Class Diagrams

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Object Oriented Programming

Agenda

1. Modeling Classes

2. Completing the exercise

1. Modeling Classes

1.1 UML

1.2 UML Class Diagram

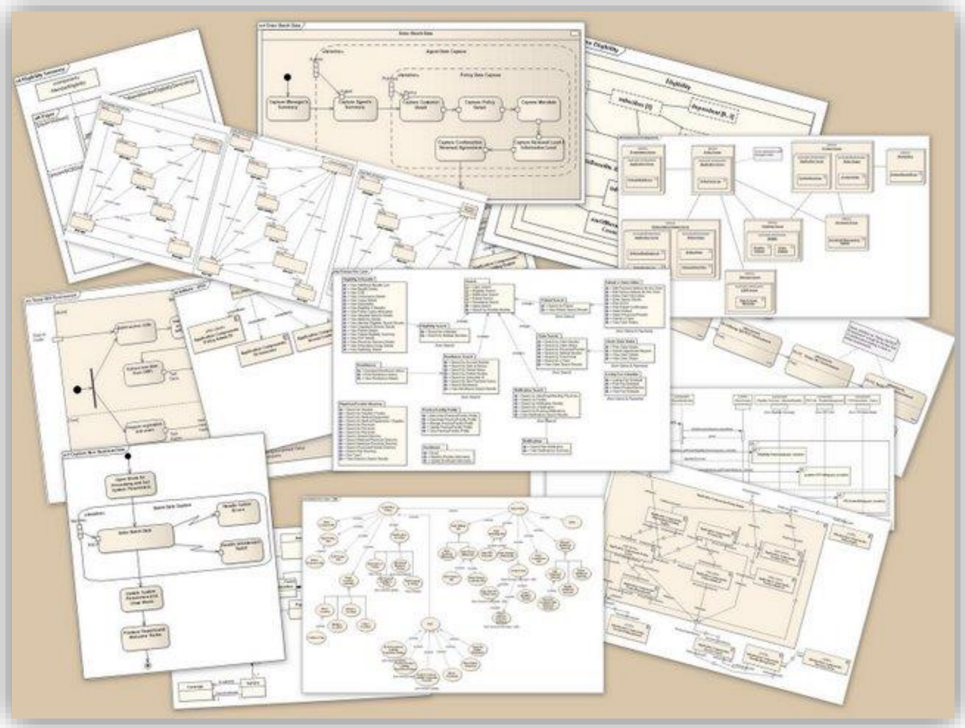
1.3 Relationship between objects: A closer approach

1.1 UML

UML is a standardized general-purpose modeling language

Unified Modeling Language (**UML**) is a standardized general-purpose modeling language in the field of **object-oriented software engineering**

UML is a standardized general-purpose modeling language



There are several diagrams in UML for **modeling object oriented systems**

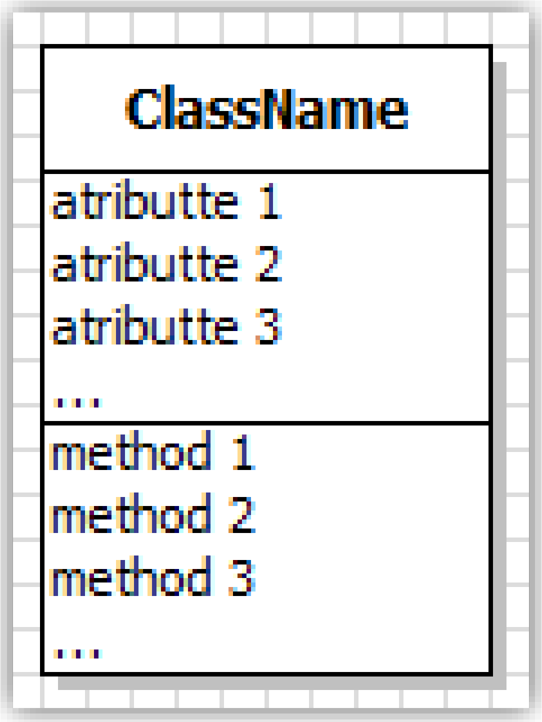
Activity diagrams and **class diagrams** are two examples

