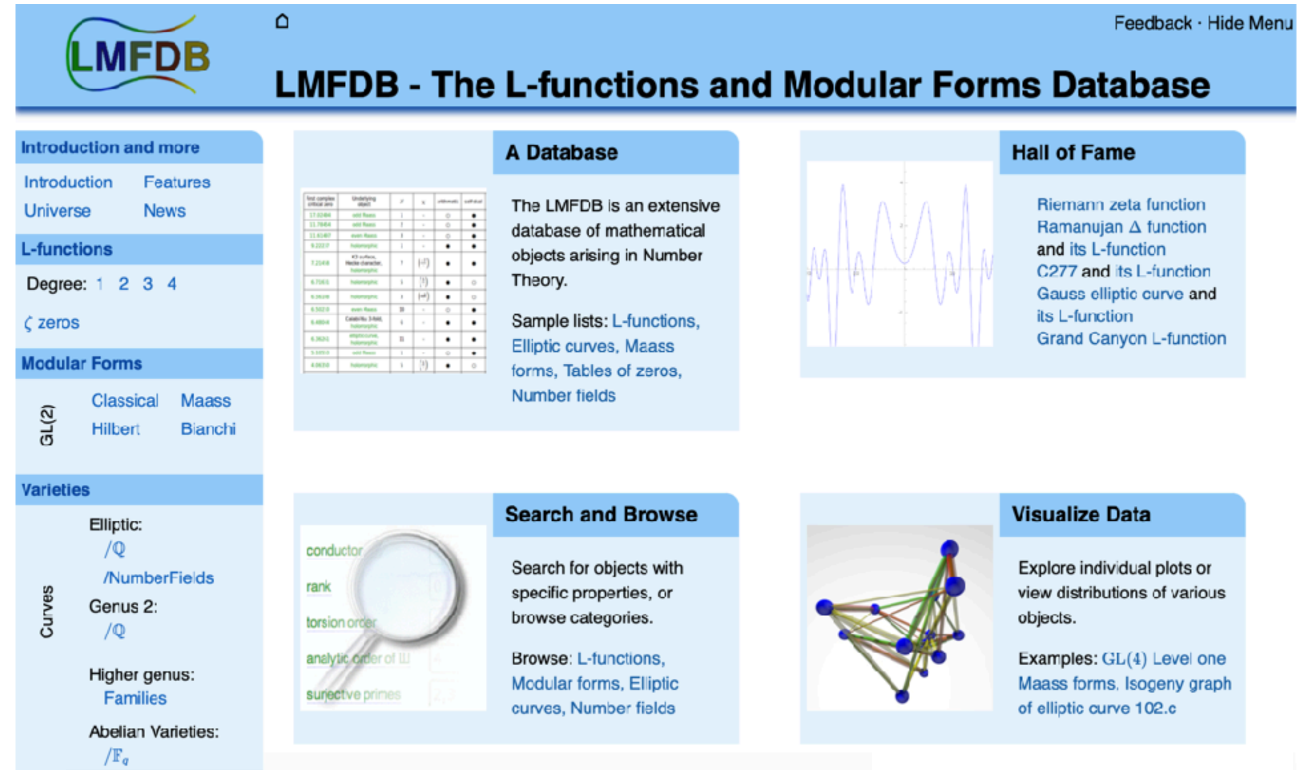
Supporting Data-Driven Mathematics

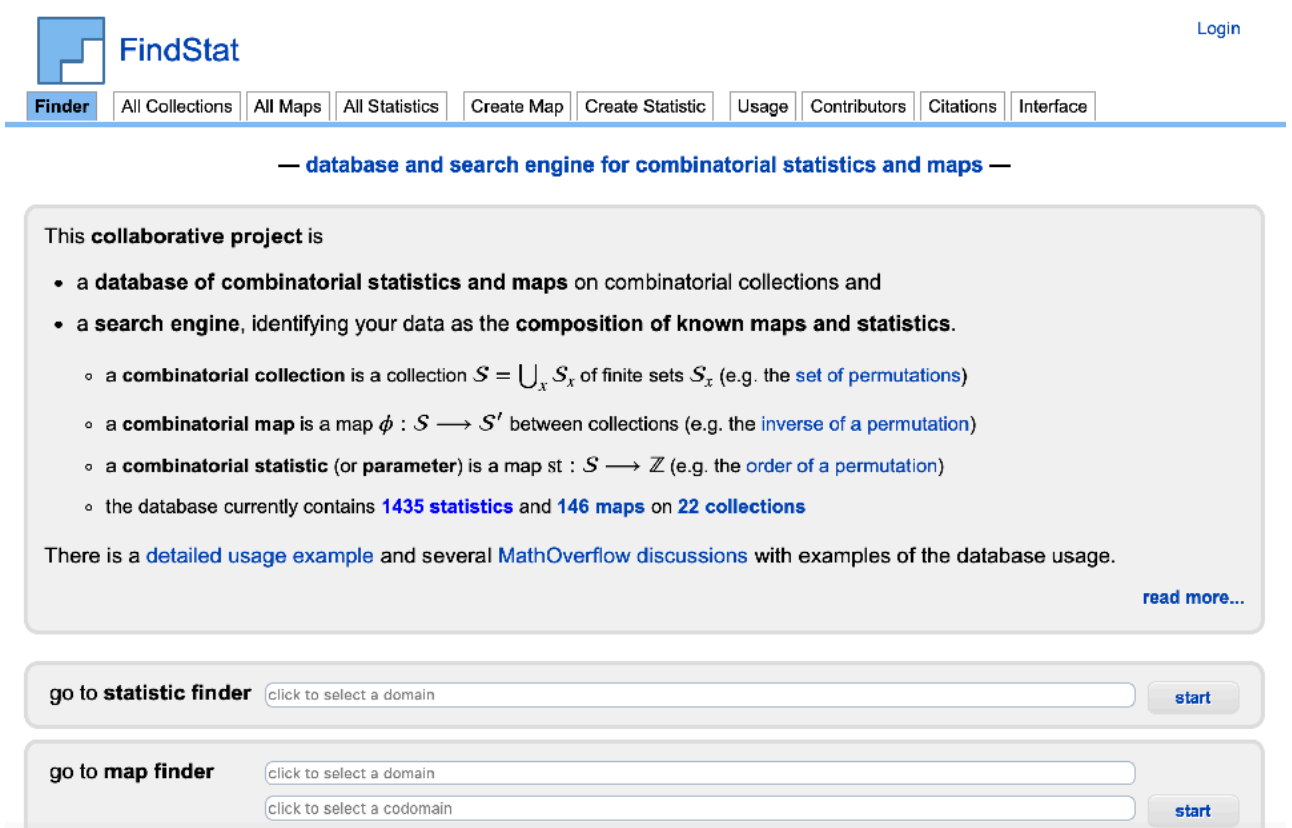
Online databases made easy (for simple datasets)

