Design

OO
Class Diagram
Sequence Diagram

What is the first P.L. you learned?

Object-Oriented Programming, Classes

- Class
  - Data + Operation

- Encapsulation
- Polymorphism
- Inheritance

- Enhance modularity!

Encapsulation

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Polymorphism

- “to process objects differently depending on their data type or class. More specifically, it is the ability to redefine methods for derived classes”
- “the provision of a single interface to entities of different types.”
- Examples

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- Implication to design?
- Benefits?
- Problems?

Inheritance

- “a mechanism for code reuse and to allow independent extensions of the original software via public classes and interfaces.”

- Examples

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- Benefits?
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Class diagram

- Describes the types of objects in the system
- Describes the static relationships among them

http://en.wikipedia.org/wiki/Class_diagram

How to decide/design classes?

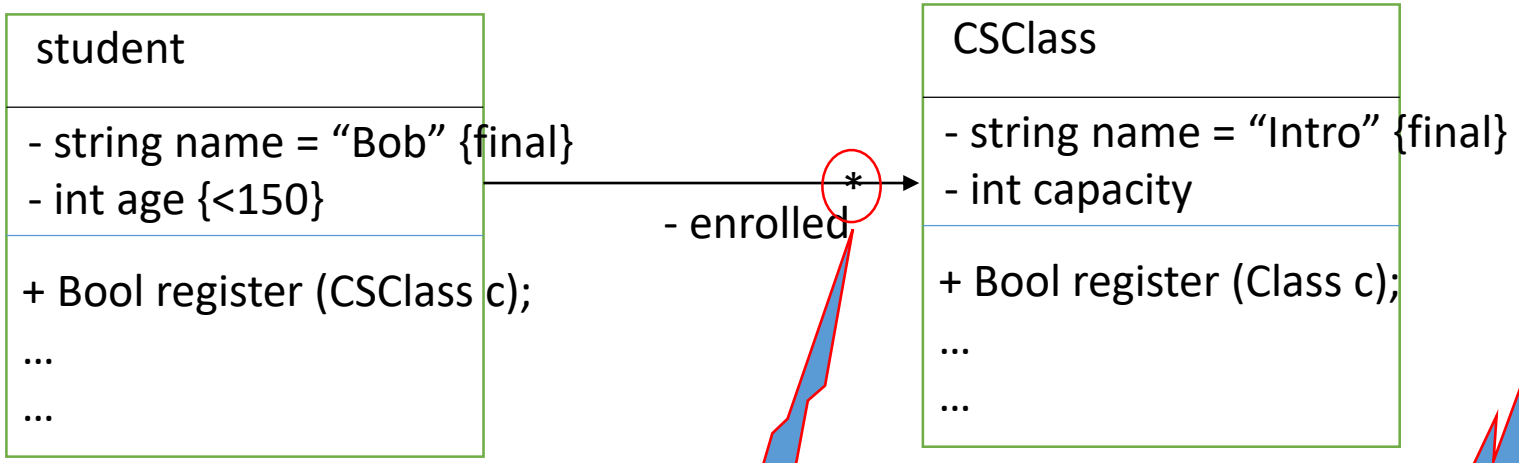
- Data+operation

Components of class diagrams

- Class name
- Class properties
  - Attributes
  - Associations (could be bi-directional) 

