If a finite group $G$ acts on itself by left and right multiplication a well known scheme is produced. Equivalently one can take a set of variables $\{x_g\}_{g \in G}$; form the group matrix $X_G = \{x_{gh^{-1}}\}$ and identify $x_g = x_h$ if $g$ is conjugate to $h$. In probability theory $X_G$ appears as the transition matrix $X^p_G$ of a Markov chain which comes from a random walk on the group with probability distribution $p$, after $x_g$ is replaced by $p(g)$. By the standard theory, if $p$ is constant on conjugacy classes $X^p_G$ can be diagonalised, and this simplifies the analysis.

The question which will be addressed is the following. Let $R$ be an equivalence relation on $G$, and set $x_g = x_h$ iff $gRh$, giving rise to the matrix $X^R_G$. Under what conditions is $X^R_G$ diagonalisable and in this case what is an upper bound for the number of classes of $R$? If $R$ is finer than conjugacy, this is equivalent to the corresponding fission of the association scheme being commutative. In the probability context, the answer gives a weaker condition for $p$ such that $X^p_G$ can be diagonalised. There are obvious generalisations. (Received March 04, 2013)