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Commuting Nilpotent Matrices.

Fix a nilpotent $n \times n$ matrix B over a field k and of Jordan partition P. Consider the centralizer $\mathcal{C}_B$ of B and its irreducible subvariety $\mathcal{N}_B$ of nilpotent matrices. There is a Jordan block partition $Q(P)$ of the generic matrix $A \in \mathcal{N}_B$, that is greater than any other Jordan partition occurring for elements of $\mathcal{N}_B$. R. Basili and A. Iarrobino show that the partition $Q(P)$ is determined by the Hilbert function of the ring $k[A, B]$ with A a generic element of $\mathcal{N}_B$. It is also shown, by T. Košir and P. Oblak, that $k[A, B]$ is Gorenstein for general enough A. From these results it follows that $Q(P)$ has parts differing pairwise by at least two. In this talk we review the basic facts and discuss a new approach to the study of $Q(P)$ developed in a joint work with R. Basili and A. Iarrobino. (Received August 30, 2009)