CSC 148: Introduction to Computer Science

Week 2

Object-Oriented Programming (continued)

Composition of classes

Reminder: revisit the readings **before lecture** !

In class: apply content in exercises, discuss, ask questions

=> develop stronger command of the concepts!

University of Toronto Mississauga,

Department of Mathematical and Computational Sciences

Composition

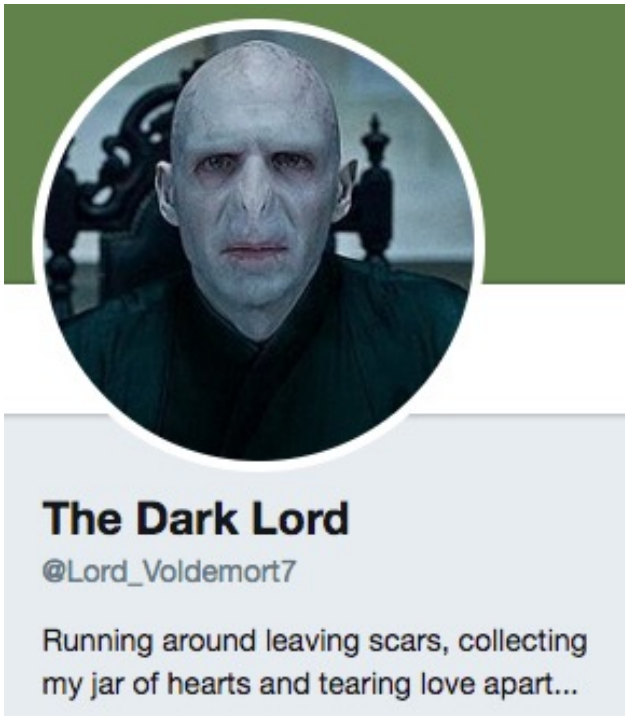
- Key concept: how do we design code in which different classes interact with each other?

- Idea: Use existing types inside new user-defined types

Example

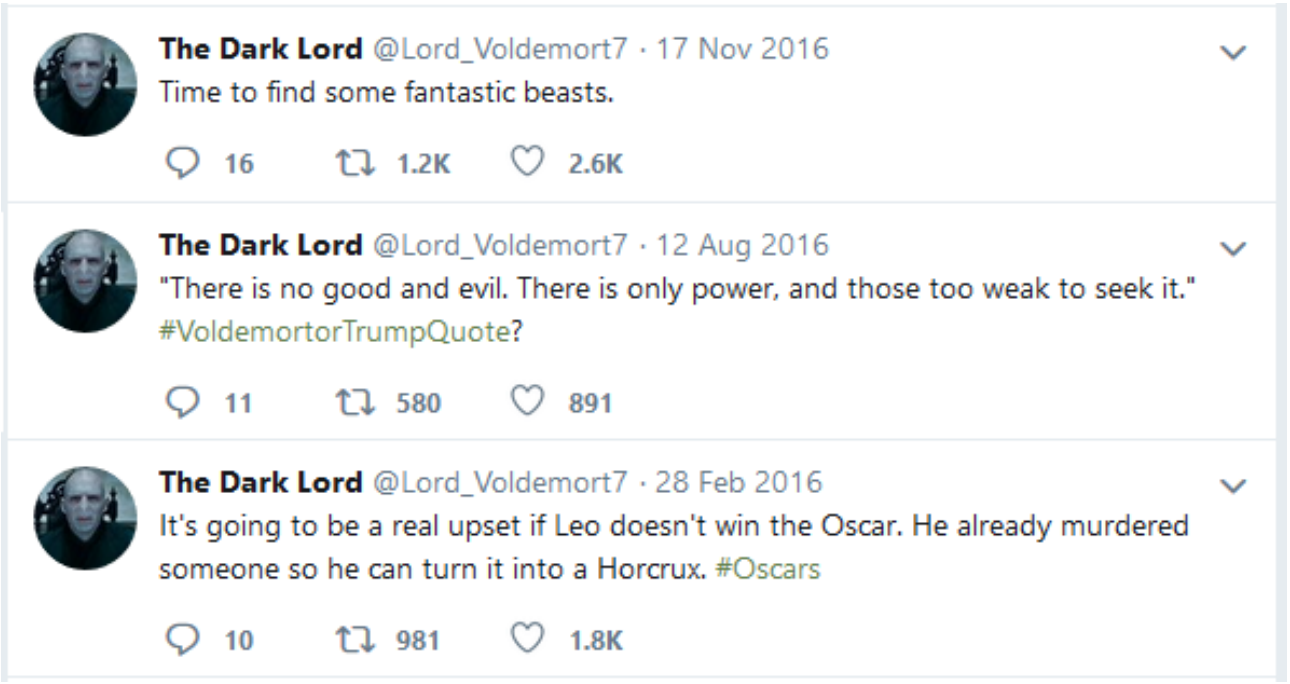
- Say we want to implement class User, based on this spec:

