GF for Python programmers

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Inari Listenmaa, based on tutorial by Herbert Lange
Stellenbosch, 5th December 2018

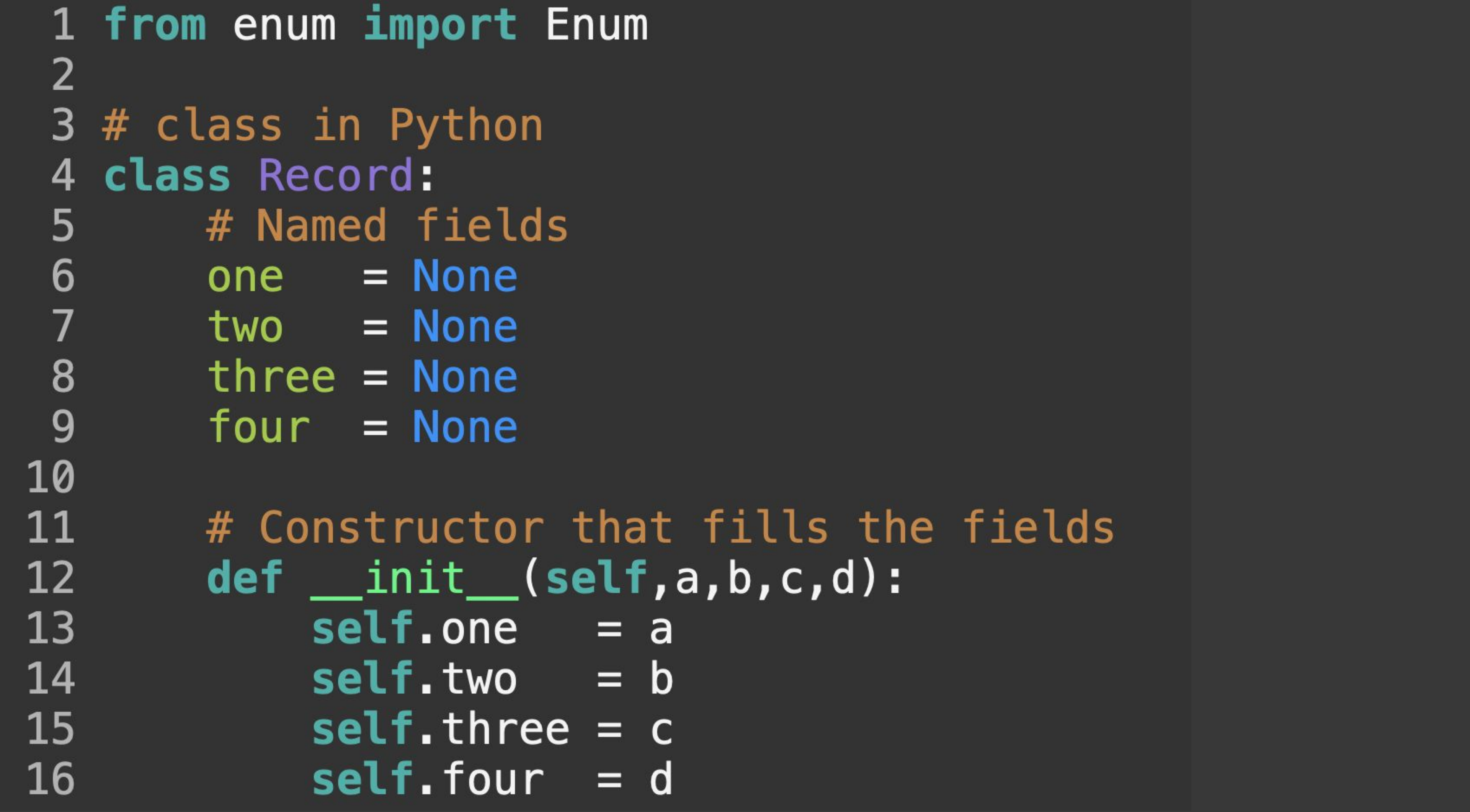
daherb.github.io/GF-for-Python-programmers/

In the link above, you find a more comprehensive GF⇔Python tutorial, with links to Jupyter notebooks and GF source code.

