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Lecture 11:

UML Activity Diagrams and UML Sequence Diagrams

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Housekeeping

The previous lecture and workshop were about UML Class Diagram. We focused on the concept of object, the structure of classes of objects, types of relationships between classes (e.g. inheritance/parent-child/generelisation), and multiplicity.

In this lecture we focus on the last two types of UML diagrams including Activity Diagram and Sequence Diagram.

Week 11 assessment structure

Before your week 11 tutorial session:

1. Ensure you have watched Week 11 lecture recording.
2. Have another look at the assessment specification file related to Design Challenge 2 (the final assessment, available on Blackboard).

During week 11:

1. Read the Week 11 tutorial slides. Think on items 5a and 5b in the assessment specification file. Draw the first draft of your activity diagram (5a) and answer item 5b **[Assessed items]**
2. Show the first draft of your answers to your tutor during your tutorial session. You need to use the screenshare feature if your tutorial is online. Your tutor will give you feedback on your work.

This is important, so I repeat:

Every week:

1. Read/review the updated assessment requirements for your final assessment (Design Challenge 2) that we posted on Blackboard in Week 8.
2. Watch the lecture recording.
3. Read this set of slides and other teaching resources each week before attending your tutorial.
4. You are expected to draw the first draft of your diagram before attending your tutorial (this is especially important if your tutorial is online) and show it to your tutor during the session.
5. Your tutor will answer your questions and provides feedback for improving your diagram.

This way you have an extended time for reading the teaching material and an opportunity for a personalised session for receiving feedback on your work during the tutorial.

Goals for today

External, internal, static and dynamic views

Activity diagram

Sequence diagram

External, internal, static and dynamic views

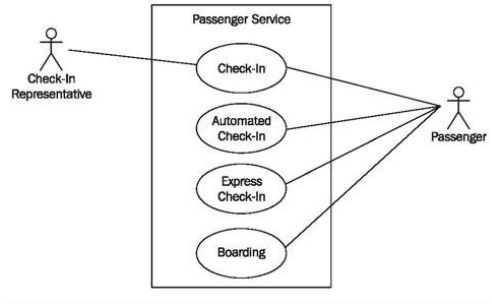
Activity diagram

Sequence diagram

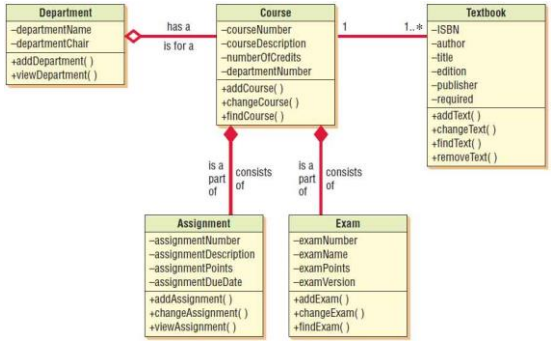
Wrap up

External views

Internal views

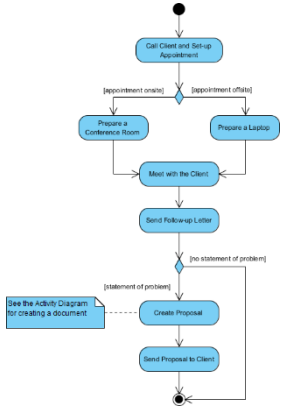


Use case diagrams

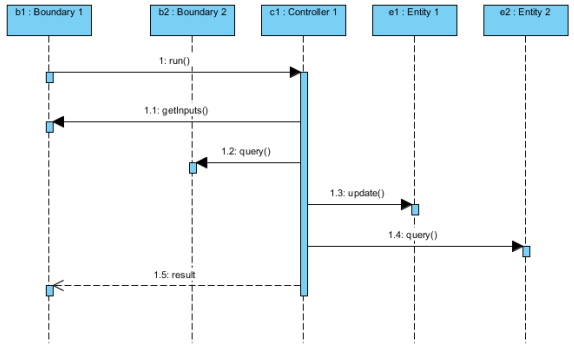


Class diagrams

Static views



Activity diagrams



Sequence diagrams

Dynamic views

External, internal, static and dynamic views

Activity diagram

Sequence diagram

Wrap up

Activity Diagrams

Activity Diagrams

ADs are used by designers/developers and business professionals to see the process of using a system (e.g. sequential actions required to purchase an item online) from the user perspective, so they know how to design a system that works in a real scenario.

- Consider it as a type of story boarding – via modelling the behaviour of using the system.

ADs are suitable for modelling:

- how the events in a single use case relate to one another
- how a collection of use cases coordinate to represent business workflows or behaviour (user behaviour) of using a system

You need to identify a scenario or key scenarios of using the system and combine them to produce comprehensive workflows.

Activity Diagrams

- An AD describes a sequential flow of activities
- An AD should describe the activities associated with ONE use case.
- AD does not make any consideration about the execution time of concurrent activities.

Activity
- Represents an action or a set of actions

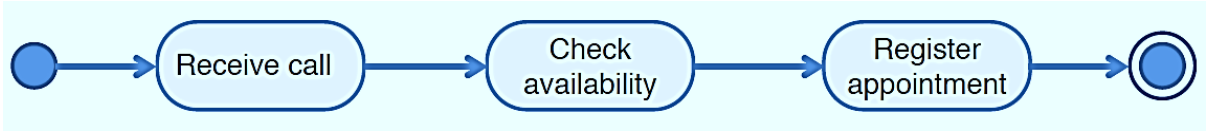
Control flow
- Shows sequence of execution

Initial node
- The beginning of a set of actions

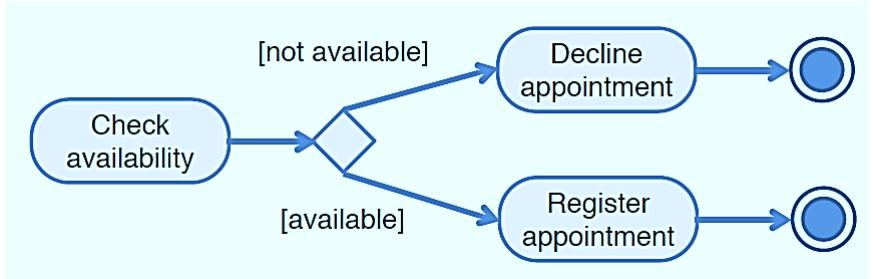
Final node
- Stops all flows in an activity

The lack of end nodes is possible but not recommended.