1.2 UML Class Diagram

UML Class diagram

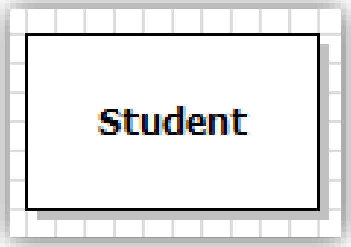
Describes the static structure of a system showing

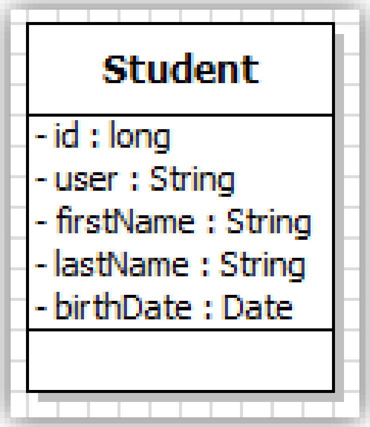
- Classes:
  - Name
  - Attributes
  - Methods
- Relationships between classes

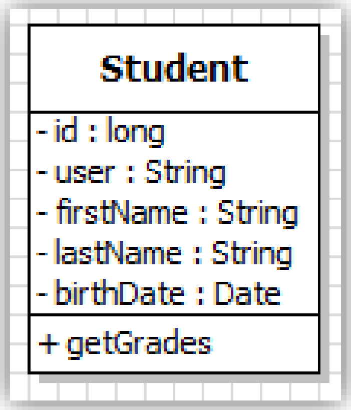


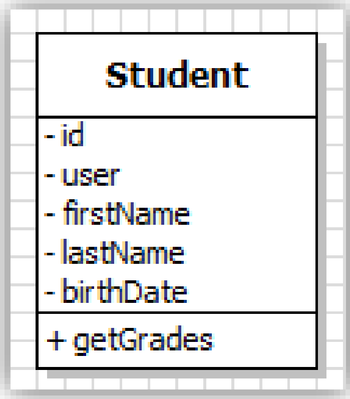
Showing classes

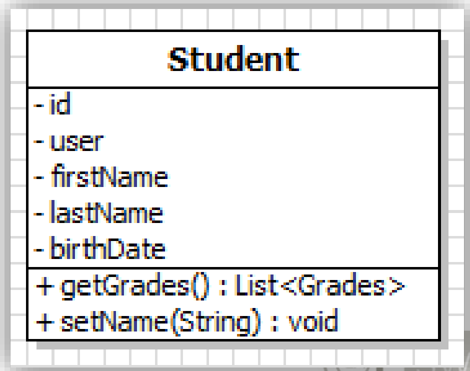
Classes can be shown at different detail level



