(14-3) More with UML

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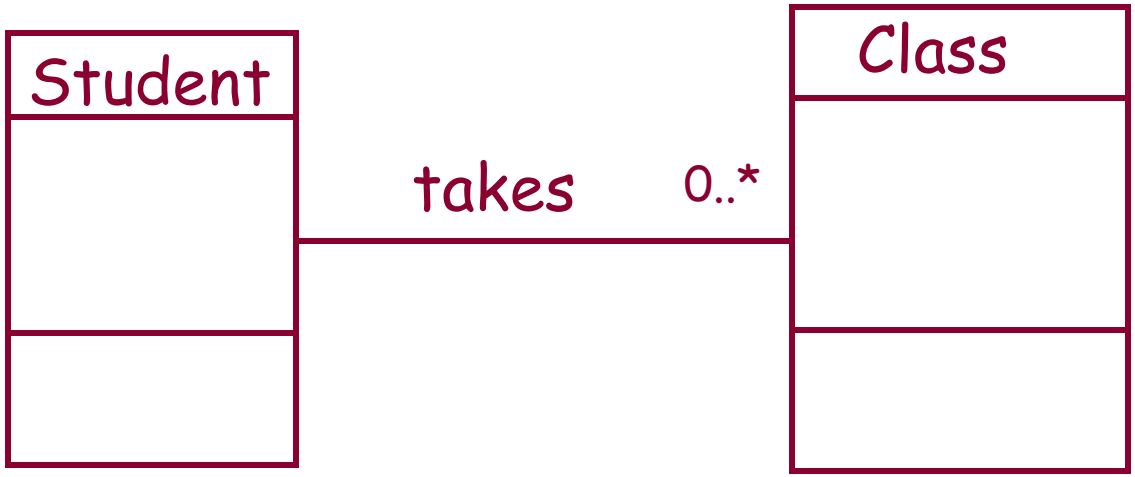
UML as a Model

- UML is a notational syntax for expressing Object Oriented models
- Merges Booch, Rumbaugh, and Jacobson
- Not a methodology (although the Unified Process is)
- UML Models can (should be) an important source for test

Relationships in UML Models

- Relationships in models can show a dependency between two instances
- The example shows a relationship such that a student takes 0 to many classes; We might question the many (limiting it to some max value) but we can definitely look for tests about this relationship



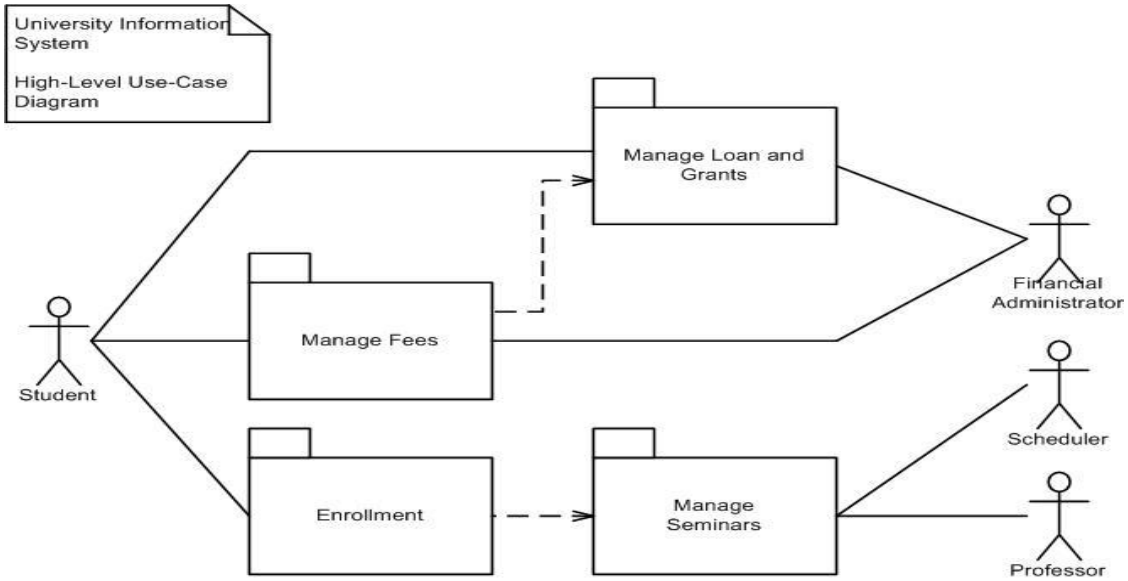
Built in relationships have a corresponding generic test requirements that can be identified by applying a relational test strategy to each UML diagram

