



Interaction Diagrams



sequence & collaboration

Modeling static parts of the system: structural diagrams



- **Class diagram:** static design view
- **Object diagram:** set of objects and their relationships. Used to illustrate data structures.
- **Component diagram:** set of components and their relationships.
- **Deployment diagram:** view of the architecture

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Modeling dynamic parts of system: behavior diagrams



- Use case diagram
- **Sequence diagram:** time ordering of messages
- **Collaboration diagram:** emp structural organization
- Statechart diagram
- Activity diagram: flow

Interaction diagrams

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Interaction diagrams contain:

- Objects
- Links
- Messages

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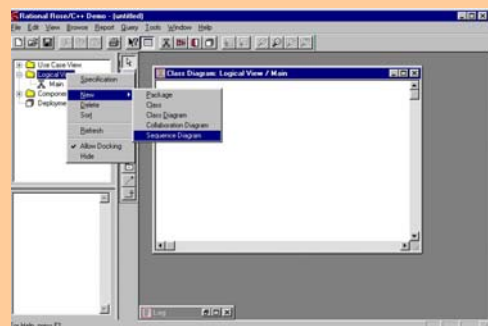
Interaction Diagrams

- Ensure that the class model can realize the use cases
- Record how objects interact to perform tasks
- UML has two types
 - sequence diagrams
 - collaboration diagrams

Some case tools can generate one from the other

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Constructing a Sequence diagram in Rose



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Sequence Diagram

- Actors or objects are at the top of the diagram
- vertical lines represent time, as seen by the object; the objects **lifeline**
- time passes from top to bottom
- a message appears as a horizontal line from the sender's lifeline to the receiver's lifeline
- order of objects, across top, doesn't matter
- narrow rectangle indicates the objects **activation**

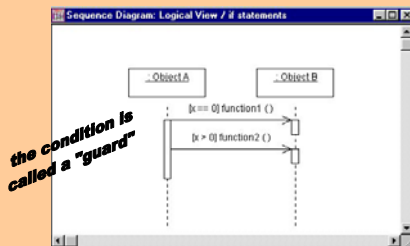
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Activation

- The lifetime of an object
- narrow rectangle used to indicate lifetime
- object ceases to have a lifetime when it responds to the message
- message arrows always point to top of activation; self messages are exceptions

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Conditional behavior



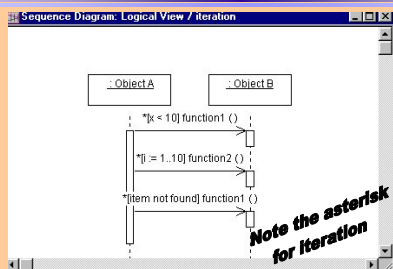
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If-else

- No provision in UML, although some CASE tools provide for it.
- UML recommends using Activity diagrams
- if-else may not belong in sequence diagram

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Iteration



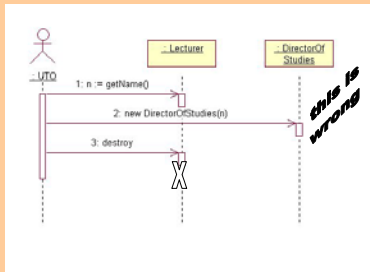
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Returned values

- Useful to indicate that an object returns a value in response to a message
- shown on the message arrow by an **assignment** to a variable name
- the assignment statement binds the variable, which can be used in subsequent messages to other objects

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new and delete



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Computerized library requirements:

• books & journals:

- several copies of books, one copy of journal
- some books for only short term loan
- all other books may be borrowed for 3 weeks
- only staff members may borrow journals
- library members may borrow up to 6 items, members of staff may borrow up to 12 items
- books & journals arrive regularly; some discarded
- at the end of a year, journals are bound

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Computerized library requirements (cont):

• Borrowing:

- system must track when items are borrowed and returned
- new system should produce reminders when items are overdue
- future enhancement: users may extend a loan if item is not on reserve

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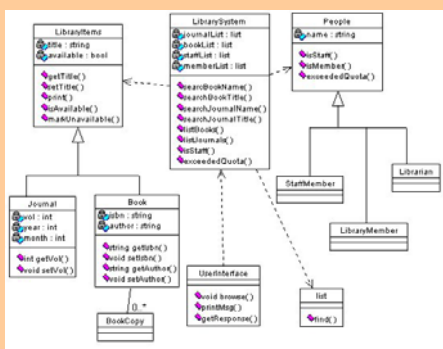
Computerized library requirements (cont):