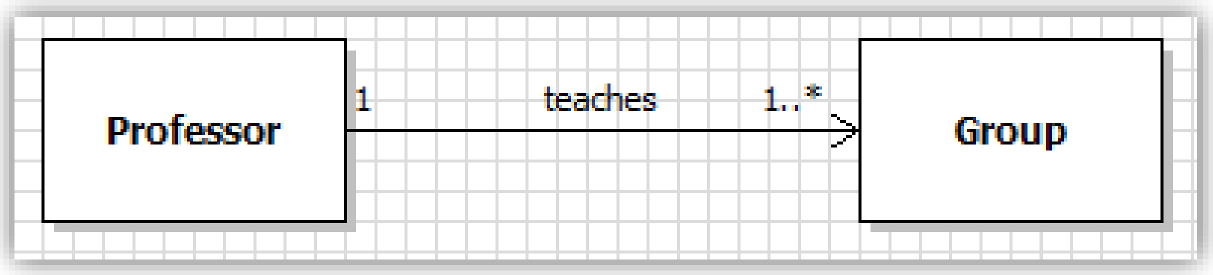






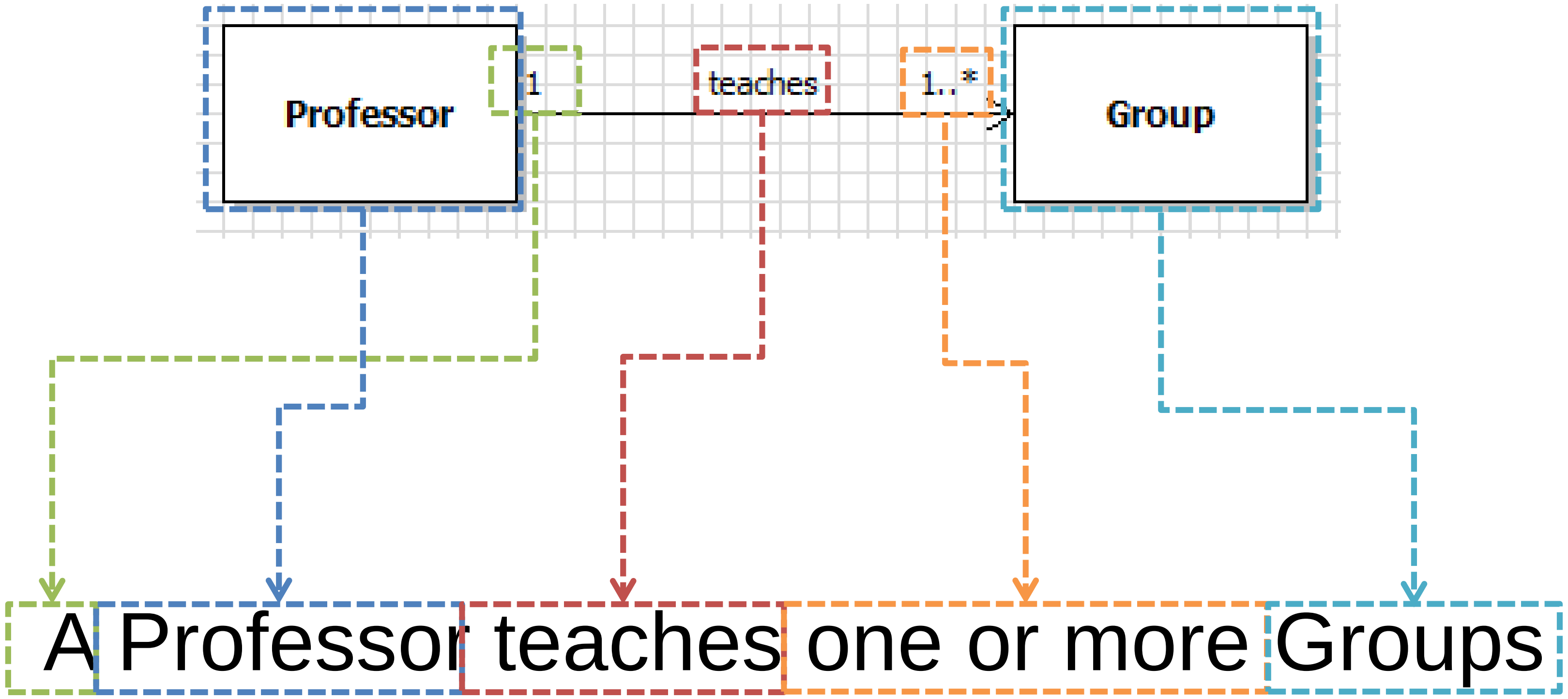


Showing relationships between classes



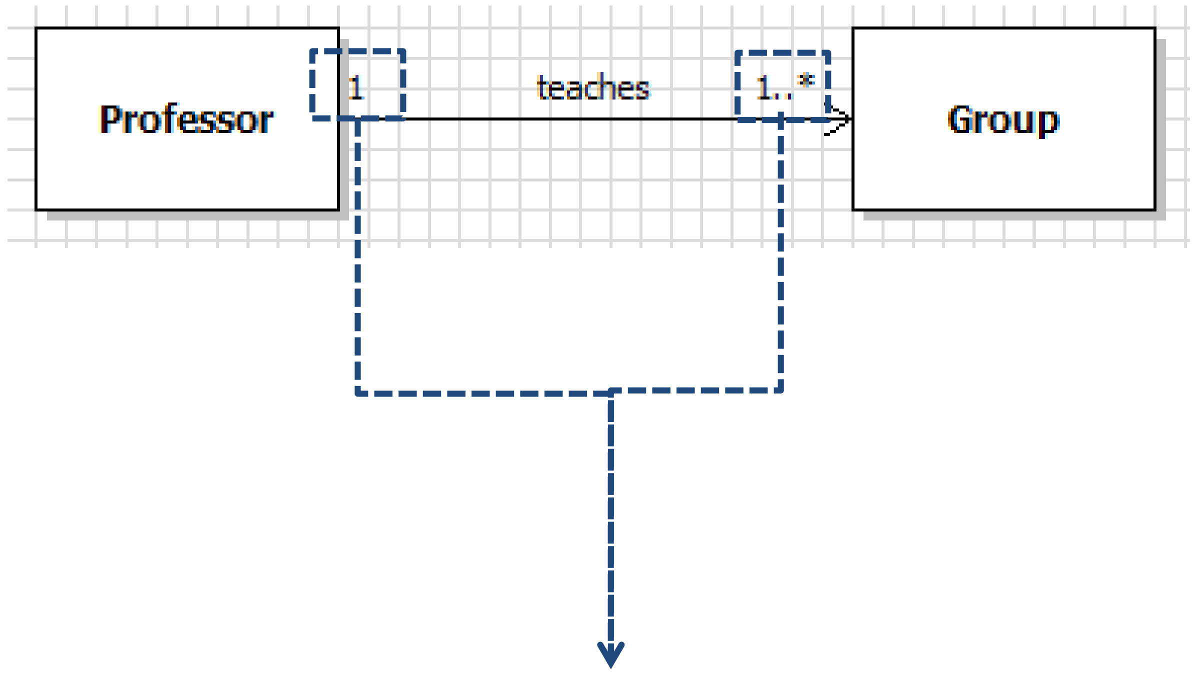
A Professor teaches one or more Groups

Showing relationships between classes



A Professor teaches one or more Groups

Showing relationships between classes



