Various bialgebras of representative functions on free monoids

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Factorization and decomposition of representative functions with values in a (commutative) ring A and on a free monoid $\mathcal{X}^*$, generated by an (infinite or infinite) alphabet $\mathcal{X}$, are equivalent to factorization and decomposition of their graphs, viewed as noncommutative rational series admitting linear representations.

To factorize and to decompose these graphs we examine various products (as concatenation, shuffle and its commutative ϕ-deformations) of noncommutative series (over $\mathcal{X}^*$ with values in A) and coproducts which are such that their associated non graded bialgebras, on a field K, are isomorphic to the Sweedler's dual of the graded noncommutative co-commutative K-bialgebra of polynomials having only Kleene stars of the plane as characters, for concatenation. Moreover, the A-subalgebra of Kleene stars of the plane is closed by these various products.