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C₄-Factorizations with Two Associate Classes.

Let $K = K(a, p; \lambda_1, \lambda_2)$ be the multigraph with: the number of vertices in each part equal to a ; the number of parts equal to p ; the number of edges joining any two vertices of the same part equal to λ_1 ; and the number of edges joining any two vertices of different parts equal to λ_2 . This graph was of interest to Bose and Shimamoto in their study of group divisible designs with two associate classes. Necessary and sufficient conditions for the existence of z -cycle decompositions of this graph have been found when $z \in \{3, 4\}$. The existence of C_4 -factorizations of K has been settled when a is even, but the odd case is much more difficult. In this paper, necessary and sufficient conditions for the existence of a C_4 -factorization of $K(a, p; \lambda_1, \lambda_2)$ are found when $a \equiv 1 \pmod{4}$. (Received September 14, 2009)