

Derivation of xUML Models

Multiple Relationships

Associative Relationships

Competitive Relationships

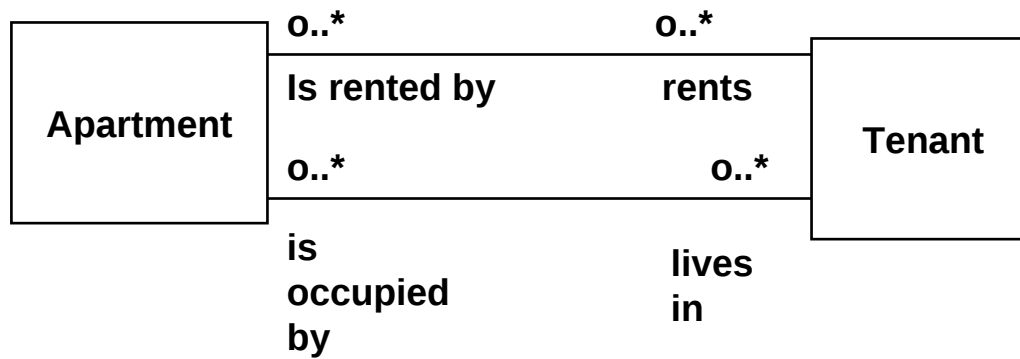
Specification Relationships

Reflexive Relationships

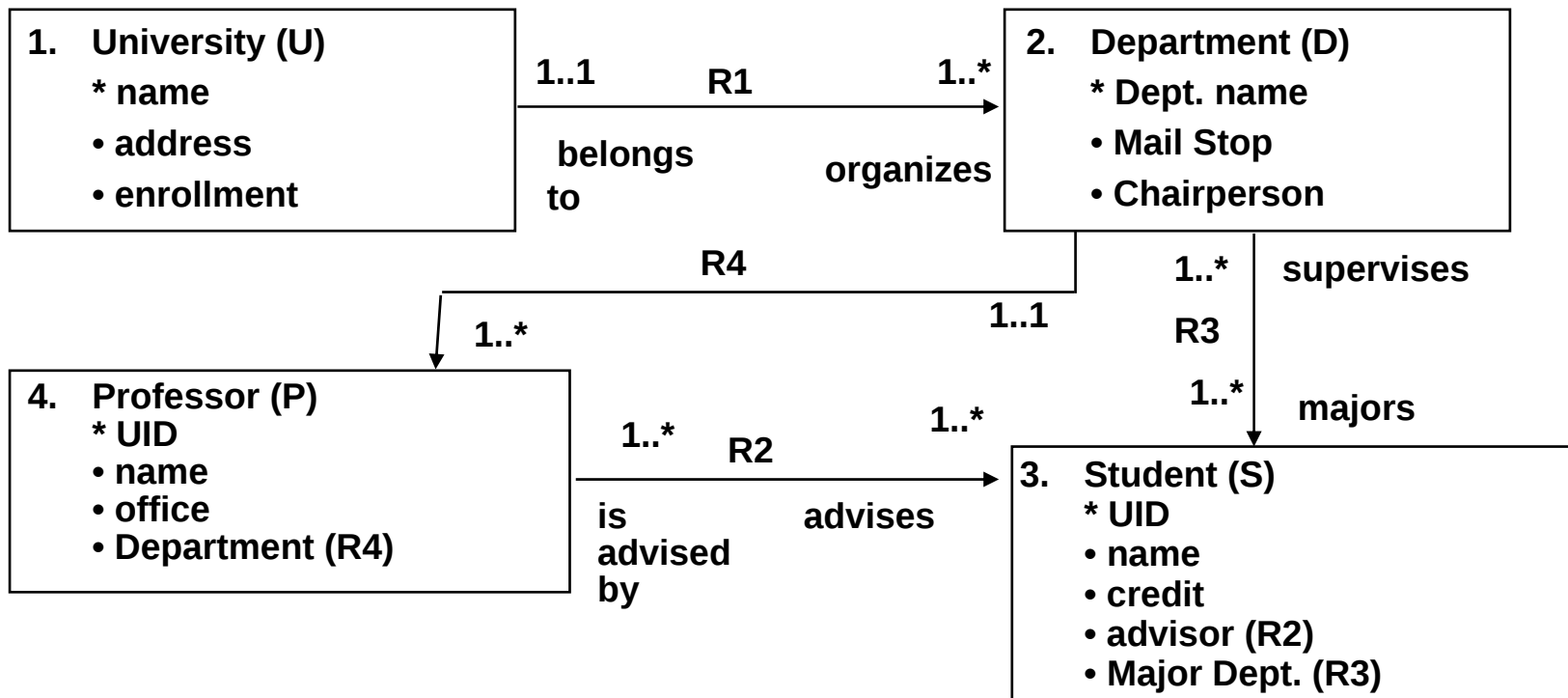
Examples

Multiple Associations between Pairs of Classes

Multiple Roles for Classes



There is a university in the city of Austin, Texas with 50,000 students. University which has departments. Departments have names, chairpersons, a mail stop and some professors. Students have majors in a given department and advisors but advisors may be in a department separate from the student's major. The system keeps track of how many credit hours each student has passed. Of course, students and professors all have UIDs. Professors have offices.

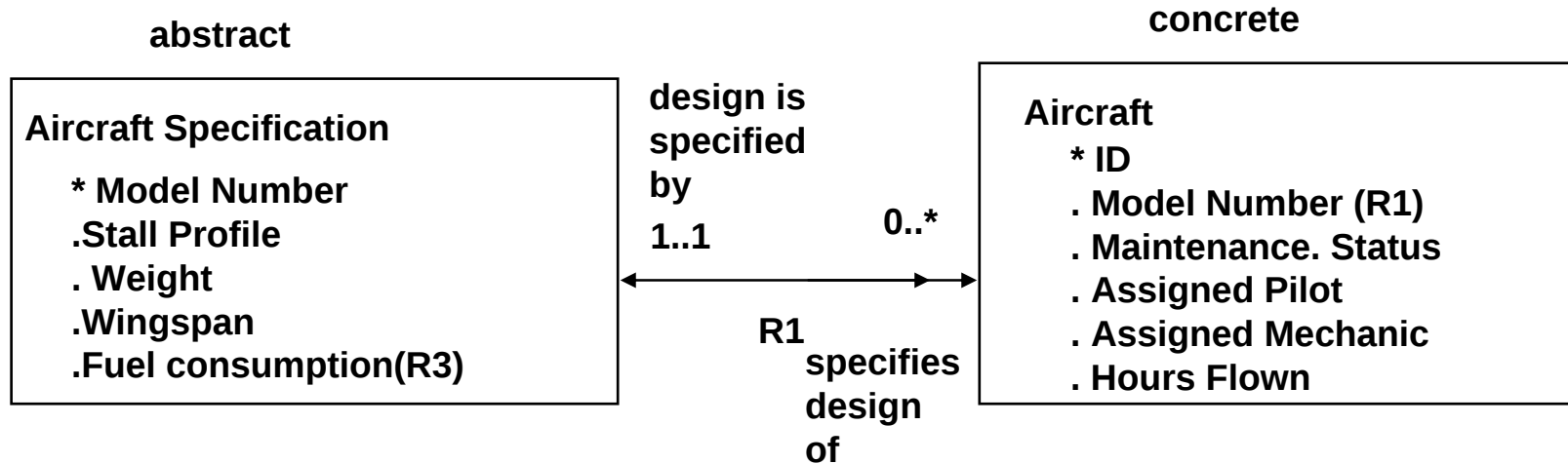


Specification Classes

An airplane leasing company owns many instances of a given airplane and leases several different types of airplanes. Each airplane is characterized by a model number, an empty weight, a wingspan, a stall profile and a fuel consumption rate.