python™

record		class
table		dictionary
param	≈	enum

static types



```python
from enum import Enum

# class in Python
class Record:
    # Named fields
    one   = None
    two   = None
    three = None
    four  = None

    # Constructor that fills the fields
    def __init__(self,a,b,c,d):
        self.one   = a
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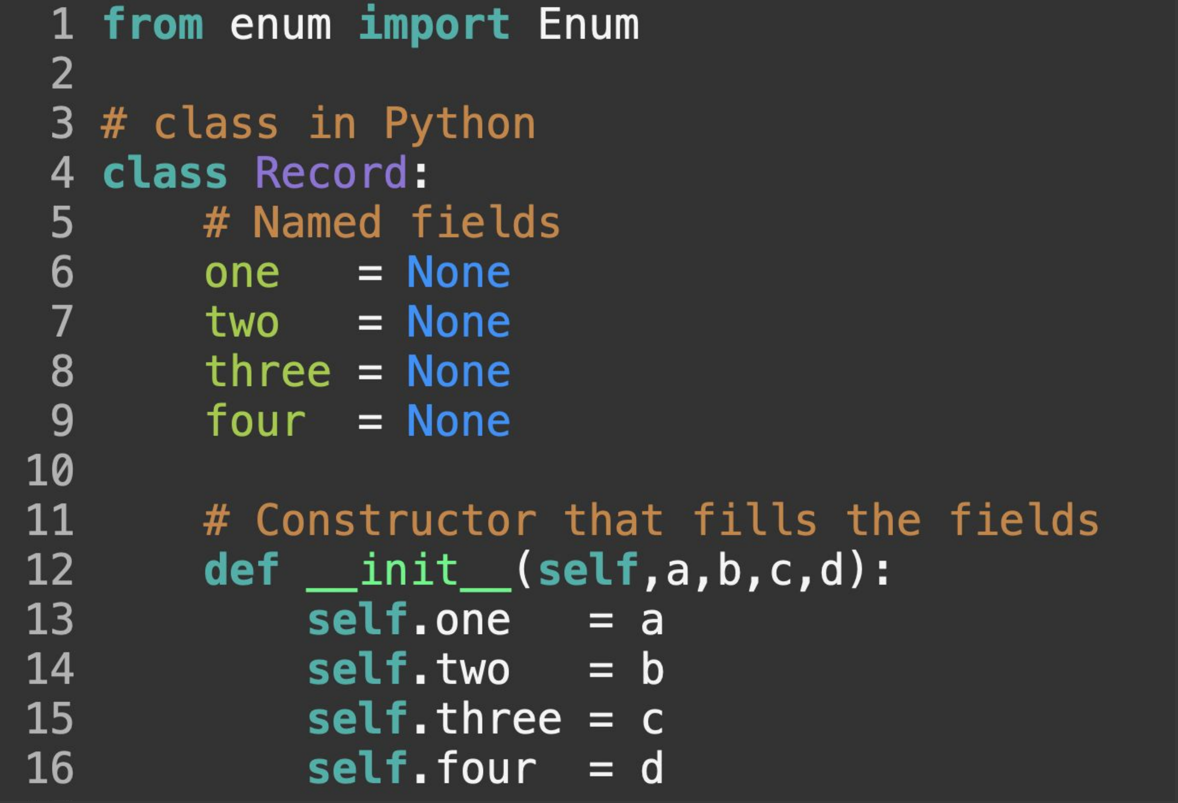
Can be any type!



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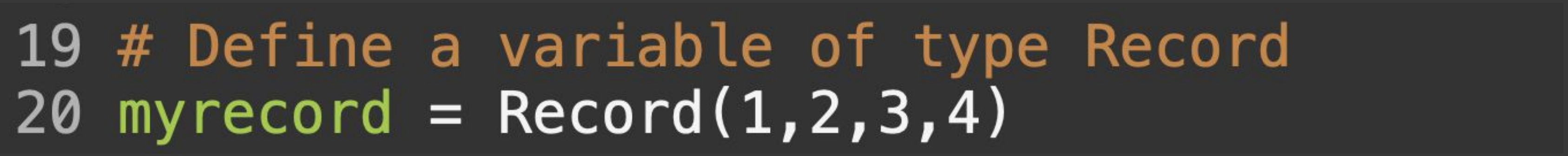
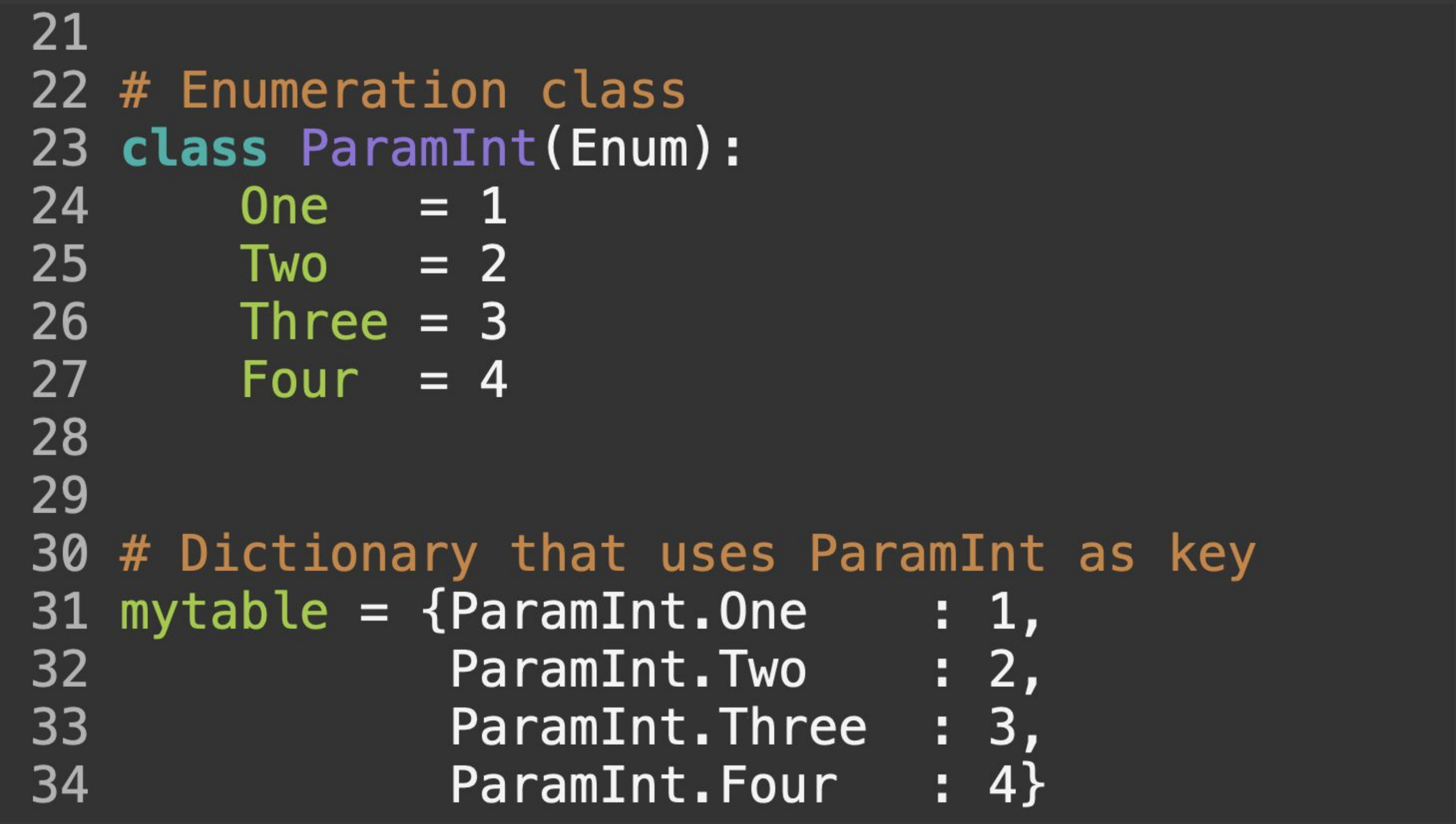


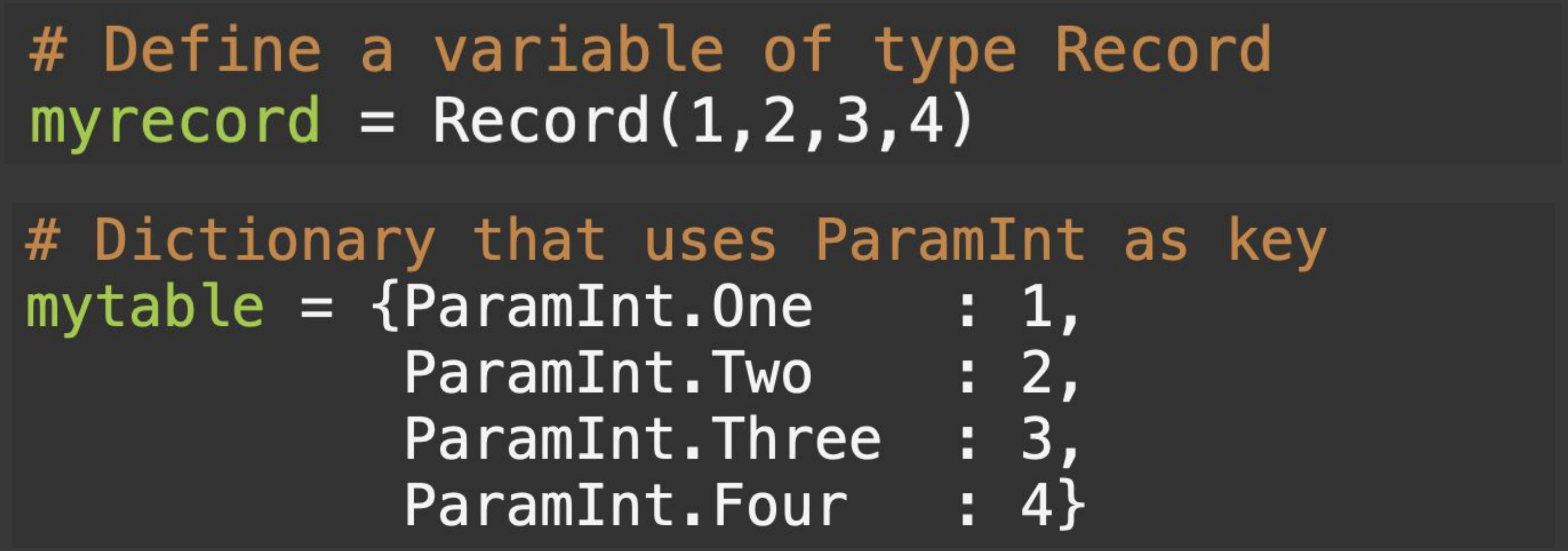
```python
# Define a variable of type Record
myrecord = Record(1,2,3,4)
```



