FARABI UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE

Lecture 5.
UML Object Diagrams

Instances, slot values and links at a particular time

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Lecture goals and plan

Learning outcomes

Read instance names and slot values.

Distinguish associations from links.

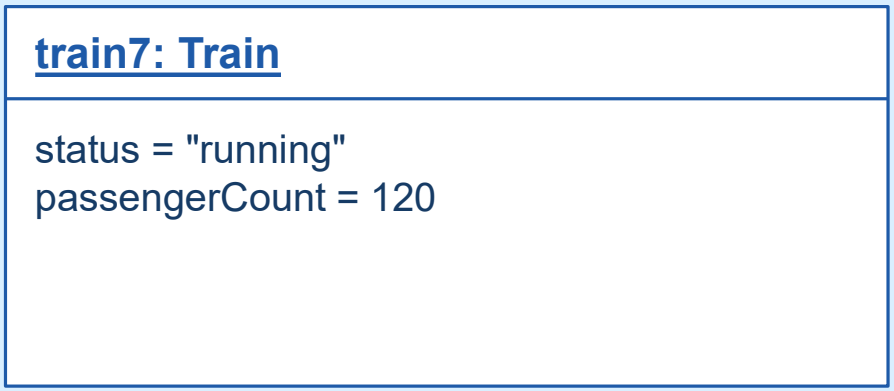
Build a snapshot from a scenario.

Check a snapshot against its class model.

Lecture plan

1. Purpose and notation
2. Classes and concrete instances
3. Worked object diagrams
4. Model validation
5. Classroom practice

A snapshot of selected objects



Snapshot at 10:00

The instance is train7.

The values describe this train at 10:00.

Another snapshot may show different values.

A snapshot records state. A sequence or state-machine diagram explains behavior over time.

Class diagrams and object diagrams

Aspect	Class diagram	Object diagram
Main elements	Classes and associations	Instances and links
Attributes	name: String	name = "Arman"
Scope	Possible system structures	One selected configuration
Relationships	Rules and multiplicities	Concrete related objects
Typical use	Define the model	Illustrate or test the model

Uses of object diagrams

During analysis and design

Explain a domain example.

Discover missing classes or relationships.

Check whether a class model permits a required scenario.

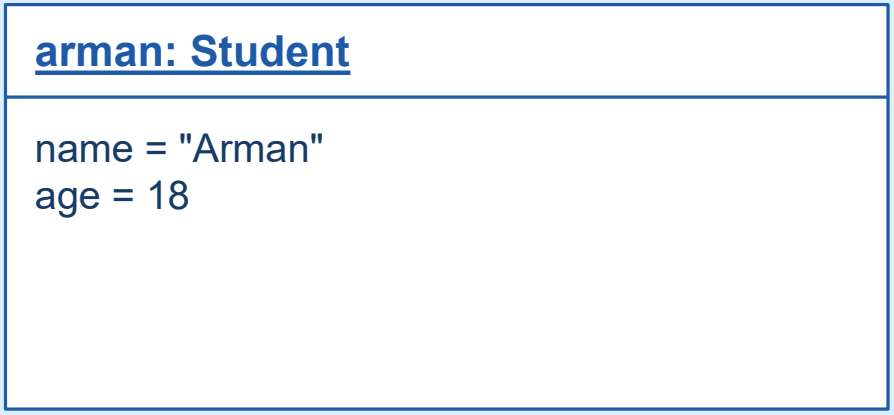
During implementation and testing

Describe a test fixture.

Document a selected runtime configuration.

Investigate unexpected links or values.

Instance specification notation



The two compartments

Underlined heading: instance : classifier

Slots: feature = value

Show the details needed for the example.

UML uses an InstanceSpecification to describe an instance in the model.

