{n,m} - G$) admitting formulas for the number of their spanning trees. Our proofs are heavily relying on the celebrated Matrix-Tree-Theorem and an expansion of the determinant of the sum of two square matrices, one of which is a diagonal matrix.

Keywords: Spanning tree; Bipartite graph; $K_{m,n}$-complement; $K_{m,n}$-complement; Induced balanced bipartite subgraphs

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