

Let G be a finite group. It is easy to compute the character of G corresponding to a given complex representation, but much more difficult to compute a representation affording a given character. In part this is due to the fact that a class of equivalent representations contains no natural canonical representation.

Although there is a large literature devoted to computing representations, and methods are known for particular classes of groups, no general method has been proposed which is practical for any but very small groups. For example, the function “IrreducibleRepresentationsDixon” which is supplied in the latest version 4.3 of the computer algebra system GAP, is very slow in computing representations for even moderately sized groups and fails to compute a representation in many cases.

We shall describe an algorithm to compute an irreducible matrix representation R which affords a given character χ of a given group G . The algorithm uses properties of the structure of G which can be computed efficiently by a program such as GAP, theoretical results from representation theory, theorems from group theory (including the classification of finite simple groups), and linear algebra. The algorithm has been implemented in GAP and appears to work well for a general group G when the character supplied has degree up to about 30.