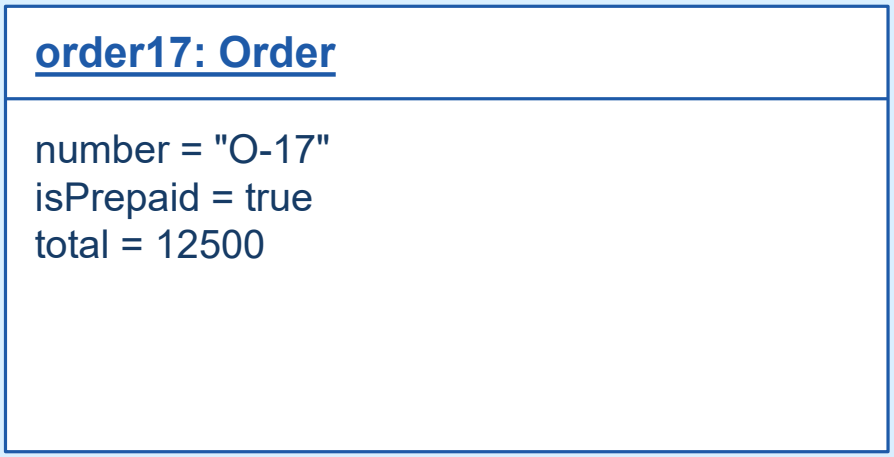
Named and anonymous instances

Heading form	Interpretation
arman: Student	Named instance classified as Student
: Student	Anonymous instance classified as Student
arman	Named instance with classifier omitted

Instance headings are underlined in the diagram.

Anonymous means the instance has no displayed name, not that it has no identity.

Slots and concrete values



Reading slot values

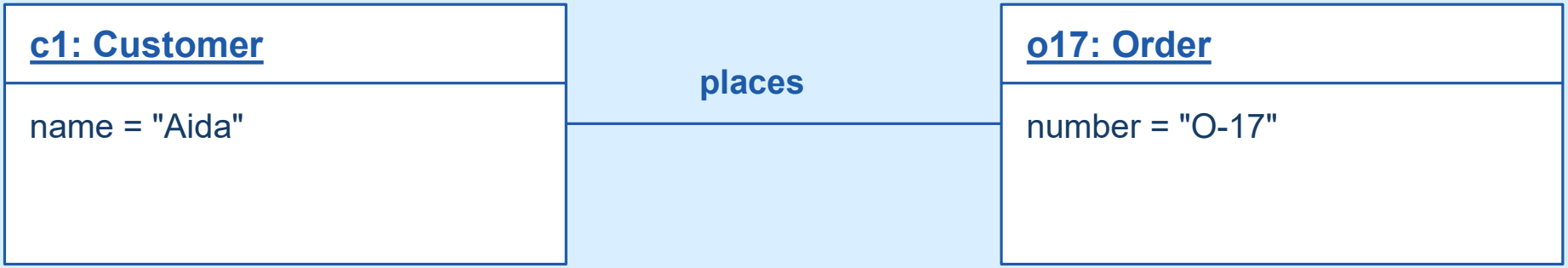
A slot supplies a value for a feature.

Values must fit the feature type.

Omitting a slot leaves that detail unspecified.

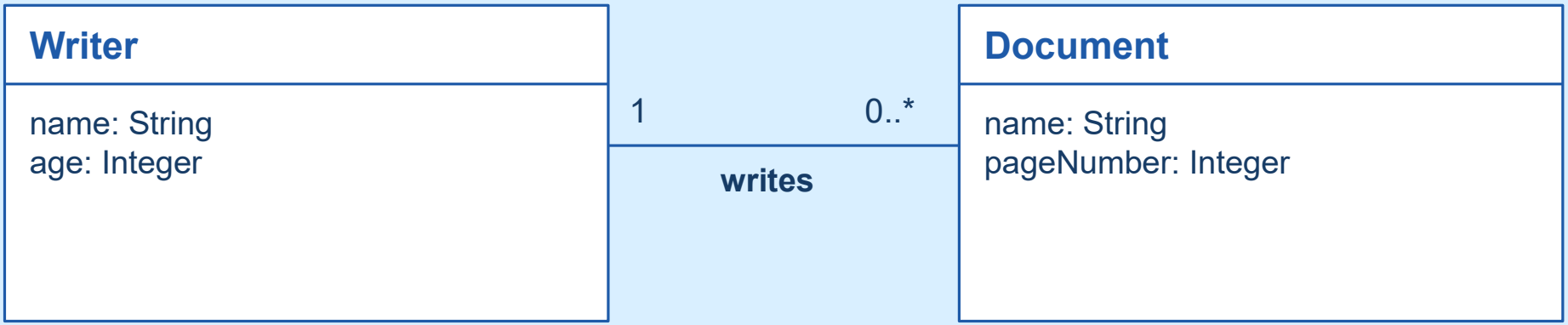
An omitted slot does not automatically mean null, zero or an empty collection.

