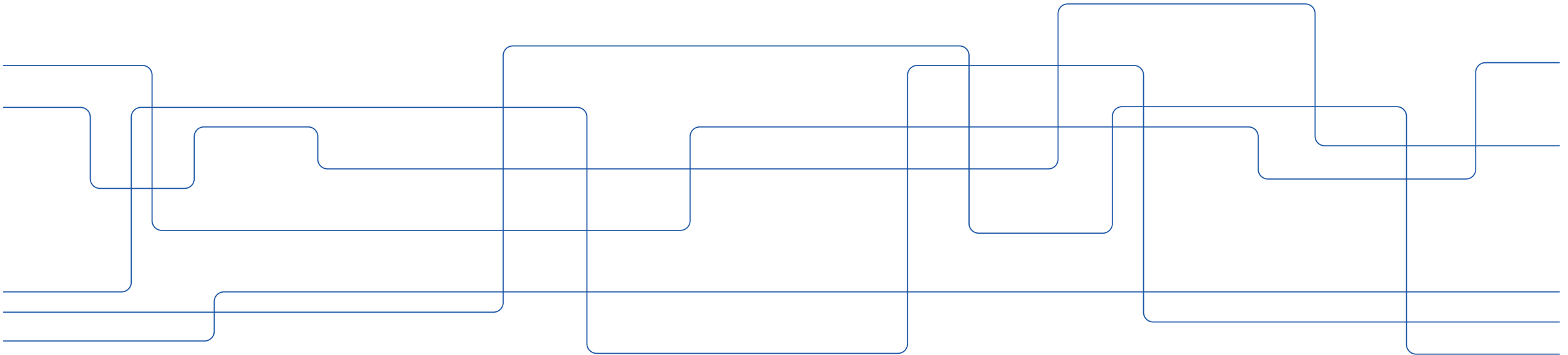# ID2207 – Third Tutorial

Amirhossein Layegh

amlk@kth.se

2025-09-17

Analysis Concepts

- Analysis Object Models and Dynamic Models
- Entity, Boundary, and Control Objects

Analysis

- Analysis focuses on producing analysis model.
- Developers focus on structuring and formalizing the requirements elicited from users.
  - New insights
  - Discovery of errors in the requirements

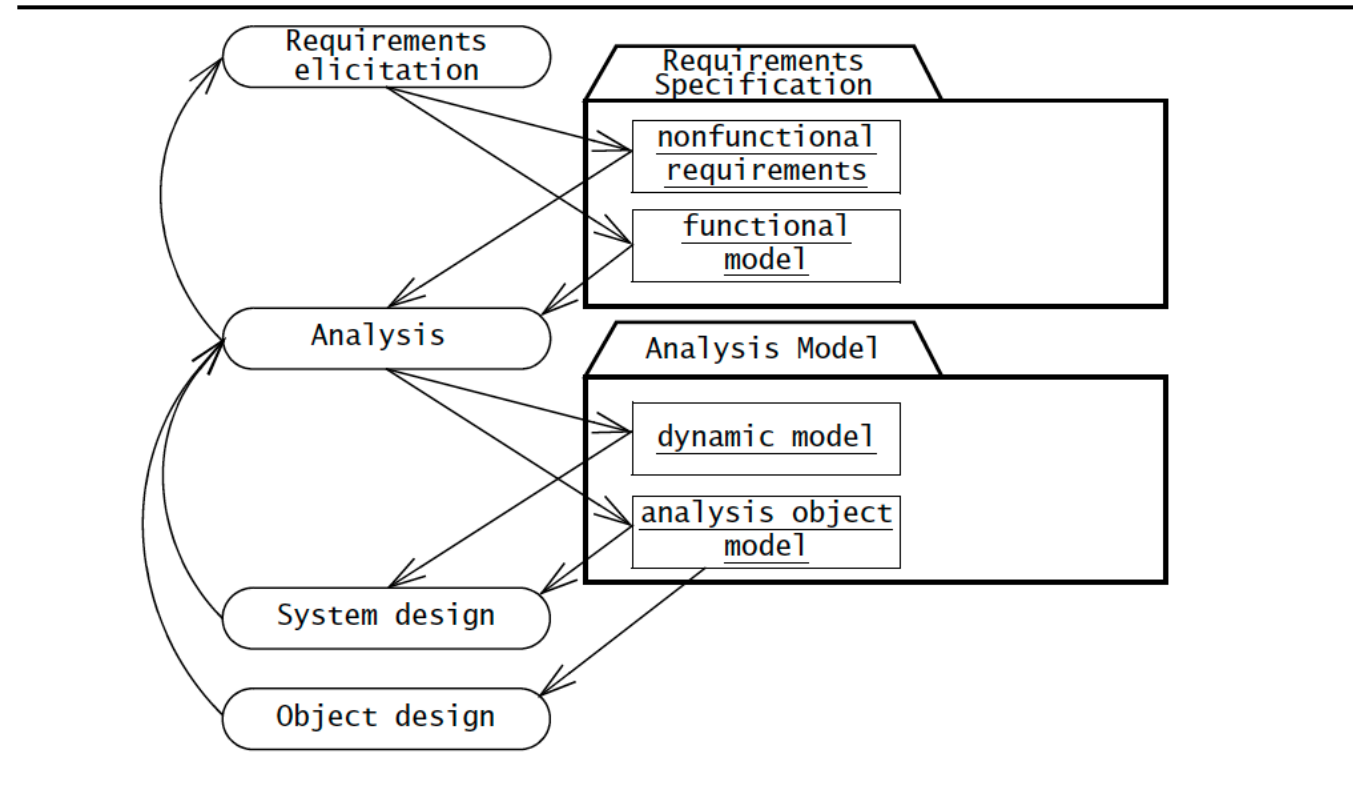The Analysis may NOT be understandable to the users and clinets.

Figure 5-2   Products of requirements elicitation and analysis (UML activity diagram).

Analysis Model

- The analysis is composed of three individual models:
    - **Functional model** represented by use cases and scenarios
    - **Analysis object model** represented by class and object diagrams
    - **Dynamic model** represented by state machine and sequence diagram

Analysis Object Models

- The analysis model represents the system under development from the user's point of view.

- The **analysis object model**:
  - Is a part of the analysis model
  - Focuses on the individual concepts that are manipulated by the system
  - Focusoes on the properties and relationships of concepts

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The analysis object model is a visual dictionary of the main concepts visible to the user.

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When working with either the analysis object model or the dynamic model, it is essential to remember that these models represent user-level concepts, not actual software classes or components.

- Analysis classes should be viewed as high-level abstractions that will be realized in much more detail later.

Domain concepts that should be represented
in the analysis object model.

| UniversalTime |
| TimeZone |
| Location |

Software classes that should not be represented
in the analysis object model.

