Perl in Bioinformatics

Gang Chen
chengang@bgitechsolutions.com

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Outline

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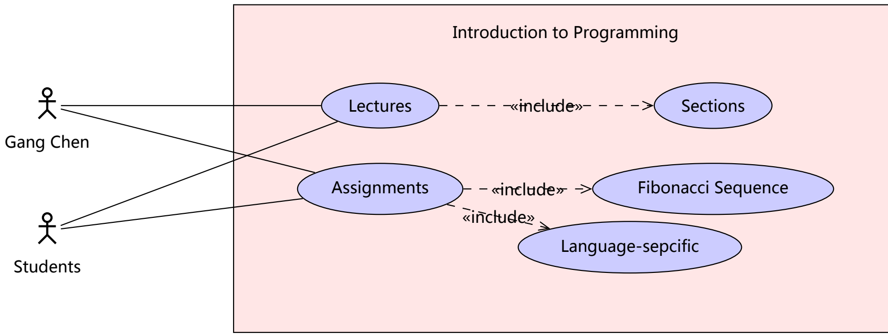
Object-oriented Programming (OOP)

- OO is a language-indedependent concept
- in principle not limited to programming (OO design)
  $\Longrightarrow$ databases, business plans
- improves reusability and exchangability of code
- separation of partial problems
- ``real world'' modelling
- representation in Universal Markup Language (UML)

Object-oriented Programming (OOP)



Basic ideas

- Everything is an object
  Gang, students, lecture
  project, world, spy, information
- Objects interact by sending/receiving messages
  Gang $\rightarrow$ students: object orientation is a concept
  world $\rightarrow$ map: what is the object at position X?
- An object consists of objects
  a course consists of lectures
  a world consists of land or water fields

Basic ideas

- Every object has a type
  Gang is a teacher
  the map is a rectangle of land / water fields
- All objects of the same type understand the same messages
  all students hear the lecture
  all spies can retrieve information

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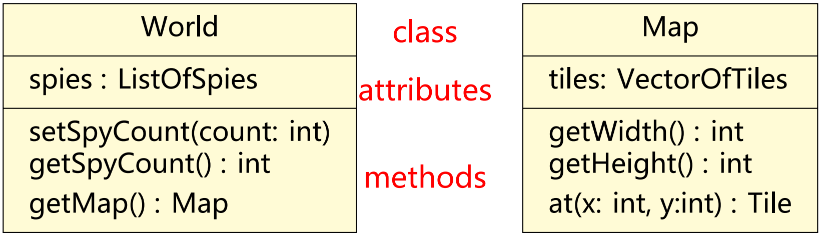
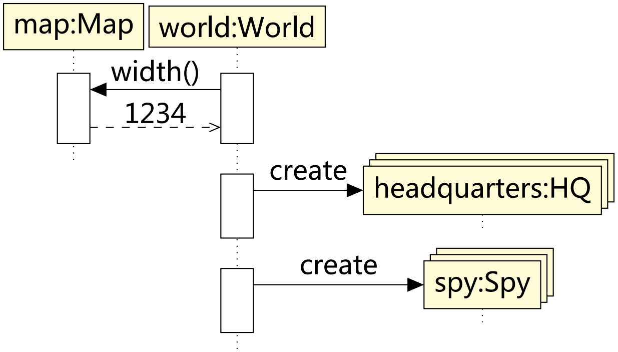
Classes, Interfaces and Methodse



Classes, Interfaces and Methods

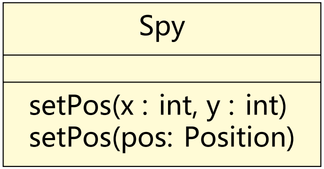
- classes describe the type of objects (define their interface)
- the interface consists of methods and attributes / properties
- methods
  - are functions that operate on objects of this class
  - can take extra arguments of arbitrary types
  - can return values of arbitrary types
- attributes are objects of arbitrary other types