Links between objects



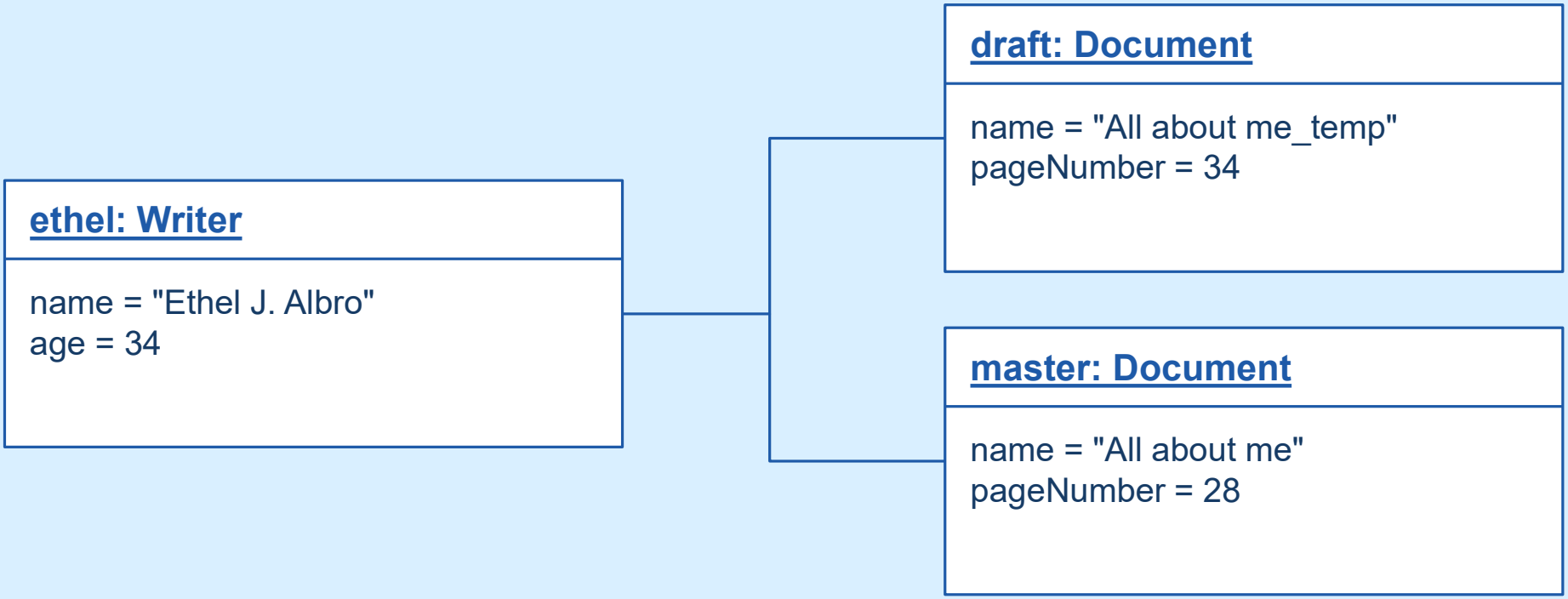
This link connects these particular instances.
The class model defines the corresponding association.