TimeZoneDatabase	Refers to how time zones are stored (design decision).
GPSLocator	Denotes to how location is measured (design decision).
UserId	Refers to an internal mechanism for identifying

Analysis Object Models

- The **analysis object model** consists of**:**
  - **Entity Objects**
  - **Boundary Objects**
  - **Control Objects**

Analysis Object Models

- The **analysis object model** consists of**:**
  - **Entity Objects ->** represent the persistent information tracked by the system (year, month, day).
  - **Boundary Objects ->**
  - **Control Objects**

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    Advantages of using three object types:
      -results in smaller and more specialized objects
      -leads to models that are more resilient to change,
       For example, the interface to the system (boundary objects)

Problem Description Q1

Scenario name	HappyHourMessage
Participating actor instances	bob, alice: BarFlies john: Friend
Flow of events	1. Bob and Alice are sitting in their favorite pub and it's happy hour. They want to invite their common friend John who likes cocktails and didn't know about the newly scheduled happy hour. Alice takes out her "mobile phone" and activates the "SMS" function. 2. Alice enters John's cell phone number and writes the message about the happy hour into the "SMS text field". She sends the message and waits for John's answer. 3. John, who is still at work, is alerted by a sound of his cell phone that a new "SMS" has arrived. He reads the lines from Alice and answers that he will come immediately. He quits working and leaves the office. 4. Alice receives John's answer at her "mobile phone".

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Problem Description Q1

Boundary Objects?

INTERACTIONS

Scenario name	HappyHourMessage
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Problem Description Q1

Boundary Objects?

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<<boundary>>
SMSForm

<<boundary>>
MessageNotif

1. SMS form
2. Message notification

Problem Description Q1

Entity Objects?

Persistent Information

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Participating actor instances	bob, alice: BarFlies john: Friend
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Problem Description Q1

Entity Objects?

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<<entity>>
SMSMessage

<<entity>>
ContactInfo

1. SMS message
2. Contact Information

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It is responsible for collecting information from the boundary objects and dispatching it to entity objects