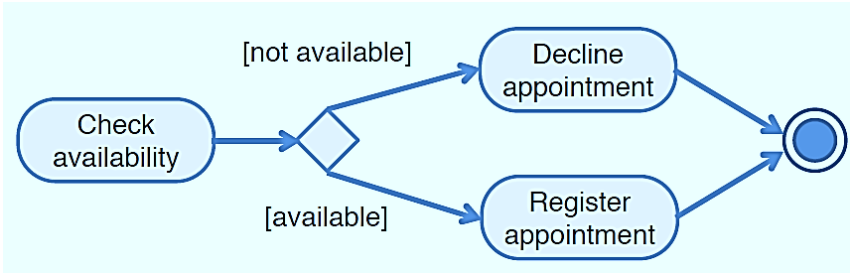
Decision node
- Represents a test condition



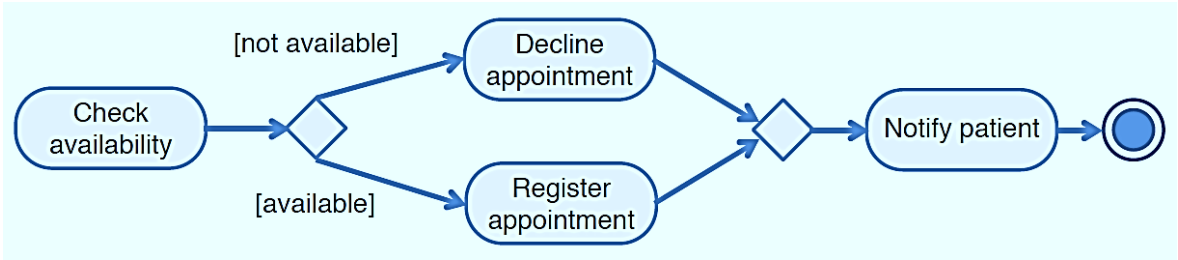
Making an appointment:
when making an appointment, the employee receives the call, checks the availability of the selected date, and registers the appointment.



Decision node:
The flow will go one way or the other but not both.



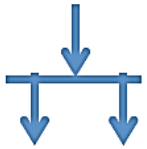
Final node:
Having one single final node is a matter of style.



Merge decision:
brings together various workflows.

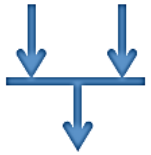
Fork

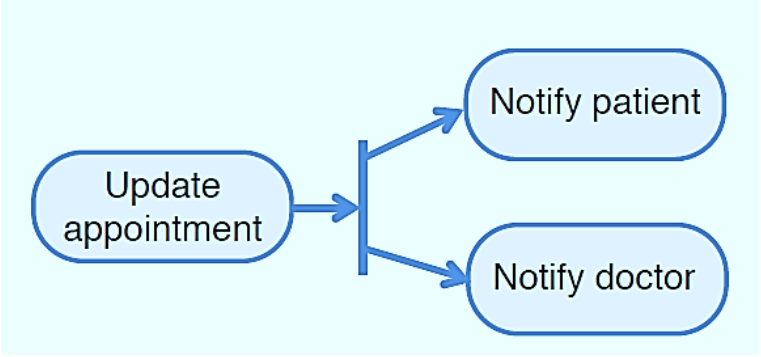
- Splits behaviour in parallel/ concurrent activities



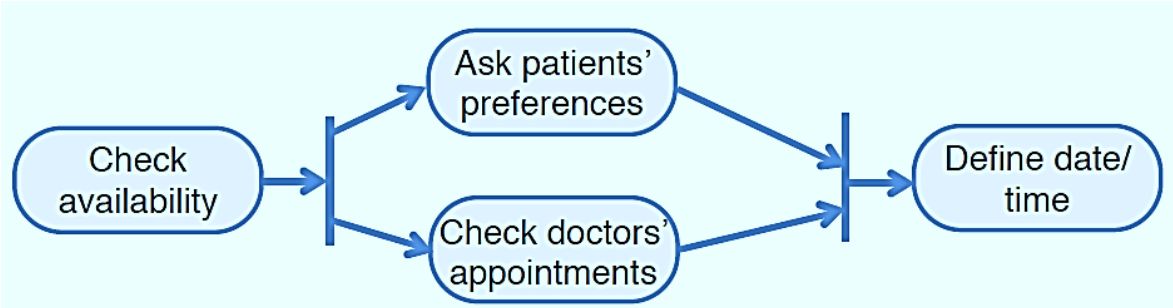
Join

- Brings back together the sequence of execution (synchronisation)





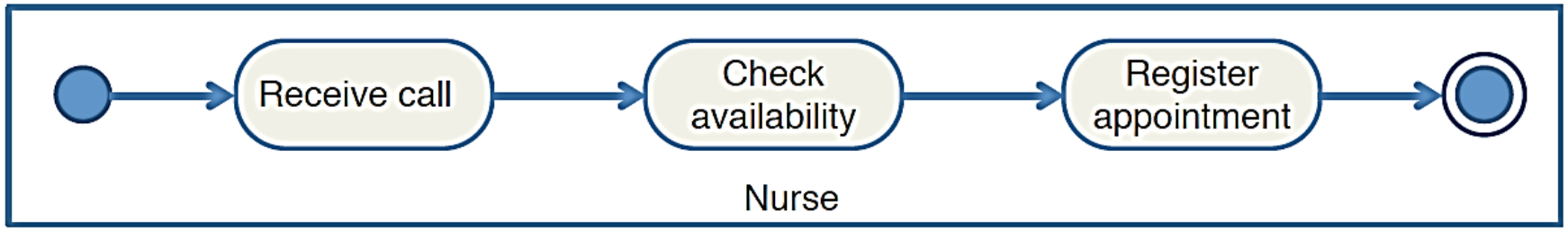
Fork: The 2 notify activities are done concurrently and without interfering with each other



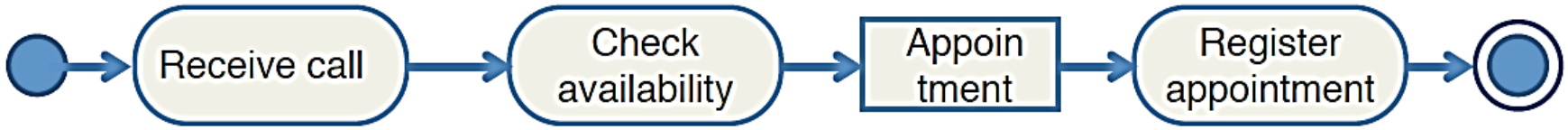
Join: The nurse **must** ask the patients' preferences and check the doctors' appointments **before** defining the date/time for a new appointment

As a recommendation, every fork should have a join.