A class model for writers and documents

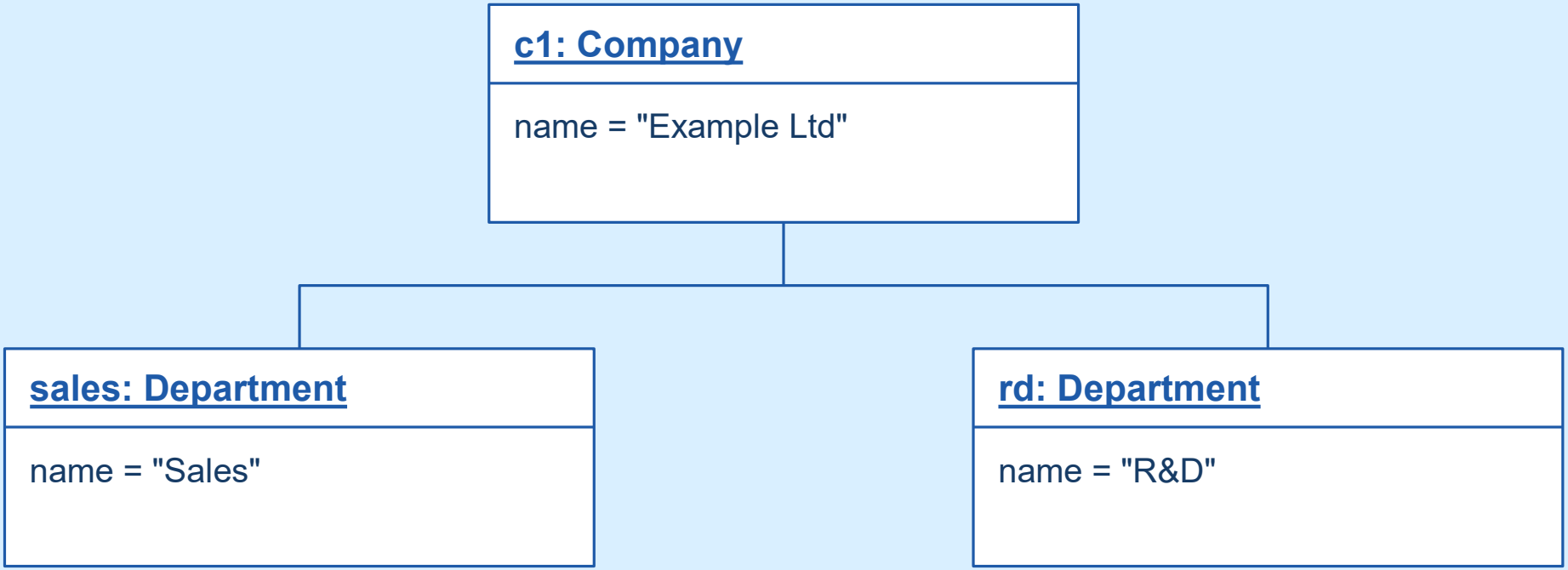


Assumption: each document has one writer.
One writer may have no documents or several documents.