General Purpose Elements of UML

- Organize diagrams
- Express details

Packages and Package Diagrams

- Package
  - A group of UML diagrams and diagram elements of any kind, including other packages
- A package diagram shows the organization of packages

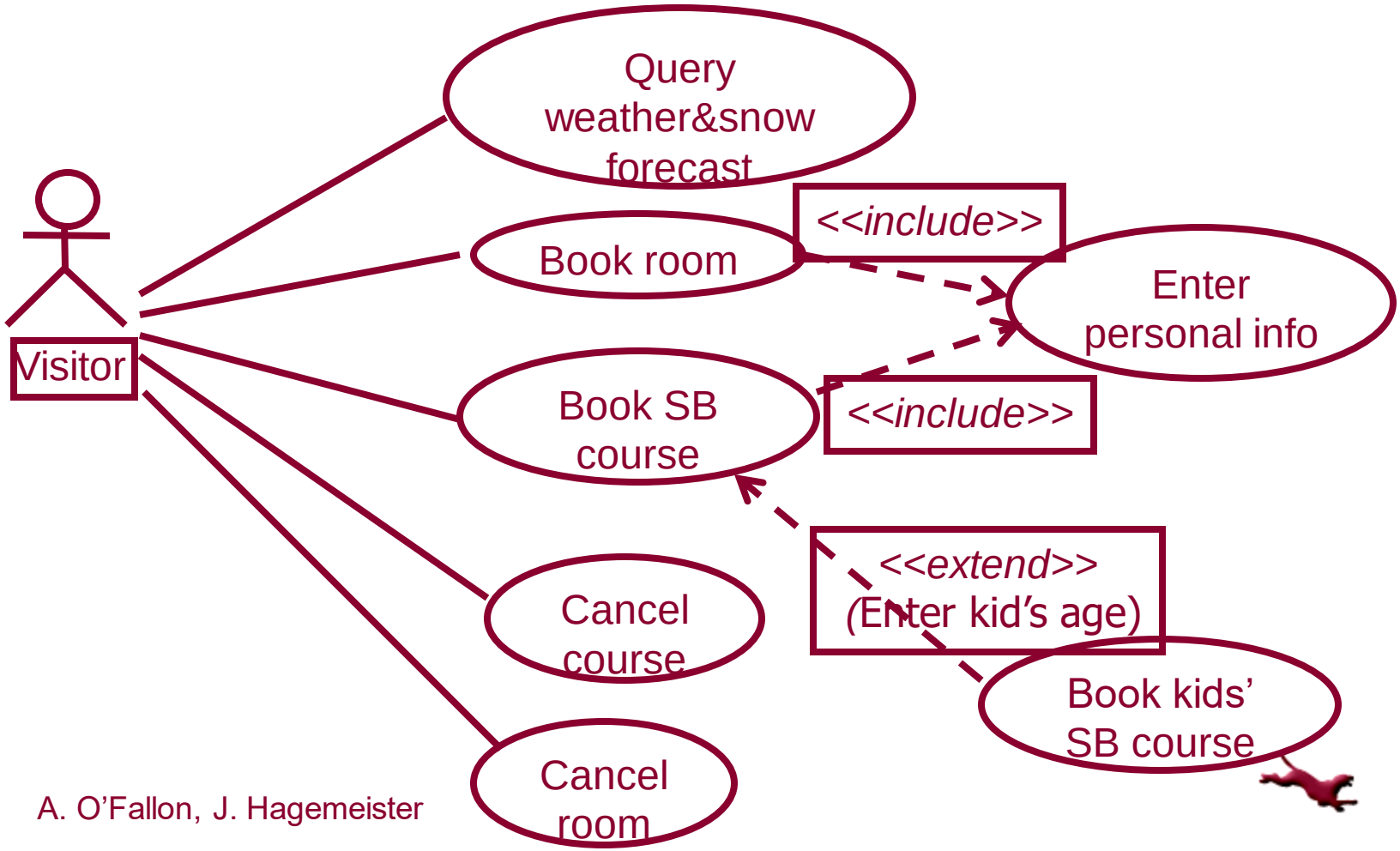


Expressions, Constraints, Comments, and NOTES

- Expression ➔ a string from an executable language that can be evaluated to produce a result
- Constraints ➔ a predicate expression on an element
- Comments ➔ a natural language constraint

A ***note*** is a box with a dog eared corner. It may or may not be connected to a diagram element. It contains a textual description or explanation.

Use Case Models (1)



Use Case Models (2)

- Use Case: Book SB course
- Precond: -
- Main flow:
  1. Visitor enters date
  2. Include (Enter personal info)
  3. (Enter kid's age)
  4. Store reservation
  5. Confirm reservation to Visitor
- Exceptional flow:
  - If number of course participants for specified date > 8, then tell visitor so and let him choose another date

Use Case Models (3)

- Use Case: Book kids' SB course
- Precond: SB course is for a kid
- Main flow:
  1. Enter kid's age
  2. Store reservation
  3. Confirm reservation to Visitor
- Exceptional flow:
  - If course for specified date is adult course, then tell visitor so and let him choose another date
- Exceptional flow:
  - If course for specified date is kids' course, and the specified age is outside the course's age range, then tell visitor so and let him choose another date

Use Case

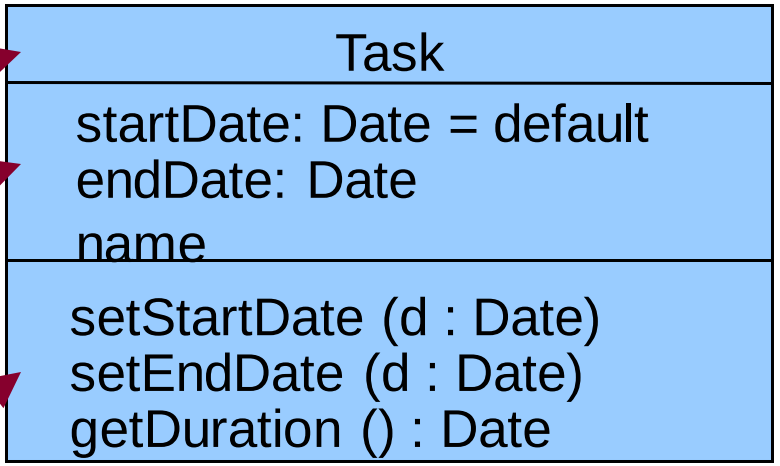
- An abstraction of the system to model behavior to external interaction
- Accomplish important tasks from the user's point of view
- Represent system requirements
  - Functional
  - Allocation to classes
  - Object interaction and interfacing
  - User interfaces
  - User documentation

