On matrix theory, graph theory, and finite geometry

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Preserver problems represent a research area in matrix theory, where a typical problem demands a characterizations of all maps on a certain set of matrices that preserve some function, subset or a relation. If the studied maps are bijective by the assumption, then the characterization of the maps involved is often easier to obtain. In the case of certain preservers of binary relations it turns out that bijectivity can be deduced automatically by using some techniques from graph theory, which involve graph homomorphisms. In the talk I will survey few such techniques. While several preserver problems on matrices over finite fields have been solved by using these techniques, an increasing number of recent examples shows that both research areas: (a) preserver problems and (b) the study of graph homomorphisms overlap also with some problems in finite geometry.