Swimlanes: Show who is responsible for a collection of activities. We use swimlanes where there are at least to actors and we need to separate their activities.



Data objects: Represent data (inputs, documents, database records, etc.) processed and/or passed between activities

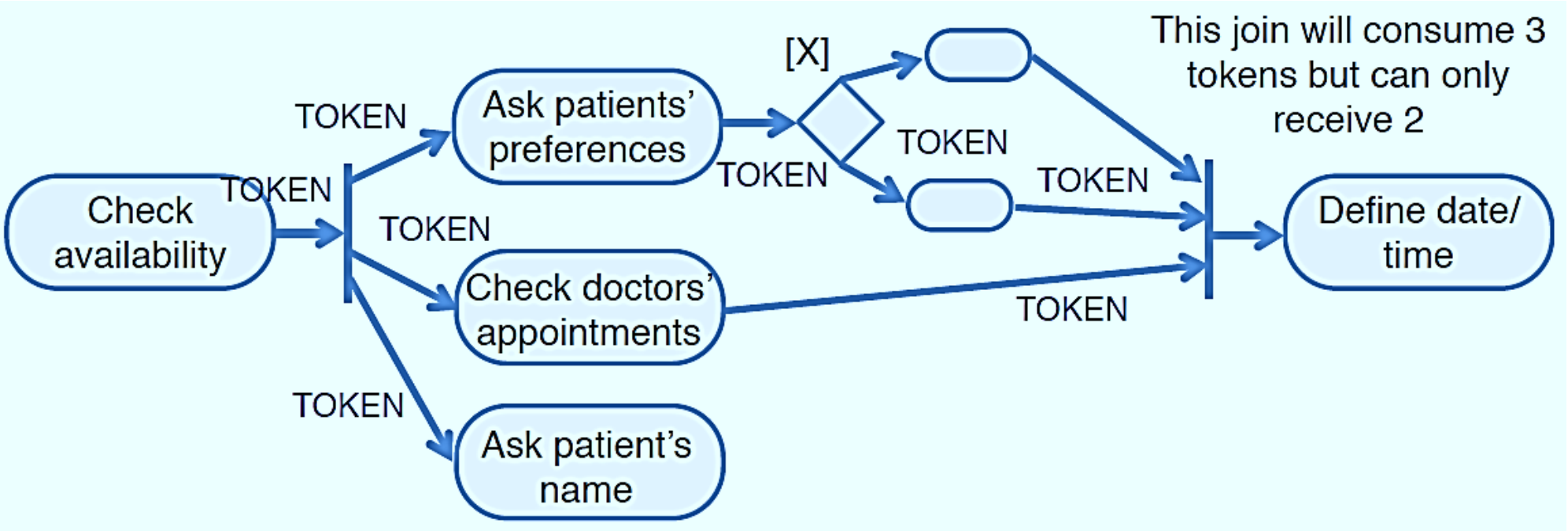


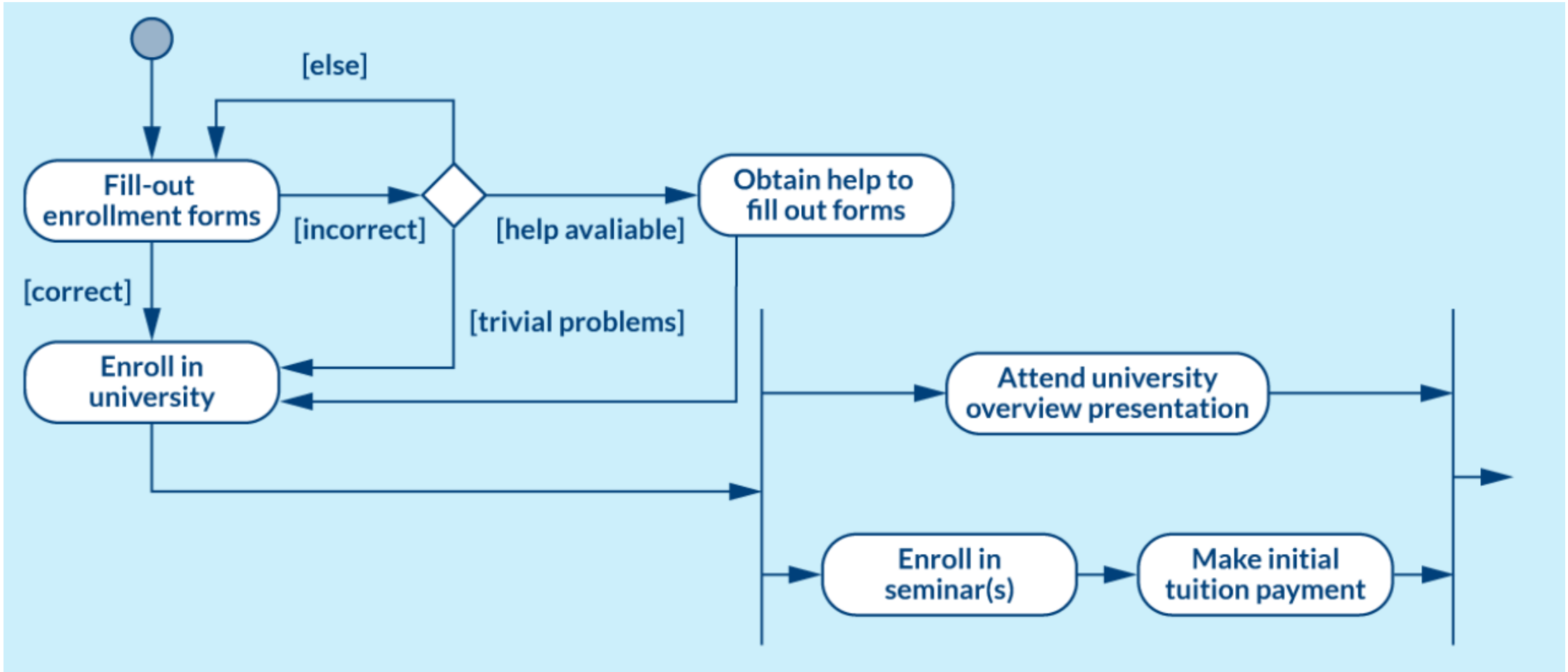
An appointment is passed between check availability and register appointment