Class Diagram

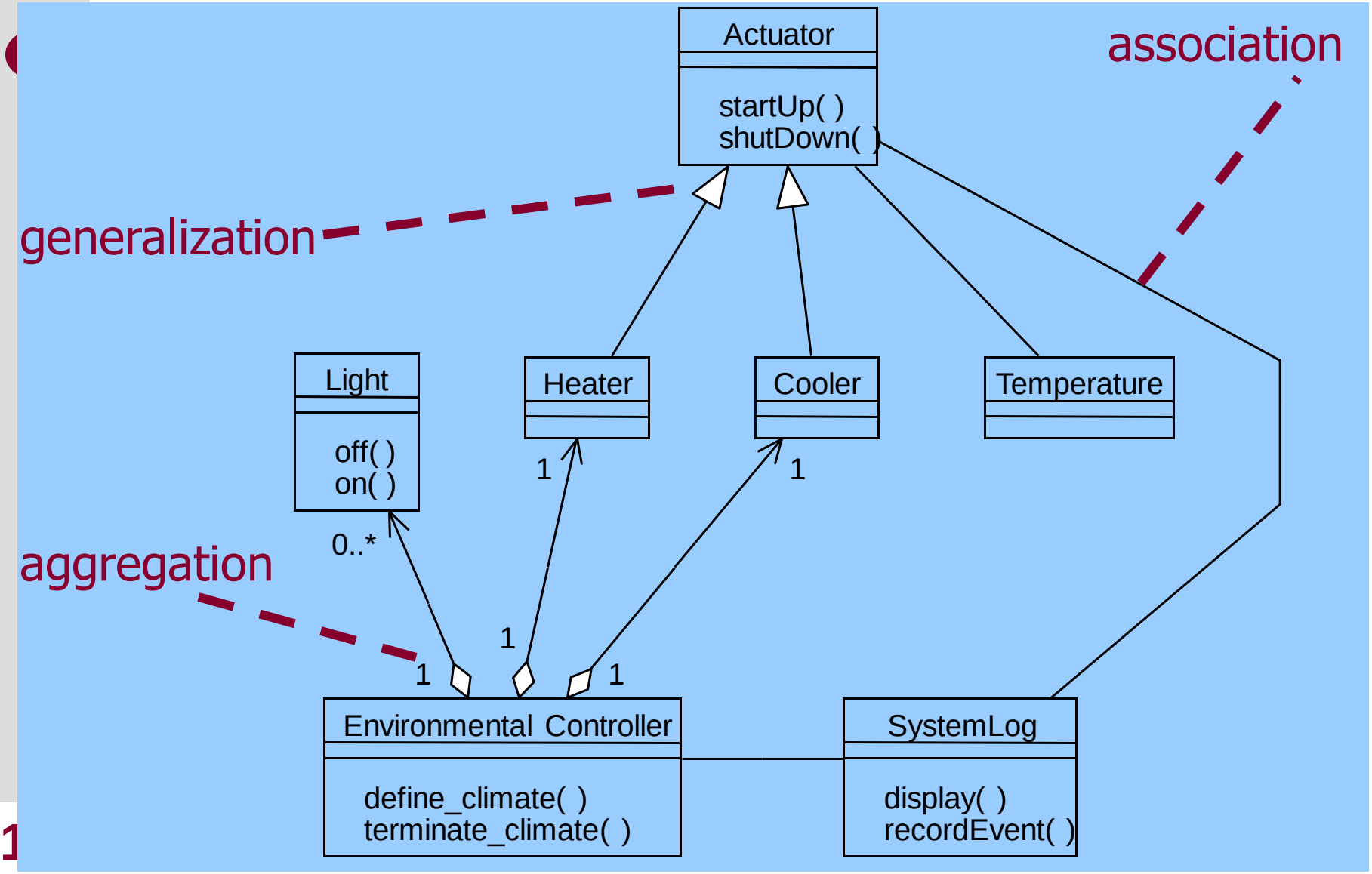
- Central for OO modeling
- Shows static structure of the system
  - Types of objects
  - Static relationships
    - Association
      (e.g.: a company has many employees)
    - Generalization (subtypes)
      (e.g.: an employee is a kind of person)
    - Dependencies (Aggregation)
      (e.g.: a company is using trucks to ship products)

Class

- Set of objects
- Defines
  - Name
  - Attributes
    (optional: type
    optional: initial value)
  - Operations