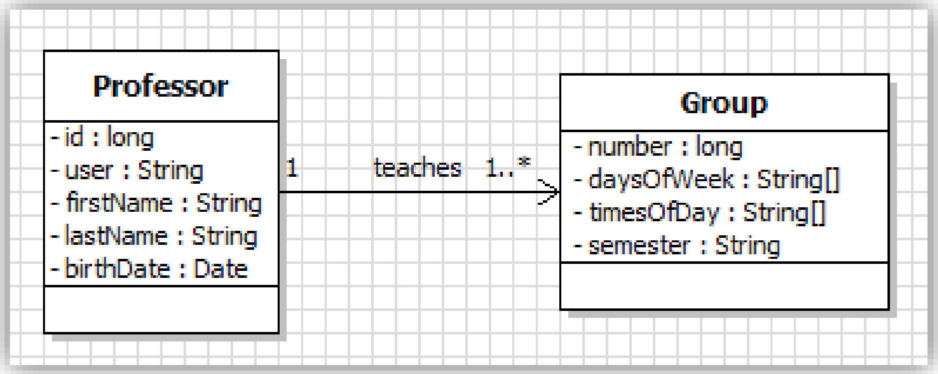
Multiplicity

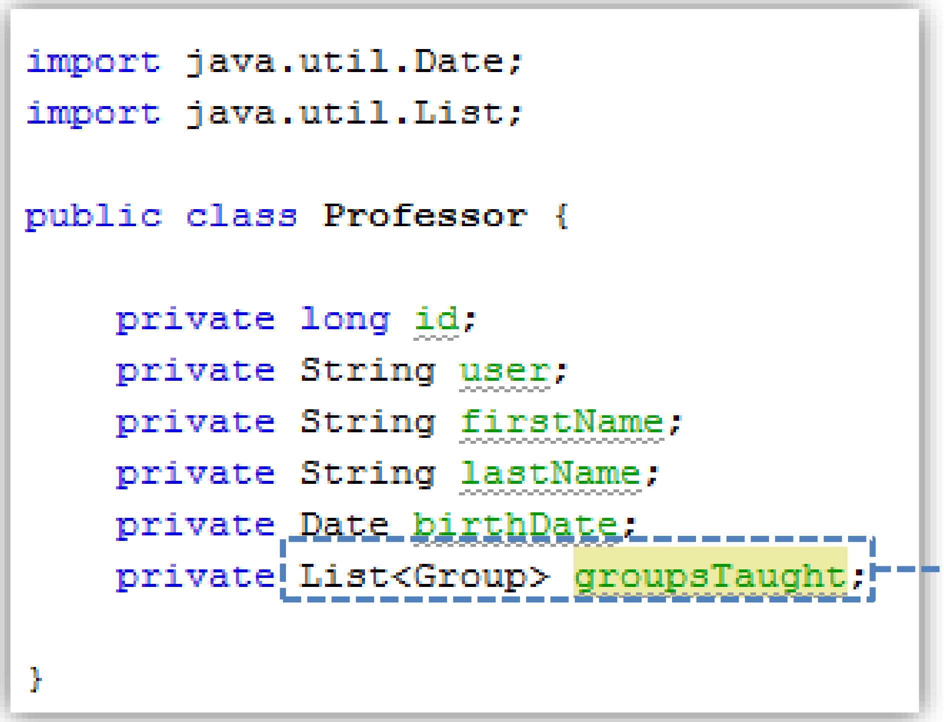
Multiplicity

Is the number of objects that participate in the relationship

0..1	No instances, or one instance (optional, may)
1	Exactly one instance
0..* or * or 0..n	Zero or more instances
1..*	One or more instances (at least one)

