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Mobius inversion, groupoids and inverse semigroup algebras

Using Mobius inversion, we give an explicit isomorphism between the algebra of a finite inverse semigroup and the algebra of its underlying groupoid (which is in turn isomorphic to a direct sum of matrix algebras over the local groups). From this one obtains a description of the irreducible representations and a character sum formula for calculating intertwining numbers. Applications include explicit decompositions of tensor and exterior powers of representations of partial permutation inverse semigroups and calculation of the eigenvalues with multiplicities for random walks on finite triangularizable semigroups.