Exception Handling

Genome 559

Review - classes

1) Class constructors -

```
class myClass:
   def __init__(self, arg1, arg2):
      self.var1 = arg1
      self.var2 = arg2
foo = myClass('student', 'teacher')
```

2) `__str__()` class function and how Python print works

3) Other core Python class functions -

```
__add__()     # used for the '+' operator
__mul__()     # used for the '*' operator
__sub__()     # used for the '-' operator
```

etc.

Extending Classes

Suppose you want to build on a class that Python (or someone else) has already written for you?

- get their code and copy it into your own file for modification
- OR use the "extension" mechanism provided for you by Python

Extension formalism – much like biological classification

class **Eukaryote**

class **Animal** (extends **Eukaryote**)
add class method **movementRate()**

class **Insecta** (extends **Animal**)
add class method **numberOfWings()**

class **Drosophila** (extends **Animal**)
add class method **preferredFruit()**

What methods are available for an object of type **Drosophila**?

Drosophila is an **Insecta** so it has all the **Insecta** data structures and methods.
Drosophila is also an **Animal** so it has all the **Animal** data structures and methods (and Eukaryote, though we didn't define any).

Writing a new Class by extension

Writing a class (review):

```
class Date:
    __init__(self, day, month, year):
        [assign arguments to class variables]
```

Extending an existing class:

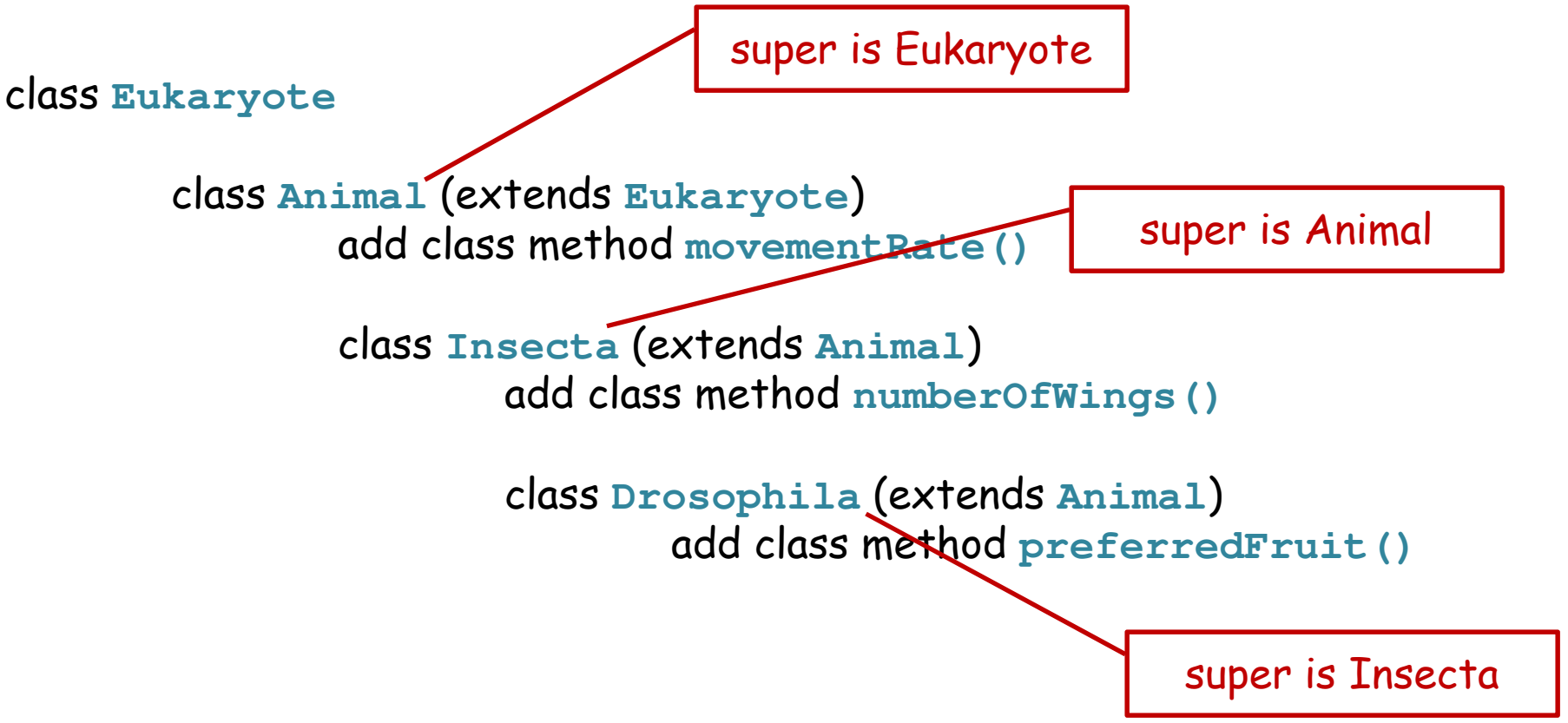
```
class HotDate(Date):
    __init__(self, day, month, year, toothbrush):
        super(day, month, year)
        self.bringToothbrush = toothbrush
```