  A Twitter (X) user has a unique identity, a short bio, and a list of tweets that they created. A user may create a new tweet or follow another user.



The Dark Lord
@Lord_Voldemort7

Running around leaving scars, collecting my jar of hearts and tearing love apart...



The Dark Lord @Lord_Voldemort7 · 17 Nov 2016
Time to find some fantastic beasts.
16 1.2K 2.6K

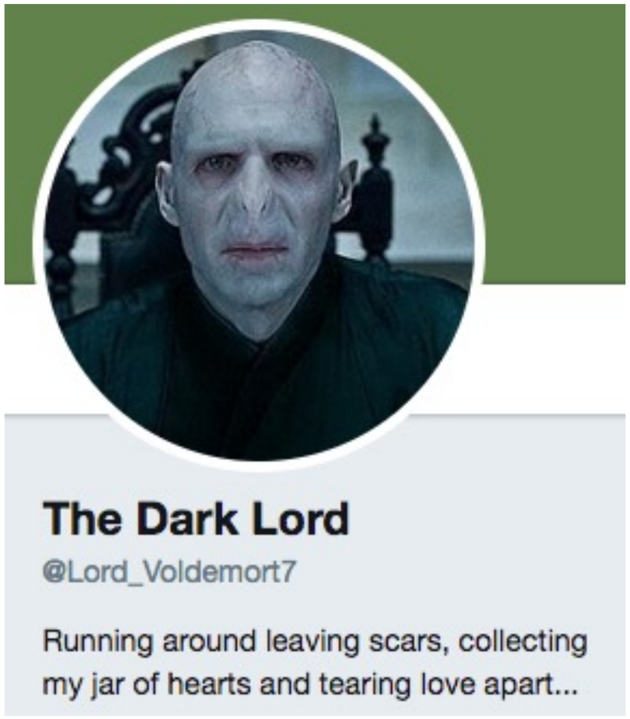
The Dark Lord @Lord_Voldemort7 · 12 Aug 2016
"There is no good and evil. There is only power, and those too weak to seek it." #VoldemortorTrumpQuote?
11 580 891

The Dark Lord @Lord_Voldemort7 · 28 Feb 2016
It's going to be a real upset if Leo doesn't win the Oscar. He already murdered someone so he can turn it into a Horcrux. #Oscars
10 981 1.8K

Example

- Say we want to implement class User, based on this spec:

*A Twitter (X) **user** has a unique **identity**, a short **bio**, and a **list of tweets** that they created. A **user** may **create** a new tweet or **follow** another **user**.*