From model to code



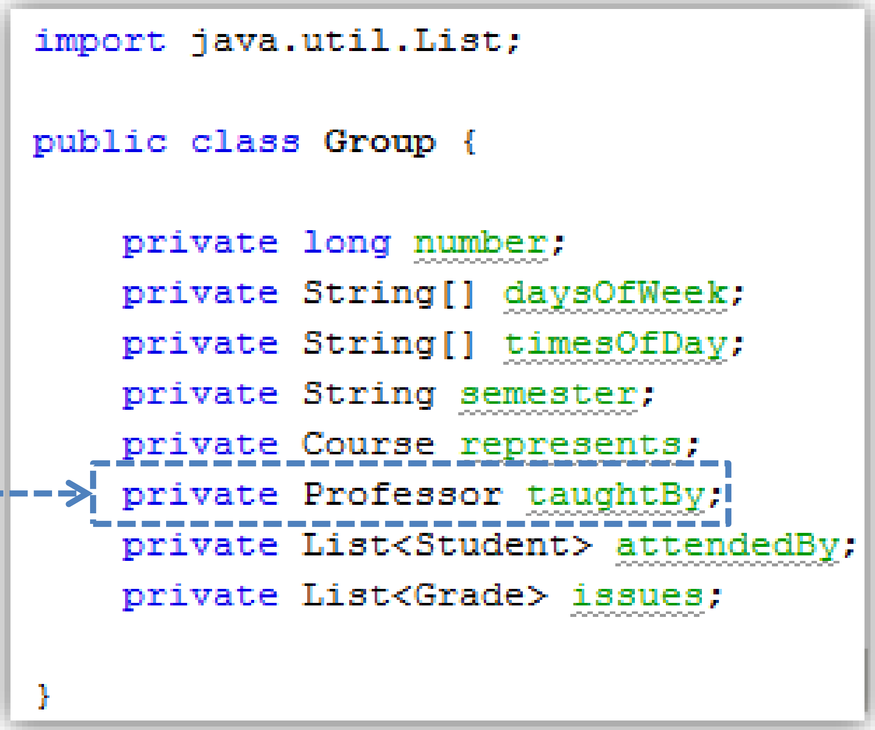


```
import java.util.Date;
import java.util.List;

public class Professor {

    private long id;
    private String user;
    private String firstName;
    private String lastName;
    private Date birthDate;
    private List<Group> groupsTaught;

}
```

