Recent work on monstrous moonshine has shown that there are exact formulas for the multiplicities of the irreducible components of the moonshine modules, showing in particular that these multiplicities are asymptotically proportional to the dimensions. With the recent proof of the umbral moonshine conjecture it is natural to ask whether this distribution result extends to other instances of moonshine, including umbral moonshine. In joint work with Victor Manuel Aricheta, we consider the general situation in which a finite group acts on an infinite-dimensional graded module in such a way that the graded-trace functions are weakly holomorphic modular forms. Under some mild hypotheses we completely describe the asymptotic module structure of the homogeneous subspaces. As a consequence we find that moonshine for a group gives rise to partial orderings on its irreducible representations. This serves as a first answer to a question posed by Griess. (Received March 20, 2017)