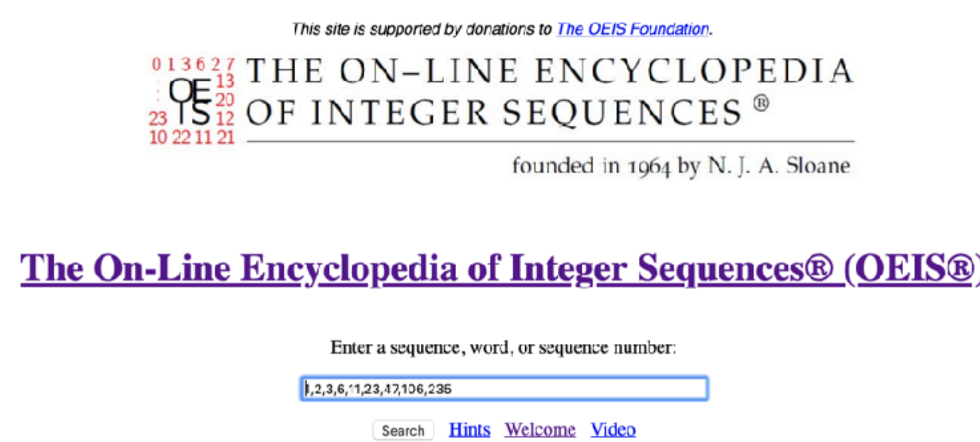
Katja Berčič
FAU Erlangen-Nürnberg

Some Famous Online Combinatorial Math Databases



lmfdb.org





oeis.org

findstat.org

The Other 80% (or more)