The leasing company keeps track of the leasee and the maintenance status of each plane. The data kept includes the pilot, the mechanic, operational status and number of hours flown for each airplane.

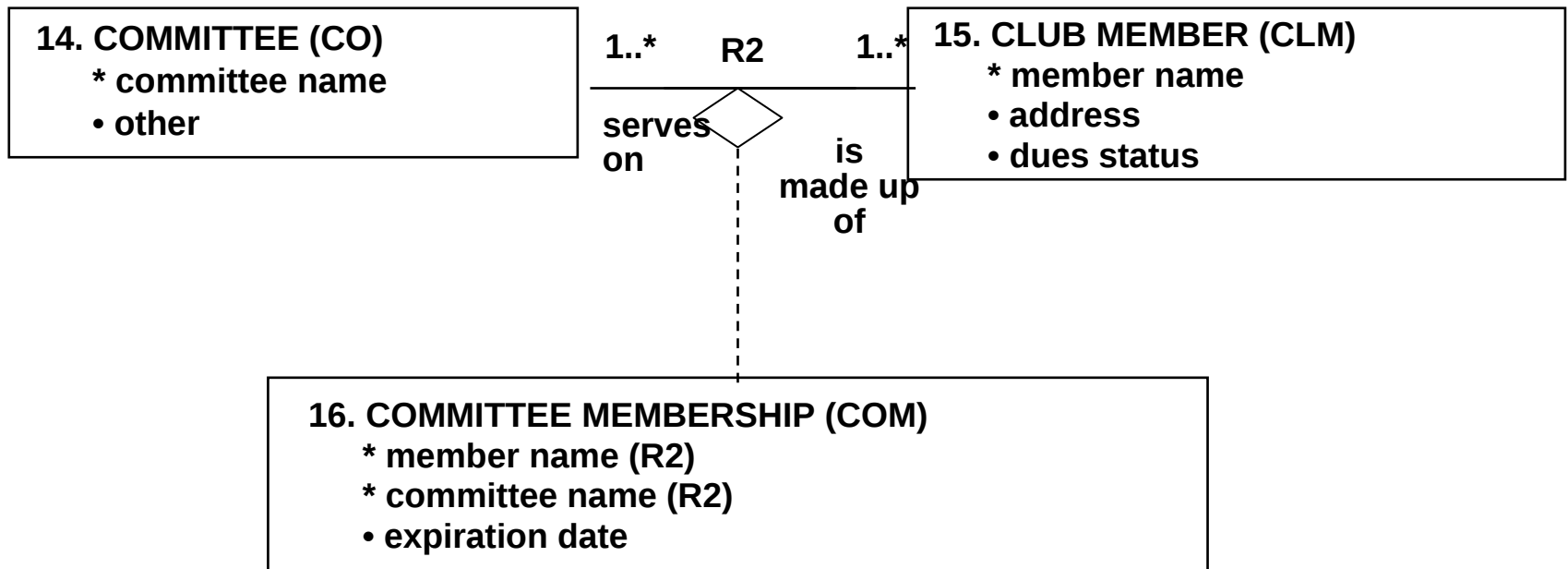
Specification classes



Why two classes rather than one?

Associative Classes and M to N Relationships

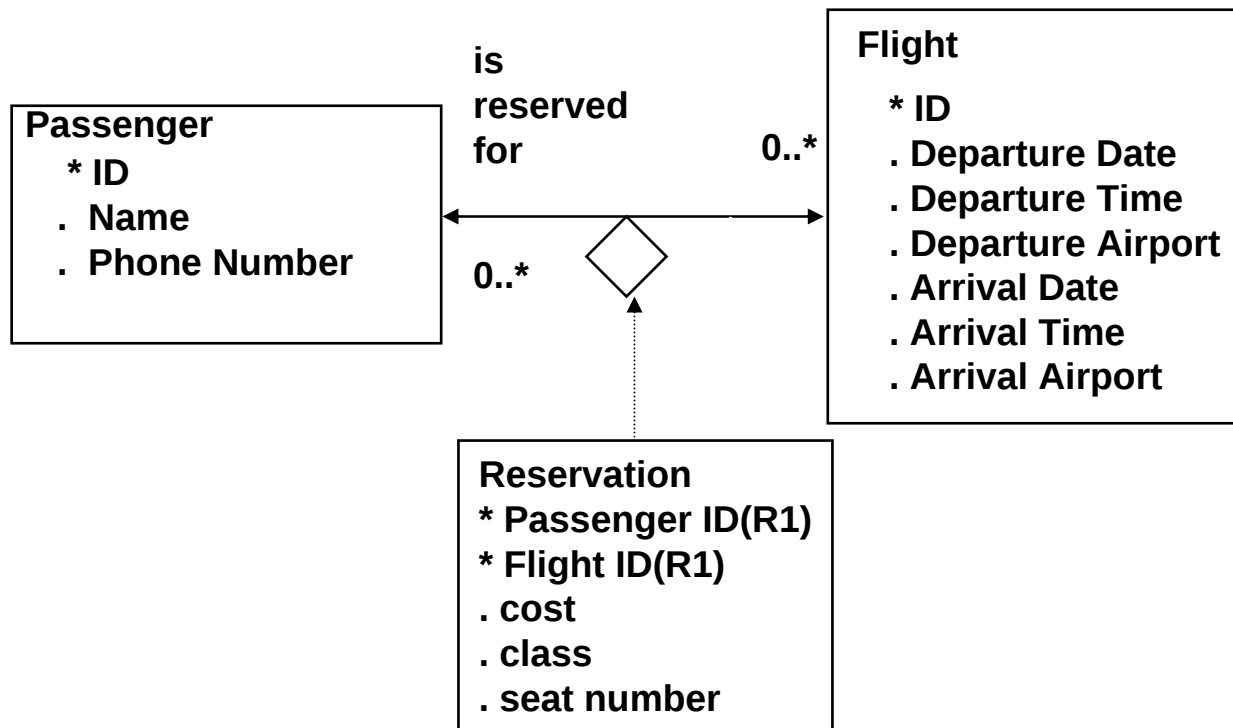
M $\longleftrightarrow$ N relationships cannot be readily represented by referential attributes. M $\longrightarrow$ N relationship $\longleftrightarrow$ associative object



Interaction classes - Associative classes

An airlines reservation system sells reservations on flights and assigns seats on flights. The flights are characterized by departure airport, date and time and arrival airport, date and time. The passengers are characterized by name and telephone number. A reservation is for a passenger on a flight with a given seat at a specific cost. A passenger may book reservations on several flights and each flight has many passengers.