Problem Description Q1

Use Case Information

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```
<<control>>
SMSFunction
```

1. SMS function

Problem Description Q2 1/2

Exercise 2 [Class Diagrams - Relationships] : Below is an excerpt from an interview transcript with one of the directors who are setting up CarMatch business. Remember, Mick Perez is the system analyst and Janet Hoffner is the director. Identify any classes and associations mentioned in the transcript:

Mick: Can we look at the way car sharing is actually organized now. I'd like to find out a bit more about the ideas you work with.

Janet: Sure. I guess at the heart of everything there is the car sharer. That's a person who has registered with us so that they can share journeys with other registered car sharers. Mick: Tell me more about how you keep details of the journey that someone wants to share. Janet: Well, a car sharer can actually register several journeys with us. They don't have to limit themselves to just one journey to share.

Mick: I guess they would have to want to share at least one journey to be classed as a car sharer though ?

Janet: That's right. Remember that they can register as many journeys as they want. When we find other car sharers that want to share a similar journey we match up the sharers and formalize things with a sharing agreement.

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Solution Q2 1/2

CarSharer

Problem Description Q2 1/2

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Solution Q2 1/2

A person who has registered with Car Match

CarSharer

Problem Description Q2 1/2

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A person who has registered with Car Match

CarSharer

Journey

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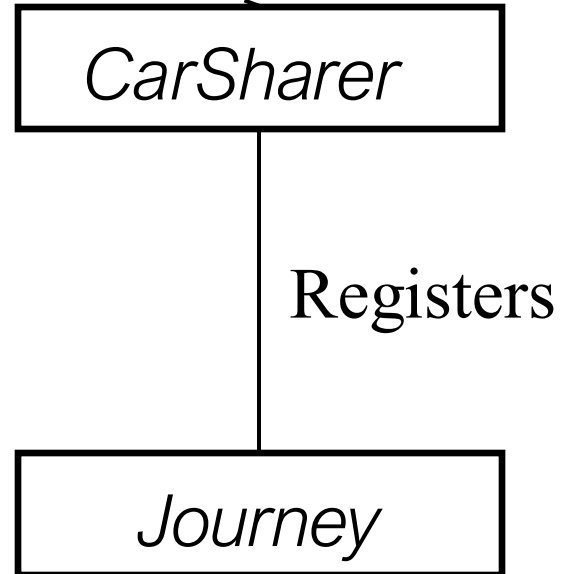
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Solution Q2 1/2

A person who has registered with Car Match