[N,i]	V	E	Tr	W?	B?	|AG|
C4[5, 1]	5	10	DT	W	NB	120
C4[6, 1]	6	12	DT	U	NB	48
C4[8, 1]	8	16	DT	U	Bip	(2^7)(3^2)
C4[9, 1]	9	18	DT	W	NB	72
C4[10, 1]	10	20	DT	U	NB	320
C4[10, 2]	10	20	DT	W	Bip	240
C4[12, 1]	12	24	DT	U	Bip	768
C4[12, 2]	12	24	DT	W	NB	48
C4[13, 1]	13	26	DT	W	NB	52
C4[14, 1]	14	28	DT	U	NB	(2^8)(7^1)
C4[14, 2]	14	28	DT	W	Bip	336
C4[15, 1]	15	30	DT	W	NB	60
C4[15, 2]	15	30	DT	W	NB	120
C4[16, 1]	16	32	DT	U	Bip	(2^12)
C4[16, 2]	16	32	DT	W	Bip	384
C4[17, 1]	17	34	DT	W	NB	68
C4[18, 1]	18	36	DT	U	NB	(2^10)(3^2)
C4[18, 2]	18	36	DT	W	Bip	144
C4[20, 1]	20	40	DT	U	Bip	(2^12)(5^1)
C4[20, 2]	20	40	DT	W	Bip	80
C4[20, 3]	20	40	DT	W	NB	320
C4[20, 4]	20	40	SS	U	Bip	(2^8)(3^1)(5^1)
C4[21, 1]	21	42	DT	W	NB	84
C4[21, 2]	21	42	DT	W	NB	336

Wilson, Potočnik; A Census of edge-transitive tetravalent graphs

- Graphs of order 4 to 300 (18 MB)
- Graphs of order 302 to 500 (66 MB)
- Graphs of order 502 to 600 (69 MB)
- Graphs of order 602 to 700 (84 MB)
- Graphs of order 702 to 800 (114 MB)
- Graphs of order 802 to 900 (147 MB)
- Graphs of order 902 to 1000 (183 MB)
- Graphs of order 1002 to 1050 (164 MB)
- Graphs of order 1052 to 1100 (113 MB)
- Graphs of order 1102 to 1150 (103 MB)
- Graphs of order 1152 to 1200 (234 MB)
- Graphs of order 1202 to 1250 (137 MB)
- Graphs of order 1252 to 1280 (131 MB)

Potočnik, Spiga, Verret; A census of small connected cubic vertex-transitive graphs

```
CubicVT:=[ [] : i in [1..1280]];

CubicVT[4,1] := Graph<4 | {{1,3}, {1,4}, {2,4}, {2,3}, {1,2}, {3,4}}>;

CubicVT[6,1] := Graph<6 | {{2,5}, {1,3}, {2,6}, {1,4}, {3,5}, {4,6}, {2,3},
{1,6}, {4,5}}>;

CubicVT[6,2] := Graph<6 | {{1,3}, {1,5}, {2,6}, {5,6}, {4,5}, {2,4}, {1,2},
{3,4}, {3,6}}>;

CubicVT[8,1] := Graph<8 | {{2,8}, {1,5}, {1,7}, {7,8}, {4,8}, {5,6}, {6,7},
{4,5}, {1,2}, {2,3}, {3,4}, {3,6}}>;

CubicVT[8,2] := Graph<8 | {{1,8}, {2,6}, {6,8}, {4,7}, {1,4}, {4,5}, {5,8},
{1,2}, {2,7}, {3,7}, {3,5}, {3,6}}>;

CubicVT[10,1] := Graph<10 | {{4,6}, {3,5}, {2,6}, {4,8}, {5,6}, {3,4}, {1,5},
{1,10}, {2,10}, {7,9}, {3,7}, {9,10}, {1,7}, {2,8}, {8,9}}>;

CubicVT[10,2] := Graph<10 | {{4,6}, {3,5}, {3,6}, {4,5}, {8,10}, {1,3}, {6,8},
{1,9}, {5,7}, {7,10}, {9,10}, {2,4}, {1,7}, {2,8}, {2,9}}>;

CubicVT[10,3] := Graph<10 | {{2,6}, {6,7}, {4,8}, {3,9}, {1,3}, {4,10}, {6,8},
{5,9}, {1,4}, {1,2}, {2,5}, {7,10}, {3,7}, {8,9}, {5,10}}>;

CubicVT[12,1] := Graph<12 | {{12,10}, {11,7}, {3,9}, {3,7}, {11,9}, {2,4},
{6,10}, {1,9}, {12,5}, {1,5}, {11,6}, {7,8}, {6,8}, {3,5}, {4,10}, {12,2},
{4,8}, {1,2}}>;
```

