Software Engineering

Sequence Diagram

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Sequence diagrams

- Shows sequence of interactions between objects to support (realize) a single use case or operation.
- Shows "...not only how a particular behavior is carried out but also which objects and actors are involved".
  ([Unhelkar:2005], p. 142)
- Interactions occur during a specific period of time.
- An interaction is a message being sent from one actor or object to another; Message = operation invocation.
- Recipient of the message executes the corresponding method to do the requested action.
  - ✓ Recall -> methods implementation of operations.

Sequence diagram

- The UML sequence diagram shows the time-based dynamics of the interaction.
- These show the sequence of events that take place during some user interaction with a system.
- You read them from top to bottom to see the order of the actions that take place.

Why use sequence diagrams

- **Emphasis on sequence:**
  - ✓ Easy to see specific order in which things occur.
- **Can show lifetime of objects:**
  - ✓ Created
  - ✓ Destroyed
  - ✓ Modified
- **Not to show structural organization of collaborating objects.**

Sequence diagrams Components

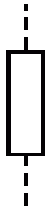
The sequence diagram consists of :

- **Objects**

  represented in the usual way - as named rectangles (with the name underlined),

- **Messages**

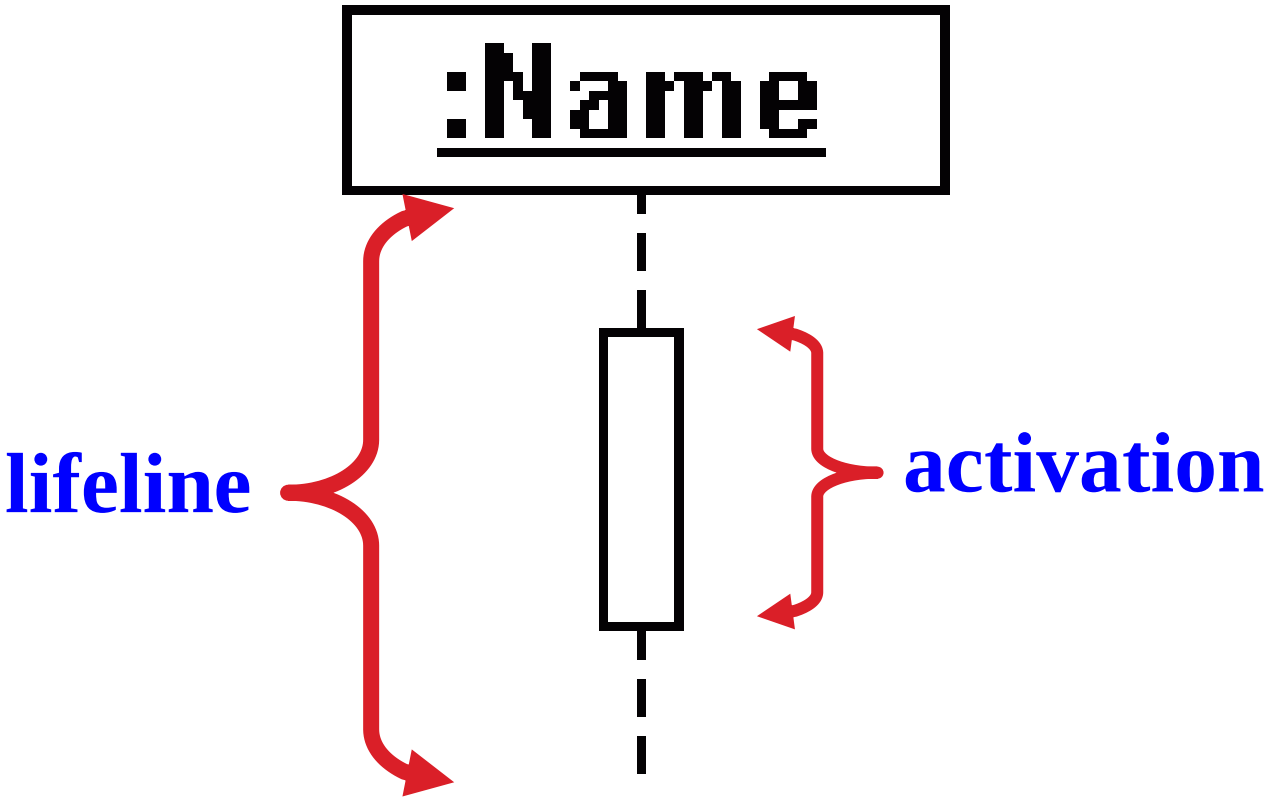
  represented as solid-line arrows, and



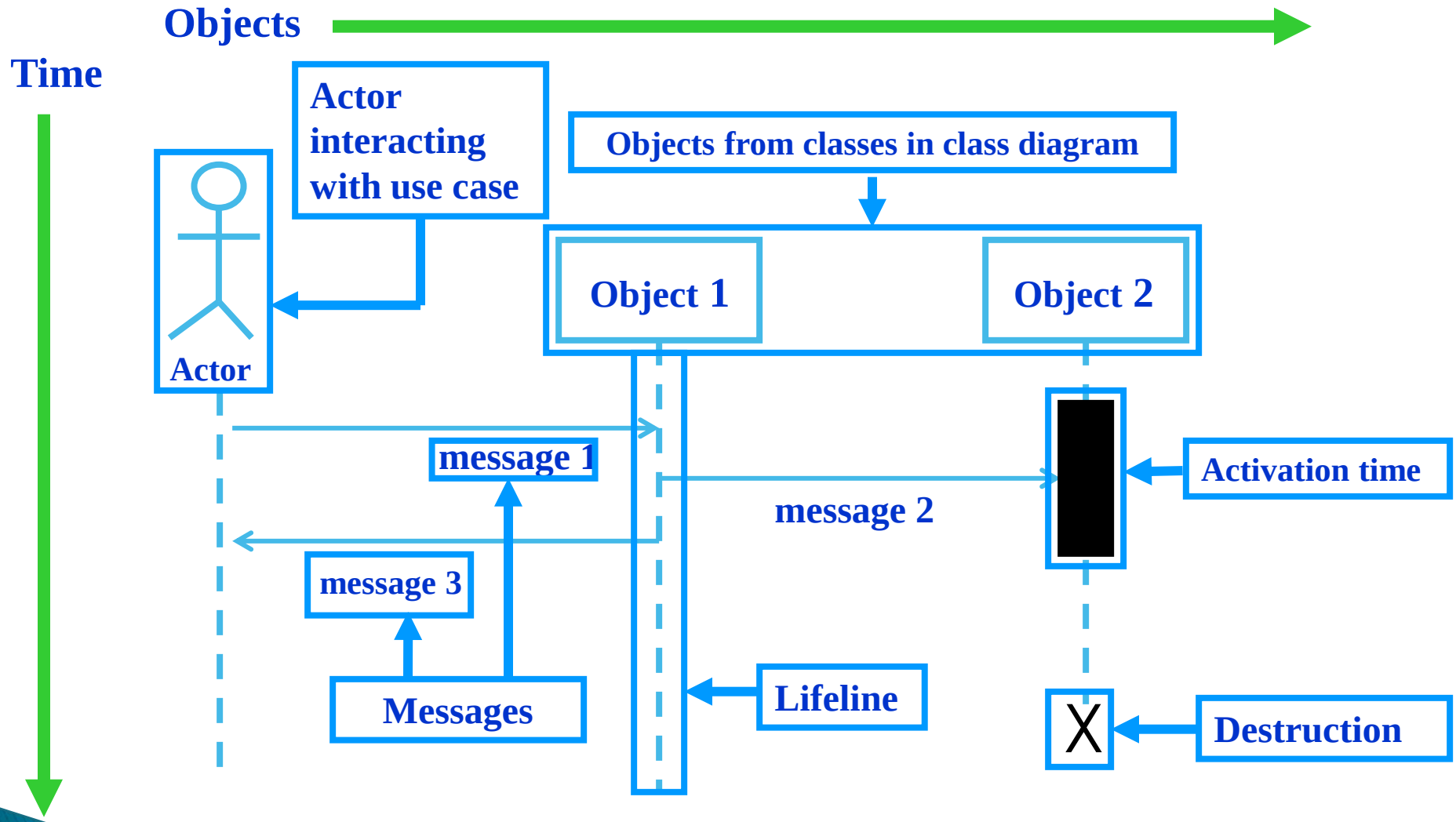
- **Time**

  represented as a vertical progression.