```python

# Enumeration class
class ParamInt(Enum):
    One   = 1
    Two   = 2
    Three = 3
    Four  = 4


# Dictionary that uses ParamInt as key
mytable = {ParamInt.One    : 1,
           ParamInt.Two    : 2,
           ParamInt.Three  : 3,
           ParamInt.Four   : 4}
```



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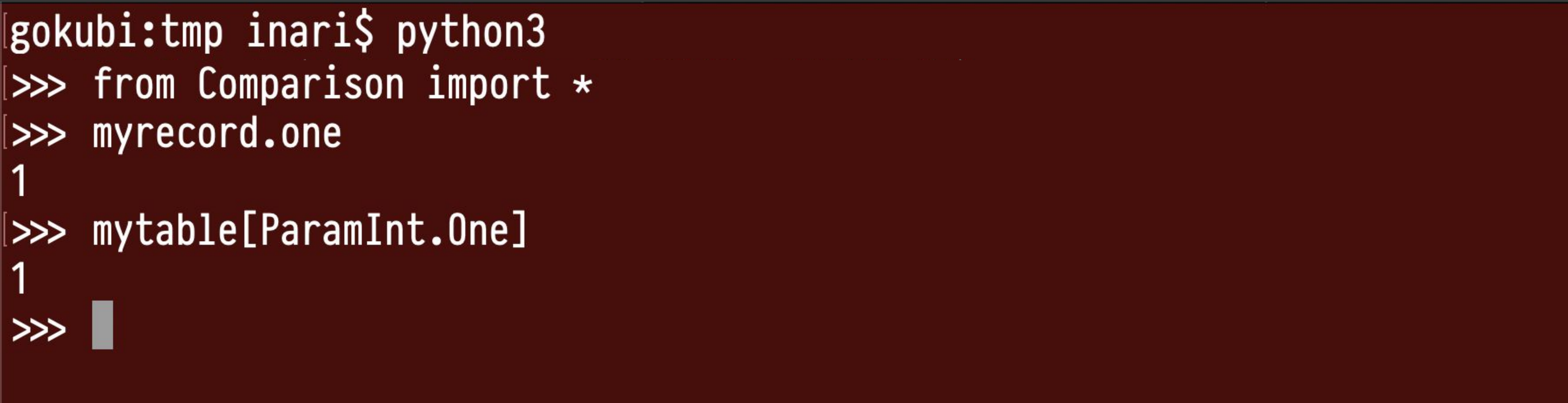
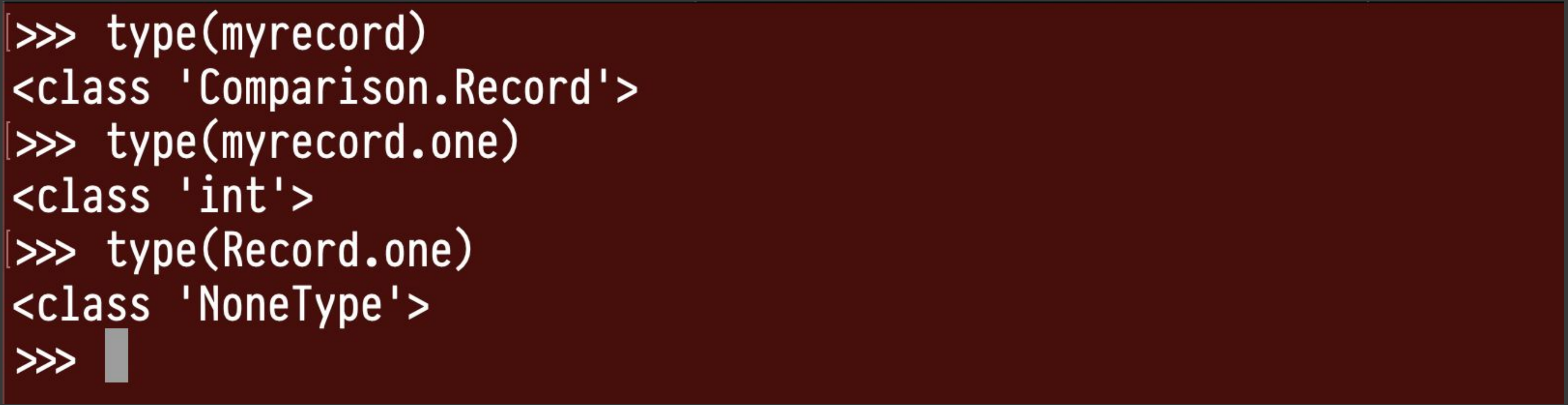


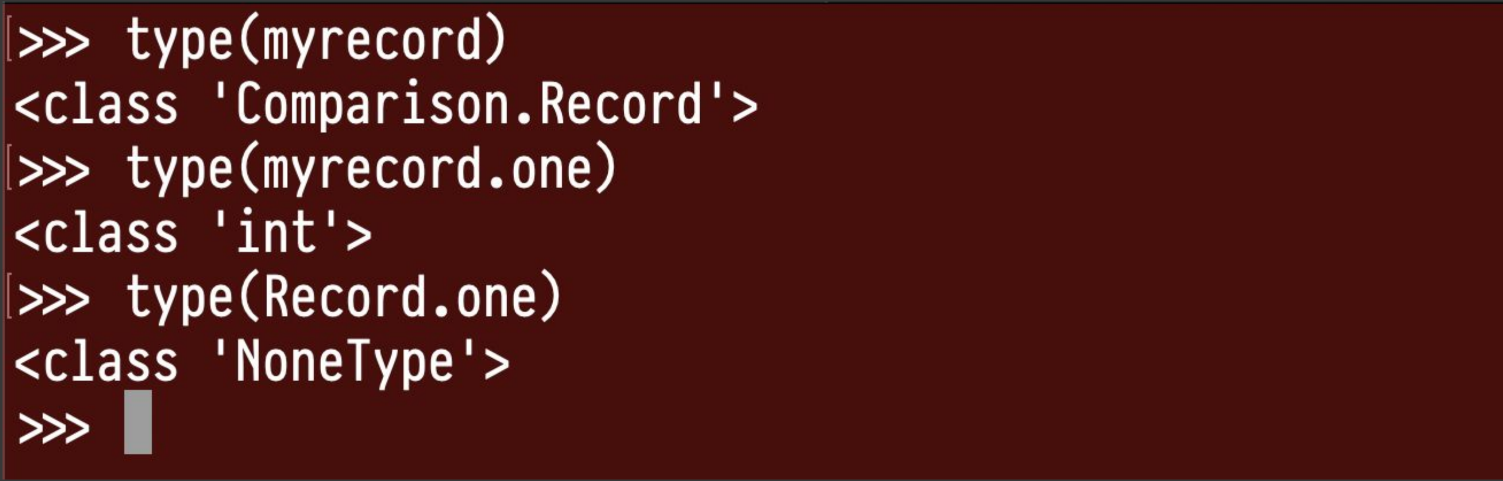
```
gokubi:tmp inari$ python3
>>> from Comparison import *
>>> myrecord.one
1
>>> mytable[ParamInt.One]
1
>>> 
```

Types