Beginnings

discrete

WEBSITE
Postgres

SAGE PACKAGE
SQLite

export

export

DATA REPOSITORY

Janoš Vidali

Janoš's SageMath package

Compare objects (both ways!)

```
sage: G = CVTGraph(10, 3)
sage: G.is_isomorphic(graphs.PetersenGraph())
True
```

Use the object `info` to query the database

```
sage: gen = info.all(is_partial_cube, orderby=order) # sort by num. of vcs.
sage: next(gen) # first matching graph
3-Cube: cubic vertex-transitive graph on 8 vertices, number 2
sage: next(gen) # second matching graph
6-Prism: cubic vertex-transitive graph on 12 vertices, number 3
```

```
sage: info.count(cvt_index) # number of graphs in the CVT census
111360
sage: info.count(cvt_index, groupby=girth) # break down by girth
{3: 160, 4: 5754, 5: 100, 6: 58674, 7: 192, 8: 13529, 9: 219,
 10: 25806, 11: 80, 12: 5423, 13: 37, 14: 1365, 15: 12, 16: 9}
```

Search

Graphs ? Maniplexes ?

- [ ] vertex transitive graphs
- [x] cubic vertex transitive graphs
- [ ] cubic arc transitive graphs

is partial cube ?

not is prism ?

chromatic index ?

clique number ?

connected components number ?

diameter ?

girth ?

Matches found: *4*

Display results

Choose columns

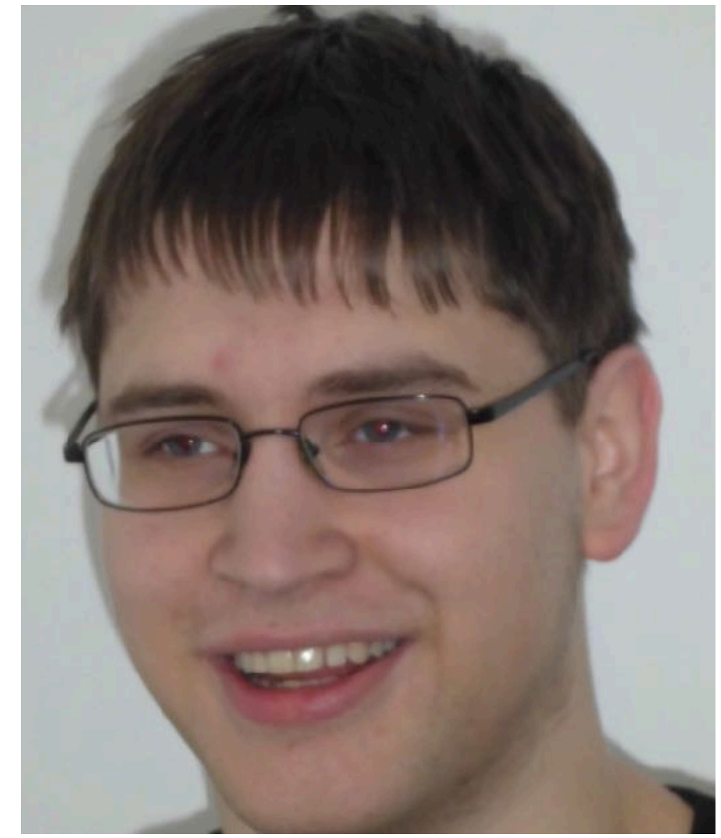
order	CVT	diameter	girth	is arc transitive	is cayley	is hamiltonian
20	7	5	6	true	false	true
24	11	6	4	false	true	true
48	29	9	4	false	true	true
120	60	15	4	false	true	true

discretezoo.xyz


Professur für Wissens-
-repräsentation und -verarbeitung
kwarc
Anything you can do,
we can do META!
FAU
FRIEDRICH-ALEXANDER
UNIVERSITÄT
ERLANGEN-NÜRNBERG

