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# Chapter 1

## Classes

### 1.1 factor.util – utilities for factorization

- Classes
  - **FactoringInteger**
  - **FactoringMethod**

This module uses following type:

**factorlist** :

factorlist is a list which consists of pairs (**base**, **index**). Each pair means  $base^{index}$ . The product of those terms expresses whole prime factorization.

### 1.1.1 FactoringInteger – keeping track of factorization

#### Initialize (Constructor)

**FactoringInteger(number: integer) → FactoringInteger**

This is the base class for factoring integers.

number is stored in the attribute **number**. The factors will be stored in the attribute **factors**, and primality of factors will be tracked in the attribute **primality**.

The given number must be a composite number.

#### Attributes

**number :**

The composite number.

**factors :**

Factors known at the time being referred.

**primality :**

A dictionary of primality information of known factors. **True** if the factor is prime, **False** composite, or **None** undetermined.

## Methods

### 1.1.1.1 getNextTarget – next target

`getNextTarget(self, cond: function=None) → integer`

Return the next target which meets `cond`.

If `cond` is not specified, then the next target is a composite (or undetermined) factor of **number**.

`cond` should be a binary predicate whose arguments are base and index. If there is no target factor, `LookupError` will be raised.

### 1.1.1.2 getResult – result of factorization

`getResult(self) → factors`

Return the currently known factorization of the **number**.

### 1.1.1.3 register – register a new factor

`register(self, divisor: integer, isprime: bool=None) →`

Register a divisor of the **number** if the divisor is a true divisor of the number.

The number is divided by the divisor as many times as possible.

The optional argument `isprime` tells the primality of the divisor (default to undetermined).

### 1.1.1.4 sortFactors – sort factors

`sortFactors(self) →`

Sort factors list.

This affects the result of **getResult**.

## Examples

```
>>> A = factor.util.FactoringInteger(100)
>>> A.getNextTarget()
```

```
100
>>> A.getResult()
[(100, 1)]
>>> A.register(5, True)
>>> A.getResult()
[(5, 2), (4, 1)]
>>> A.sortFactors()
>>> A.getResult()
[(4, 1), (5, 2)]
>>> A.primalities
{4: None, 5: True}
>>> A.getNextTarget()
4
```

### 1.1.2 FactoringMethod – method of factorization

#### Initialize (Constructor)

**FactoringMethod()** → *FactoringMethod*

Base class of factoring methods.

All methods defined in **factor.methods** are implemented as derived classes of this class. The method which users may call is **factor** only. Other methods are explained for future implementers of a new factoring method.

## Methods

### 1.1.2.1 factor – do factorization

```
factor(self, number: integer, return_type: str='list', need_sort:  
bool=False )  
    → factorlist
```

Return the factorization of the given positive integer `number`.

The default returned type is a **factorlist**.

A keyword option `return_type` can be as the following:

1. 'list' for default type (**factorlist**).
2. 'tracker' for **FactoringInteger**.

Another keyword option `need_sort` is Boolean: `True` to sort the result. This should be specified with `return_type='list'`.

### 1.1.2.2 †continue\_factor – continue factorization

```
continue_factor(self, tracker: FactoringInteger, return_type:  
str='tracker', primeq: func=primeq )  
    → FactoringInteger
```

Continue factoring of the given tracker and return the result of factorization.

The default returned type is **FactoringInteger**, but if `return_type` is specified as 'list' then it returns **factorlist**. The primality is judged by a function specified in `primeq` optional keyword argument, which default is **primeq**.

### 1.1.2.3 †find – find a factor

```
find(self, target: integer, **options ) → integer
```

Find a factor from the `target` number.

This method has to be overridden, or **factor** method should be overridden not to call this method.

### 1.1.2.4 †generate – generate prime factors

```
generate(self, target: integer, **options ) → integer
```

Generate prime factors of the `target` number with their valuations.

The method may terminate with yielding (1, 1) to indicate the factorization is incomplete.

This method has to be overridden, or **factor** method should be overridden not to call this method.



# Bibliography