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Temperley Lieb invariants and covariants

Hivert defined an action of the symmetric group on polynomials in n variables for which the quasi-symmetric polynomials correspond to the invariants of the action. The symmetric group algebra mod out by the kernel of this action can be identified with the temperley-Lieb algebra TL_n, an algebra of dimension equal to the nth Catalan number C_n. The quasi-symmetric polynomials are thus identified as the polynomial invariants of the algebra TL_n.

The action of Hivert is not compatible with multiplication and does not preserve the ideal generated by non-constant homogeneous quasi-symmetric polynomials. Yet we can still consider the quotient R_n of the polynomial ring by this ideal. This yields some striking facts related to TL_n-invariants: The quasi-symmetric functions are closed under multiplication in particular they form a subring of polynomials. Moreover, if we let n go to infinity, there is a graded Hopf algebra structure on quasi-symmetric functions that is free and cofree with cogenerators in every degree. Moreover, the space R_n of TL_n-covariants has dimension equal to C_n, the dimension of TL_n.

These facts are very similar to the classical theory of group invariants. Unfortunately the analogy is incomplete as Hivert's action does not induce an action on R_n. This raises new open questions for future investigation...