Interaction Object - Associative Object

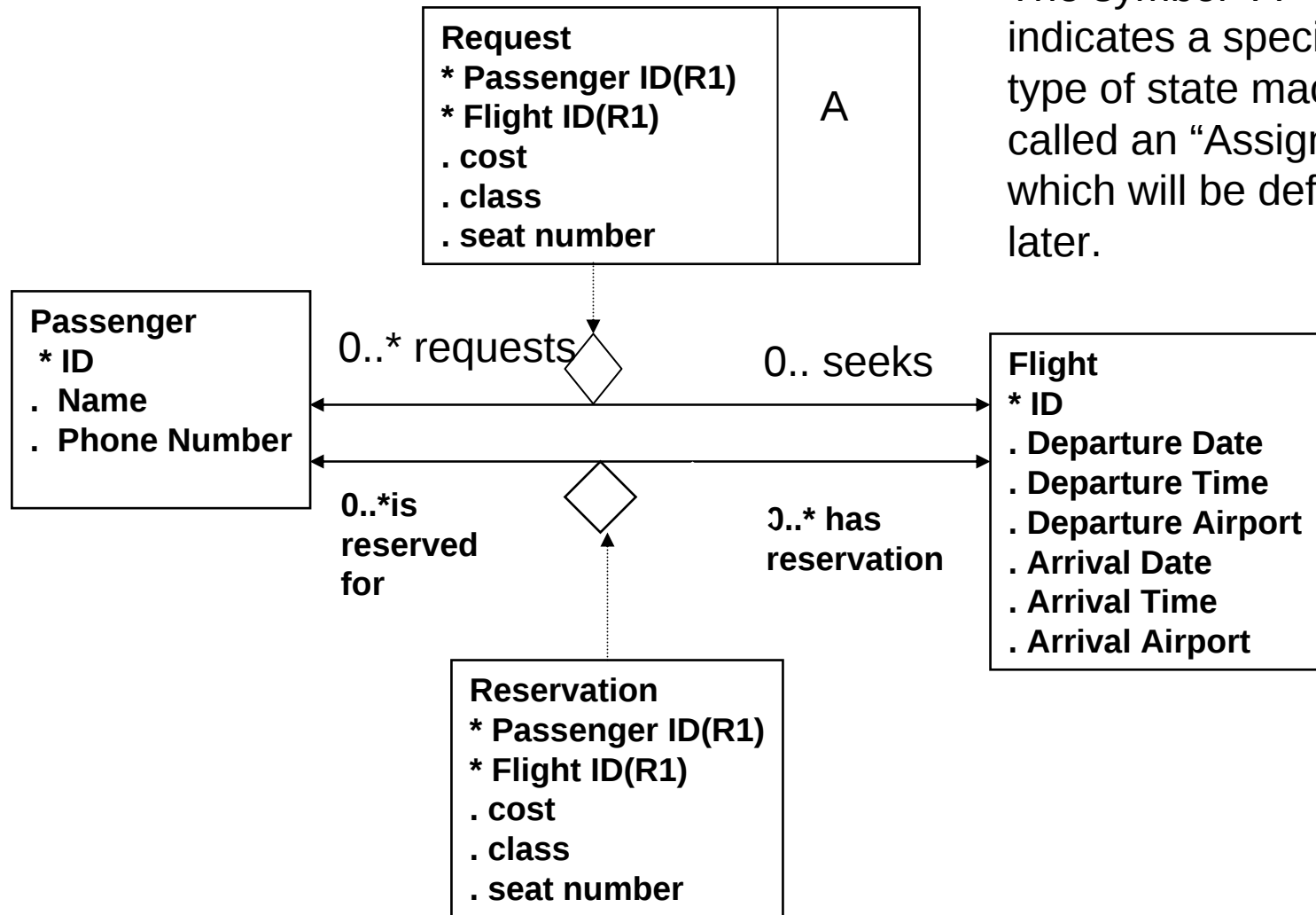


Associate Relationships – Scheduled Access

An airlines reservation system sells reservations on flights and assigns seats on flights. *Seats are scheduled on a first come first served basis and the flight is not overbooked.* The flights are characterized by departure airport, date and time and arrival airport, date and time. The passengers are characterized by name and telephone number. A reservation is for a passenger on a flight with a given seat at a specific cost. A passenger may book reservations on several flights and each flight has many passengers.

Interaction Object - Associative Object

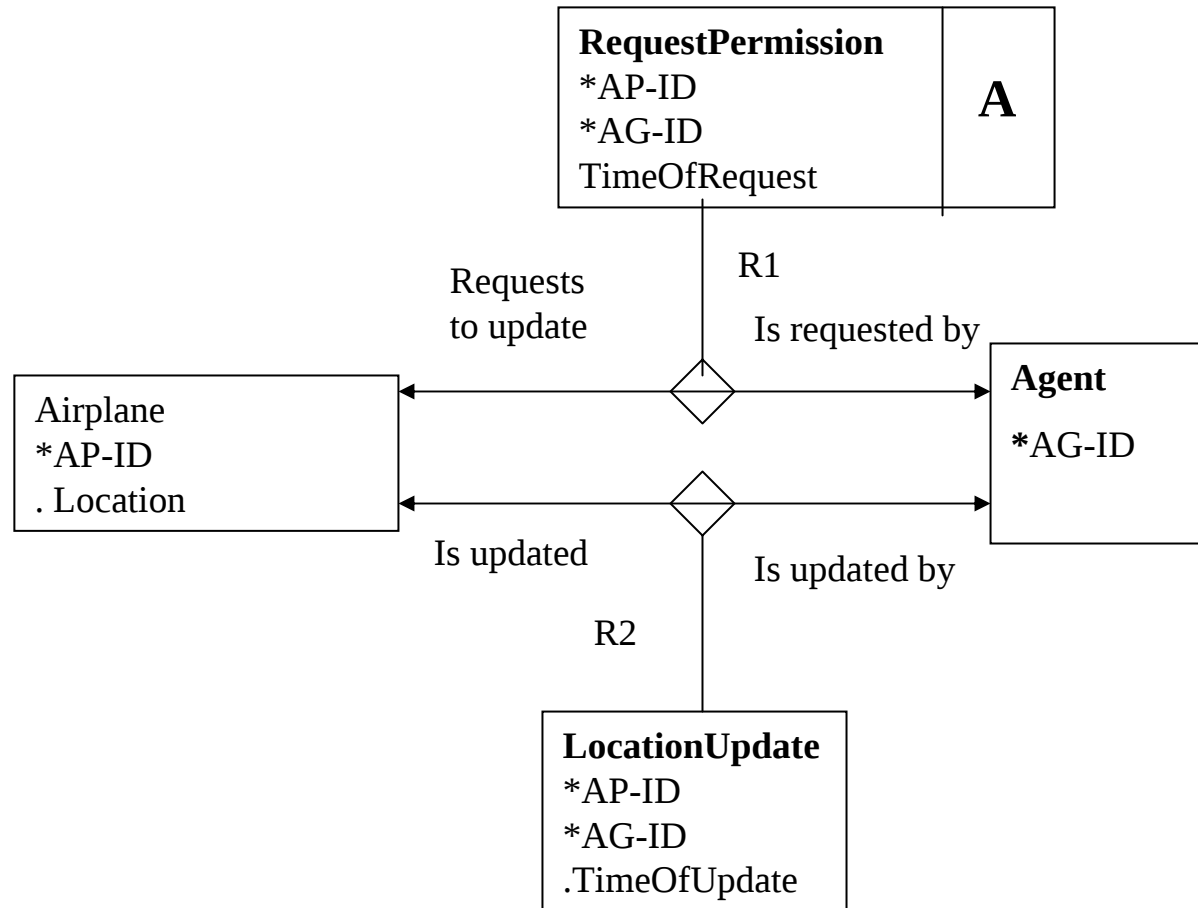
The symbol “A” indicates a special type of state machine called an “Assigner” which will be defined later.