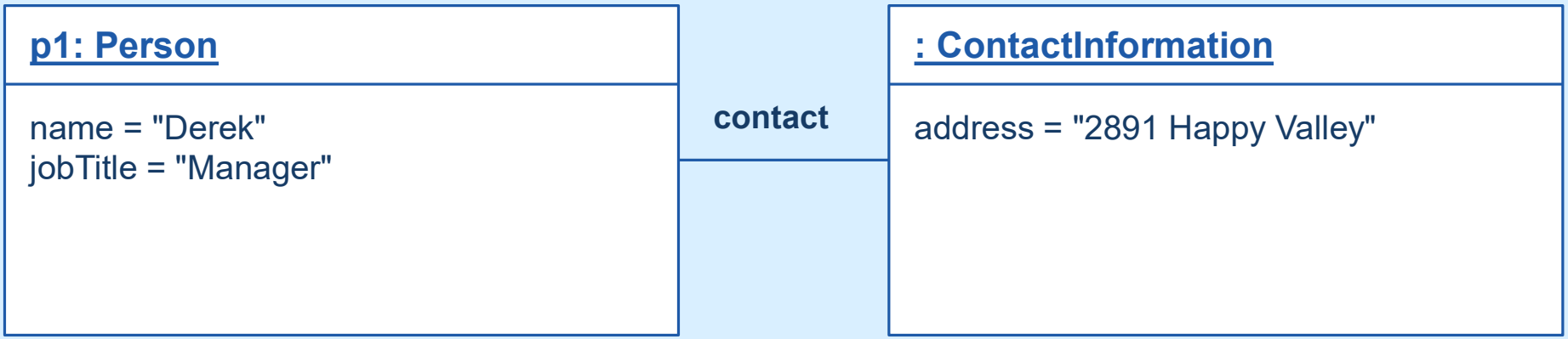
A writer with two document instances



Company and department instances

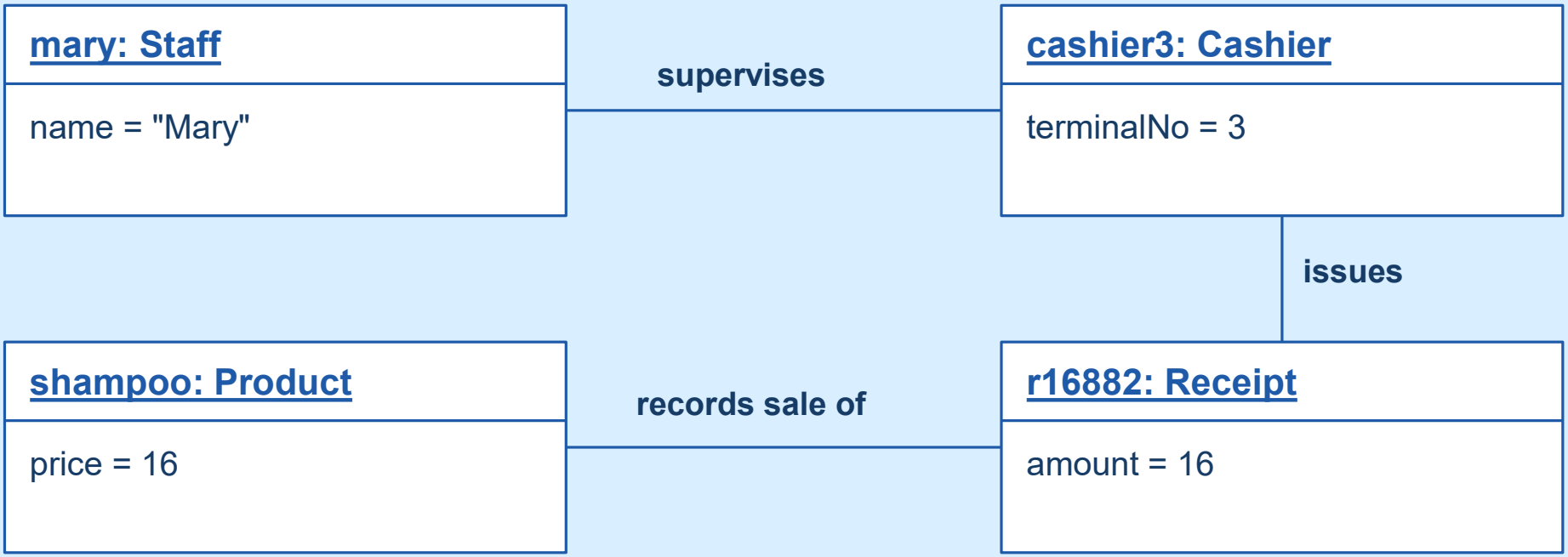


An anonymous contact information instance



The contact instance has a classifier and a slot value.
Its instance name is omitted because the example does not need one.