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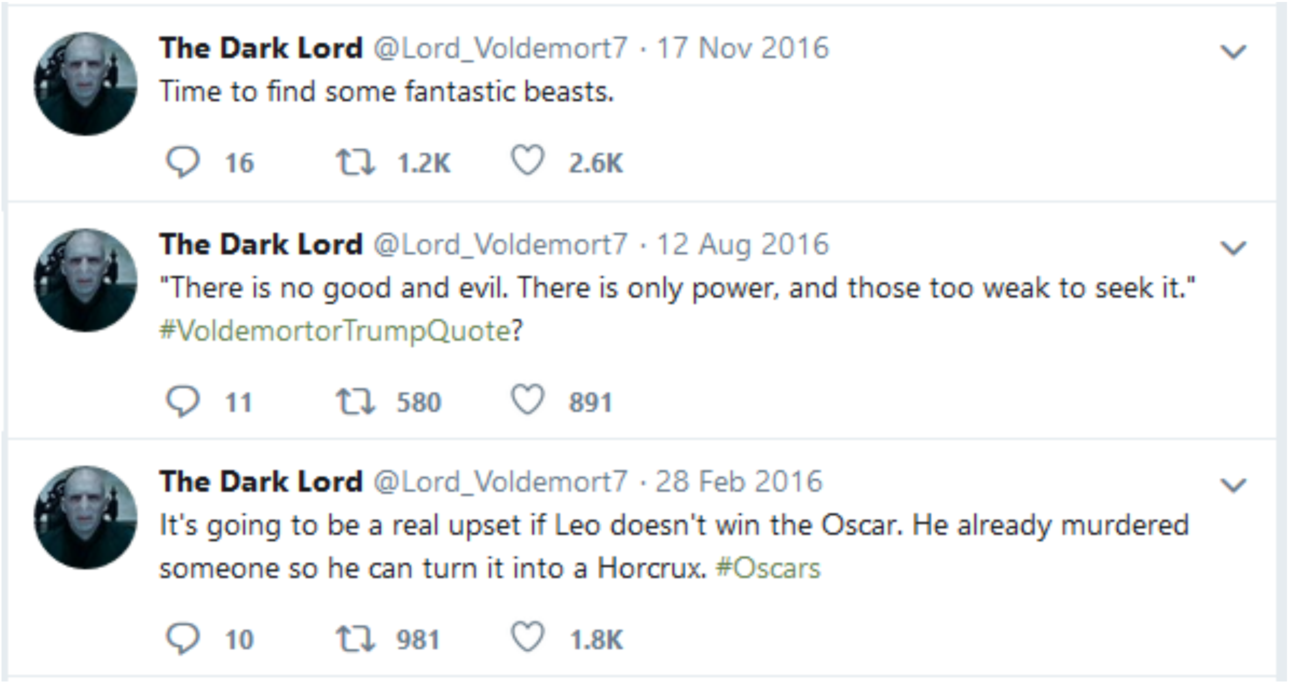

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Worksheet: a `User` class

```
class User:
    """A Twitter user.

    === Attributes ===
    userid: the userid of this Twitter user.
    bio: the bio of this Twitter user.
    tweets: a list of the tweets that this user has made.
    """
    userid: str
    bio: str
    tweets: list[Tweet]
```

Composition - summary

- Composition: a relationship between two classes where instances of one class contain references to instances of the other

- User and Tweet:
  - “has” relationship, e.g. “user has tweets”

Data encapsulation

- General idea: attributes or methods of a class are made "private" to hide implementation details or protect them from unauthorized use
  - Basically, only allow reading and writing to them via special methods that the class designer can control
- Marking an attribute/method as private signals that client code should not access it

- Python - **conventions** for making attributes or methods "private":
  - _name => Should not be used outside of class definition
    - e.g., _content for Tweet
  - __name => Inaccessible & Invisible (in theory anyway, there is actually a way to access them in Python)

Privacy is about communication

- A private attribute/method could be…
  - very complicated
  - subject to several representation invariants
  - seemingly unrelated to the actual purpose of the class
  - changed at any time

Interface vs. Implementation

Learning Tips: What to do after lecture

- **Review:** summarize, question, re-explain
- **Share:** meet with a friend or study group
- **Get help:** come to office hours!