Associate Relationships – Scheduled Access

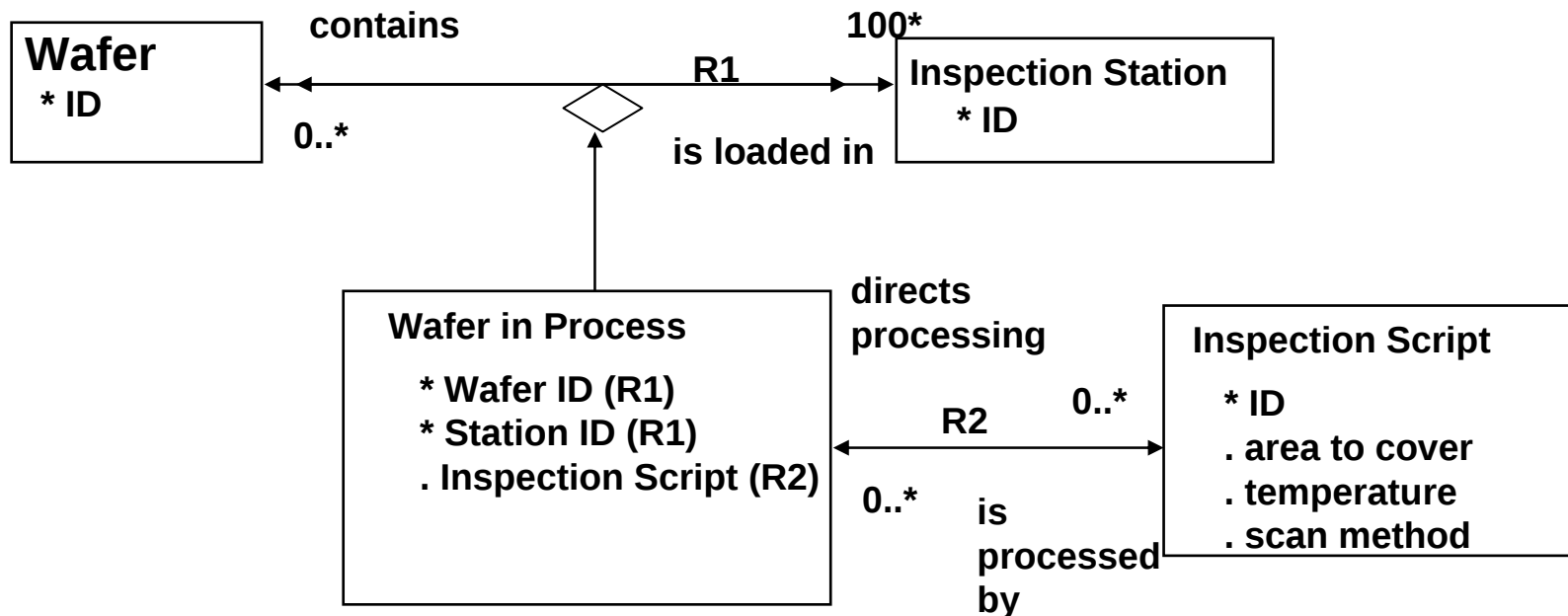
The specification for one concrete example of the Consistent and Auditable Data Objects Problem is updating the locations of airplanes being tracked and updated by agents at radar consoles. Agents have a unique identifier. The airplane, which has a unique identifier and a location specified as a string, may appear on one or more radar consoles at a given time. Any or all of the agents who sees a given airplane on their radar screen may request to update the location of that plane but consistency requires that only one agent at a time update the position of any given plane. Security requires that must be a record of updates to the positions of the airplanes so there is accountability in case of a collision.

Approximate Class Diagram for The Consistent and Auditable Data Objects Problem



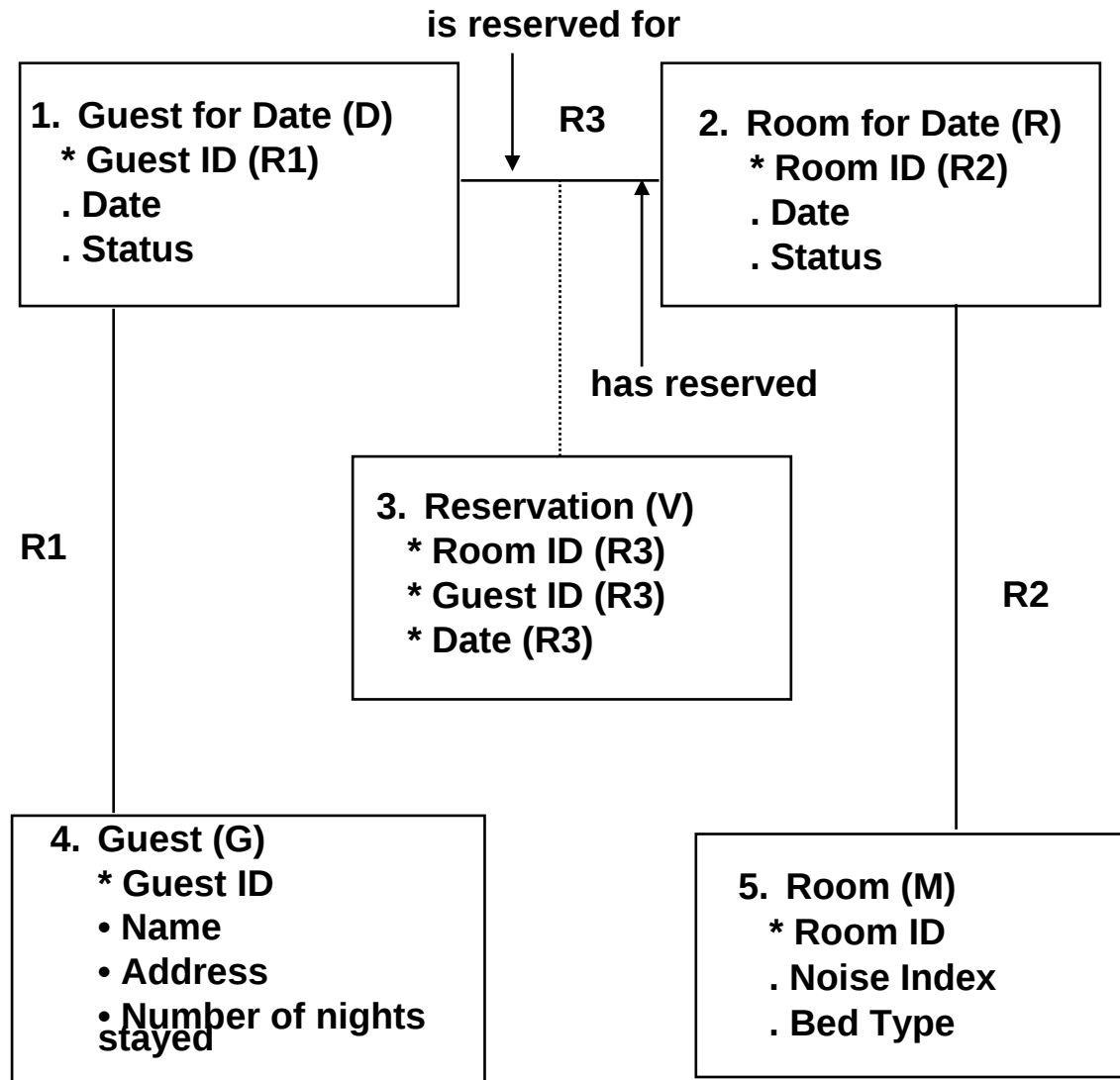
Role classes as Associative classes

A silicon wafer is formed and then is inspected at an inspection station. Each wafer is processed through inspection stations by one or more inspection scripts. An inspection script has an area to cover, a temperature and a scan method. There are many wafers and several inspection stations. A wafer may undergo inspection under the control of several scripts. A wafer is regarded as “in process” until it completes all of its inspections.