Objects



Sequence diagram notation



Messages

A message that goes from one object to another goes from one object's lifeline to the other object's lifeline.

Message Types

- **Simple**

This is a transfer of control from one object to another.

- **Synchronous**

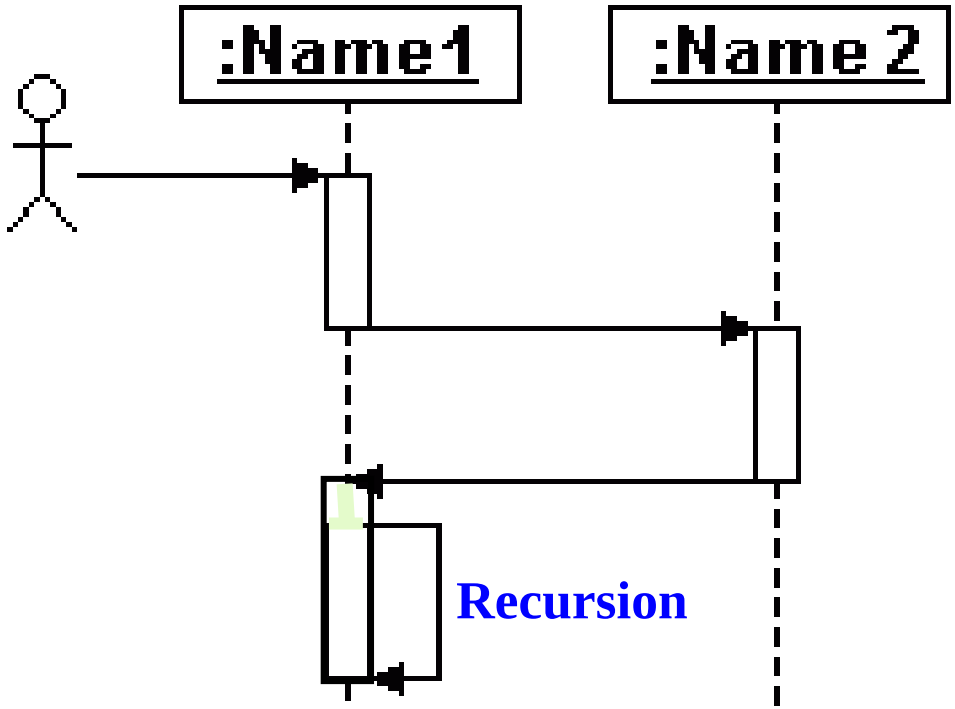
If an object sends a synchronous message, it waits for an answer to that message before it proceeds with its business.

- **Asynchronous**

If an object sends an asynchronous message, it doesn't wait for an answer before it proceeds.

Time

Time starts at the top and progresses toward the bottom. A message that's closer to the top occurs earlier in time than a message that's closer to the bottom.