CarSharer

Registers

Journey

Problem Description Q2 1/2

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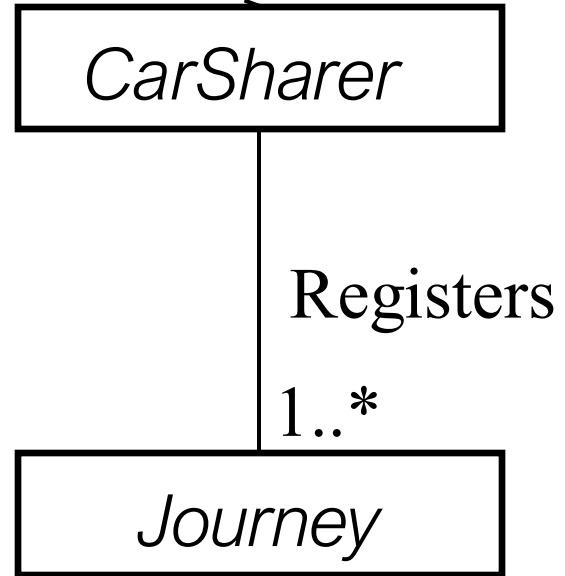
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Solution Q2 1/2

CarSharer

Registers

1..*

Journey

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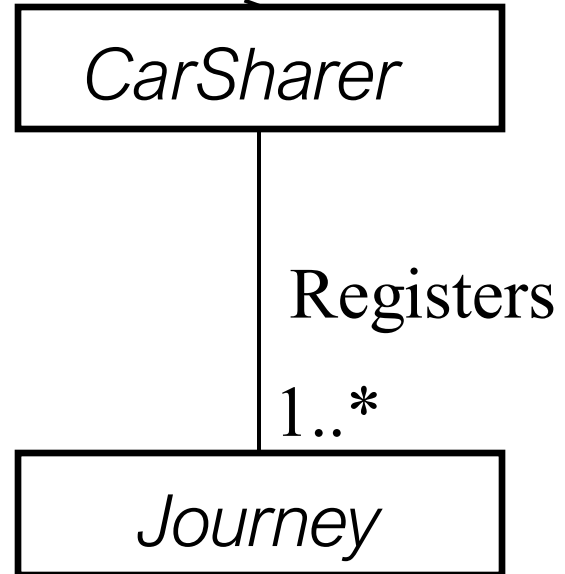
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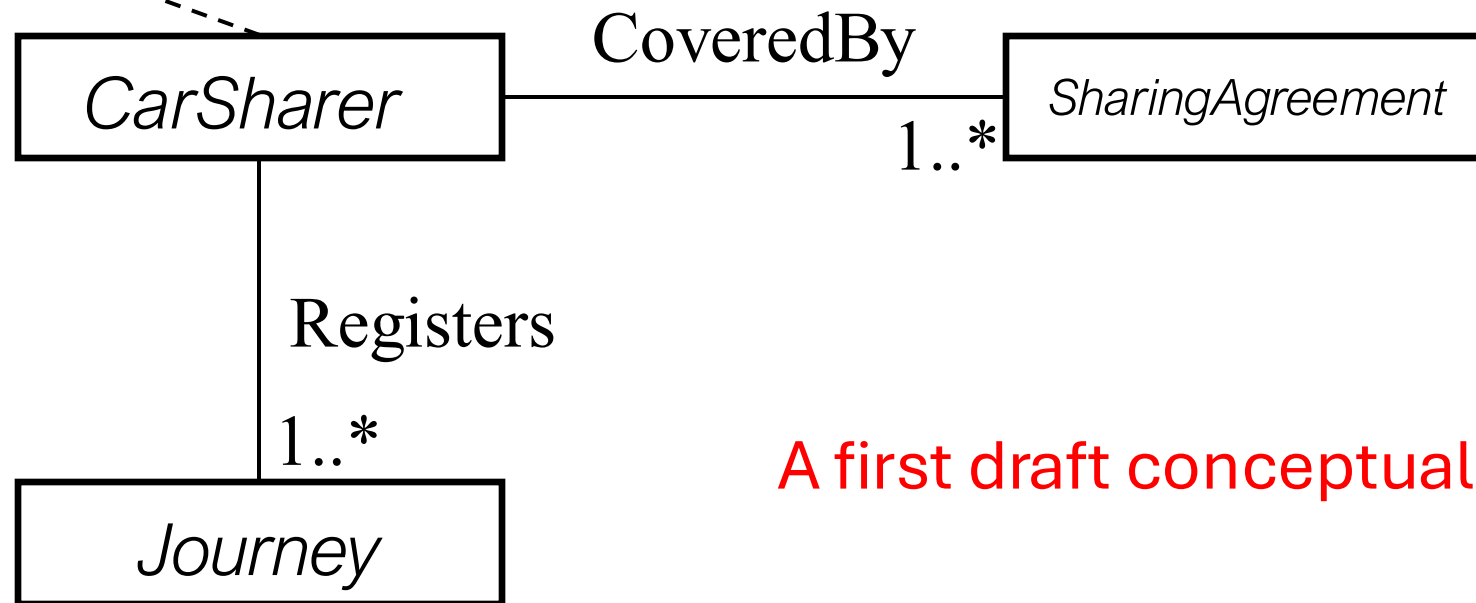
Solution Q2 1/2

CarSharer

Registers

1..*

Journey

SharingAgreement

Solution Q2 1/2

A person who has registered with Car Match

CarSharer

CoveredBy

SharingAgreement

1..*

Registers

1..*

Journey

A first draft conceptual class diagram

Problem Description Q2 2/2

Consider another extract from the transcript of the interview, and identify any attributes and operations that can be added to the class model.

Mick: What kind of information do you hold about the journeys that car sharers will register with you ?

Janet: Well, I'm sure that you realize it will primarily be 'where from' and 'where to'. We need to know where each journey will start from and where it will end. We will also want to know travel times for each direction of the journey. That is to say, the desired departure and arrival times for both the outward and return journeys.

Mick: What kind of things do you need to know about the start and destination of each journey ? Will that information need to be used to match up possible shared journeys ? Janet: Good point. Yes, I guess that however we hold the start and destination address, we will need to be able to use that information to automate the matching of car sharers. The home address of a person might also be used in some journey matching.

Problem Description Q2 2/2

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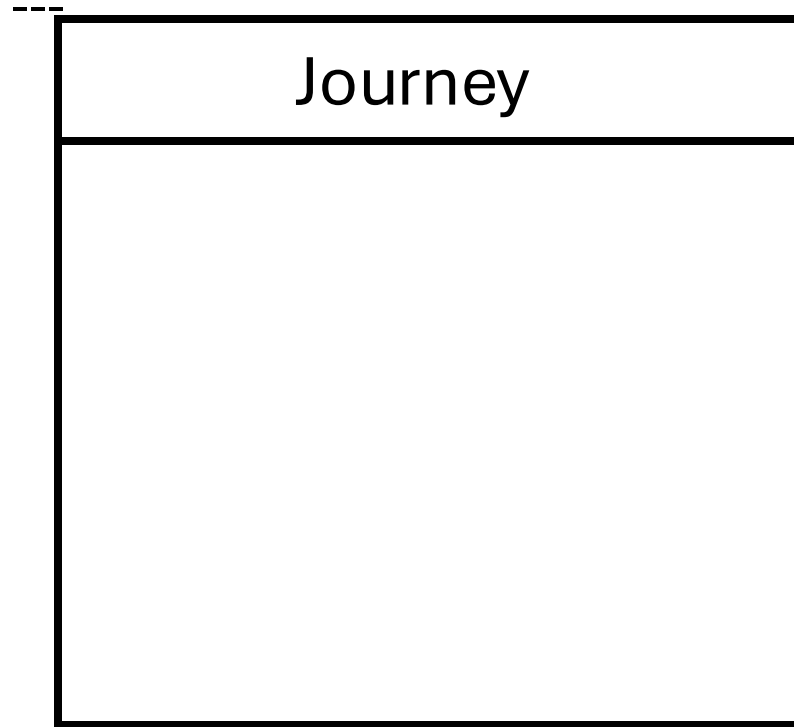---

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Journey

