DESIGN DOCUMENT FOR FUNCTION FIELD PROJECT

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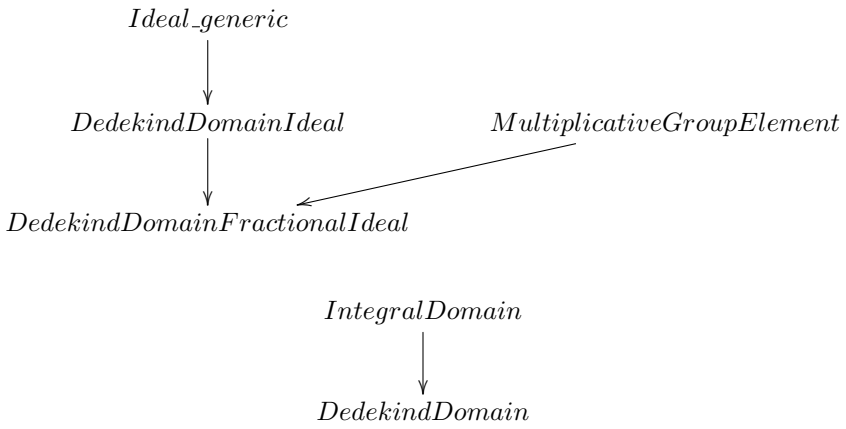
1. Class hierarchy

An arrow $A \longrightarrow B$ indicates that the class B inherits from the class A.

Remark. The DedekindDomain class is depreciated, but already exists in sage. However, the implementation there seems to be unsubstantial.

The documentation also recommends the creation of a DedekindDomain *category*. We should probably ask about this. Regardless, it seems like we need to code the class anyways.



2. Classes

2.1. Class/Category: DedekindDomain. :

Attributes:

- Maximal Order

Init:

- NumberFields → Invoke sage's routines
- FunctionFields → do our things
- Else → NotImplementedError

Methods:

- FractionalIdealGroup

Date: August 18, 2017.

- krull_dimension
- is_commutative
  - Force this to be true. We may even consider changing the class to CommutativeDedekindDomain.
- valuation

2.2. **Class/Category: DedekindDomainElt.** :

Attributes:

- denominator

Init:

- NumberFields → Invoke sage's routines
- FunctionFields → do our things
- Else → NotImplementedError

Methods:

- FractionalIdealGroup
- krull_dimension
- is_commutative
  - Force this to be true. We may even consider changing the class to CommutativeDedekindDomain.

2.3. **Class: DedekindDomainIdeal.** :

Do we want to make the 2-element representation/ OM representation different classes, or do we want the same object to record both representations?

Attributes:

- Basis

Methods:

- is_prime
- denominator
- comparison method
- mult
- norm
- index
- inertia_degree
- ramification_degree
- maximal_order_basis
- convert_to_OM
  - if self is prime, do conversion
  - else raise NotImplementedError
- convert_to_hnf-representation
  - Only for number fields
- $\mathbb{Z}$-basis to 2-elt representation

2.4. **Class: DedekindDomainFractionalIdeal.** :

Attributes:

- Basis

Methods:

- is_integral
- denominator
- comparison method
- mult
- inver
- norm
- index
- inertia_degree
- ramification_degree
- convert_to_OM
  - if self is prime, do conversion
  - else raise NotImplementedError
- convert_to_hnf-representation
  - Only for number fields

3. Accessory functions

4. TODO

(i) Set up Git repository
(ii) Decide if 2-elt/OM representations should be distinct classes or unified in a single class
(iii) Decide on Category versus Object approach
(iv) Determine useful information to store as attributes