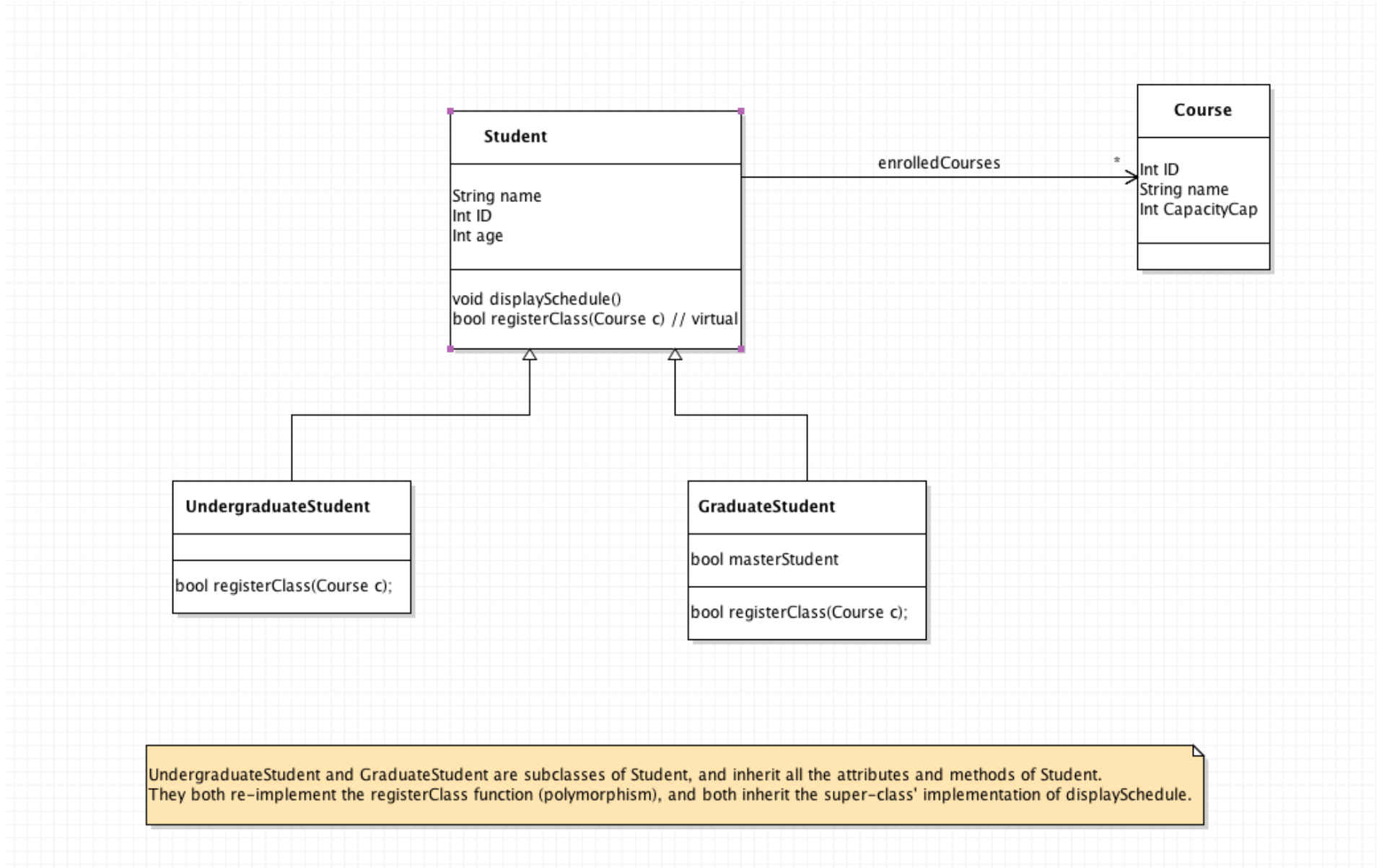
    visibility name : type [multiplicity] = default {property-string}
- Class operations

  Visibility name (parameter list) : return-type {property-string}
- Generalization 
  - Inheritance (subclass, super class, interface, …)
- Dependency 
- Constraints {}




```
Class student{
private:
   final string name;
   int age;
   Set enrolledSet<CSClass>;
public:
   student (string n, int a);
   bool register (CSClass c);
   …
}
```

- * represents unknown number of CSClass property objects of a student object
- If we put a constant number, like 4, here, we should replace the “Set” data structure into Array


Student
String name
Int ID
Int age
void displaySchedule()
bool registerClass(Course c) // virtual
enrolledCourses
*
Course
Int ID
String name
Int CapacityCap
UndergraduateStudent
bool registerClass(Course c);
GraduateStudent
bool masterStudent
bool registerClass(Course c);
UndergraduateStudent and GraduateStudent are subclasses of Student, and inherit all the attributes and methods of Student.
They both re-implement the registerClass function (polymorphism), and both inherit the super-class' implementation of displaySchedule.

How to turn class diagram to code

- A private attribute → ??
- A * attribute/association → ??
- Class declaration
  - Some attributes may not map to fields

Advanced Class-Diagram Features

- Composition ◆ vs. Aggregation ◇
  - Belong to relationship
  - Composition: single owner, disappear with the owner
- Abstract class
- Template class

We didn't talk about this in lecture, so this will not appear in quiz/exam

What are the constraints to set?