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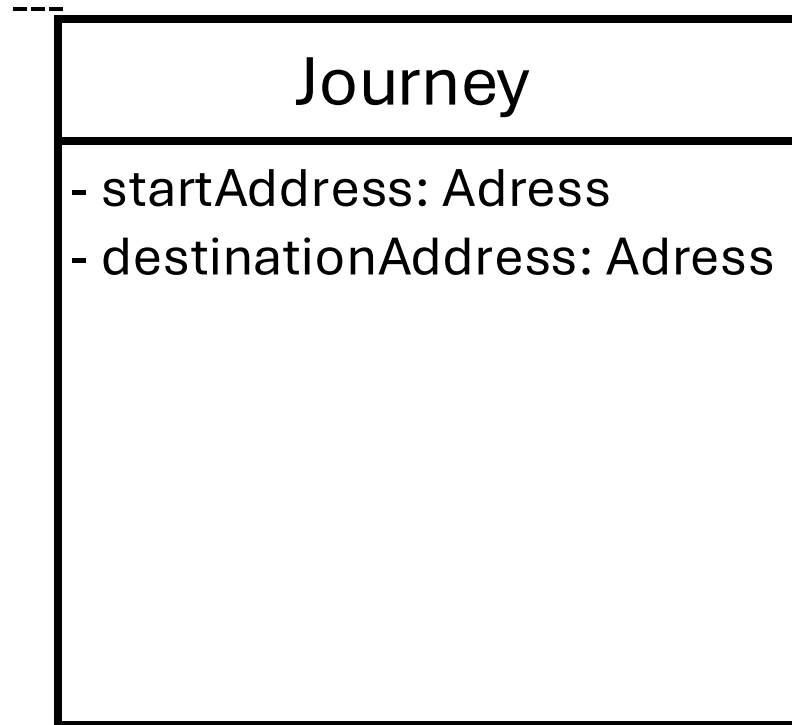---

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Journey
- startAddress: Adress - destinationAddress: Adress

Problem Description Q2 2/2

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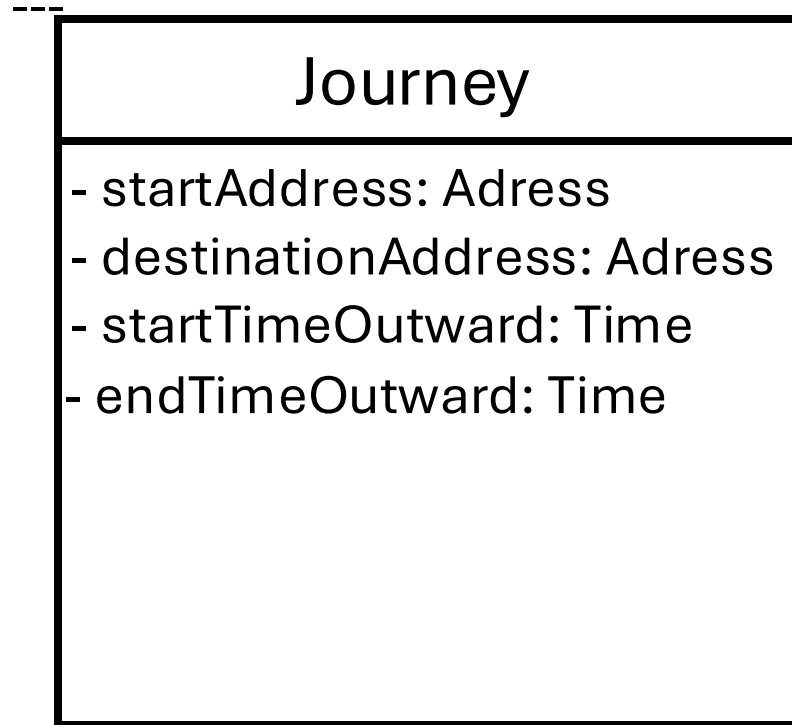---

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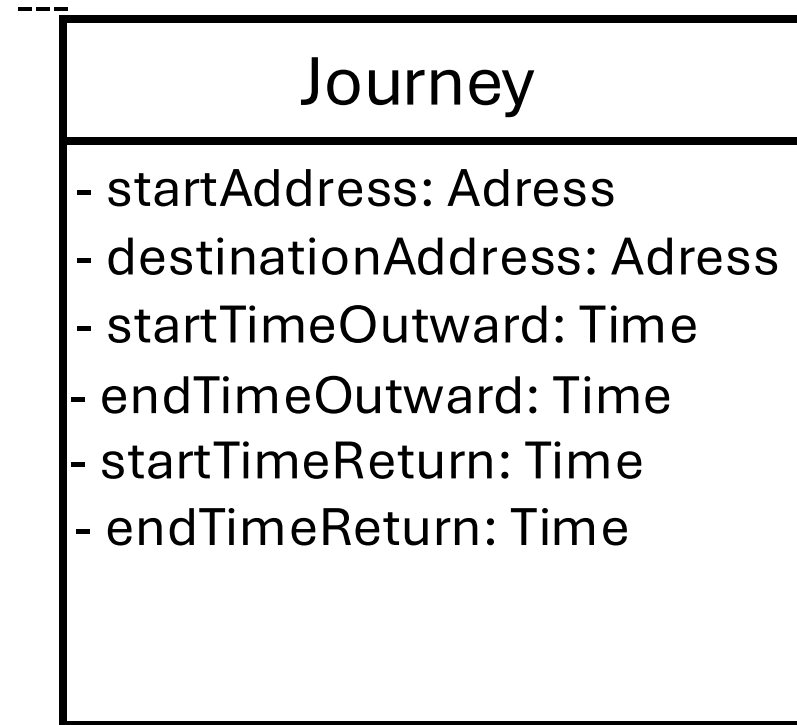
Problem Description Q2 2/2

Consider another extract from the transcript of the interview, and identify any attributes and operations that can be added to the class model.

Journey
- startAddress: Adress - destinationAddress: Adress - startTimeOutward: Time - endTimeOutward: Time

Problem Description Q2 2/2

Consider another extract from the transcript of the interview, and identify any attributes and operations that can be added to the class model.

Journey
- startAddress: Adress - destinationAddress: Adress - startTimeOutward: Time - endTimeOutward: Time - startTimeReturn: Time - endTimeReturn: Time

Problem Description Q2 2/2

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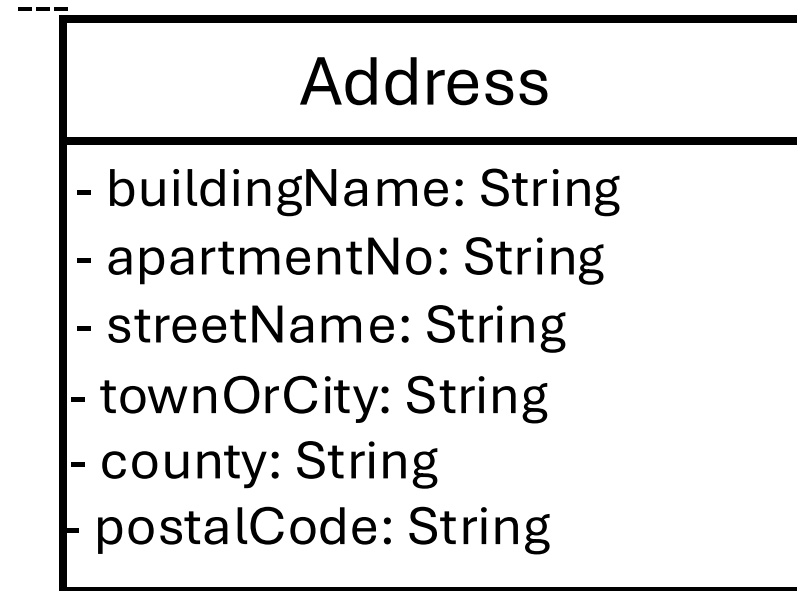
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Consider another extract from the transcript of the interview, and identify any attributes and operations that can be added to the class model.

Address
- buildingName: String
- apartmentNo: String
- streetName: String
- townOrCity: String
- county: String
- postalCode: String

Problem Description Q2 2/2

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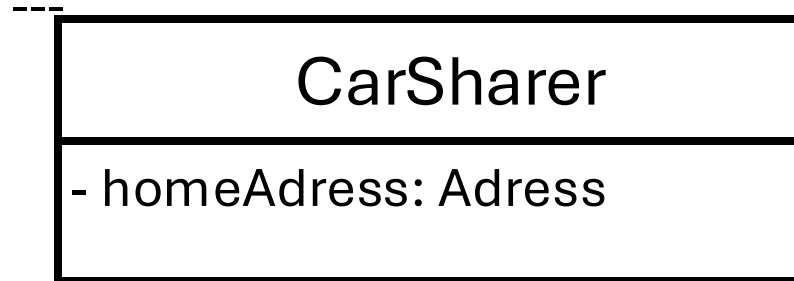
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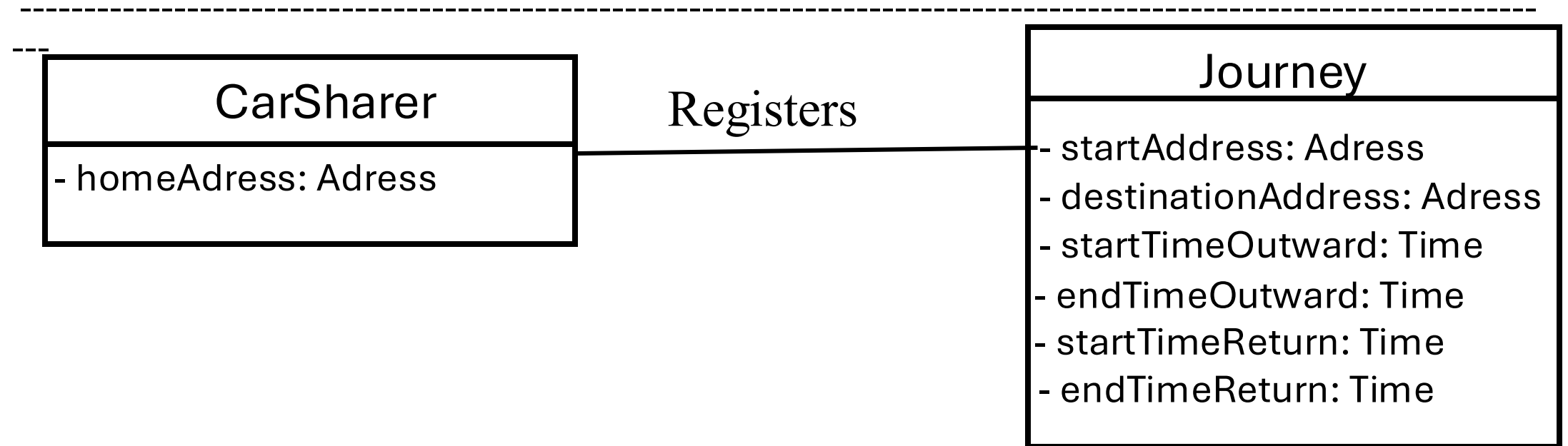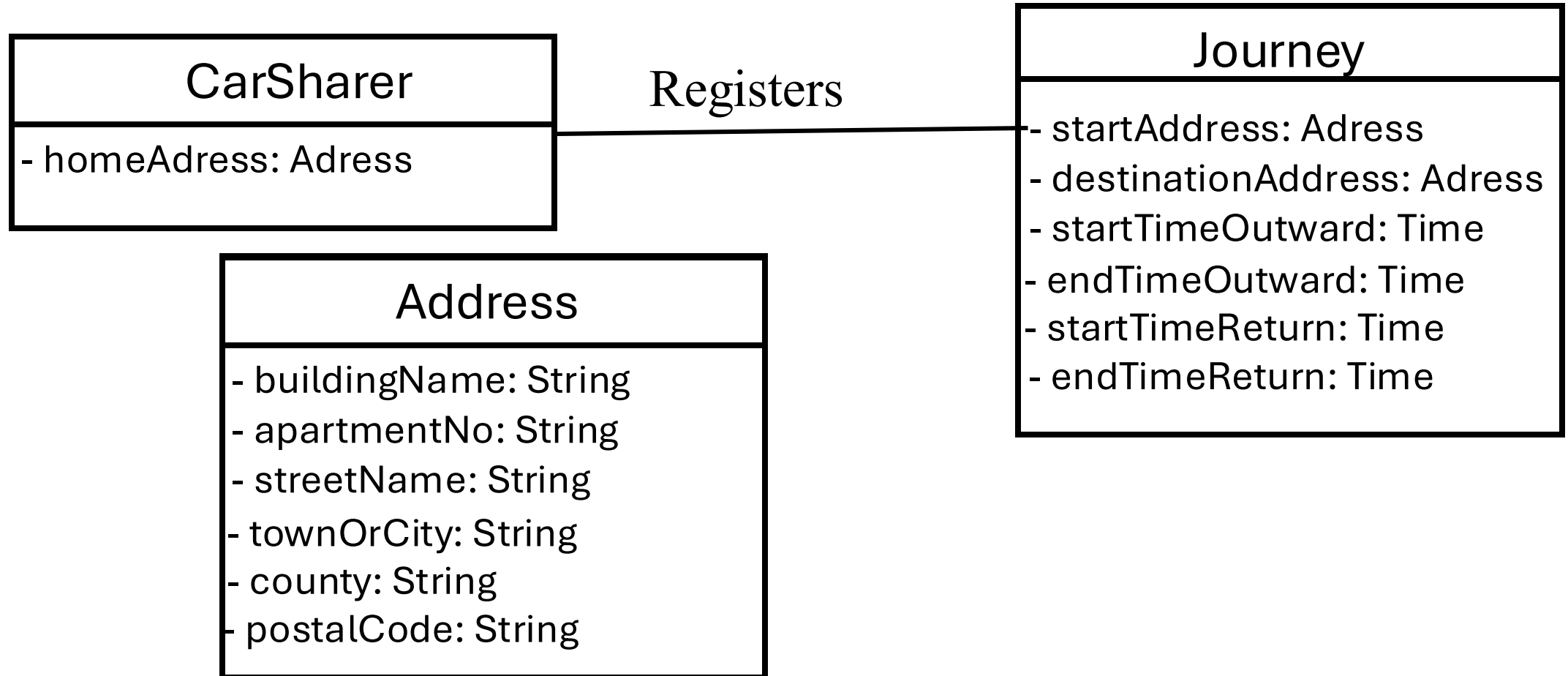
Problem Description Q2 2/2

Consider another extract from the transcript of the interview, and identify any attributes and operations that can be added to the class model.

CarSharer
