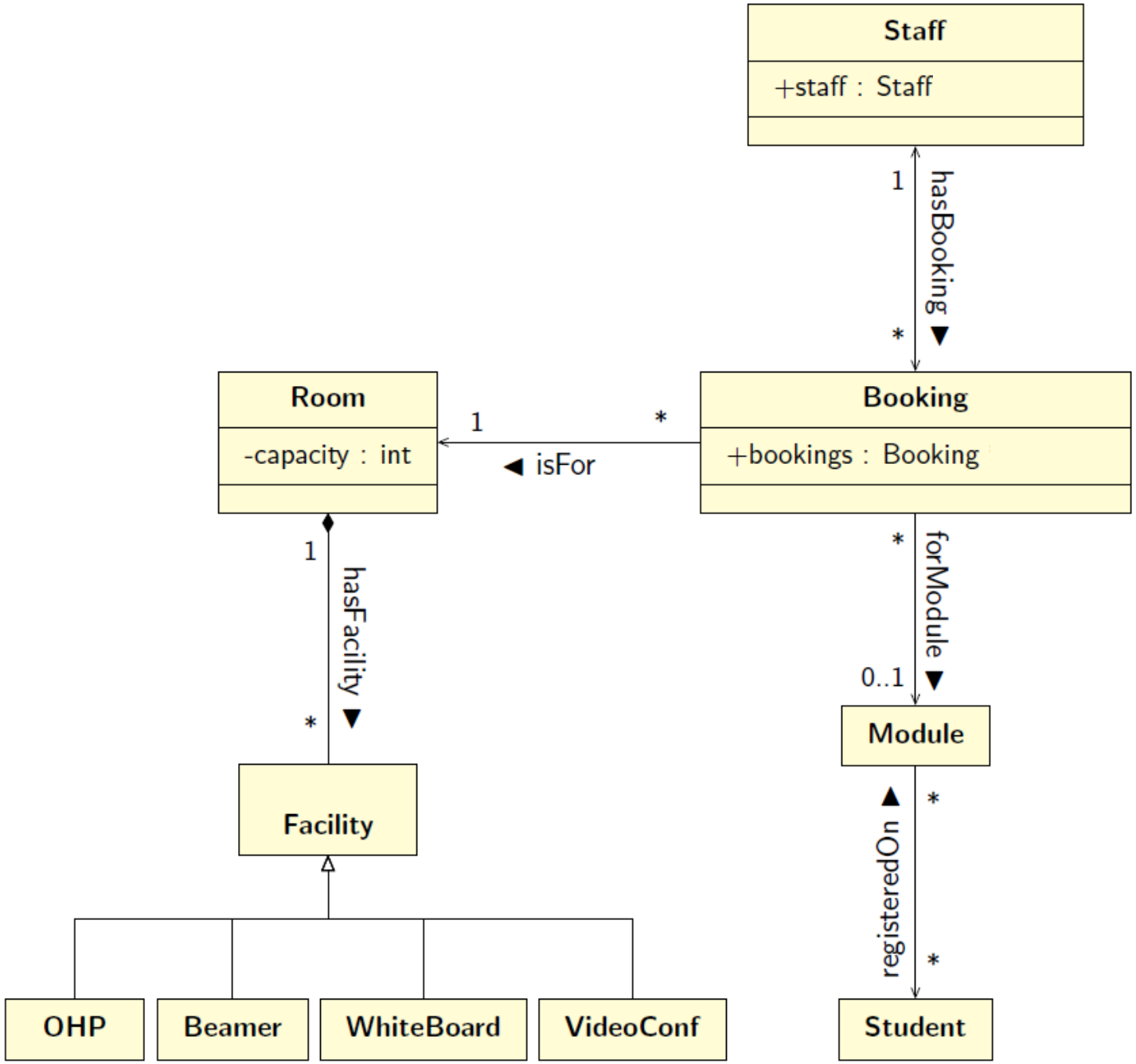
A room booking system for a University is required. The project description is as follows:

The University maintains a set of rooms that are bookable, mostly for lectures and small group teaching associated with modules but also for one-off events and meetings. Individual rooms have a capacity and have facilities associated with them, e.g. overhead projectors, beam projectors, white boards, video-conferencing facilities etc., and the number and type of each such facility must be recorded and available so that searches for suitable rooms can include conditions that the room has the required facilities. Only staff members can request a room to be booked and the system must be able to contact the staff member who booked a room in case some rescheduling is necessary. A room booking always specifies the day, time and duration that the booking is for and may have a module associated with it. Bookings for rooms associated with modules are only allowed if no student registered on the associated module has a timetable clash, where a timetable clash means that a student is registered on two different modules which have bookings for different rooms on the same time and day.

Conduct a conceptual class design for the above application description and draw a conceptual UML Class Diagram to describe your final design. You may omit attributes and operations from your class diagram.


Staff
+staff : Staff
1
hasBooking
*
Room
-capacity : int
1
*
isFor
Booking
+bookings : Booking
1
hasFacility
*
*
forModule
0..1
Module
Facility
*
registeredOn
*
OHP
Beamer
WhiteBoard
VideoConf
Student

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Extract three functional and non-functional requirements.