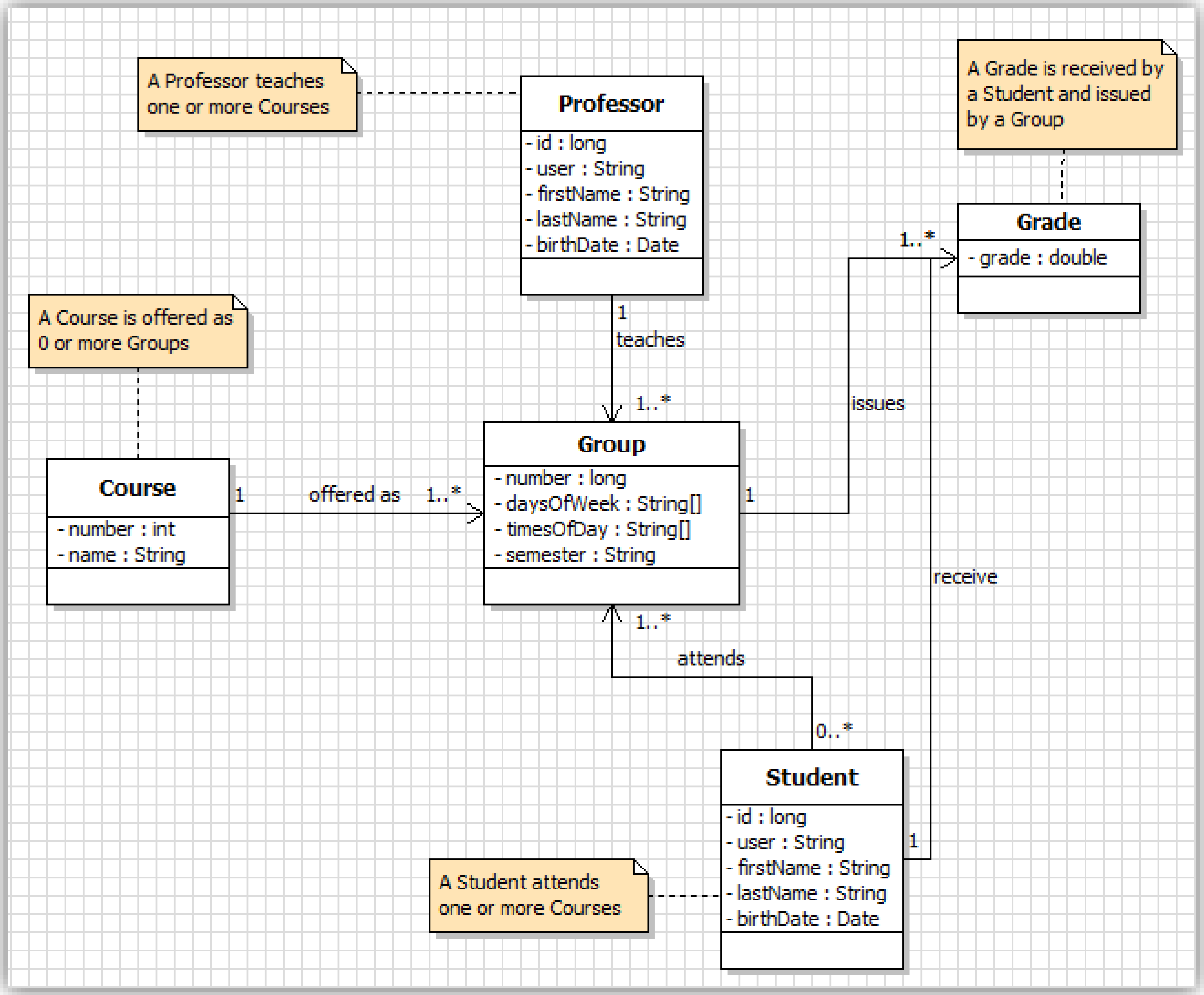


```
import java.util.List;

public class Group {

    private long number;
    private String[] daysOfWeek;
    private String[] timesOfDay;
    private String semester;
    private Course represents;
    private Professor taughtBy;
    private List<Student> attendedBy;
    private List<Grade> issues;

}
```