The way forks/joins works can be understood by using tokens

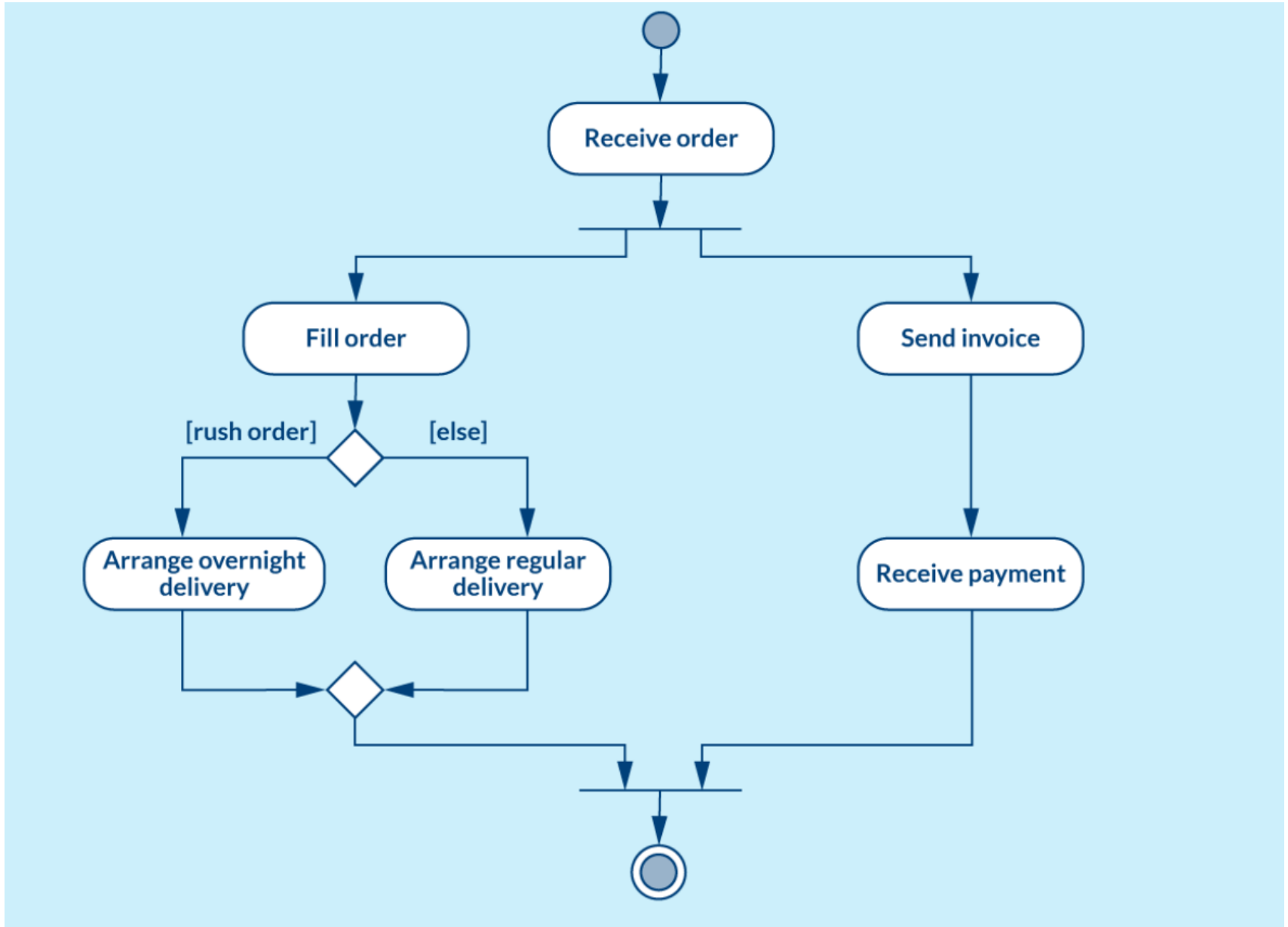
Each outgoing arc moves a token forward;

Forks produce tokens and joins consume tokens





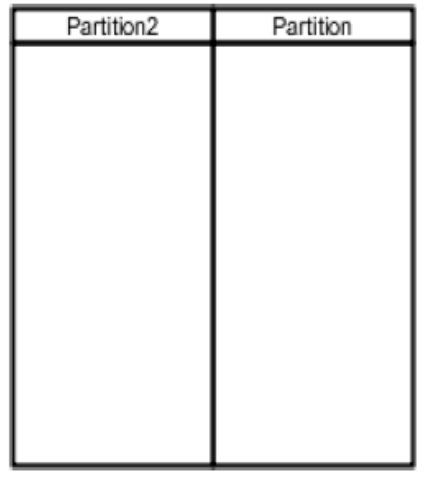
Enrolling at a university (2020) adapted from Visual Paradigm

