

# Fast Fourier Transforms for Inverse Semigroups

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## Abstract

We define the notion of an inverse semigroup  $S$  and the notion of the Fourier transform on  $S$ . We exhibit a method for constructing Fast Fourier transforms for finite inverse semigroups. Our construction uses partially ordered sets, Mobius inversion, and group-based FFTs. We give an explicit construction for the rook monoid, which is the collection of placements of non-attacking rooks (1's) on an  $n \times n$  chessboard (i.e., in an  $n \times n$  matrix, with all other entries being 0), under the operation of matrix multiplication.