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The (abstract) classification of soluble Frobenius complements.

A Frobenius group is a finite transitive permutation group in which the elements that fix no point form a regular normal subgroup. A Frobenius complement is the stabilizer of a point in a Frobenius group. What one would like to have is a list of presentations (generators and defining relations) such that each defines a Frobenius complement and each Frobenius complement is isomorphic (as abstract group) to precisely one of the groups so defined.

Passman's book on permutation groups is the most useful source I know, but it is not quite this conclusive. The case of Z -groups and the case of insoluble Frobenius complements is adequately covered by Suzuki's paper and Passman's book read together (quite a challenging task for a student). Soluble Frobenius complements that are not Z -groups (but have a normal subgroup of very small index that is a Z -group) seem to be the elusive ones, though pinning them down should not be too hard for somebody who has really digested that reading.

The techniques learned in the process are central tools of finite group theory, so learning them would be great preparation for future work. The result would fill a gap in the literature and should be publishable if well written. The undertaking is rather ambitious at the Honours or Masters level, but does not look substantial enough for a PhD. Any one of us group theorists could happily supervise it for a really good student with the right coursework background.