On the rank of shifted matrices

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Abstract

Given two square matrices over a fixed field such that their difference is a multiple of the all ones matrix J, we study the relationship between kernels of the two matrices. For example, it is shown that their kernel dimensions can only differ by at most one. If one of the kernels is strictly smaller, then it is contained in the other one. Moreover, for every square matrix A the family of matrices $A - \mu J$ admits at most two different ranks. Restricting ourselves to symmetrical matrices, we show that the rank of at most one matrix $A - \mu_0 J$ may differ from the others. We apply our results to eigenspaces of graph complements.

Keywords: matrix, rank

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