A Professor teaches one or more Courses
Professor
- id : long
- user : String
- firstName : String
- lastName : String
- birthDate : Date
A Grade is received by a Student and issued by a Group
Grade
- grade : double
1..*
1
teaches
1..*
issues
A Course is offered as 0 or more Groups
Course
- number : int
- name : String
1
offered as
1..*
Group
- number : long
- daysOfWeek : String[]
- timesOfDay : String[]
- semester : String
1
receive
1..*
attends
0..*
Student
- id : long
- user : String
- firstName : String
- lastName : String
- birthDate : Date
1
A Student attends one or more Courses

1.3 Relationship between objects: A closer approach

1.3.1 Association and Links

1.3.2 Aggregation and Composition

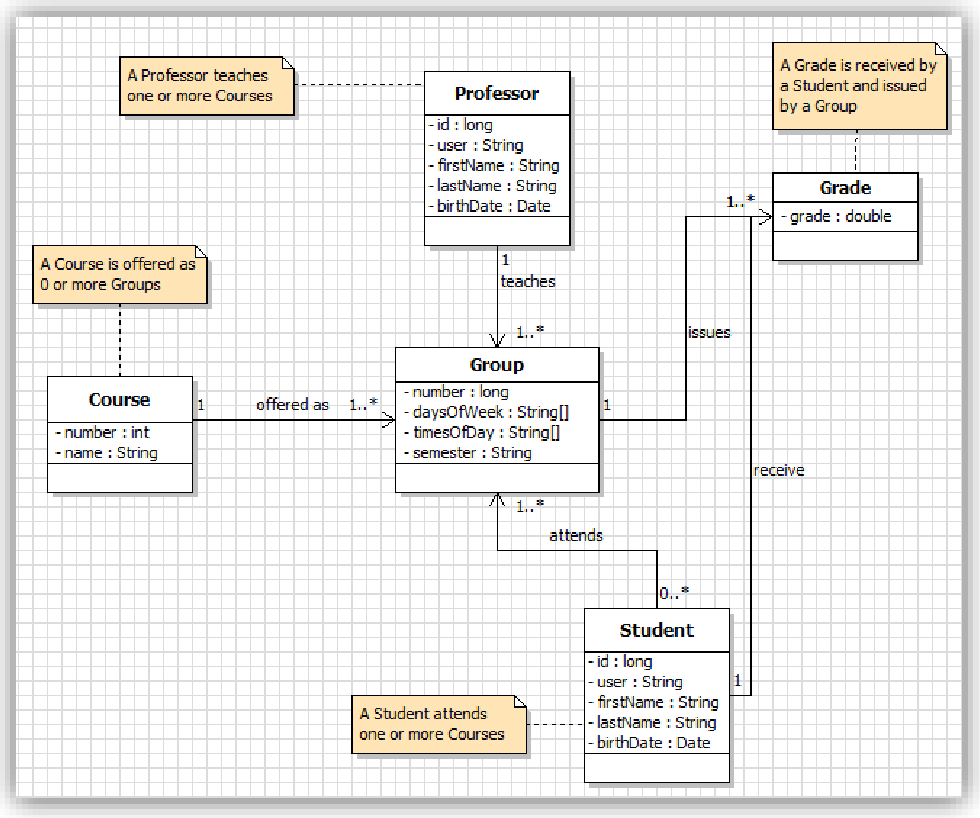
1.3.3 UML Notation

1.3.1 Association and Links

Associations are structural relationship

Associations are structural relationship that exists between **classes**

- A **Professor** *teaches* one or many **Groups**
- A **Course** *is offered* as one or many **Groups**
- Zero or many **Students** *attends* one or many **Groups**



Links

Links are relations between two specific **objects** (*instances*)