Class diagram example

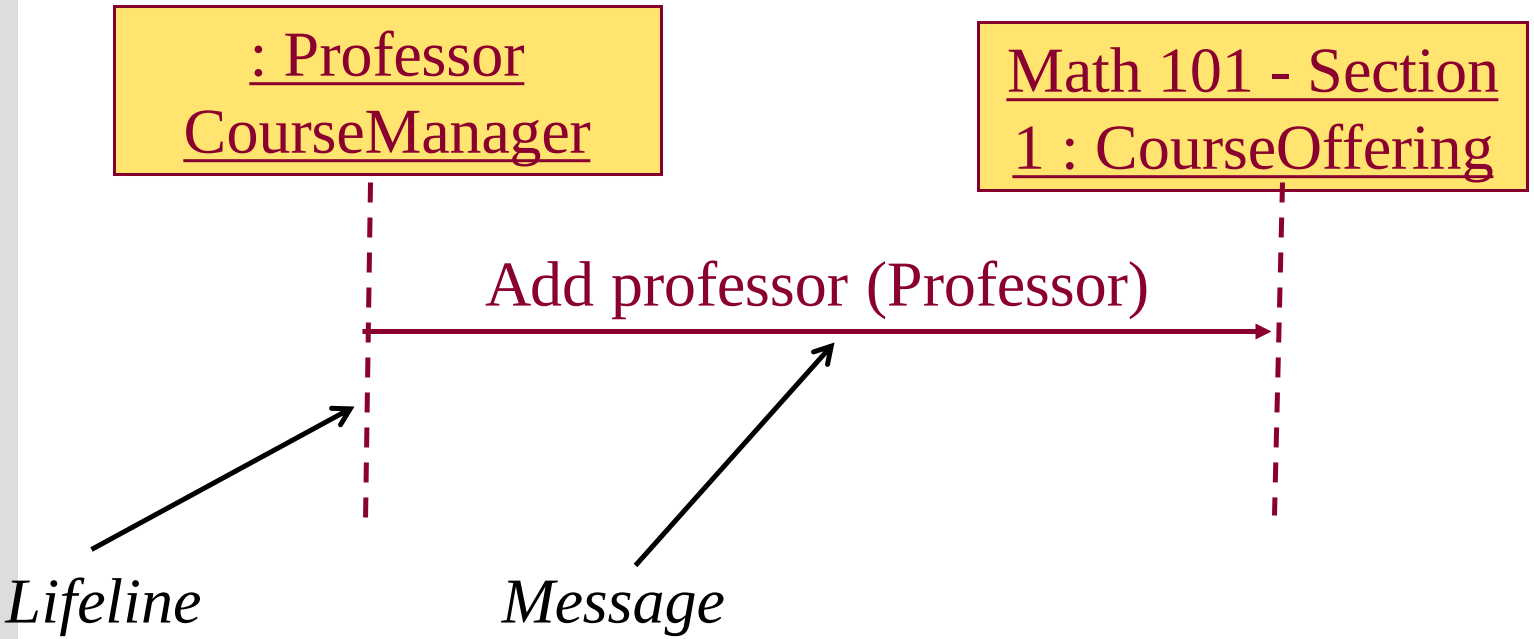


Sequence Diagrams

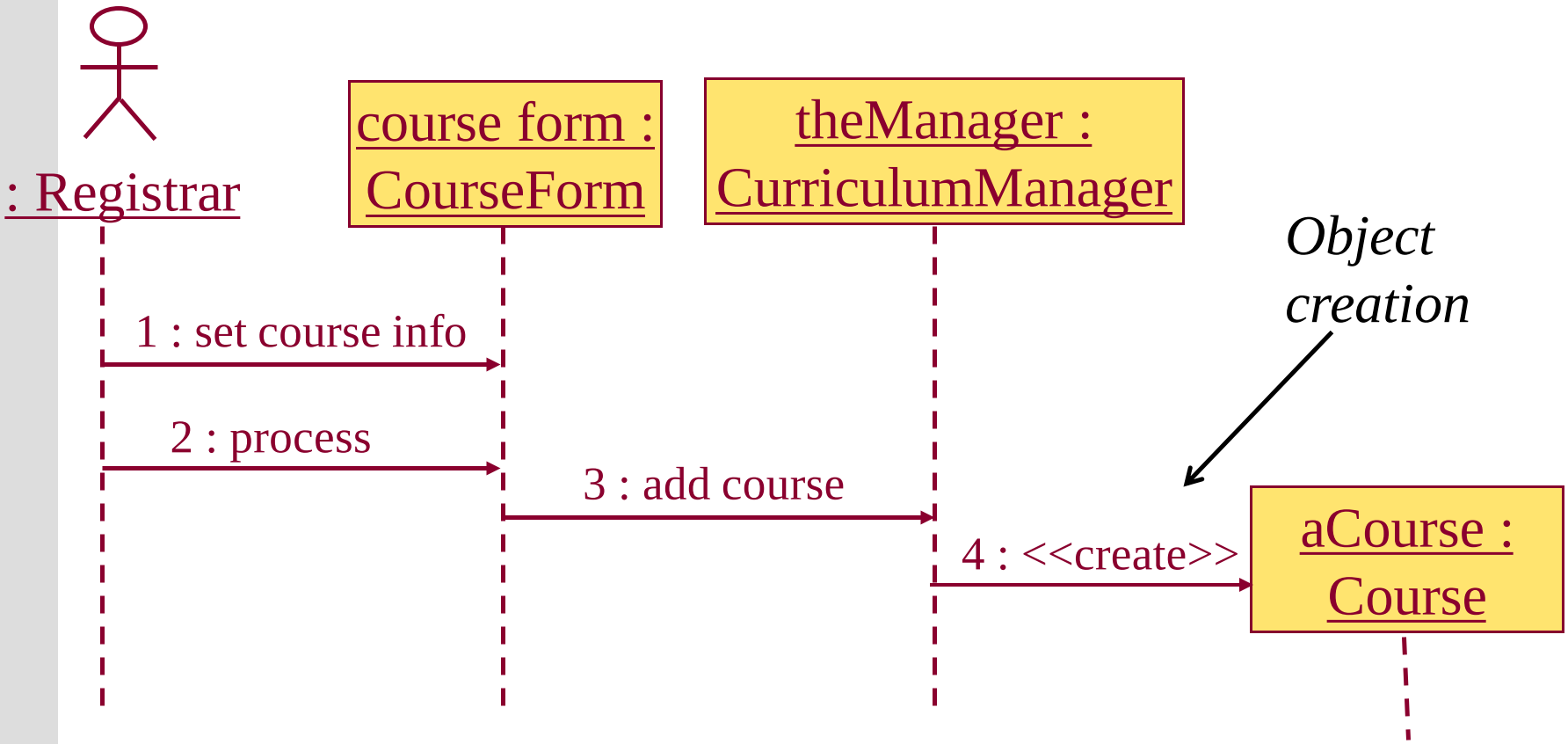
- Shows object interactions arranged in time sequence
- It focuses on
  - Objects (and classes)
  - Message exchange to carry out the scenarios functionality
- The objects are organized in an horizontal line and the events in a vertical time line

Notation Example (simple version)