```
>>> type(myrecord)
<class 'Comparison.Record'>
>>> type(myrecord.one)
<class 'int'>
>>> type(Record.one)
<class 'NoneType'>
>>> 
```

Types



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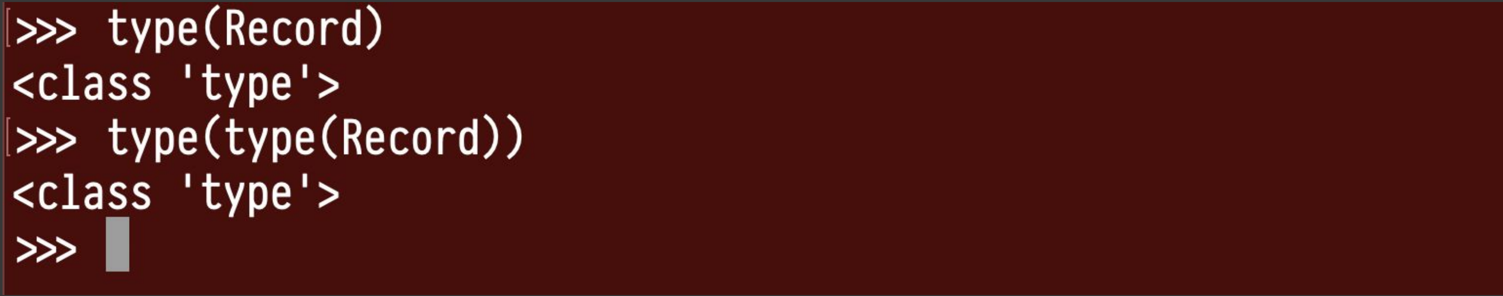
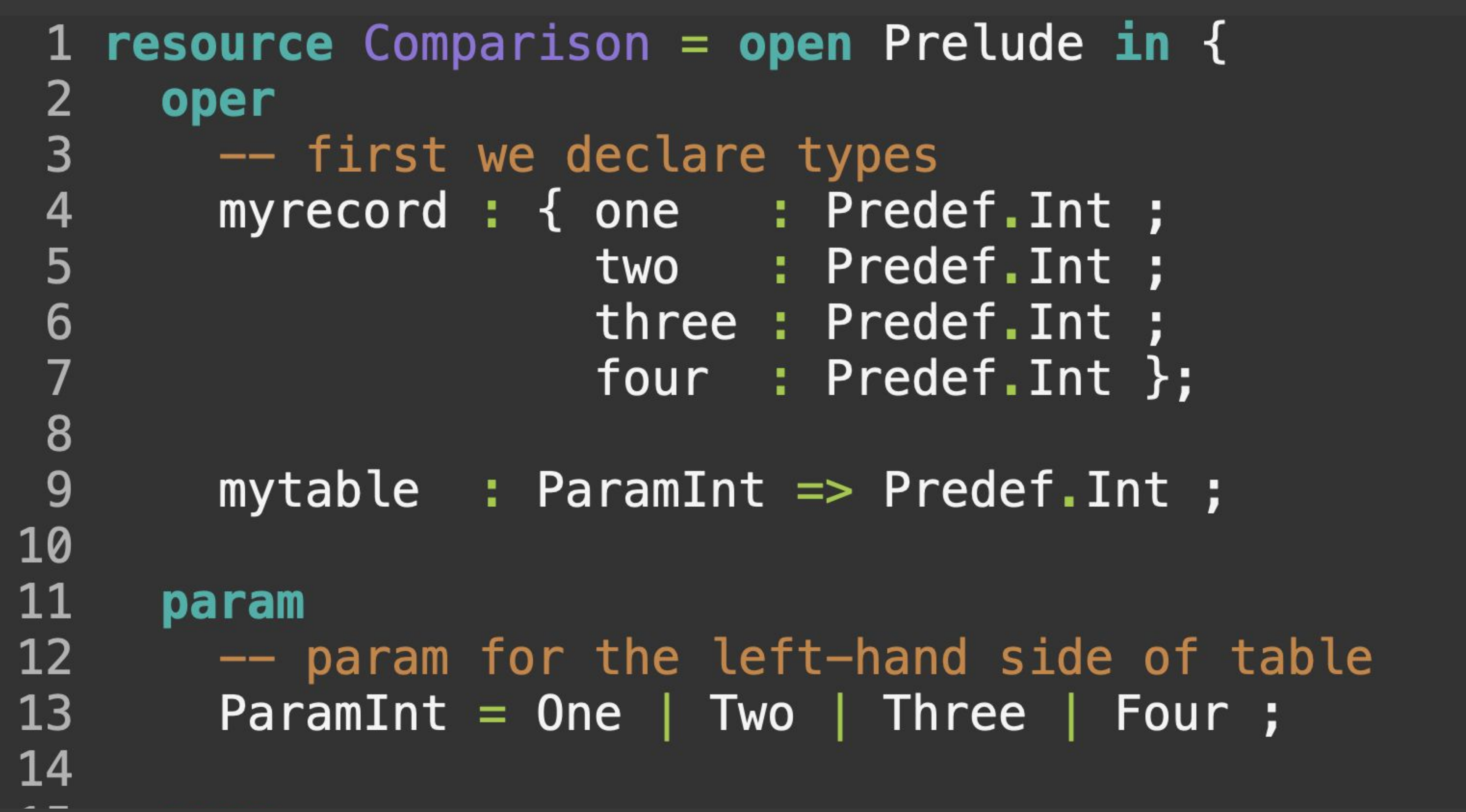


