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Noncommutative invariants and coinvariants of the symmetric group

The algebras NCSym_n and Sym_n ($n \in \mathbb{N}_+$) are defined to be the $\mathfrak{S}_n$-invariants inside $\mathbb{Q}\langle A_n \rangle$ (resp. $\mathbb{Q}[X_n]$), the polynomial functions on a noncommutative alphabet A_n (resp. commutative, X_n) of cardinality n. The abelianization ($a_i \mapsto x_i$) realizes Sym_n as a quotient of NCSym_n. Here, we view it as a subspace. Some surprising identities on the ordinary generating function for the Bell numbers appear as an immediate corollary. In case $n = \infty$, we obtain new information on the (Hopf) algebraic structure of NCSym_n.

Time permitting, we outline similar results for Hivert's r-QSym_n algebras ($r, n \in \mathbb{N}_+ \cup \{\infty\}$) and their noncommutative analogues.

Joint work with F. Bergeron.