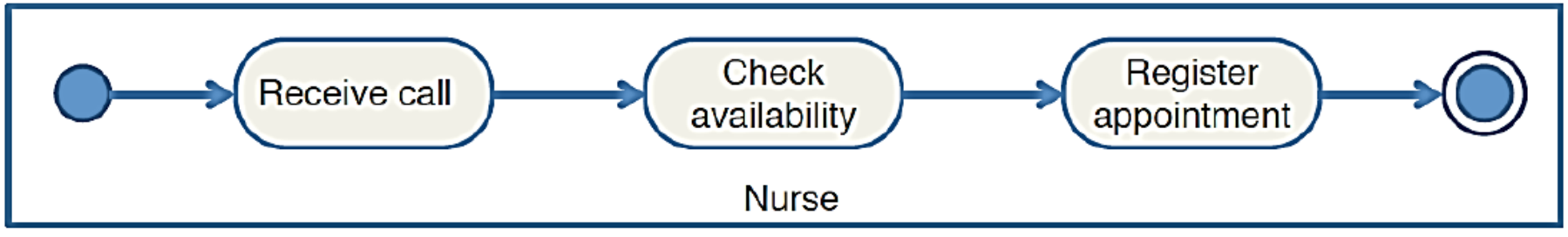


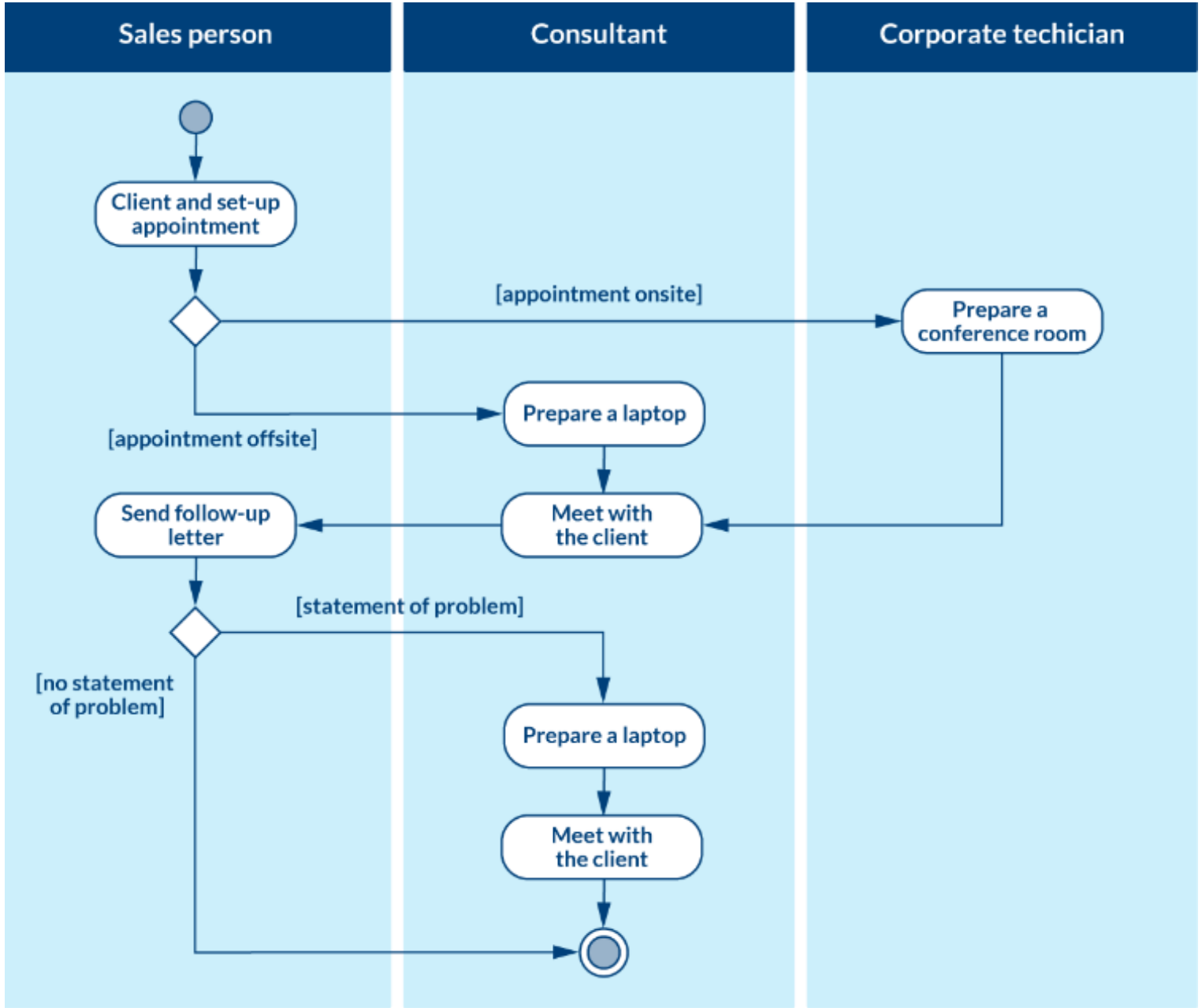
Processing online purchases (2020) adapted from Visual Paradigm

Swimlanes: show who is responsible for a collection of activities. We use swimlanes where there are at least to actors and we need to separate their activities.

- Where workflows cross technology boundaries, use swimlanes to map the activities