```
>>> type(Record)
<class 'type'>
>>> type(type(Record))
<class 'type'>
>>> 
```



```
resource Comparison = open Prelude in {
  oper
    -- first we declare types
    myrecord : { one   : Predef.Int ;
                 two   : Predef.Int ;
                 three : Predef.Int ;
                 four  : Predef.Int };

    mytable  : ParamInt => Predef.Int ;

  param
    -- param for the left-hand side of table
    ParamInt = One | Two | Three | Four ;

```

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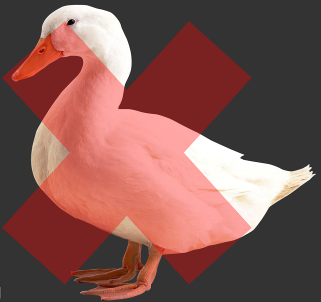
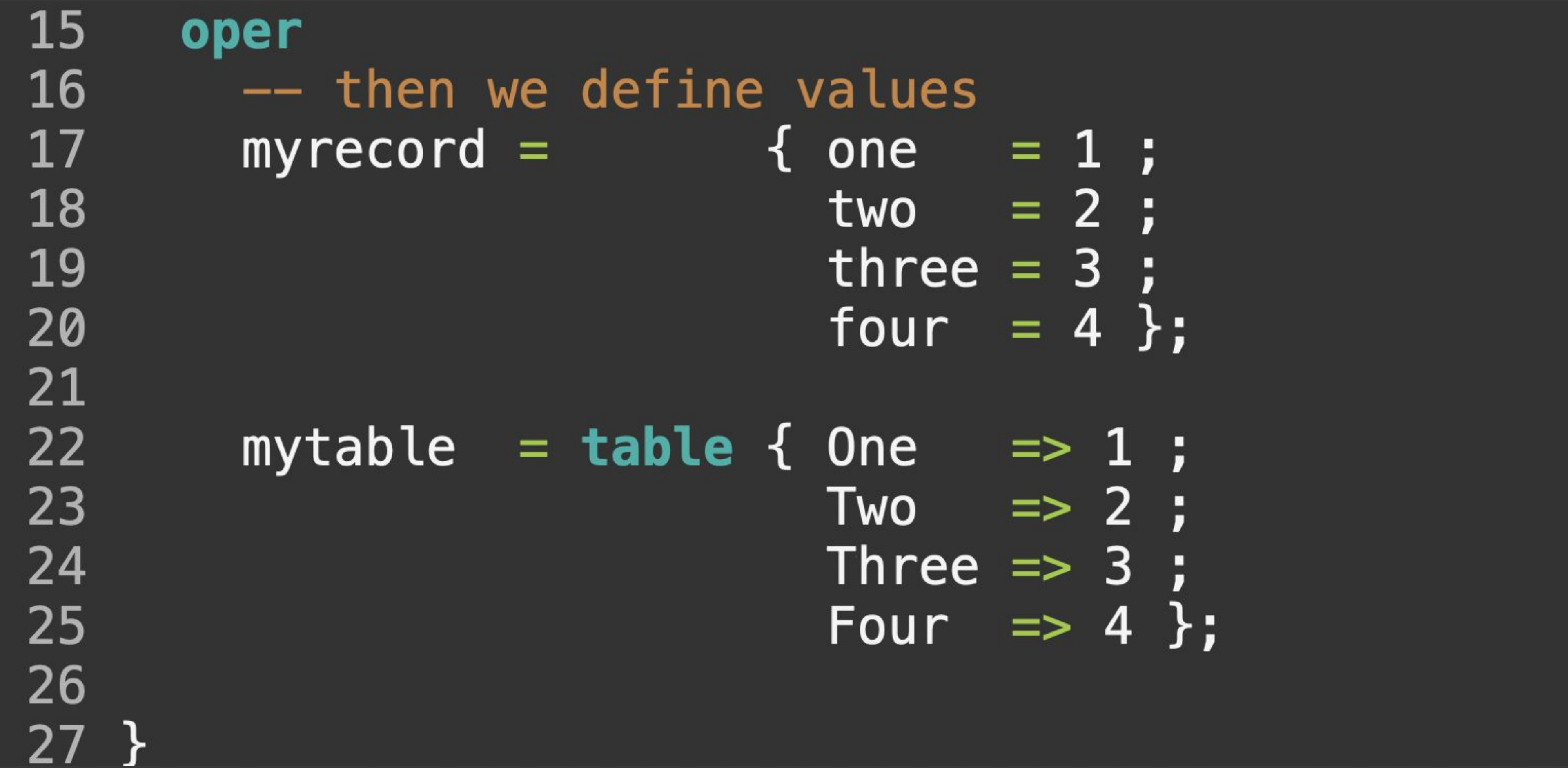
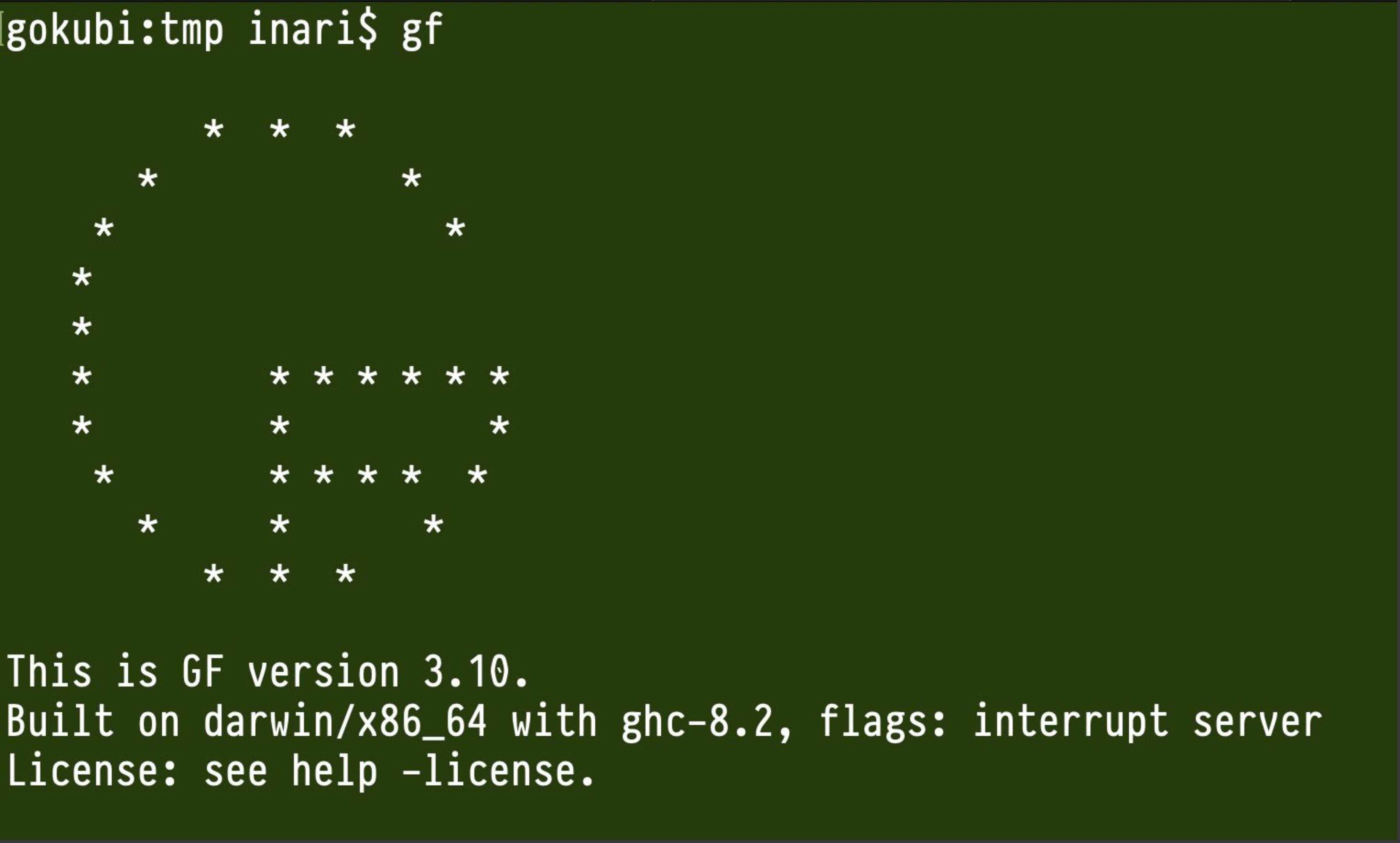
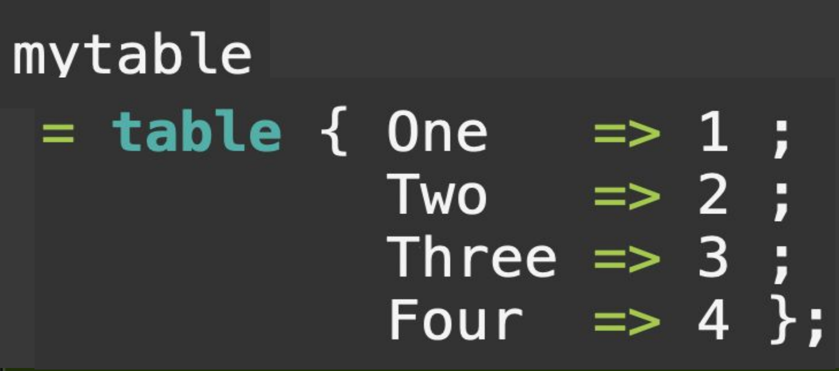




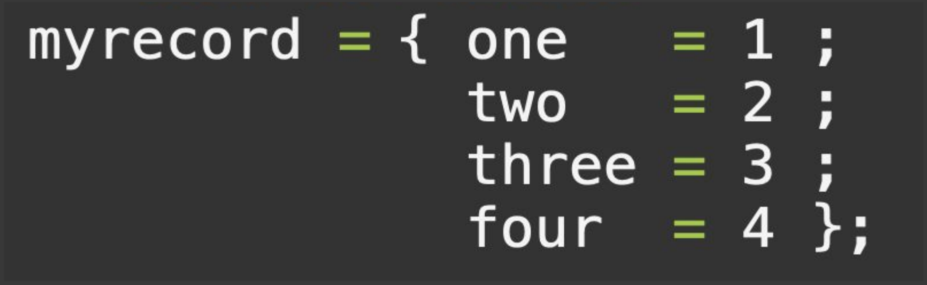
```
  oper
    -- then we define values
    myrecord =       { one   = 1 ;
                       two   = 2 ;
                       three = 3 ;
                       four  = 4 };

    mytable  = table { One   => 1 ;
                       Two   => 2 ;
                       Three => 3 ;
                       Four  => 4 };

}
```



```
gokubi:tmp inari$ gf

         *  *  *
      *           *
    *               *
   *
   *
   *        * * * * * *
   *        *         *
    *       * * * *  *
      *     *      *
         *  *  *

This is GF version 3.10.
Built on darwin/x86_64 with ghc-8.2, flags: interrupt server
License: see help -license.
```



```
mytable
 = table { One   => 1 ;
           Two   => 2 ;
           Three => 3 ;
           Four  => 4 };
```