Objects/Instances



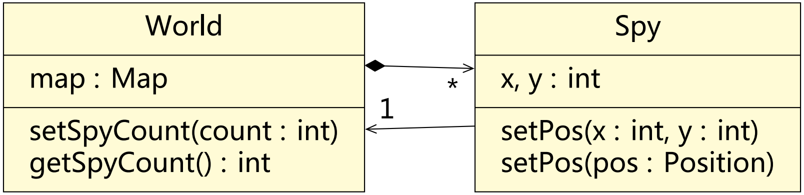
- every object has an immutable class assigned when it is created
- objects communicate via their class interfaces
- classes can communicate via static member functions

Overloading and signature



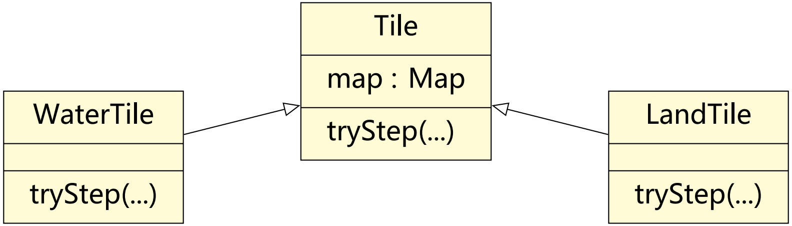
- a method is described by name and signature
- signature is formed by the types of all taken arguments
  - setPos(x : int, y : int)
  - setPos(pos : Position)
- methods with identical names but different arguments can exist in one class -- overloading
- return type is not part of the signature -- cannot always resolve overload at compile time

Composing classes



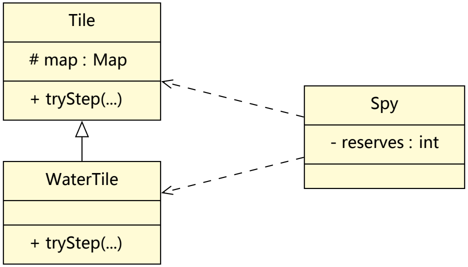
- objects are made of objects (attributes) --- classes declare the types of these objects
- simple attributes appear below class name
- complex classes shown as composition
- ``has-a'' or ``has-many'' relations:
  - a world hosts many spies,
  - a spy belongs to one world

Inheritance and class hierarchy



- subclasses of classes -- class hierarchy
- subclasses inherit methods and attributes of all superclasses
- no need to duplicate code
- .. but methods might behave differently (polymorphism)
- abstract classes implement only parts of the interface

Implementation hiding



- public (`+') elements are visible to all
- protected (`#') elements are only visible to derived classes
- private (`-') attributes or methods are not visible to other objects
- map is protected $\Longrightarrow$ visible to WaterTile, not to Spy
- Spy can access tryStep of all tiles

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OOP in Perl

- A class is a package.
- An object is a reference that knows its class.
- A method is a subroutine.

OOP in Perl: Example

- snp.pm
- runoop.pl
- wesnp.pm

Other OOP Systems in Perl

- Moose

Next

1. Objec Oriented Prorgamming
2. OOP in Perl
3. Bioinformatics Projects in Perl
    - Annovar
    - Cirocs
    - BioPerl

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Annovar

Annovar

ANNOVAR: Functional annotation of genetic variants from high-throughput sequencing data

http://www.openbioinformatics.org/annovar/

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Circos

Circos

Circos is a software package for visualizing data and information. It visualizes data in a circular layout — this makes Circos ideal for exploring relationships between objects or positions.

http://circos.ca

iGENETICS
A Molecular Approach
FUTURE
nature biotechnology
American Scientist
Science Translational Medicine
REPORT ON BUSINESS
GET A JOB
Web INTRIGU
The CANCER GENOME challenge
EMBO JOURNAL

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BioPerl

http://bioperl.org

Installation

- from source
- cpan (recommended)

Usage

see bioperl.pl

Thanks!