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A Number Fields Database

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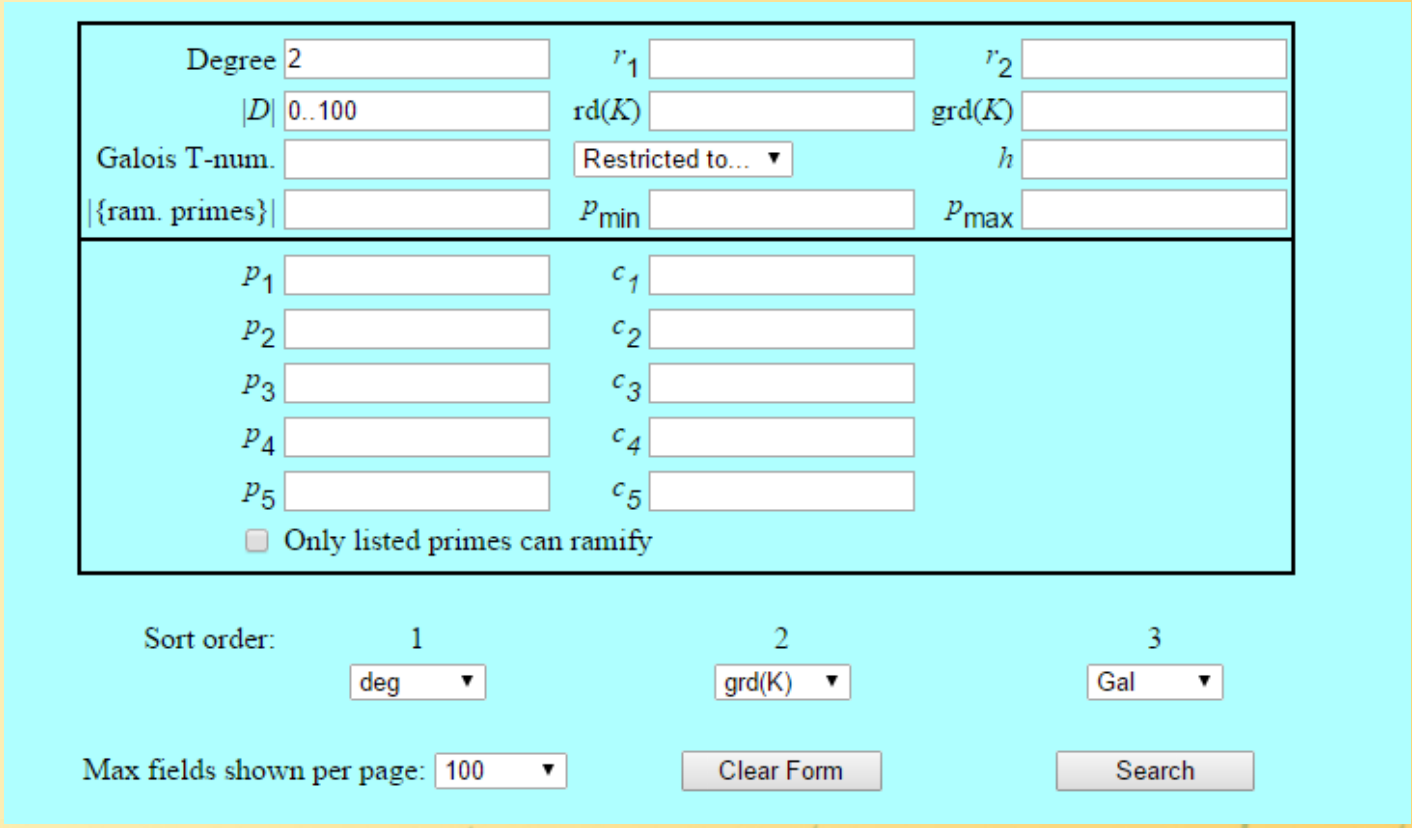
Introduction

- NumberFields@Home is a volunteer distributed computing project based at the Arizona State University Math Department.
  - http://numberfields.asu.edu/NumberFields
- Uses BOINC for the distributed computing.
- Uses PARI/GP for the number field computations.
- It is being used to help construct a number field database:
  - NumberFields@home is primarily concerned with degree 10 fields.
  - The number field database contains fields of all degrees.

The Number Fields Database

- http://hobbes.la.asu.edu/NFDB/
- John W. Jones and David P. Roberts, *A database of number fields*, LMS J. Comput. Math. 17 (1) (2014) 595–618



NumberFields@Home Description

- Focuses on imprimitive decic (degree 10) number fields having a quadratic subfield.
  - –Imprimitive fields having a quintic subfield are inherently easier and don't require a distributed computation.
  - –Primitive fields are harder and have not been attempted yet.
- The project has two primary objectives:
  1. Minimum discriminant decic fields with bound 1.2E11.
  2. Decic fields unramified outside a set of primes S.
     - Completed single primes up to p=47.
     - Completed prime pairs {2,3}, {3,7}, {3,11}, {7,11}.
     - Currently processing S={2,5}.

A Few Words About BOINC

- BOINC = Berkeley Open Infrastructure for Network Computing
- Open source code allows anyone with a computer and IP address to create a work server.
- Famous Distributed Computing Projects:
  - GIMPS: Great Internet Mersenne Prime Search
  - SETI: Search for Extra Terrestrial Intelligence
- NumberFields@home current stats:
  - > 5000 users
  - > 19000 host computers
  - > 12 TFLOPS (equivalent to a 6000 core super computer)
  - > 2400 years of compute time (summed over all hosts)

Additions or Changes to PARI/GP?

- I was asked if there were any additions/changes to PARI/GP that could benefit the number fields project.
  - I have Hunter and Martinet subroutines for doing lower degree searches. May not be relevant given the existence of multiple databases.
  - I have code for higher degree searches (up to 10), but due to computational complexity might be impractical.
  - I have Hunter/Martinet code for targeting specific ramification. Again, most anything that one would want can be found in a database, so may not be useful.

Questions?