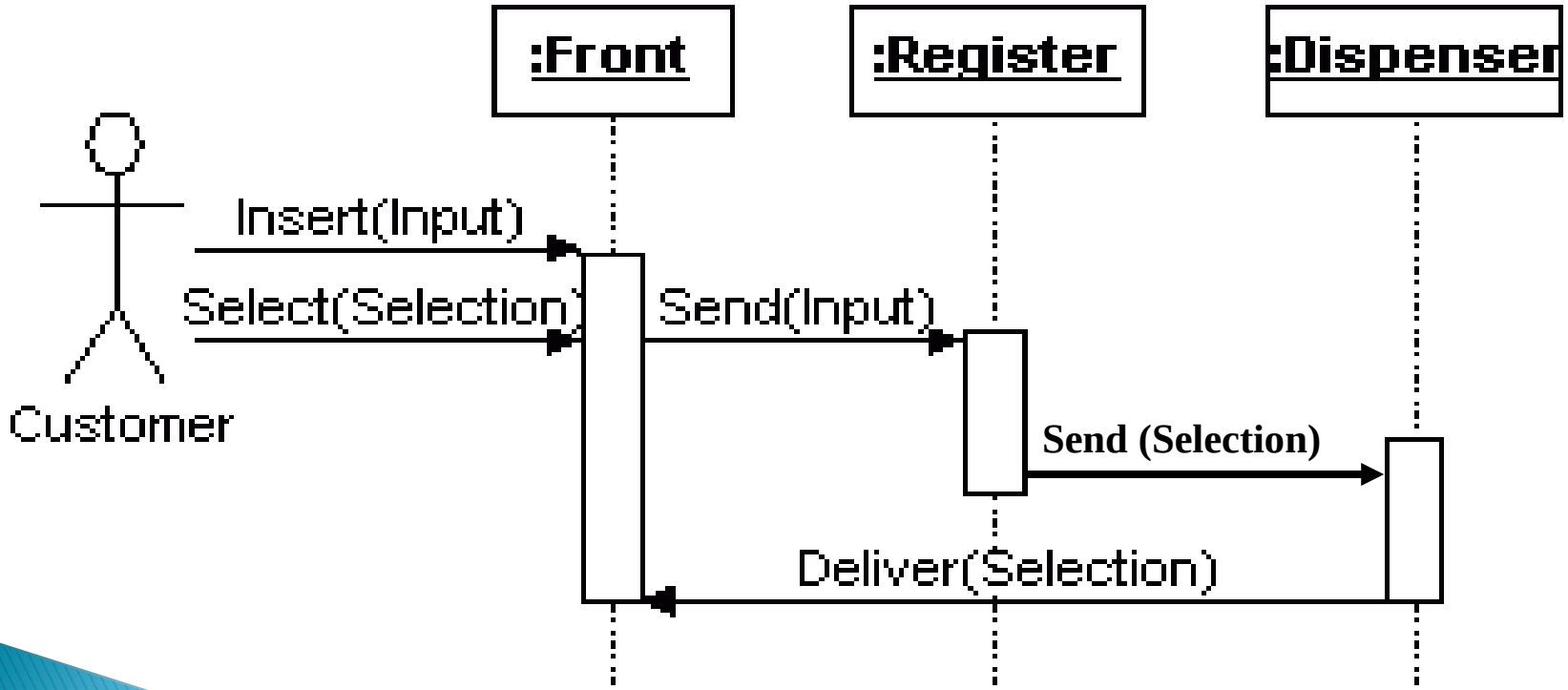
Example

Simplest Scenario

1	The customer inserts money in the money slot
2	The customer makes a selection
3	The money travels to the register
4	The register checks to see whether the selected product is in the dispenser
5	The register updates its cash reserve
6	The register has a dispenser deliver the product to the front of the machine