- homeAdress: Adress

Problem Description Q2 Relationships 2/2

Consider another extract from the transcript of the interview, and identify any attributes and operations that can be added to the class model.
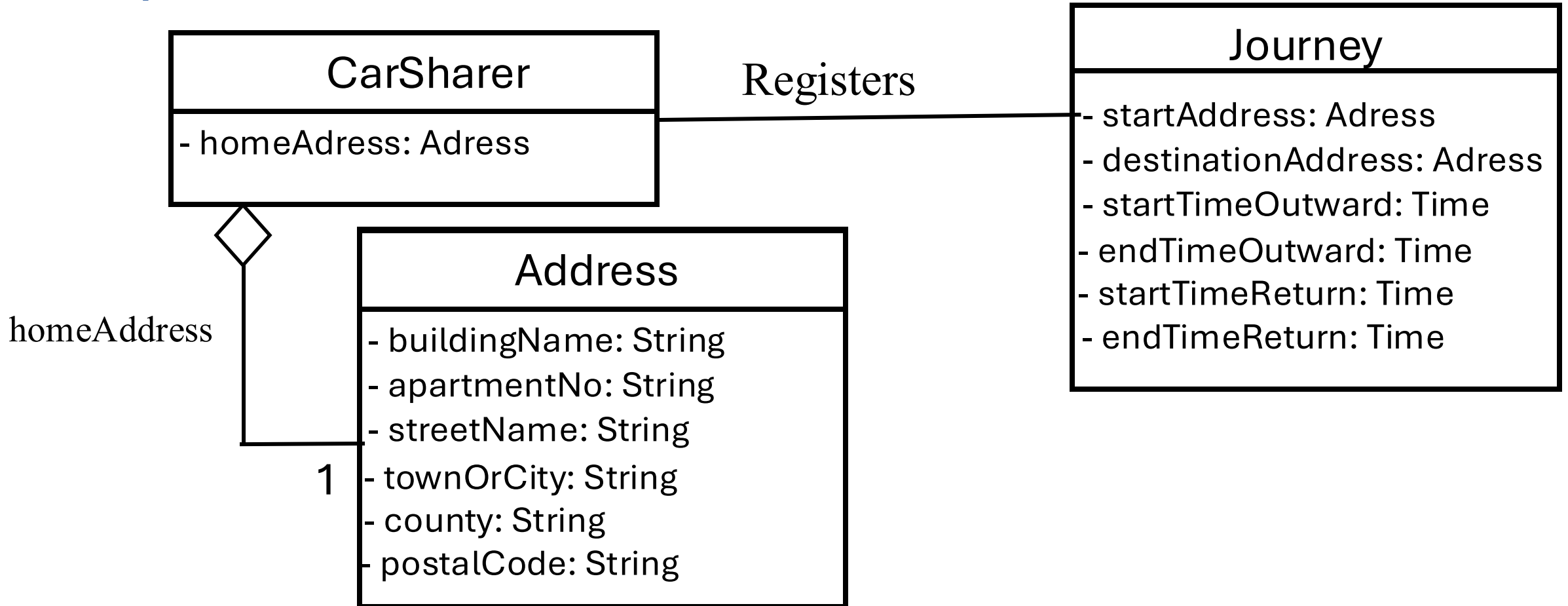

CarSharer
- homeAdress: Adress

Registers

Journey
- startAddress: Adress
- destinationAddress: Adress
- startTimeOutward: Time
- endTimeOutward: Time
- startTimeReturn: Time
- endTimeReturn: Time

Problem Description Q2 Relationships 2/2

CarSharer

- homeAdress: Adress

Journey

- startAddress: Adress
- destinationAddress: Adress
- startTimeOutward: Time
- endTimeOutward: Time
- startTimeReturn: Time
- endTimeReturn: Time

Registers

Address

- buildingName: String
- apartmentNo: String
- streetName: String
- townOrCity: String
- county: String
- postalCode: String

Problem Description Q2 Relationships 2/2

CarSharer

- homeAdress: Adress

homeAddress

1

Address

- buildingName: String
- apartmentNo: String
- streetName: String
- townOrCity: String
- county: String
- postalCode: String

Registers

Journey

- startAddress: Adress
- destinationAddress: Adress
- startTimeOutward: Time
- endTimeOutward: Time
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- endTimeReturn: Time

Problem Description Q2 Relationships 2/2

CarSharer

- homeAdress: Adress

Journey

- startAddress: Adress
- destinationAddress: Adress
- startTimeOutward: Time
- endTimeOutward: Time
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Registers

homeAddress

Address

- buildingName: String
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- postalCode: String

1

startAddress

1

Problem Description Q2 Relationships 2/2

CRC Cards

- Class-Responsibility-Collaborators (CRC) card technique: A CRC card is a small piece of card or paper. The name of the class is written at the top of the card. The responsibilities are written of the left-hand side and on the right hand side the other classes with which the class collaborates with are listed. The goal from this brainstorming technique is to help in identifying the need for new classes or functional responsibilities.