Association: ______ *attends at* ______

A student Any group

Link: Bruce Wayne *attends at* Math 3B

A ***specific*** student A ***specific*** group

1.3.2 Aggregation and Composition

Aggregation and Composition

Aggregation: Is a specific type of association, is represented typically by "*consists of*", "*is composed of*" and "*has a*"

A Team ***is composed by*** one or more Students

A Department ***is composed of*** one or more Professors

A Club ***has*** Members

Composition: Is a strong form of aggregation, in which **the "parts" cannot exist without the "whole."**

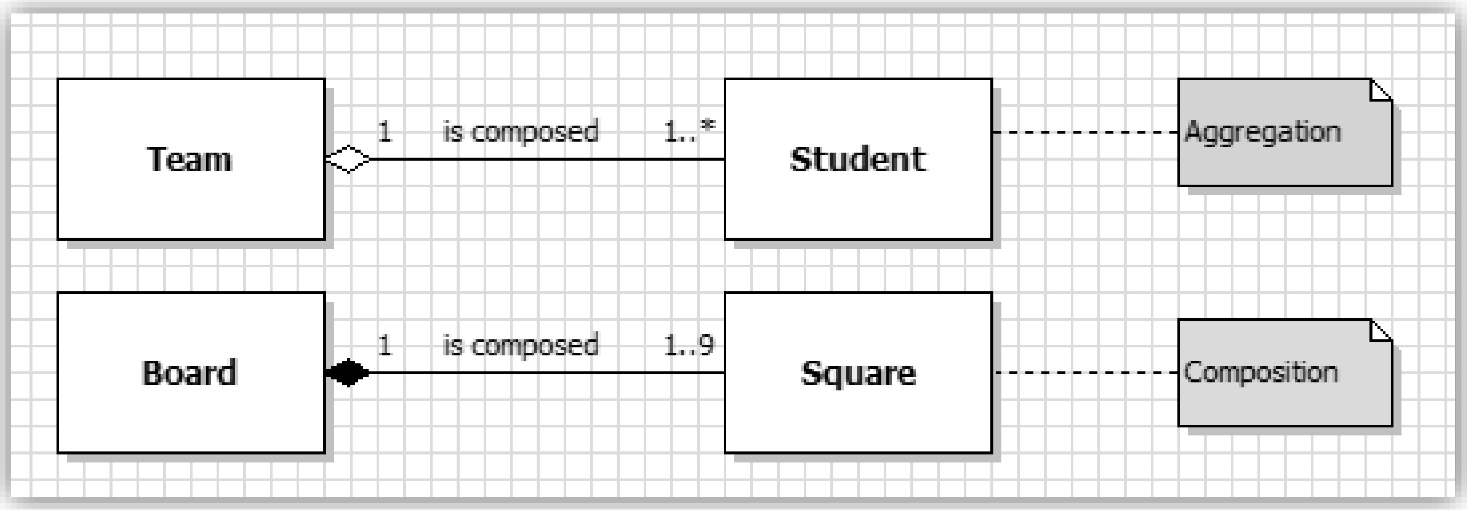
A Building ***is composed by*** one or more Rooms

A University ***is composed of*** Departments

A Board ***is composed of*** Squares

1.3.3 UML Notation

UML notation



Aggregation is depicted as an **unfilled diamond**

Composition is depicted as a **filled diamond** and a solid line.

2. Completing the Exercise

Now is your turn for using your model

1. Abstract the model to submit the grades of a student in the SIA (Classes, behaviors, attributes, etc)
2. **Create a Java project in NetBeans or Eclipse**
3. **Create the Java classes of the proposed model**
4. **Encapsulate the classes**
5. **Do all setters and getters for all classes**
6. **Test your classes with the following test class:**

   Test Class
7. **Do more tests creating new objects of other classes.**

References

- [Barker] J. Barker, *Beginning Java Objects: From Concepts To Code*, Second Edition, Apress, 2005.
- [Deitel] H.M. Deitel and P.J. Deitel, *Java How to Program*, Prentice Hall, 2007 - 7th ed.
- [Sierra] K. Sierra and B. Bates, *Head First Java*, 2nd Edition, O'Reilly Media, 2005.