RENATE SCHEIDLER, University of Calgary
Constructing Imaginary Quadratic Fields with Large n-Class Rank

Constructing imaginary quadratic fields whose ideal class groups have large n-rank is a challenging practical problem, due in part because heuristically and experimentally such examples are very rare. One of the most successful methods for producing many fields of relatively small discriminant with large 3-class rank is due to Diaz y Diaz dating back to the 1970s. His technique formed the basis of the approach used by Quer in 1987 to find three fields with 3-class rank equal to 6, which still stands as the current record. We describe generalizations to this method to allow the construction of fields with large n-class rank for any positive odd integer n. An extensive search using our new algorithm in conjunction with a variety of further practical improvements produced billions of fields with non-trivial p-class rank for the primes $p = 3, 5, 7, 11$ and 13, and a large volume of fields with high p-class ranks and unusual p-class group structures. Our numerical results include a field with 5-class rank equal to 4 with the smallest absolute discriminant discovered to date and the first known examples of imaginary quadratic fields with 7-rank equal to 4. This is joint work with Christian G. Bagshaw, Michael J. Jacobson, Jr. and Nickolas Rollick.