CRC Cards

Journey	
Responsibilities	Collaborations
Check if another journey is the same at this one Maintain the details of a journey	Address, CarSharer

Problem description Q3

- A museum requires a system that will enable museum staff to keep track of guided tours of the museum. When a party of visitors arrives, a staff member must be able to record the date, start time and number of visitors undertaking the tour. Also, a staff member must be able to assign a guide to the tour, from available museum tour guides (i.e., those not currently conducting a tour or performing some other duty); the assigned guide will be notified of the assignment. During a tour, its guide must be able to record special incidents that might occur, such as a visitor becoming ill. Each such incident will be related to the tour on which it occurred and will include a description and a time. Incident reports must be communicated to the Museum's Safety Office.

- create **a set of CRC cards** for the key candidate classes needed to realize the use cases.

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Problem description Q3

Possible Classes?

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- create **a set of CRC cards** for the key candidate classes needed to realize the use cases.

CRC Cards

Tour	
Responsibilities	**Collaborations**
1. Save date, start time and number of visitors in the tour 2. Keeps track of id of the assigned guide (those not currently conducting a tour or performing some other duty) ← condition 3. Notify guide of assignment	Guide, Incident

CRC Cards

Guide	
Responsibilities	**Collaborations**
1. Keeps track of guide information 2. Receive notifications of assignment	Tour, Incident

CRC Cards

Visitor	