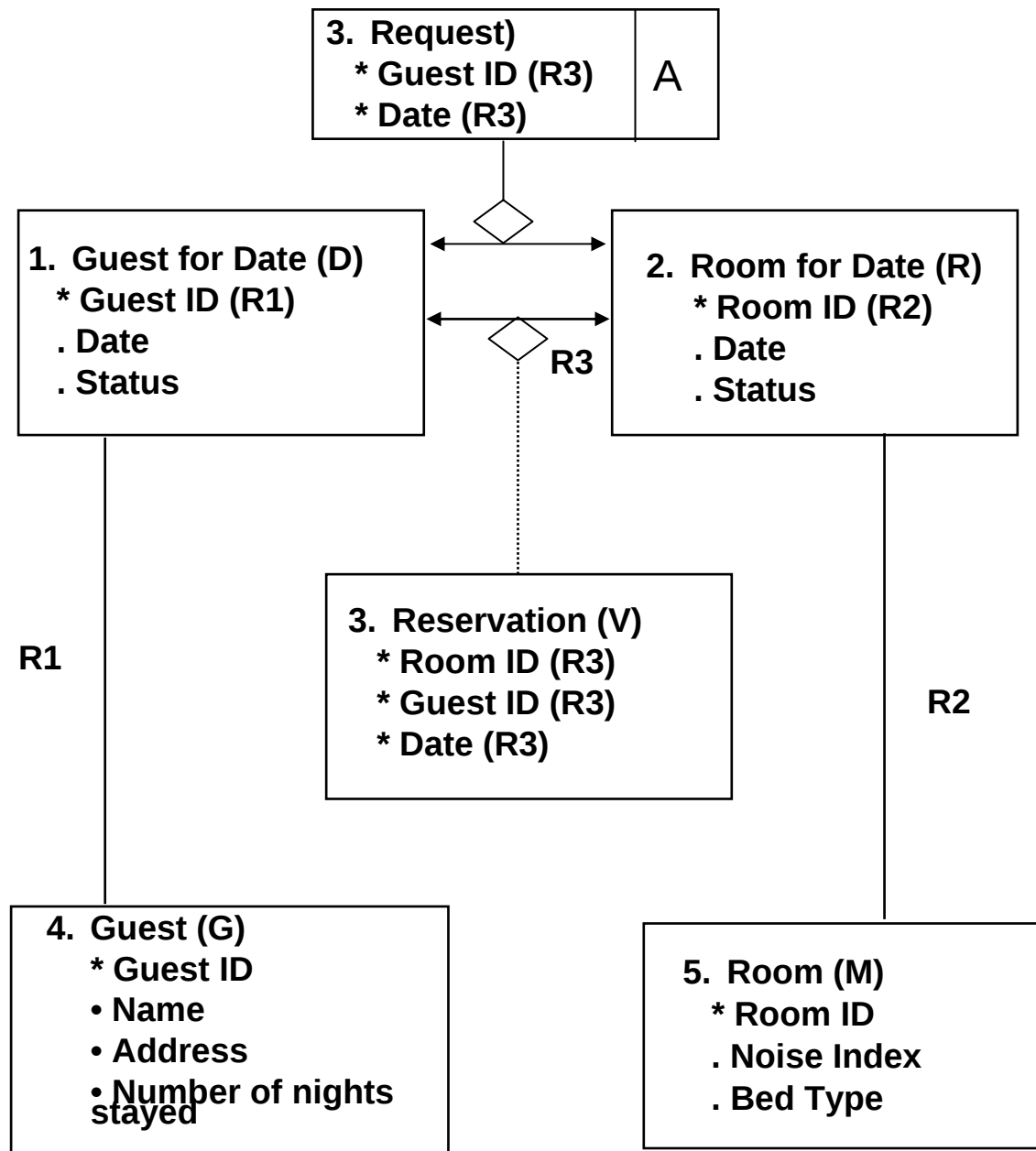


Requirements Statement for Hotel Room Reservation System

A hotel is developing a system for matching available rooms to requests for reservations from potential guests. The potential guest provides a request for a room for some dates and the system is to match the available supply of rooms available for specific dates to the requests for rooms on a given date.



In practice this reservation situation would be competitive and a Request class would be required.



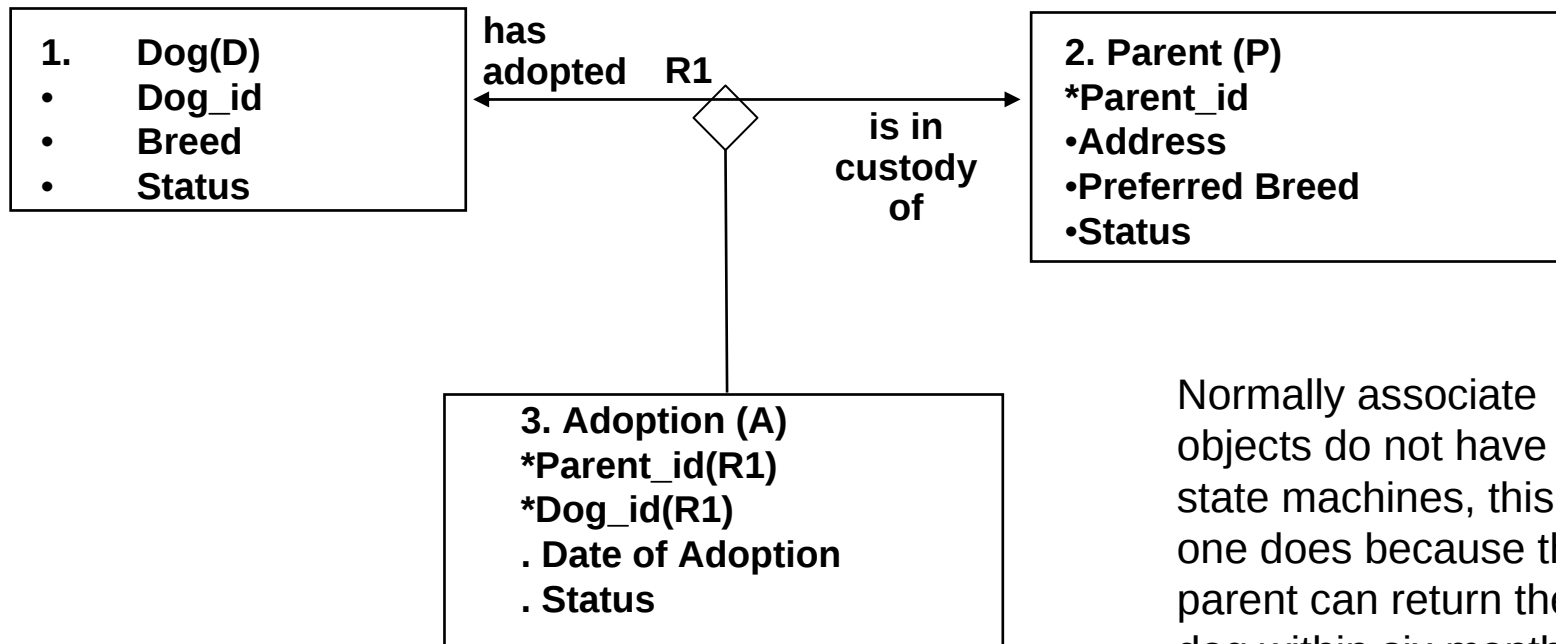
In practice this reservation situation would be competitive and a Request class would be required.