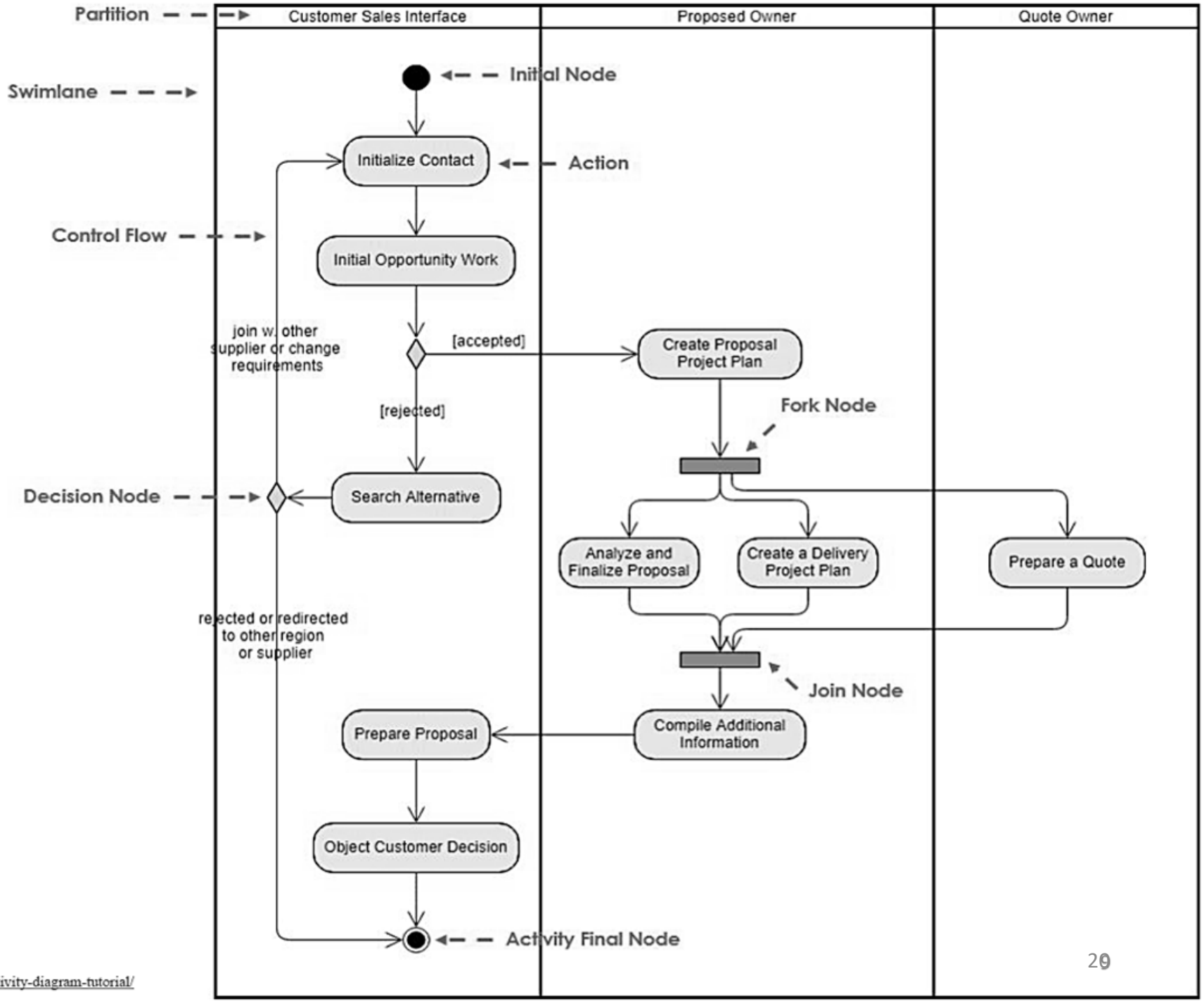






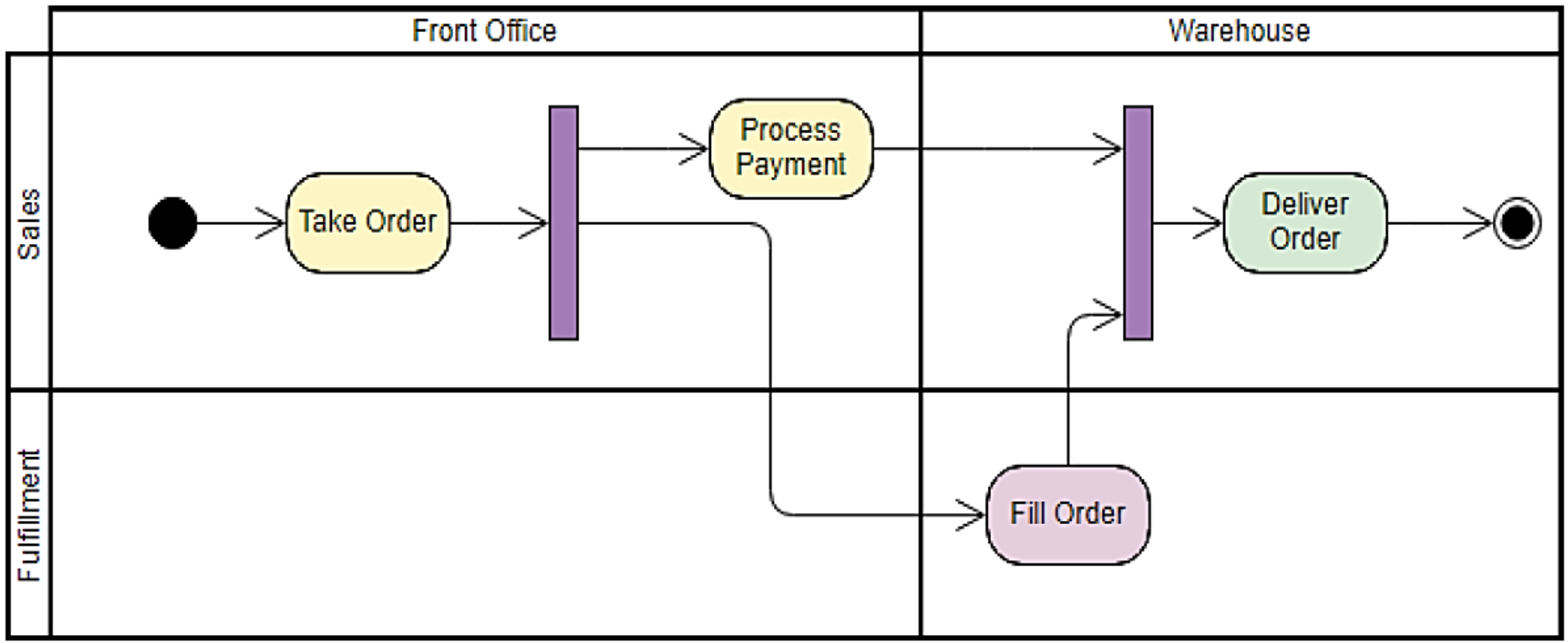
Booking a conference room (2020) adapted from Visual Paradigm

Performing a Proposal process, with three areas of responsibilities (Customer Sales Interface, Proposal Owner, and Quote Owner)



https://online.visual-paradigm.com/tutorials/activity-diagram-tutorial/

Multidimensional Swimlanes:



https://online.visual-paradigm.com/tutorials/activity-diagram-tutorial/

Software

Use Lucidchart, Draw.io, Signavio or any tool that you are comfortable with. You have used these tools in the previous weeks, so you are familiar with using them. Also, please see the 'software' section of the assessment specification document.

How detailed the activity diagram should be?

Follow the guidance in the assessment specification document. You just need to draw the process that a user goes through to purchase item(s) online via the website. Explore the website we have mentioned in Case 2. Overall, you need to use between 50 to 80 shapes (boxes, decision nodes, forks and joins, and arrows…) to draw a complete activity diagram. Avoid too much details (do not include every small thing) and avoid drawing a very general diagram that does not show important activities such as login, search for an item, select item, select payment type,...

Guidelines for answering items 5a and 5b are available in the Assessment Specification file. Please read the guidelines carefully.

External, internal, static and dynamic views

Activity diagram

Sequence diagram

Wrap up

Sequence Diagrams

Sequence diagrams vs Activity diagrams:

- Activity diagrams describe behaviour from the users' point of view — how they interact with the system.