- Assertion
  - Pre-condition
  - Post-condition
  - Invariant

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Sequence diagram

- Describes how objects collaborate/interact with each other in one scenario

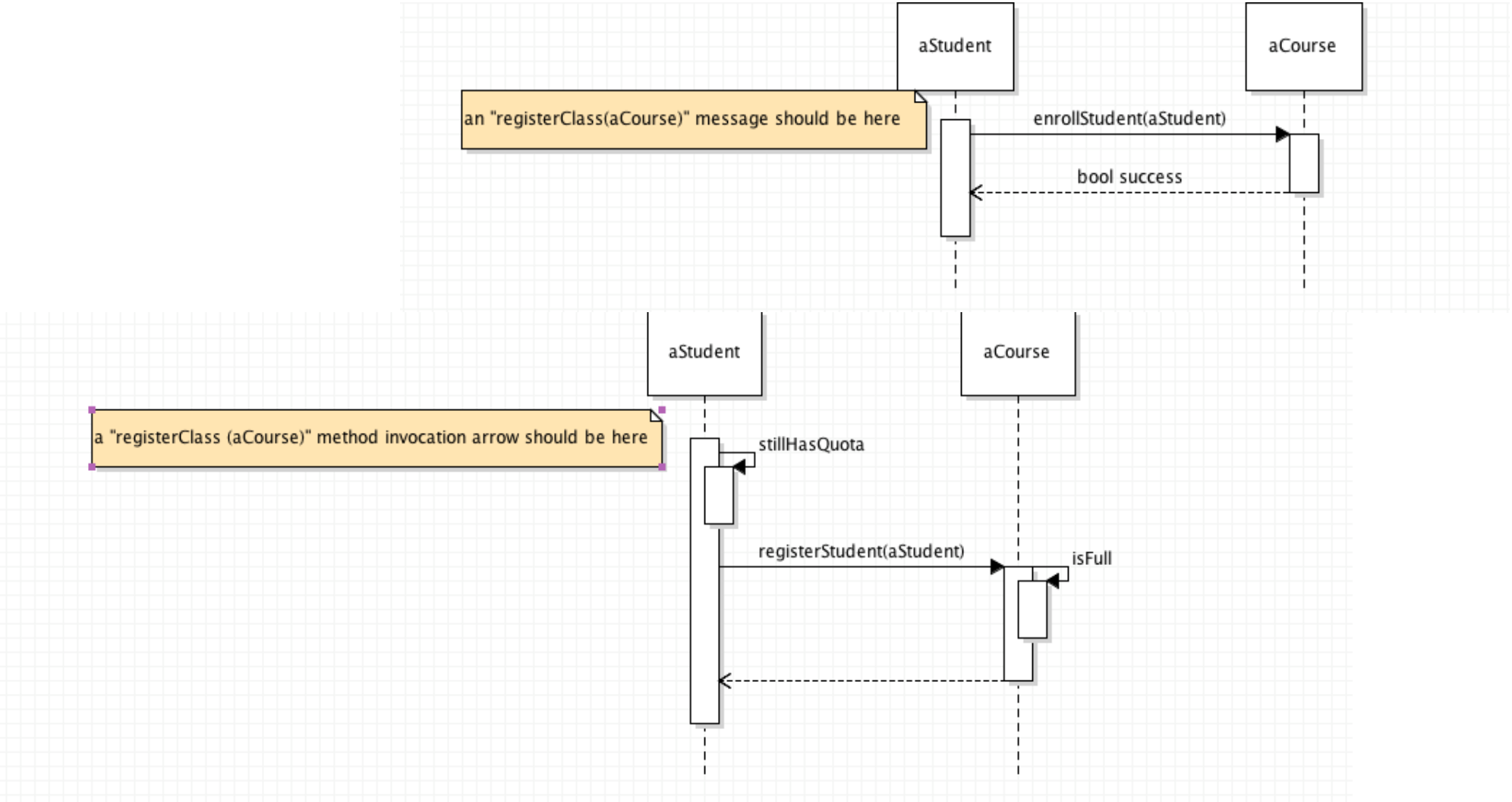
Components of sequence diagram

- Participants
- Life-line
- Activation bar
- Message
  - Regular calls, self calls