Dog Adoption Agency

A dog adoption agency accepts requests for dogs from potential adopters (=parents). The potential parent specifies the characteristics of the dog desired. Dogs are sent to the agency to be assigned to parents. When a parent makes an application then the agency tries to match the request. If a dog is available then an assignment is made. Note the possible competition for dogs considered desirable.

The parent also has the option of returning the dog after a six months probationary period and either asking for a new dog or withdrawing from the adoption program.

Competitive assigner where instance of Relationship Object has State Model



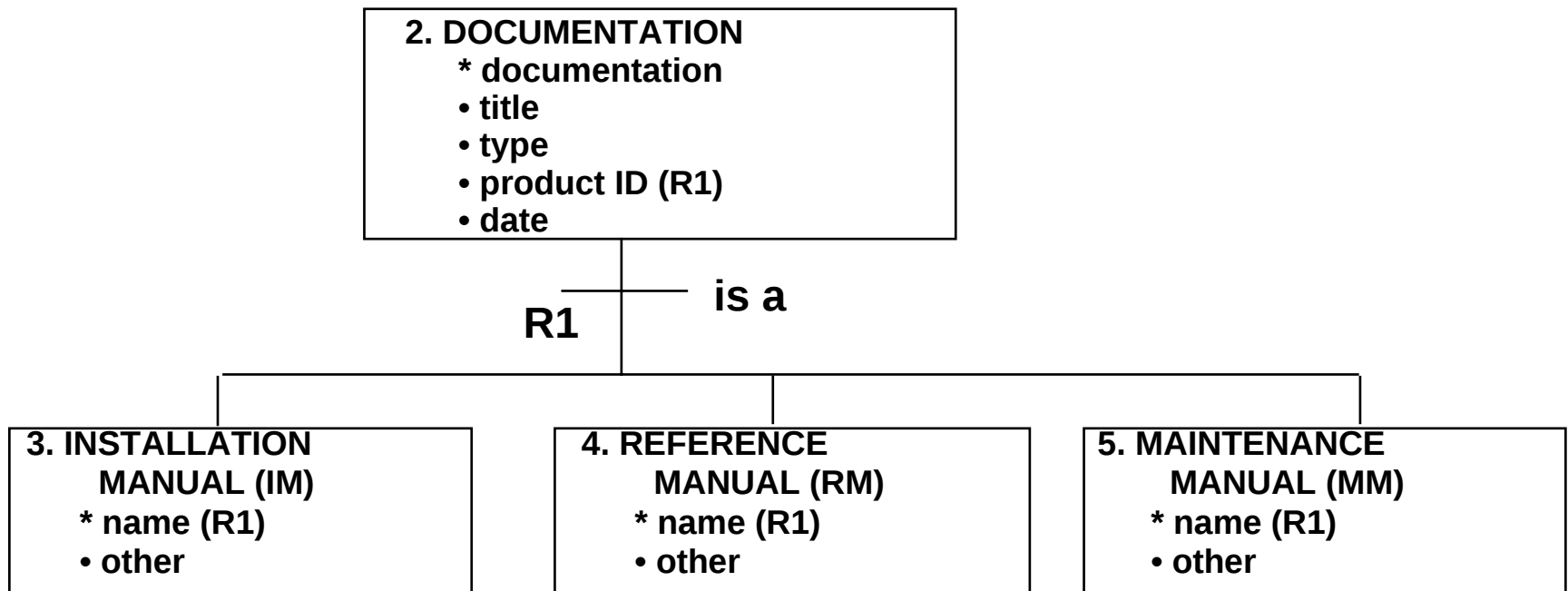
Parent has 6 months to finalize adoption.

Normally associate objects do not have state machines, this one does because the parent can return the dog within six months. This is managed in the associate object.

“is a” Relationships

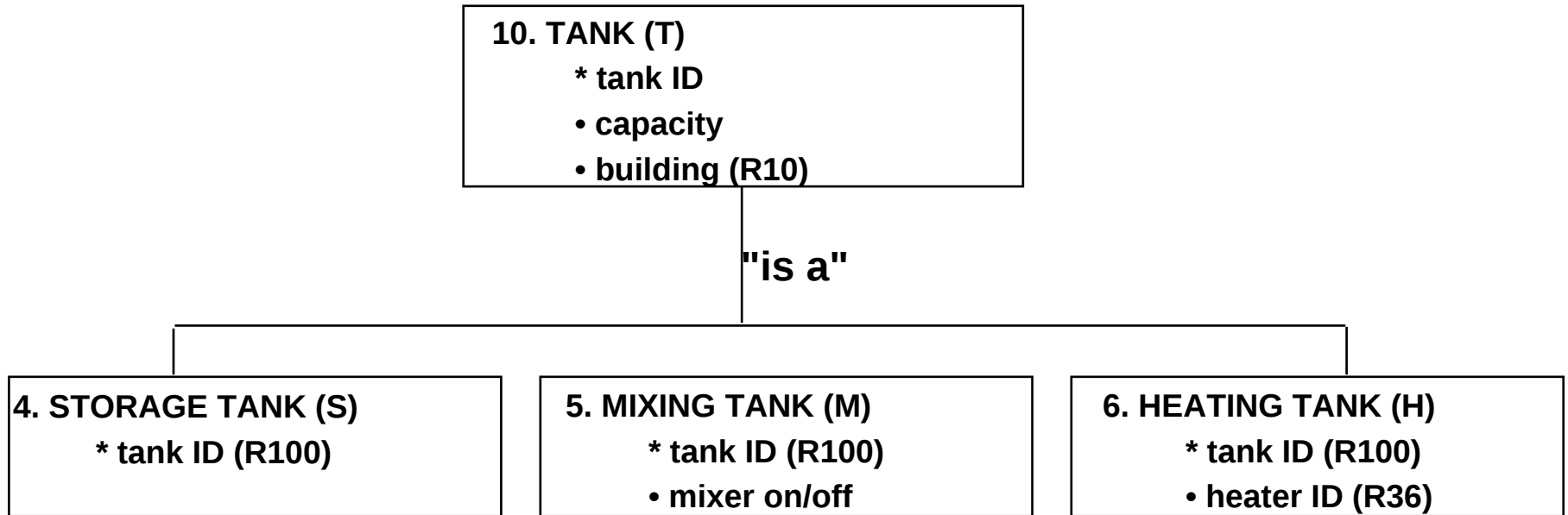
Specialization of classes to serve more differentiated roles.

Similar to “inheritance” in object-oriented programming languages.

