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A factorization theorem for m-rook placements

Consider a Ferrers diagram $B = (b_1, b_2, \ldots, b_n)$. Let $r_k(B)$ be the number of placements of k non-attacking rooks on B and $x\downarrow_k = (x)(x-1)\cdots(x-k+1)$. The famous Factorization Theorem of Goldman-Joichi-White states that $\sum_{k\geq 0} r_k(B) x\downarrow_{n-k} = \prod_j (x + b_j - j + 1)$. Briggs and Remmel considered a generalization of rook placements to m-rook placements which are related to wreath products $C_m \wr S_N$ where C_m is a cyclic group and S_N a symmetric group. They were able to prove a version of the Factorization Theorem in this setting, but only for certain B. We give a generalization which holds for all B. This is joint work with Loehr and Remmel.