A retail snapshot with explicit roles



Two snapshots of the same train

10:00

train7: Train

status = "running"
passengerCount = 120

10:15

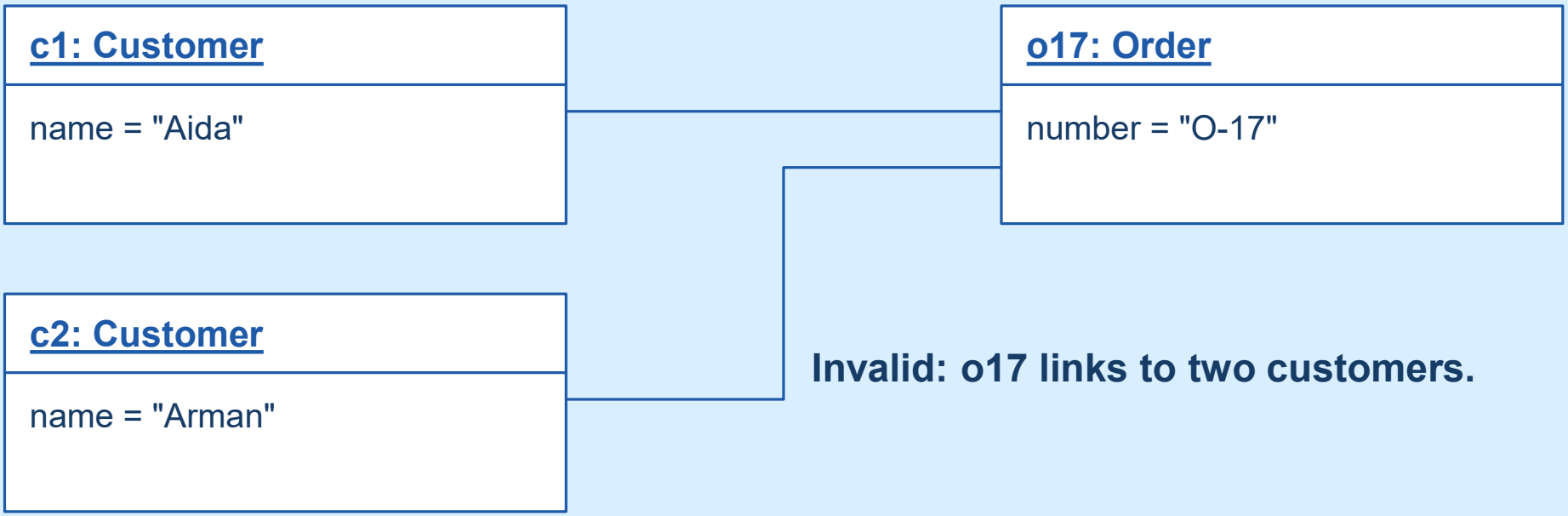
train7: Train

status = "stopped"
passengerCount = 95

The instance identity stays the same while selected values change.
The snapshots alone do not explain the events between them.

Snapshot validation against multiplicities

Rule: each Order has exactly one Customer.



Partial snapshots and completeness

A focused diagram

Show the instances relevant to the question.

Omit unrelated values and objects.

State the time and scope of the snapshot.

A validation boundary

A missing link may be outside the displayed scope.

To test a lower multiplicity bound, declare the relevant links complete.

A partial picture cannot prove global correctness.

A workflow for drawing an object diagram

Step	Question
1. Define the purpose	Which scenario and moment does this describe?
2. Select instances	Which objects matter to that scenario?
3. Add slots	Which concrete values explain the situation?
4. Add links	Which associations connect these instances?
5. Check the model	Do types, multiplicities and constraints hold?
6. State the scope	Which details or links are intentionally omitted?

Classroom practice: library lending

Scenario

Reader Aida has two active loans.

Loan L1 is for copy B17.
Loan L2 is for copy B24.

Each loan has a due date.
Each copy has at most one active loan.

Tasks

Draw the five instances and their links.

Choose due dates and label them as example values.

Explain the multiplicities you checked.

Show how a second active loan for B17 violates the rule.

Reading and references

Core reading

Dennis, A., Wixom, B. H., & Tegarden, D. (2021).
Systems Analysis and Design: An Object-Oriented Approach
with UML, 6th ed. Wiley. ISBN 9781119559917.

UML notation reference

Object Management Group (2017). Unified Modeling Language,
Version 2.5.1. Section 9.8: Instances.

Teaching examples adapted from the supplied UML object diagrams lecture.