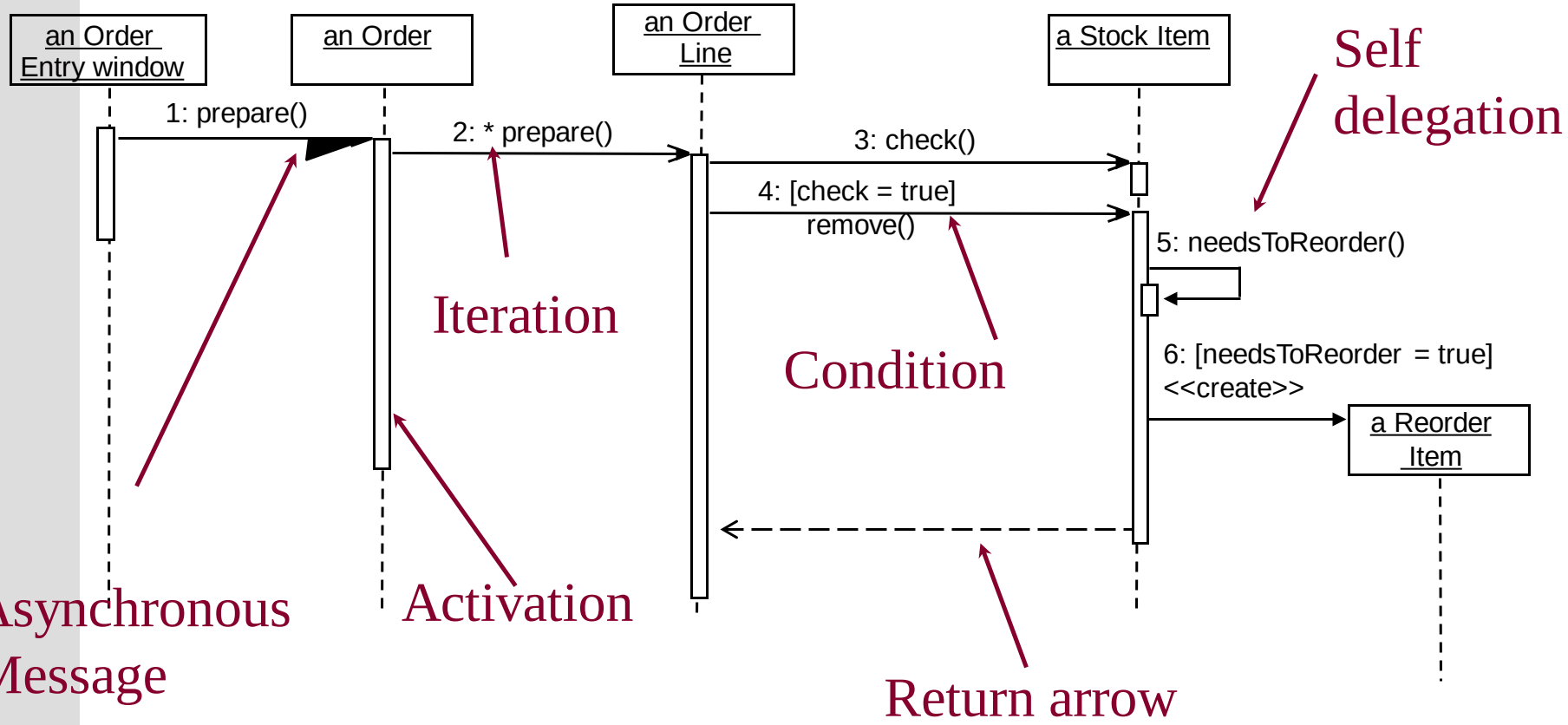
- Messages point from client to supplier