Example

Simplest Scenario



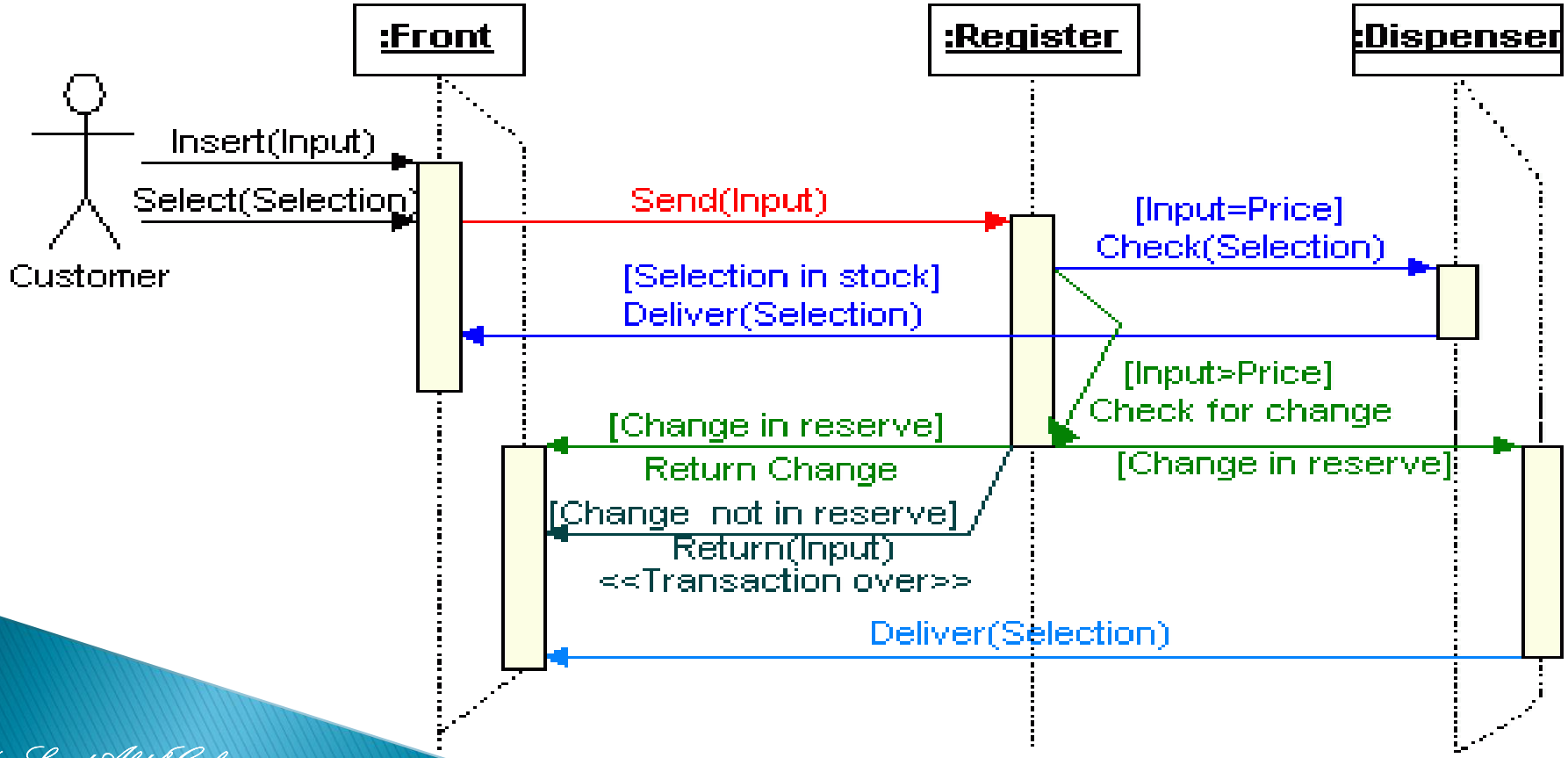
Example

For the incorrect-amount-of-money scenario

1	The register checks customer's input with the price of the product
2	If the amount is greater than the price, the difference is calculated, and register checks its cash reserve
3	If the difference is present in the cash reserve, the register returns the change to the customer and everything proceeds as before
4	Other way, the register returns the input amount and displays a message that prompts the customer for the correct amount
5	If the amount is less than the price, the register does nothing and the machine waits for more money