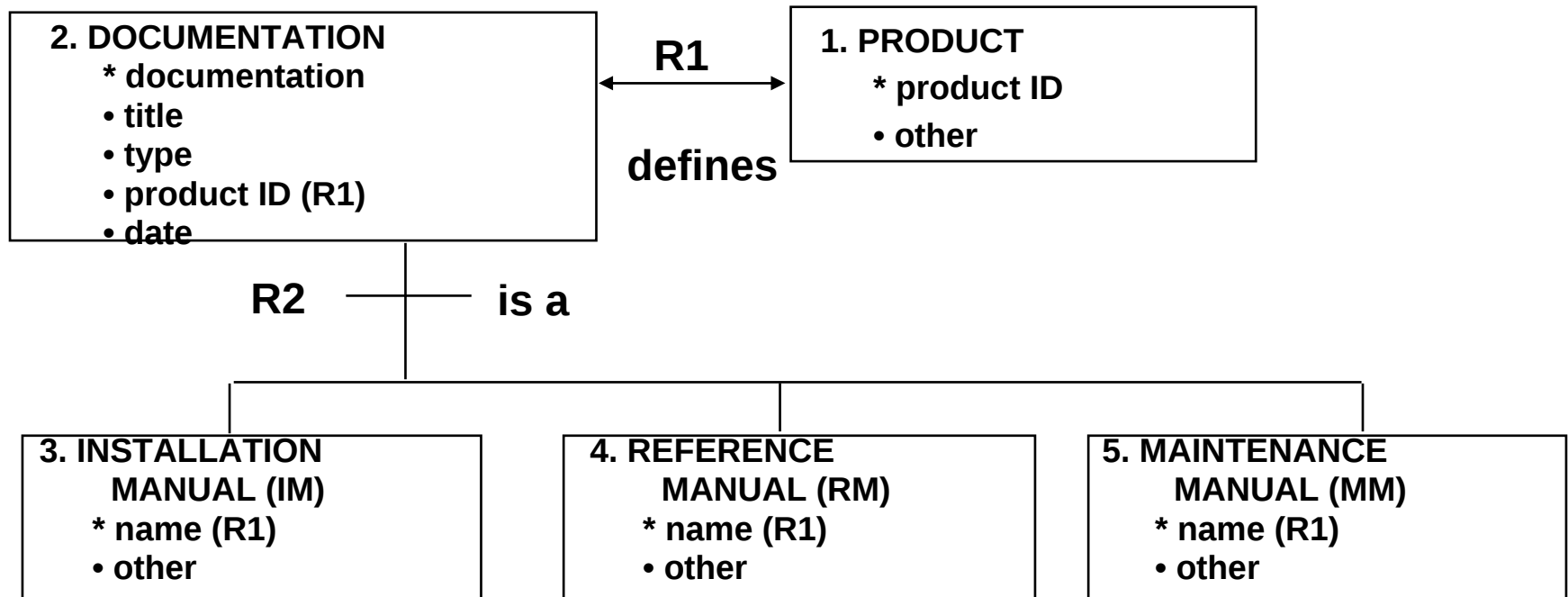


Examples of classes/Relationships (Shlaer/Mellor)

Juice Factory Process Control System

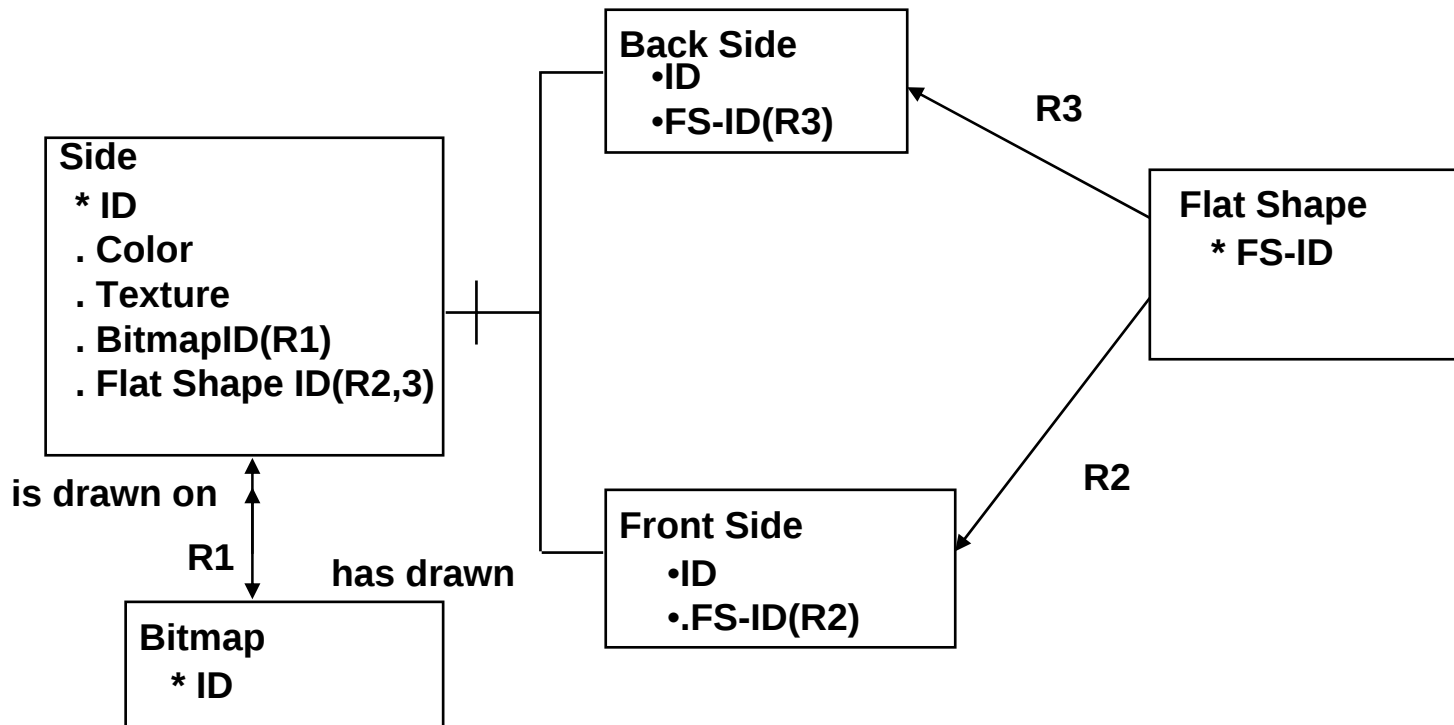


EXAMPLE OF COMBINING "has" AND "is a" RELATIONSHIPS



Role classes

A flat object has a front side and a back side. An object model for a circumstance where it is needed to include front and back sides can be represented as follows.