```
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             two   = 2 ;
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```
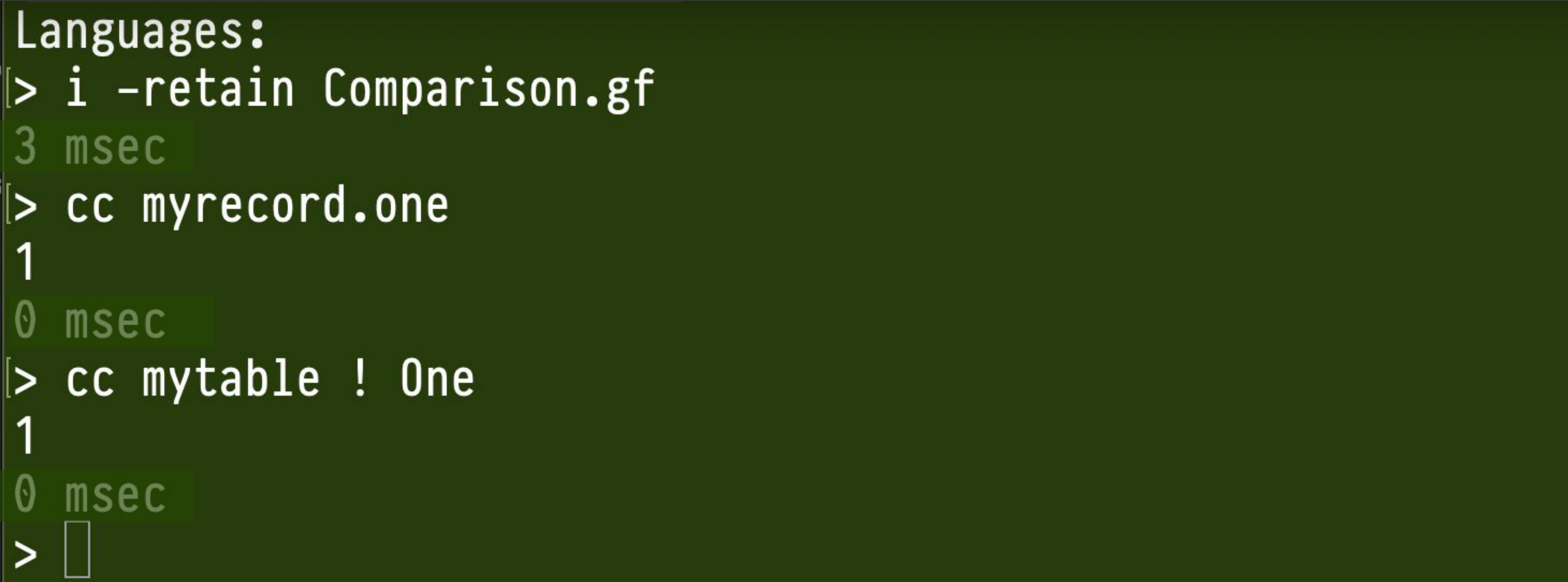
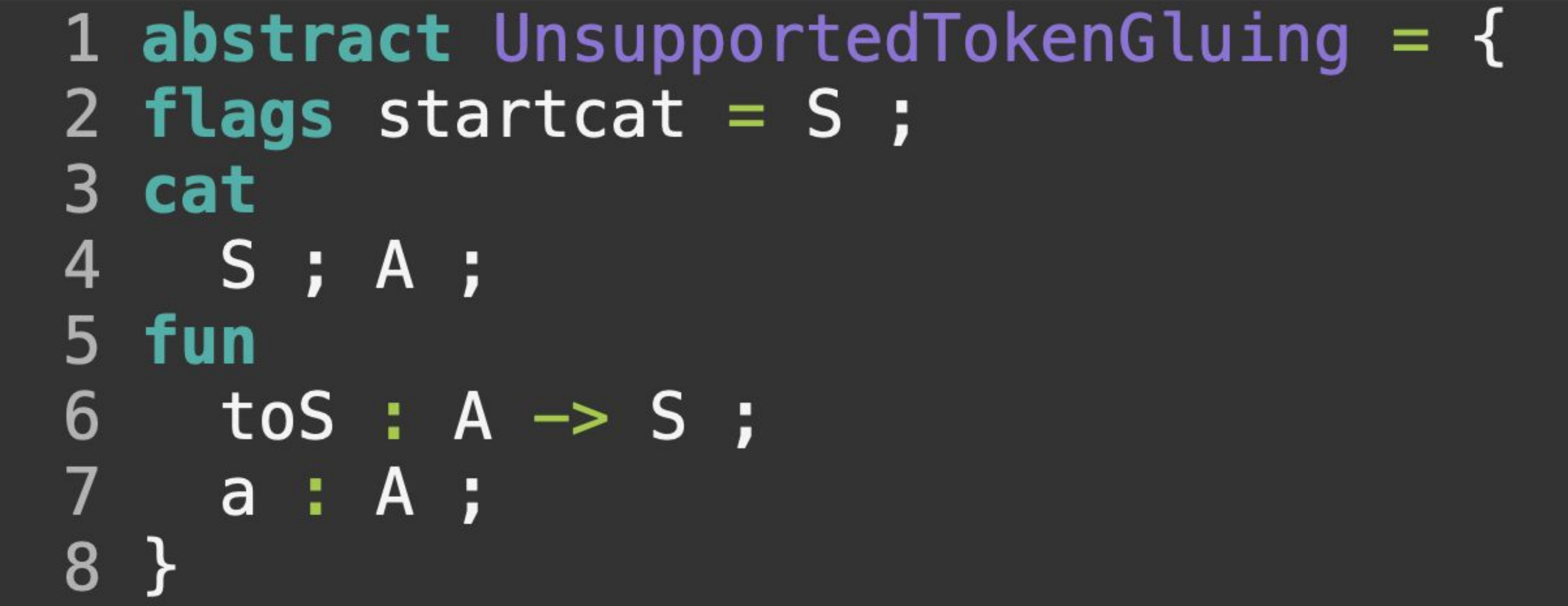



```
Languages:
> i -retain Comparison.gf
3 msec
> cc myrecord.one
1
0 msec
> cc mytable ! One
1
0 msec
> 
```