Example

For the incorrect-amount-of-money scenario



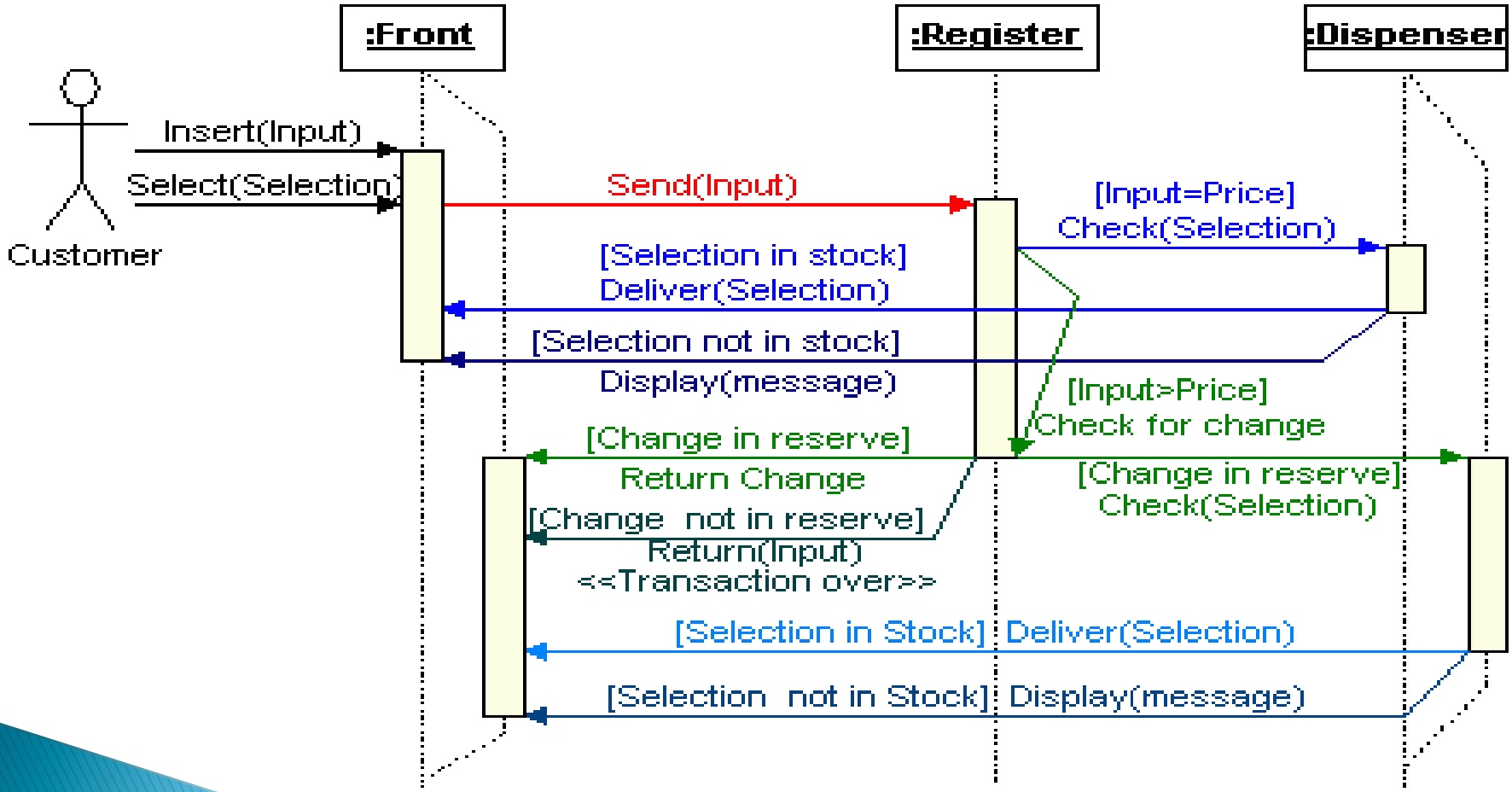
Example

The out-of-product scenario

1	After selecting a sold-out brand, the "SOLD OUT" message flashes
2	Prompt for another selection must be displayed
3	The customer has the option of pushing a button that returns money
4	If the customer selects an in-stock brand, everything proceeds as in the best-case scenario if the input amount is correct. If not, the machine follows the incorrect-amount-of-money scenario
5	If the customer selects another sold-out brand, the process repeats until the customer selects an in-stock brand or pushes a button that returns his or her money

Example

The out-of-product scenario



Approach to creating sequence diagrams

1. Identify all objects and actors involved in scenario.
2. Identify each message required to carry out scenario.
3. Determine whether each message is always sent or if only sent under certain conditions.
4. Sequence messages correctly and attach to appropriate lifelines.
5. Add formal syntax on messages.
6. Add response messages and communications to complete diagram.