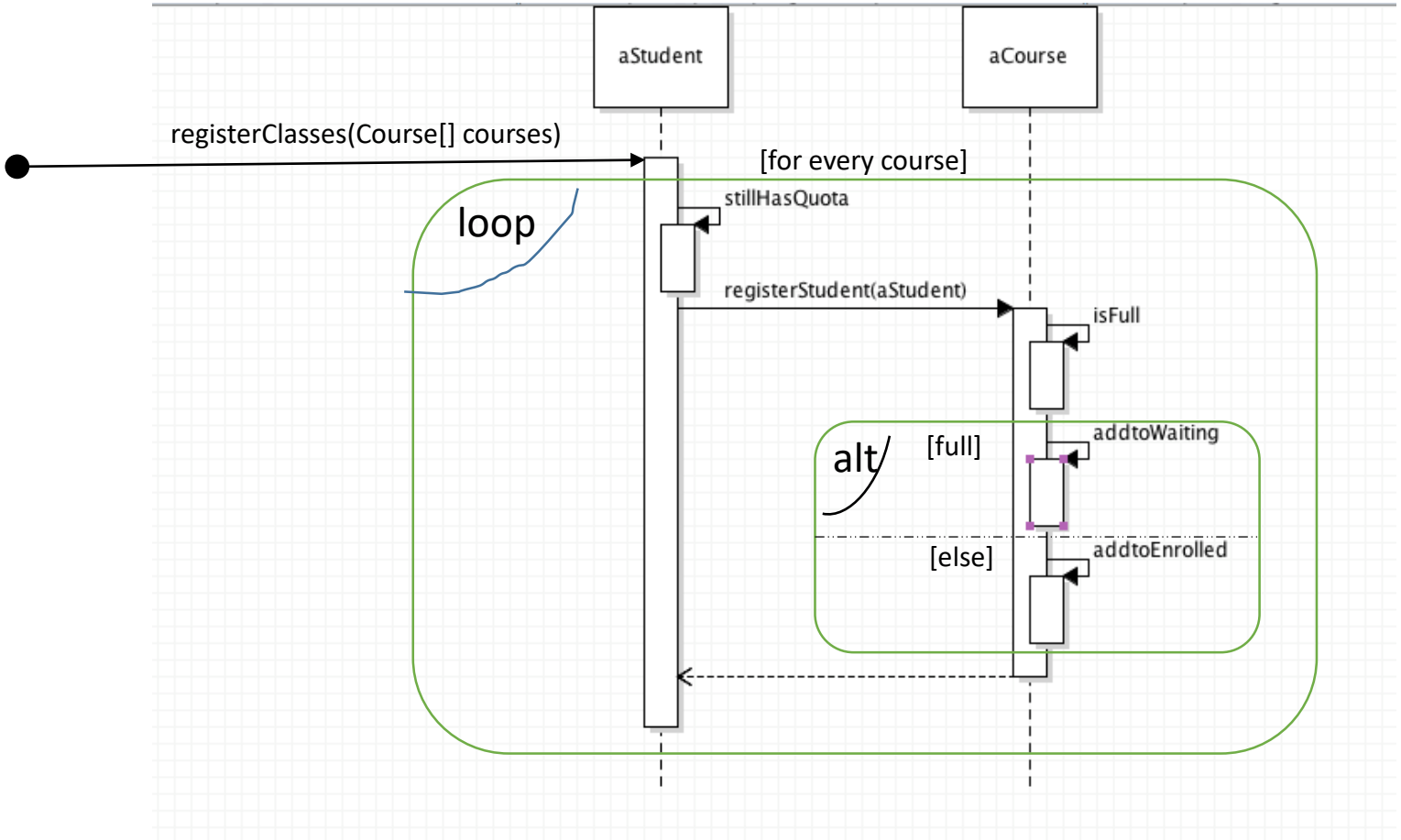
- Creating and deleting object
- Loops and conditionals
  - loop, alt, opt

http://en.wikipedia.org/wiki/Sequence_diagram

Sequence diagram example 1



Sequence diagram example 2



Summary

- Class diagram
- Sequence diagram