• browsing:

- system should allow users to search by topic, title, author
- users should be able to check if an item is available
- if an item is not available, users should be able to reserve the item
- anybody can browse the library

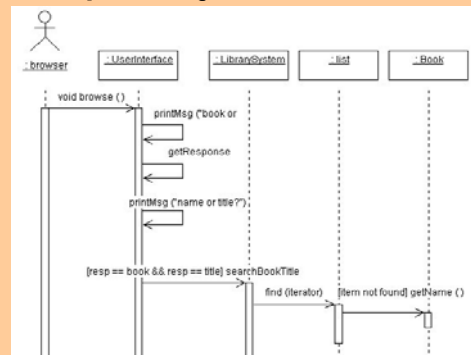
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A Class diagram for Library Application



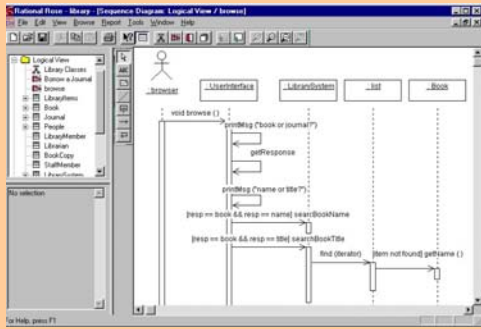
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Sequence Diagram: Browse book title



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Example Sequence Diagram



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Sequence vs. collaboration

- **Sequence:** Table that shows objects arranged along the X axis and messages, ordered in increasing time, along the Y axis
- **Collaboration:** collection of vertices (the objects) and arcs (links that connect these objects). The arcs are adorned with the messages that objects send/receive

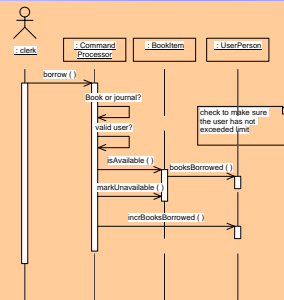
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Two features of collaboration diagrams

- First: the path
- second: the sequence number to indicate the time sequencing of messages

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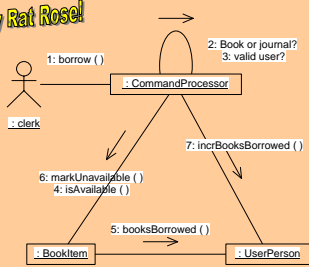
Sequence Diagram to Borrow a Book



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Collaboration diagram to Borrow a Book

Generated by Rat Rose!



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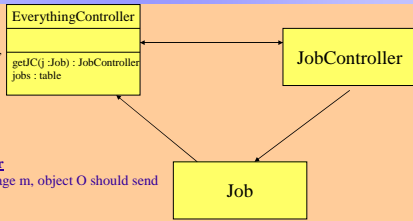
Where should messages go?

- Underlying every interaction, there is a collaboration: set of objects & links
- objects can only exchange messages if there is a link (association)
- If the class model doesn't show a link that exists in a collaboration, there is a bug in the model

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Breaking the law of Demeter

To send a message to JobController, Job sends getJC() to EverythingController, which returns a reference to JobController. Job uses that reference to send a message to JobController.



The law of Demeter

In response to message m, object O should send a message only to:

1. O itself
2. Objects sent as arguments to m
3. Objects which O creates as part of its reaction to m
4. Objects which are directly accessible from O, that is, using values of attributes of O

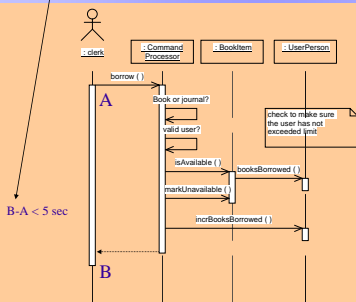
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Suppressing detailed behavior

- It is sometimes desirable to describe interactions at a higher level
- Can collapse objects in a sub-collaboration and regard them as a package.
- Give the package a name and treat it as though it were one object

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Timing: an advantage of sequence over collaboration



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Some wisdom from the UML User Guide

- “Because they both derive from the same information in the UML model, both sequence diagrams and collaboration diagrams are semantically equivalent.”
- Hint: use branching sparingly; you can represent complex branching much better using activity diagrams

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