Case study

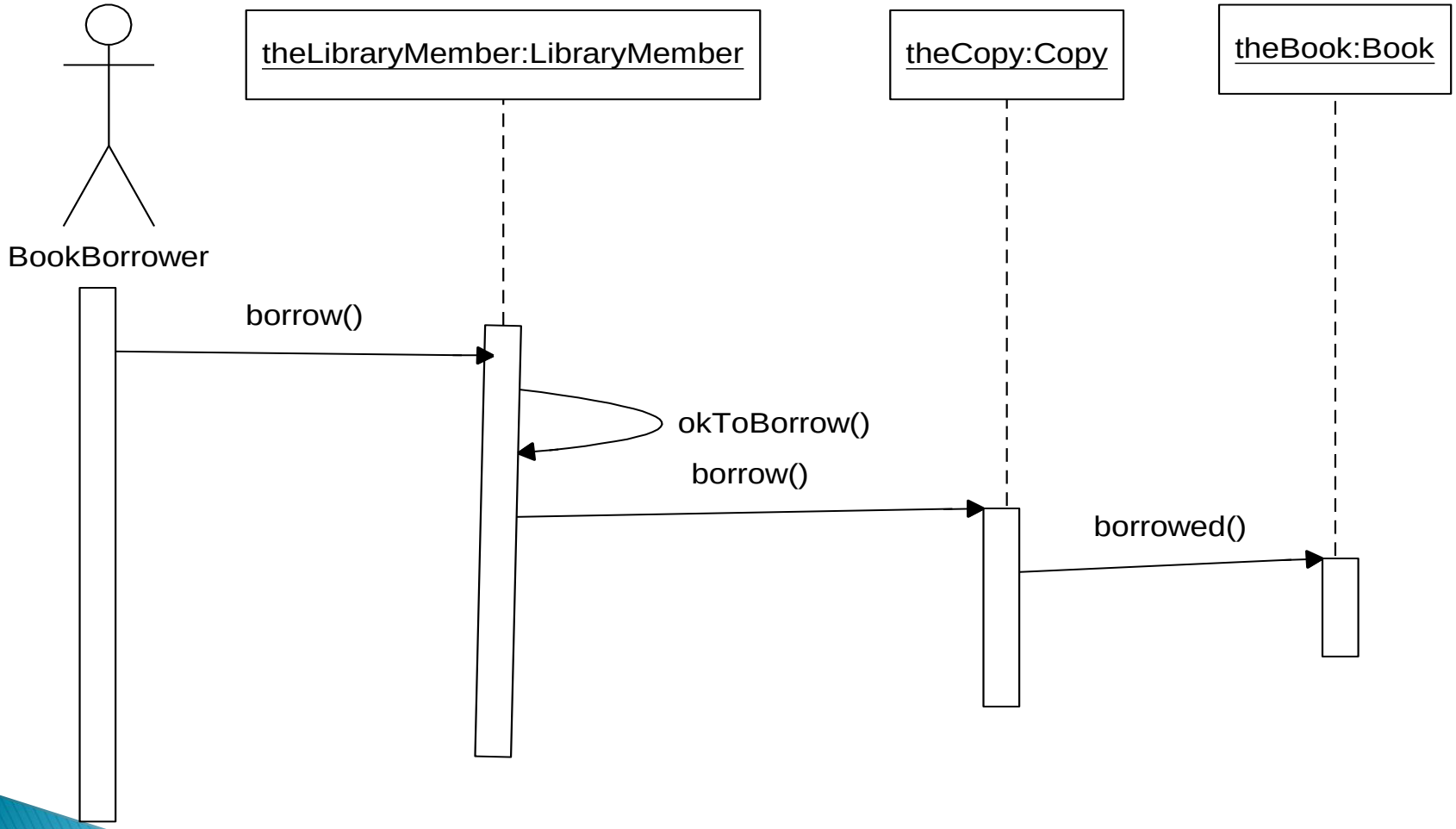
Library System

The library contains books and journals. It may have several copies of a given book. Some of the books are for short term loans only. All other books may be borrowed by any library member for three weeks. Members of the library can normally borrow up to six items at a time, but members of staff may borrow up to 12 items at one time. Only members of staff may borrow journals.

The system must keep track of when books and journals are borrowed and returned, enforcing the rules described above.

The system should allow users to search for a book on a particular topic, by a particular author etc., to check whether a copy of book is available for loan and, if not, to reserve the book. Anybody can browse in the library.

Library system – sequence diagram



Questions

Wilderness weather station

The government of a country with large areas of wilderness decides to deploy several hundred weather stations in remote areas.

Weather stations collect data from a set of instruments that measure temperature and pressure, sunshine, rainfall, wind speed and wind direction.

The weather station includes a number of instruments that measure weather parameters such as the wind speed and direction, the ground and air temperatures, the barometric pressure and the rainfall over a 24-hour period. Each of these instruments is controlled by a software system that takes parameter readings periodically and manages the data collected from the instruments. The weather station information system consists of:

- **The weather station system**
  This is responsible for collecting weather data, carrying out some initial data processing and transmitting it to the data management system.
- **The data management and archiving system**
  This system collects the data from all of the wilderness weather stations, carries out data processing and analysis and archives the data.
- **The station maintenance system**
  This system can communicate by satellite with all wilderness weather stations to monitor the health of these systems and provide reports of problems.

Sequence diagram describing data collection