- Sequence diagrams describe behaviour from the system's point of view — how the object interact to provide functionality to users.

SDs are used by software developers and business professionals to:

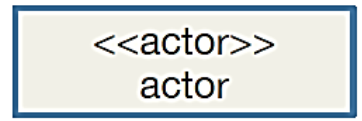
- Describe how a group of objects works together, or
- To document an existing process, or
- Plan and understand the detailed functionality of an existing or future scenario

Overall, SDs describe high-level interactions:

- between user of the system and the system,
- between the system and other systems, or
- between subsystems.

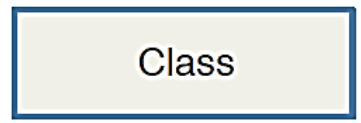
Actors

- As specified by use cases



Classes/objects

- As specified by class diagrams

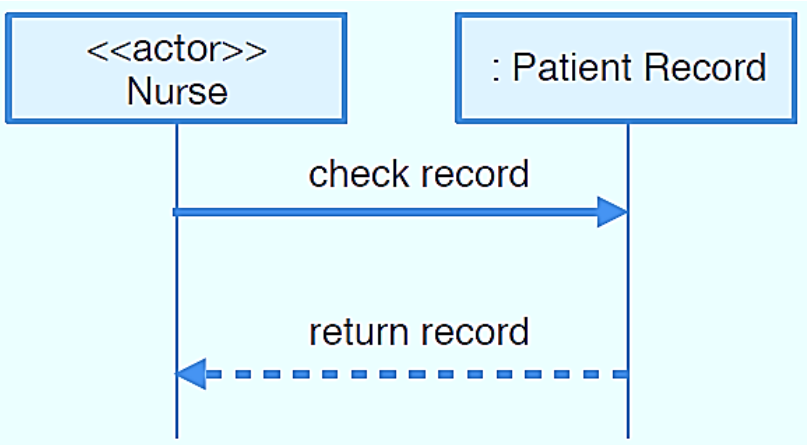


Lifeline

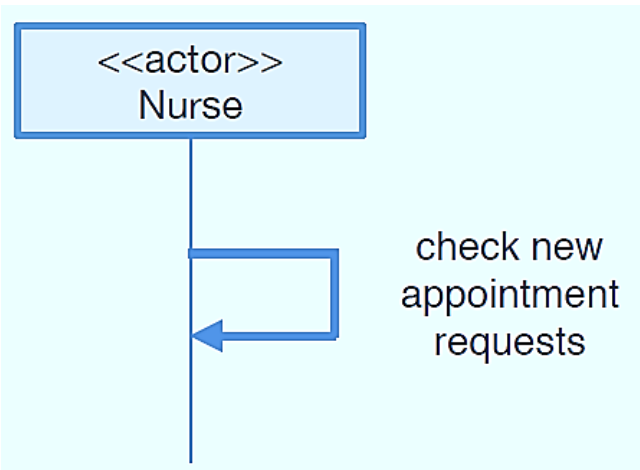
- Depicts the life time of the actor, class or object

Message

- Conveys information from one object to another
- Can be a **call** or a **return**