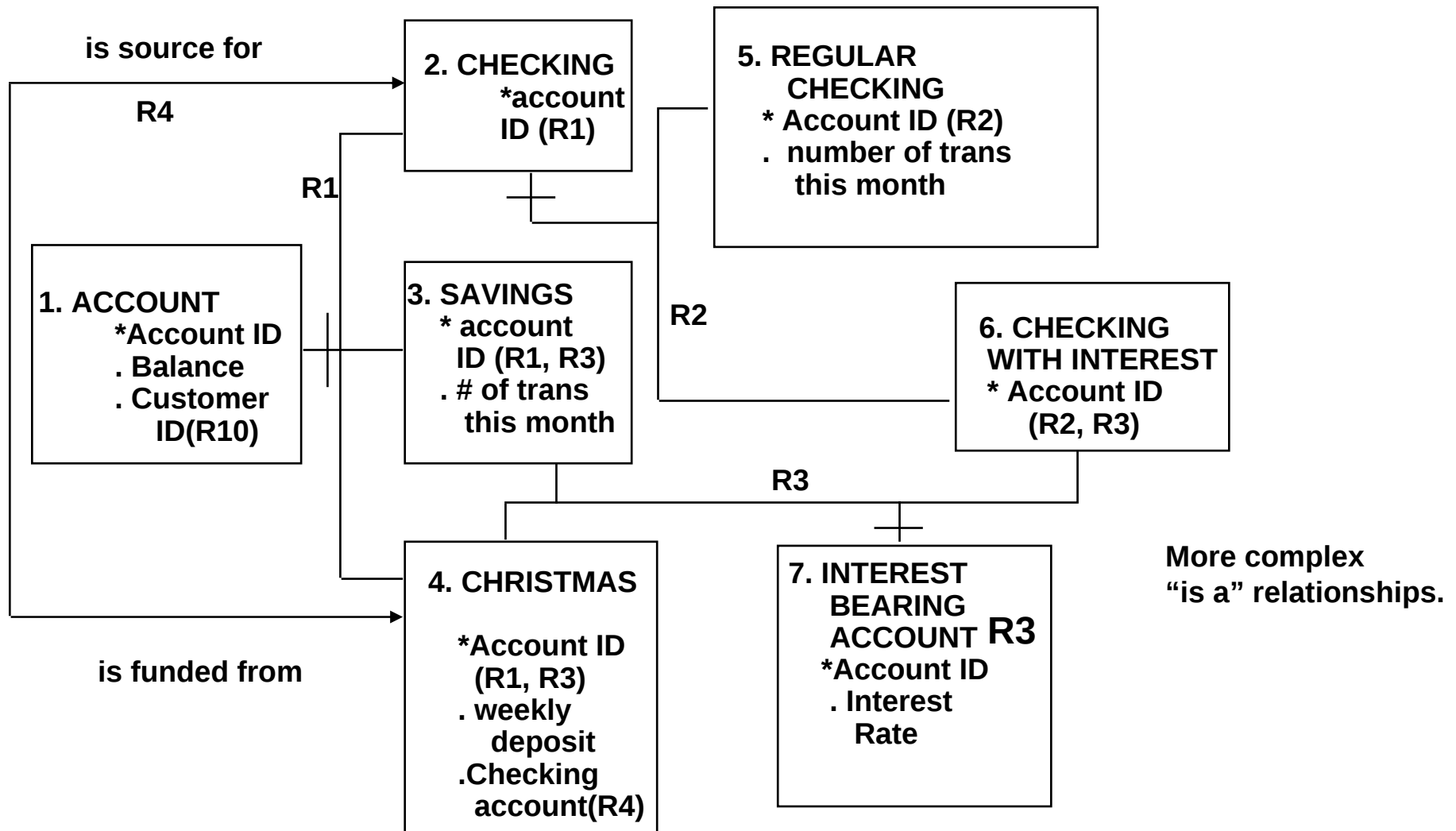


Requirements Analysis for Checking Accounts

There are three types of accounts: checking accounts, savings accounts and automatically-funded accounts or "Christmas Club" accounts. Some types of accounts bear interest and some types of accounts do not bear interest. For example, a regular checking account does not bear interest. On the other hand, a savings account, a Christmas Club account or a checking account with interest are all interest-bearing accounts.

All accounts have an account ID, a balance and a customer ID. A checking account has fees determined by the number of transactions each month. A savings account has a limit on the number of transactions in a given month. A Christmas Club account is tied to a checking account from which a weekly deposit amount is transferred. An interest-bearing checking account has an interest rate which it pays as does a savings account and a Christmas Club account. An interest-bearing checking account also has a limit on the number of transactions per month.

The task is to construct an information model reflecting the "has a" and "is a" relationships of this requirements analysis.



TIMER OBJECTS

Timers are an explicit element of the method

Timer instances are created and reused.

Multiple timer objects are created as needed.

States for Timer

set, counting, firing, resetting

Events for Timer

TIM1: set_timer (timer ID), duration, event label, instance ID)

TIM2: reset_timer (timer ID)

TIM6: tick_occurred (timer ID)

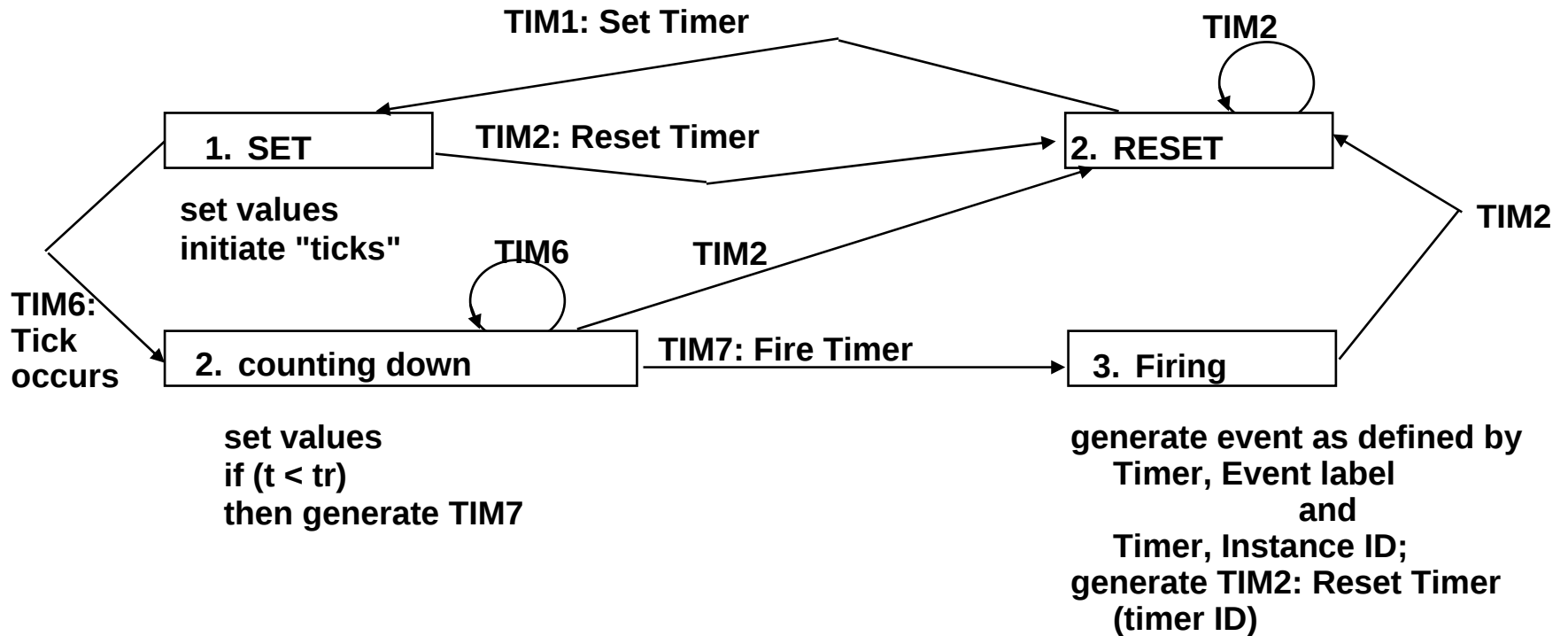
TIM7: fire (timer ID)

TIMER OBJECTS

Object Definition:

TIMER (TIM)

- * Timer ID
- time remaining
- event label
- identifier data
- other data



Reflective Relationships

The Drug Manufacturing Problem

When a patent on a given prescription drug expires it becomes available for manufacture by companies other than the original patent holders.

Potential manufacturers of the drug may apply for licenses to manufacture the drug. **Each drug may require certain other drugs for its manufacture.** To become licensed to manufacture a given drug requires that the manufacturer already hold a valid license for those drugs required for the manufacture of the drug for which the application is made or have an application for a license to all of the constituent drugs. A given manufacturer cannot simultaneously hold licenses for more than k drugs. If there are simultaneous applications by a single manufacturer or licenses for a given drug and its constituent drugs either all are approved or all are rejected. The applications are evaluated in FIFO order and those applicants who qualify are licensed to manufacture the drug for some fixed duration. Applications which do not qualify are rejected and deleted from the system.