Common pitfalls

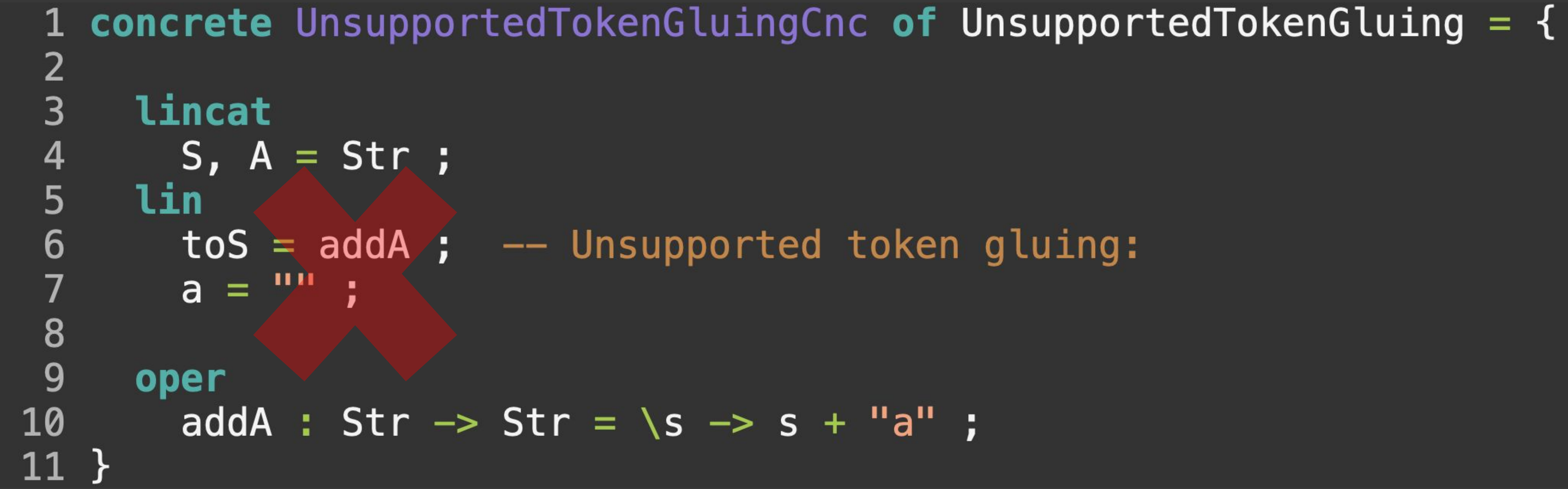
Compile-time tokens vs. runtime strings



```
abstract UnsupportedTokenGluing = {
flags startcat = S ;
cat
  S ; A ;
fun
  toS : A -> S ;
  a : A ;
}
```

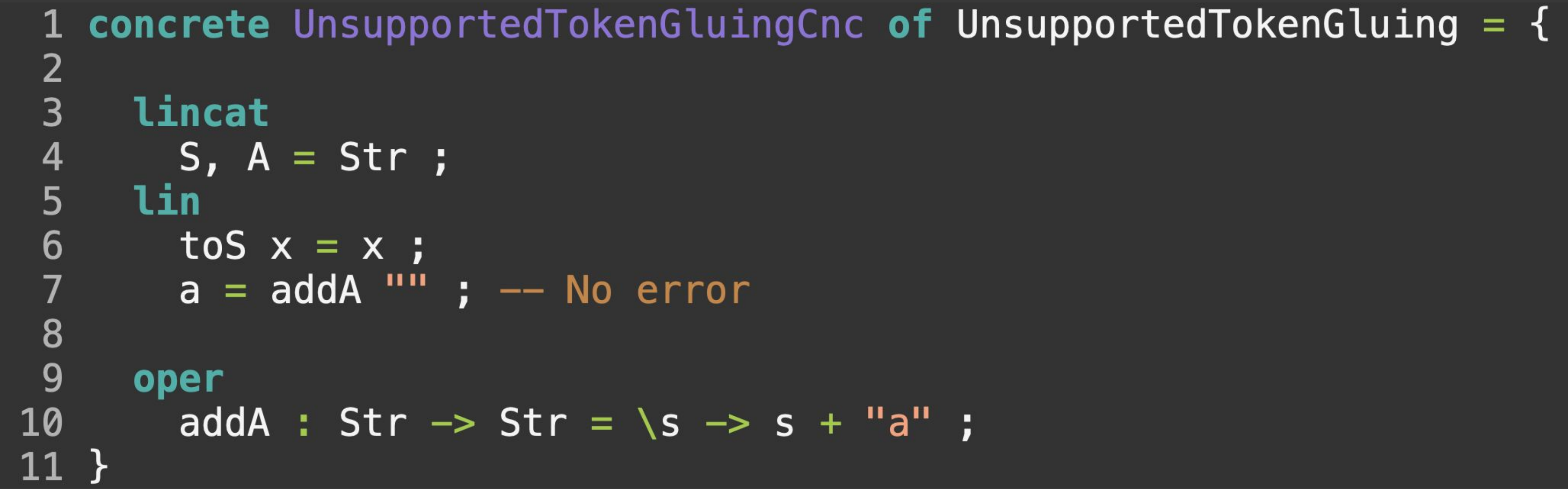
https://gist.github.com/inariksit/edde72f43d439571c79f8ef758443c11

Compile-time tokens vs. runtime strings



```
concrete UnsupportedTokenGluingCnc of UnsupportedTokenGluing = {

  lincat
    S, A = Str ;
  lin
    toS = addA ;  -- Unsupported token gluing:
    a = "" ;

  oper
    addA : Str -> Str = \s -> s + "a" ;
}
```

Compile-time tokens vs. runtime strings



```
concrete UnsupportedTokenGluingCnc of UnsupportedTokenGluing = {

  lincat
    S, A = Str ;
  lin
    toS x = x ;
    a = addA "" ; -- No error

  oper
    addA : Str -> Str = \s -> s + "a" ;
}
```

Now for the dreaded compile-time string token rule: GF requires that every token -- every separate word -- be known at compile-time. Rearranging known tokens in new ways, no problem: GF can generate an infinite variety of different combinations of words.

But they have to be words known to GF at compile-time. GF is not improv: as Shakespeare might have said, if anybody's going to make up new words around here, it'll be the playwright, not the actor. You can + tokens together but only at compile-time. If you try to do it at run-time, you will get weird errors, like unsupported token gluing or, worse, Internal error in GeneratePMCFG.

This is very different to what Python does: Python quite happily manipulates strings at any time, because to Python, strings are just arrays of characters. Space is just another character. But to GF, words carry meaning; and run-time is too late to make up new words and new meanings.

https://daherb.github.io/GF-for-Python-programmers/Tutorial.html

Using GF grammars from Python

Live demo using grammaticalframework.org/doc/runtime-api.html#python