class to extend

super - call the constructor for Date

ALL OF THE DATA TYPES AND METHODS WRITTEN FOR `Date` ARE AVAILABLE!!

Class hierarchy



Exception Handling

What if you want to enforce that a `Date` have integer values for day, month, and year?

```
class Date:
   def __init__(self, day, month, year):
      self.day = day
      self.month = month
      self.year = year
```

```
myDate = Date("Ides", "March", "IXIV")
```

Does this work?

Checking command line arguments

```
import sys

intval = int(sys.argv[1])
```

How could you check that the user entered a valid argument?

```
import sys

try:
   intval = int(sys.argv[1])
except:
   print "first argument must be parseable as an int value"
   sys.exit()
```

You can put **`try-except`** clauses anywhere.

Python provides several kinds of exceptions (each of which is of course a class!). Here are some common exception classes:

```
ZeroDivisionError # when you try to divide by zero
NameError # when a variable name can't be found
MemoryError # when program runs out of memory
ValueError # when int() or float() can't parse a string
IndexError # when a list or string index is out of range
KeyError # when a dictionary key isn't found
ImportError # when a module import fails
SyntaxError # when the code syntax is uninterpretable
```

Example - enforcing format in the `Date` class

```
class Date:
   def __init__(self, day, month, year):
      try:
         self.day = int(day)
      except ValueError:
         print 'Date constructor: day must be an int value'
      try:
         self.month = int(month)
      except ValueError:
         print 'Date constructor: month must be an int value'
      try:
         self.year = int(year)
      except ValueError:
         print 'Date constructor: year must be an int value'
```

indicates only catches this class of error

You may even want to force a program exit with information about the offending line of code:

```
import traceback
import sys

class Date:
   def __init__(self, day, month, year):
      try:
         self.day = int(day)
      except ValueError:
         print 'Date constructor: day must be an int value'
         traceback.print_exc()
         sys.exit()
```

special traceback function that prints information for the exception

Create your own `Exception`

```
import exceptions

class DayFormatException(exceptions.Exception):
   def __str__(self):
      print 'Day must be parseable as an int value'
```

What does this mean?

`DayFormat` extends the Python defined `Exception` class

Remember that the `__str__()` function is what print calls when you try to print an object.

Using your own Exceptions

```
class Date:
   def __init__(self, day, month, year):
      try:
         self.day = int(day)
      except:
         raise DayFormatException
```

The DayFormatException will get returned to where ever the constructor was called - there it can be "caught"

```
try:
   myDate = Date("Ides", "March", "IXIV")
except:
   <do something>
```

Exercise 1

Write a program check_args.py that gets two command line arguments and checks that the first represents a valid int number and that the second one represents a valid float number. Make useful feedback if they are not.

```
> python check_args.py 3 help!
help! is not a valid second argument, expected a
float value
> python check_args.py I_need_somebody 3.756453
I_need_somebody is not a valid first argument,
expected an int value
```

```
import sys

try:
   arg1 = int(sys.argv[1])
except ValueError:
   print "'sys.argv[1]' is not a valid first argument,
expected an int value"
   sys.exit()
try:
   arg2 = int(sys.argv[2])
except ValueError:
   print "'sys.argv[2]' is not a valid second argument,
expected a float value"
   sys.exit()

<do something with the arguments>
```

Exercise 2

Write a class **`fastaDNA`** that represents a fasta DNA sequence, with the name and the sequence itself stored as class variables (members). In the constructor, use exception handling to check that the sequence is valid (consists only of the characters 'A', 'C', 'G', 'T', or 'N' (either upper or lower case). Provide useful feedback if not.

```
import sys
import re
class fastaDNA:
    __init__(self, name, sequence):
        self.name = name
        match = re.match('[^ACGTNacgtn]')
        if match != None:
            print sequence, 'is an invalid DNA sequence'
            sys.exit()
        self.sequence = sequence
```

Challenge Exercise

Change your class definition from Exercise 2 so that it useful traceback information so that you can find where in your code you went wrong.