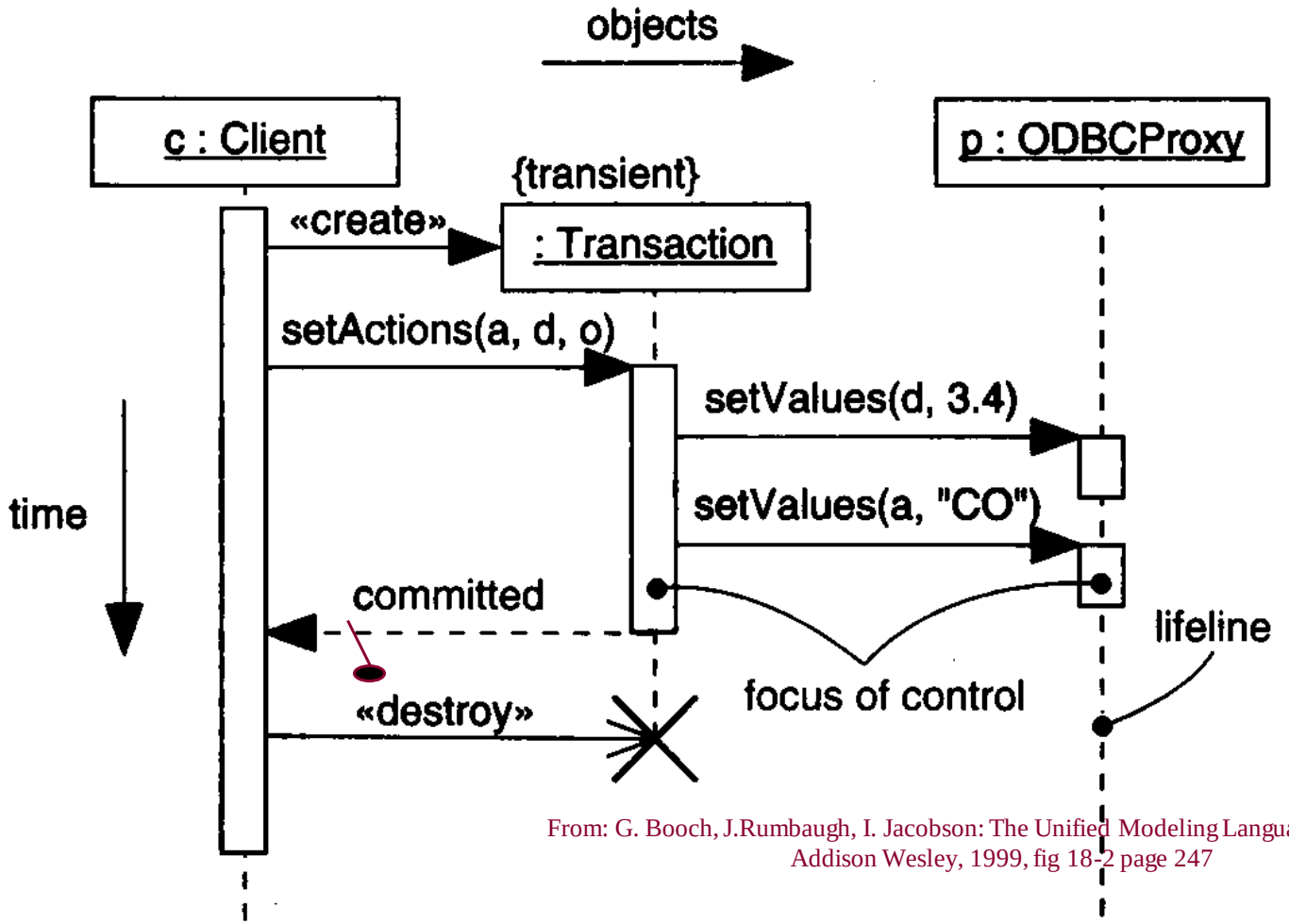
Sequence Diagram: Larger Example



Sequence Diagrams: More Details



Example of a Transaction



From: G. Booch, J.Rumbaugh, I. Jacobson: The Unified Modeling Language User Guide. Addison Wesley, 1999, fig 18-2 page 247

Content of Sequence Diagrams

- Objects
  - They exchange messages among each other
- Messages
  - **Synchronous**: “call events,” denoted by the full arrow; Duration of synchronization should be indicated by activation bar or return arrow
  - **Asynchronous**: “signals,” denoted by a half arrow
  - There are also «create» and «destroy» messages

Asynchronous messages

- Do **not block** the caller
- Can do 3 things:
  - Create a new thread
  - Create a new object
  - Communicate with a thread that is already running

References

- Robert V. Binder, *Testing Object-Oriented Systems: Models, Patterns, and Tools*, Addison-Wesley, 2000.

Collaborators

- Jack Hagemeister