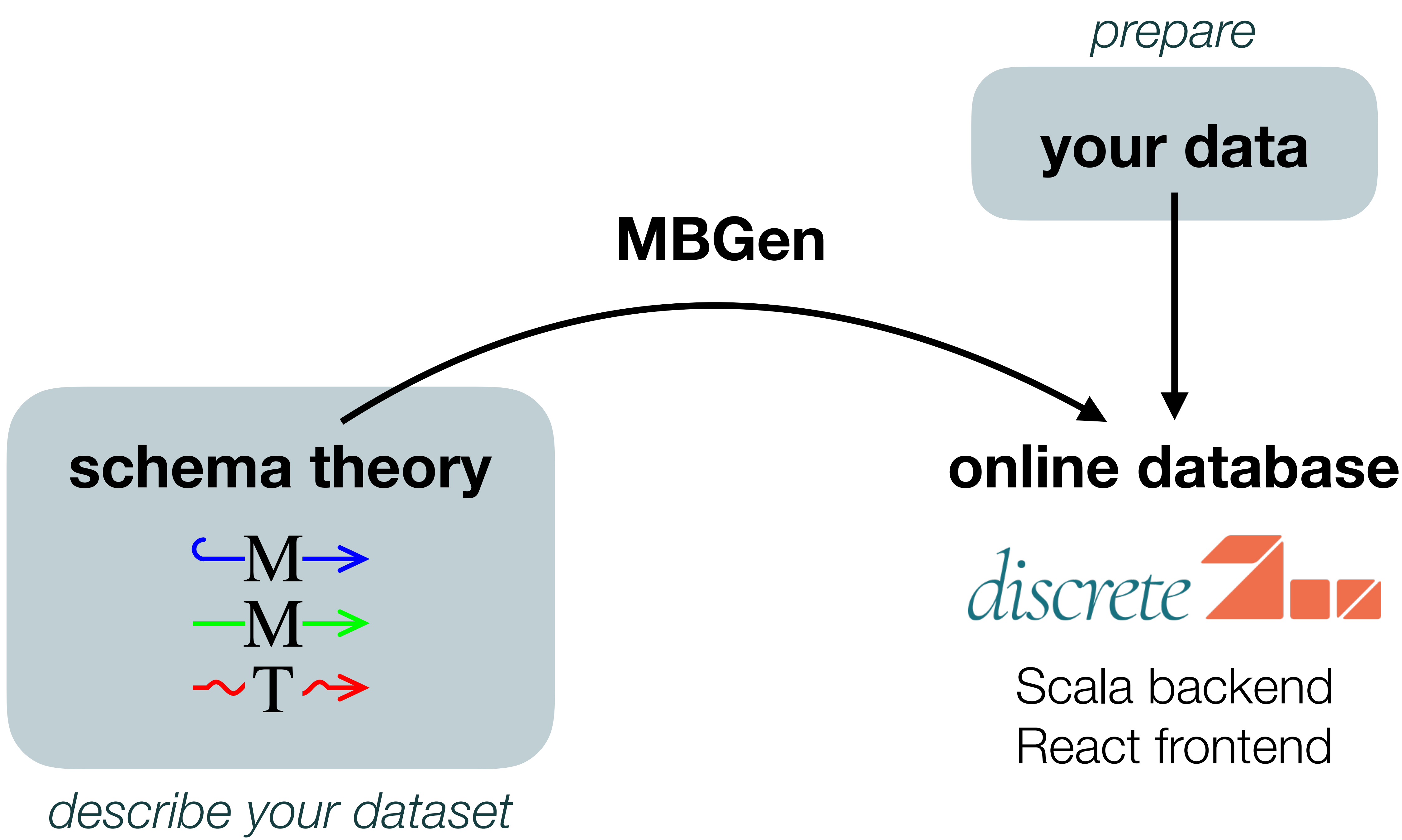
Michael Kohlhase

Florian Rabe



Tom Wiesing

From a dataset to an online database



Anatomy of a schema theory

a name

```
theory Matrix : ?MDDL =

  ...

  orthogonal: bool |
    meta ?Codecs?codec BoolIdent |

  ...
```

property name, mathematical type

the body

how it is stored in the database

Take-away points

If you would like to use this project for your data, please contact me!

katja.bercic@fau.de

You can also help with gathering information about math datasets:

mathdb.mathhub.info

A big thanks goes to OpenDreamKit.
It made the existence of this project possible and gave it a big boost.

OPEN DREAMKIT

```
namespace http://data.mathhub.info/schemas ❚

theory MatrixS : ?MDDL =
  meta ?MDDL?schemaGroup "Joe" ❙

  mat: matrix int 2 2 ❘
    meta ?Codecs?codec MatrixAsArray IntIdent ❘
    tag ?MDDL?opaque ❘
  ❙

  trace: int ❘
    meta ?Codecs?codec IntIdent ❘
  ❙

  orthogonal: bool ❘
    meta ?Codecs?codec BoolIdent ❘
  ❙

  eigenvalues: list int ❘
    meta ?Codecs?codec ListAsArray IntIdent ❘
    tag ?MDDL?opaque ❘
  ❙
```