Responsibilities	**Collaborations**
1. Save visitor information	Incident

CRC Cards

Incident	
Responsibilities	**Collaborations**
1. Each such incident will be related to the tour on which it occurred and will include a description and a time.	Tour, Visitor

State Chart Diagrams

State Chart Diagrams

- State machines describe the behavior of dynamic model elements, and are closely related to activity diagrams. Whereas activity diagrams describe flow between areas of work, state machines describe flow between states. State machines are developed as follows:
  - Identify entities that have complex behaviour
  - Determine the initial and final states of the entities
  - Identify the events that affect the entity
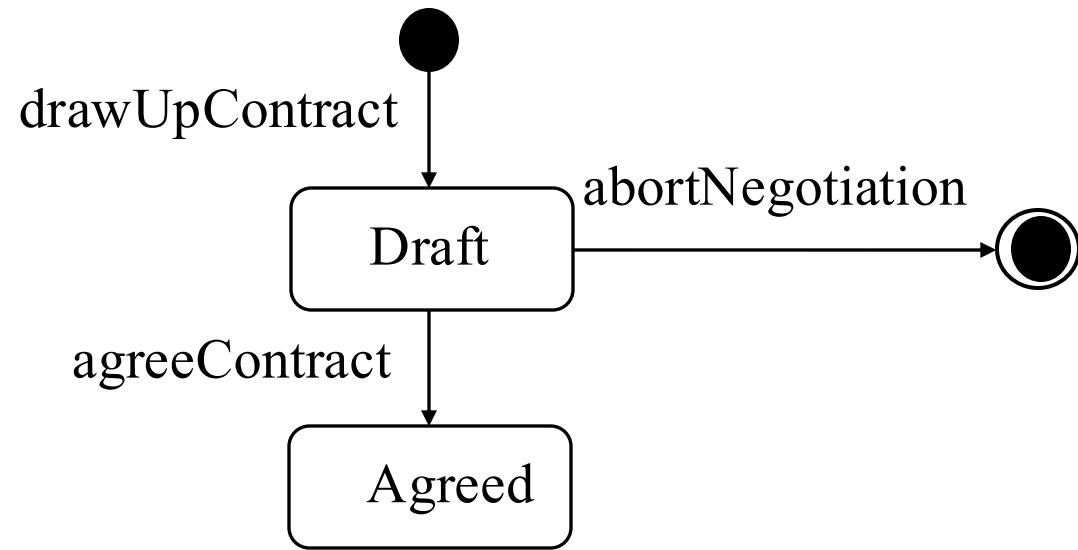 - Trace the impact of events and identify the intermediate states.

State Chart Diagrams

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  - Identify the events that affect the entity
  - Trace the impact of events and identify the intermediate states.

Only objects with an extended lifespan

Problem Description Q4

- CarMatch intend that members could obtain a discount for road-pricing schemes. CarMatch negotiates with each authority independently. Each pricing scheme has its own computer system. CarMatch would prefer to take over the billing of their own members and attempt to negotiate this first, but sometimes that is not possible. They will then negotiate discounts for members. Finally, they will agree on the mechanism for exchanging information. If negotiations are successful, then contracts will be drawn up and agreed. Sometimes the contract stage will cause some negotiation. At any time, either party can suspend or cancel negotiations.
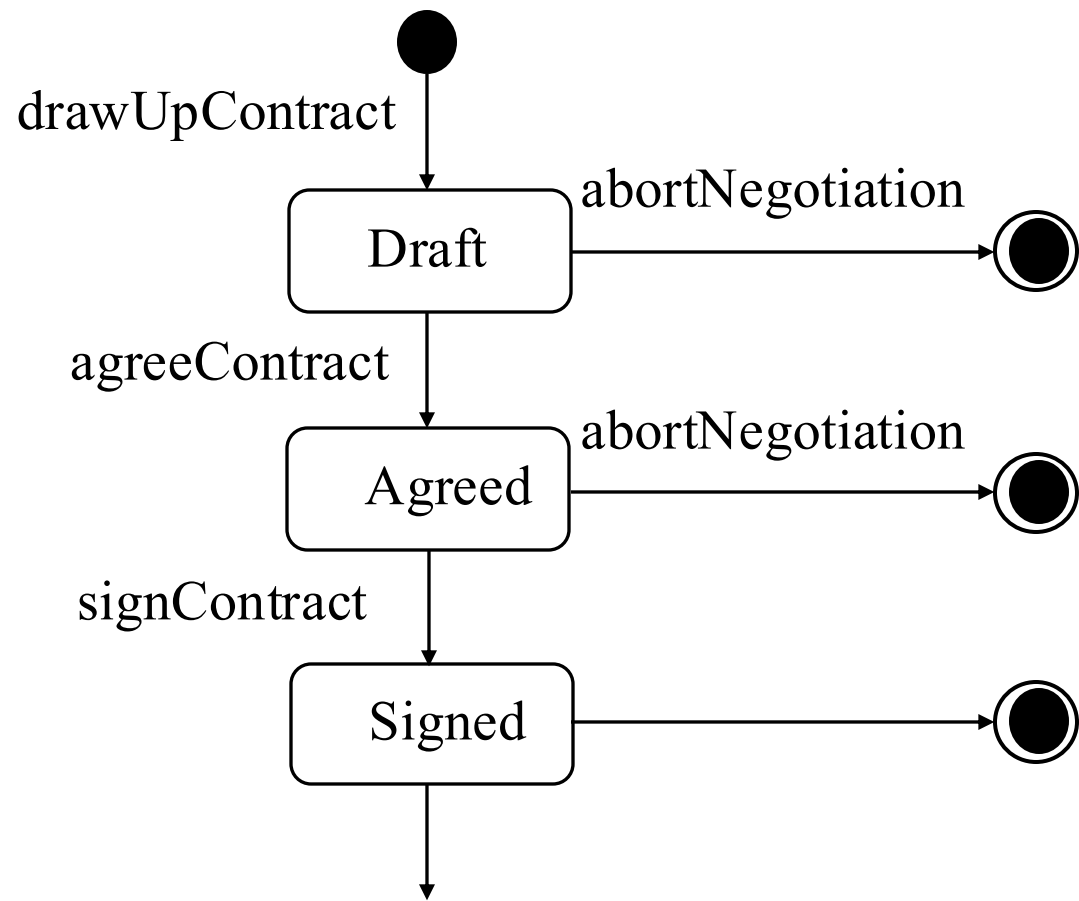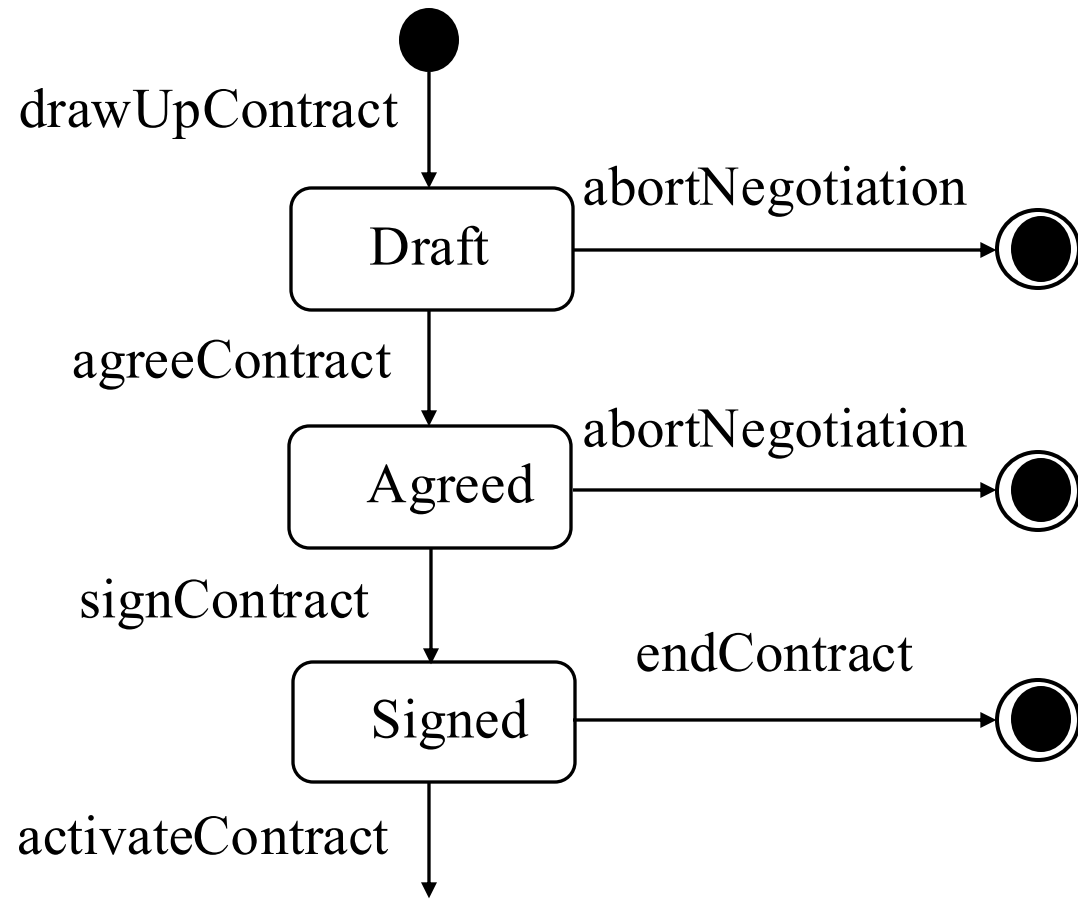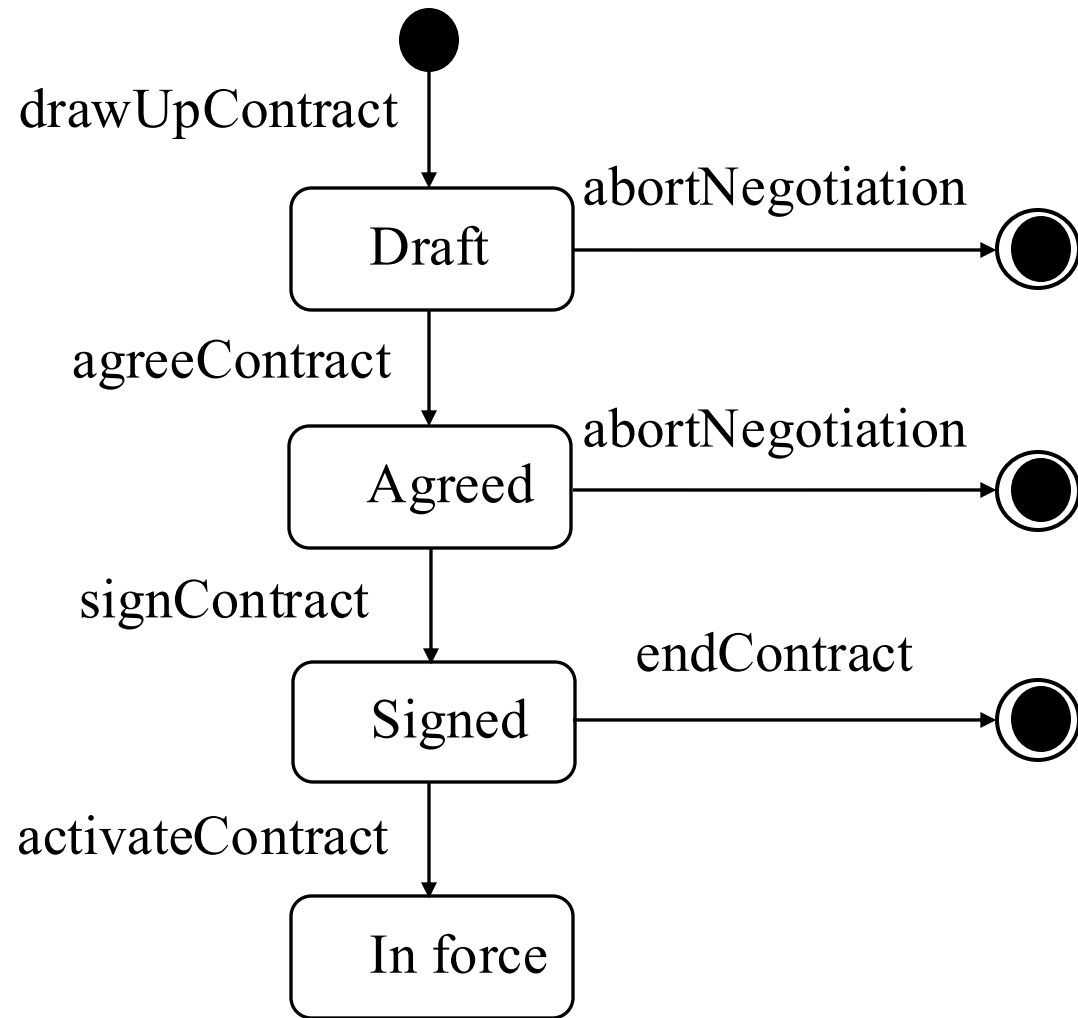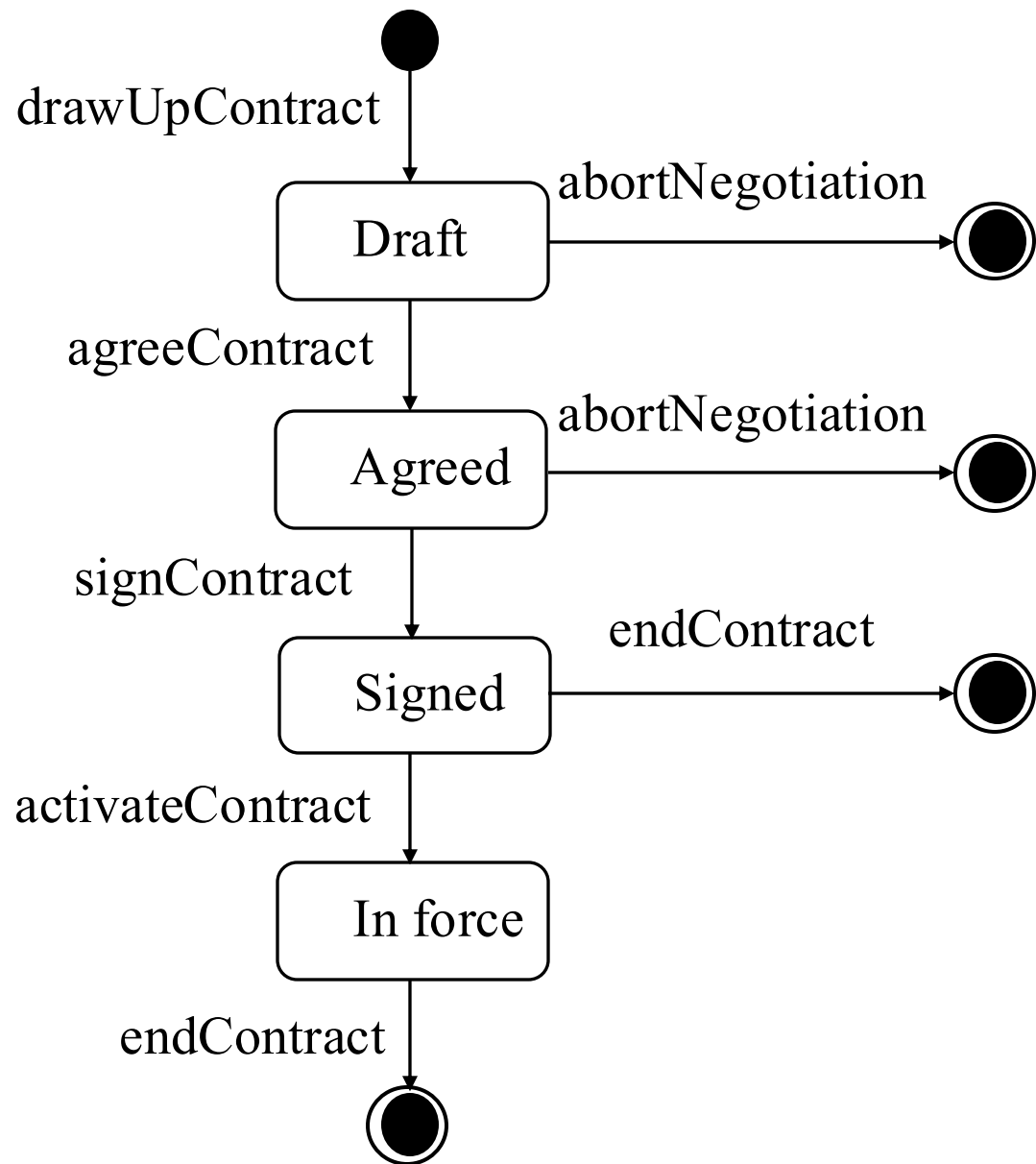
drawUpContract

drawUpContract

Draft

Thank you!