Classes and Interfaces

Programming I - tutorial #9

Jakub Sýkora

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Semester project proposals deadline

Linked Lists

Linked Lists

- Design class LinkedList
  - add_first(elem) adds element to front
  - add_last(elem) adds element to end
  - remove(elem) remove all elements matching __eq__()
  - forward() - return list from start to end
  - backward() - return list from end to start
  - Is backward(), forward() implemented efficiently?

Linked Lists

- Implement class LinkedListNode
  - Used by LinkedList
  - item
  - next
  - previous
- Implement class LinkedList
  - encapsulates linked list inside

Linked Lists

Extensions

- Strings - implement StringsLinkedList
  - join(delim) joins words into one string, separated by delim
- Numbers - implement NumbersLinkedList
  - remove_multiples(n) removes all multiples of n

Linked Lists
Design

- Numbers, Strings extensions might copy code to iterate LinkedList
- Numbers, Strings methods needs only to access elements! Now forced to use LinkedList only, might use List or other data structure
  - Solution (idea): class with static methods
    - But how to get elements from our LinkedList and e.g build-in List?
      - Option #1 Type check + duck typing? No
      - Option #2 LinkedList implementing Iterable protocol (advanced)

Abstract base classes

Shapes - class hierarchy

- We want to define *base* class Shape
  - area()
  - draw()
- What can Shape class do with such methods? Use as *abstract* class!
- Implement Circle(Shape), Square(Shape)

Shapes - abstract class problem

- Imagine someone adds scale() method to Shape
  - Rectangle, Circle needs to implement scale()
  - No verification Rectangle, Circle actually implements it!
  - Rectangle has no scale() implementation, calls Shape’s scale()!

Solution: ABC

100%

more bug-free implementation

Abstract Base Classes

- Module abc in python
- Base class (Shape) derives from metaclass=ABCMeta
  - Assume Rectangle() does not implement shape()
  - Now error during Rectangle object instantiation!
  - Error appears sooner, easier to debug!

Decomposition exercise

Example: Word processor

- Each word processor receives words from one source
  - File
  - Communication protocol
  - Console
- Examples of word processors
  - One which count words
  - One which prints words with alignment to column

How to reuse code effectively?

Problem decomposition

- Does each word processor implementation need to know source of words?
  - File, console, …
- Does each word processor need to iterate directly over the source?