The nurse sends a message to the patient record in order to get the data record



A message to self

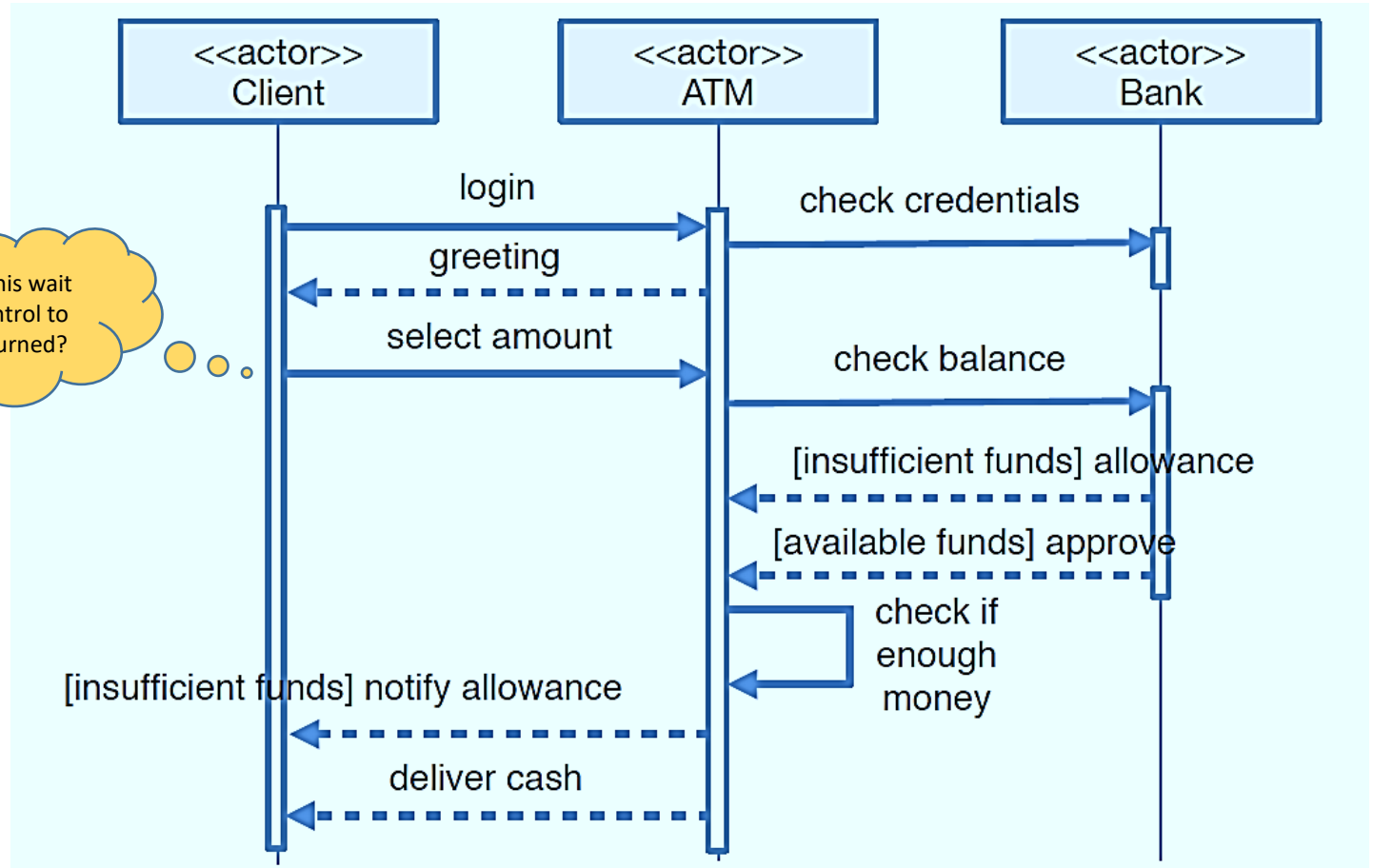
Execution occurrence

- Denotes when an object is sending or receiving messages

Guard conditions

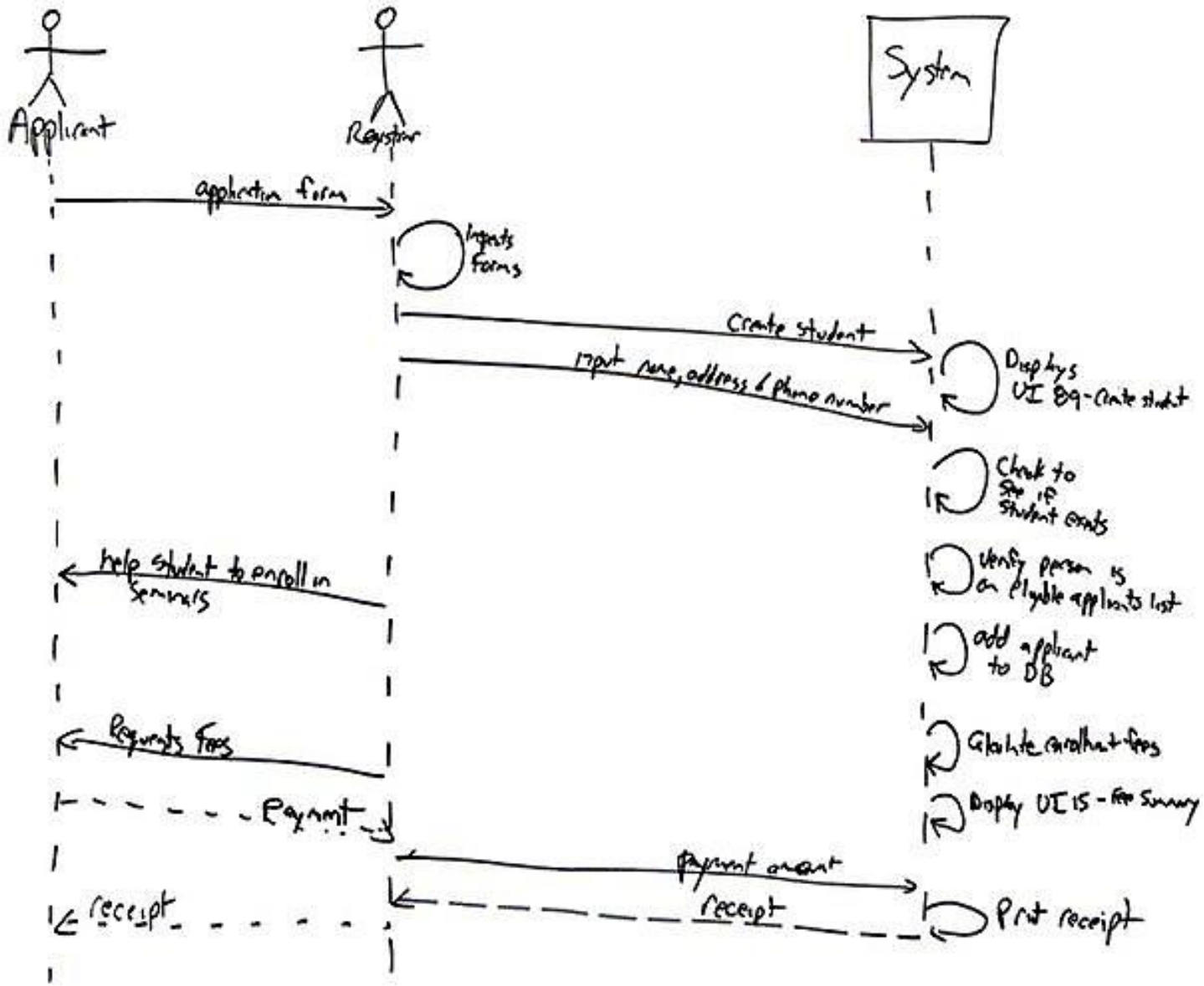
- Represent a test that must be met for the message to be sent

[a guard condition]



In an agile design environment you may need to use a 'whiteboard' approach.

E.g: a whiteboard view of a Sequence diagram for the "Enrol in University" use case



http://www.agilemodeling.com/artifacts/sequenceDiagram.htm

Recommendations for Sequence Diagrams

- The sequential nature of the logic should be shown via the ordering of the messages (the horizontal arrows).
- Lay out the messages from top to bottom of the diagram based on the order in which they are sent
  - Do **not** represent returns if they are obvious
- Check that both SD and activity diagram involve the same actors
- Check that both SD and class diagram involve the same objects

We taught UML Activity Diagram and UML Sequence Diagram. Activity Diagram is a part of your assessment, but we don’t assess Sequence Diagram.

What about UML Component diagram and UML Package diagram?

You learn these models in future units.

External, internal, static and dynamic views

Activity Diagram

Sequence Diagram

Wrap up

Drawing it all together

There are several types of UML diagrams. They all together provide information on use cases, flow of data and what happens within a process.

We covered UML use case diagrams, UML class diagrams, UML activity diagrams and UML sequence diagrams.

Next week, we focus on topics such as analysis of impact (impact of designing an IT system) and customer journey maps.

Acknowledgment

The examples about health record management and ATM are based on the content taught at Victoria University of Wellington as a part of systems analysis and design course in 2013-15. Associate Professor Pedro Antunes (coordinator) and Dr Alireza Nili were the teachers of the course. The slides that provide examples for the activity diagram and sequence diagram are also being taught in a module of the online masters version (2020 and beyond), developed by Dr Alireza Nili and facilitated by OES.

Questions?

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