Examples of functional requirements

- The user shall be able to search for available rooms using different search criterias.
- The system shall allow staff members book a room.
- The system should authenticate staff members
- The system shall allow staff members to add new rooms to the rooms database

Examples of non-functional requirements

- The system shall be available to all users during normal working hours of the University.
- Search speed should be fast enough
- The system should easy to use

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One of the operations that the system must support is for staff members to book rooms for a module. The staff member specifies a required set of facilities, a required number of lectures per week and start and end dates for the module.

Write a use case to support handling such bookings.

[10%]

(b) Name Staff books rooms for module
Initiator Staff
Goal A set of rooms are booked for the staff member for a specified module, required facilities, required number of lectures per week within the specified dates.

Main Success Scenario
1. Staff requests room booking for module
2. System requests module code, facilities required, number of lectures per week and begin and end dates
3. Staff enters requested data
4. System identifies available rooms that meet requirements
5. System presents options to staff and requests confirmation
6. Staff confirms options
7. System records options as booking

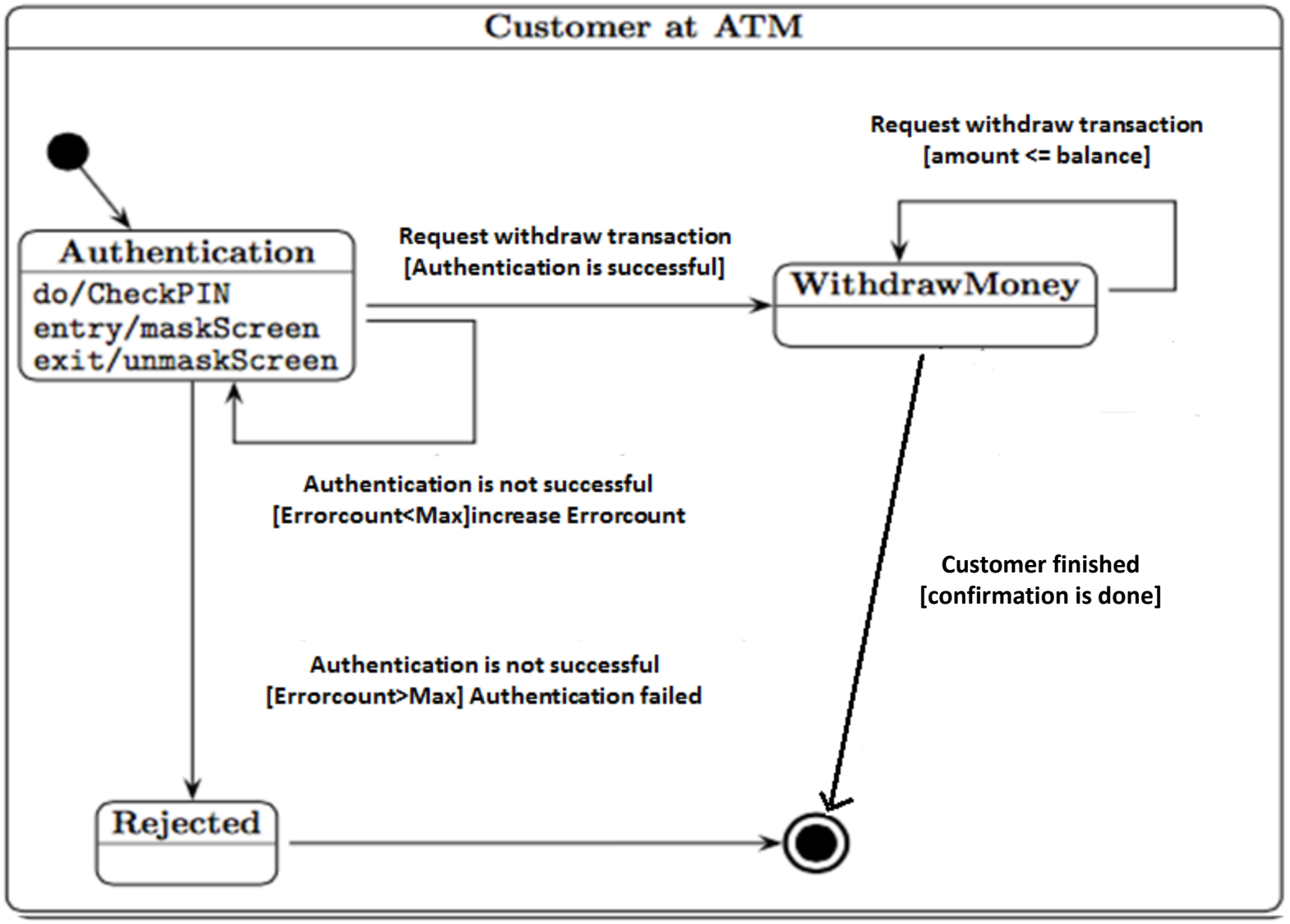
Extension
3. Staff cancels
   1. Fail
4. Module code invalid
   1. System notifies Staff of error and requests corrections to data
   2. Resume 3.
4. No set of rooms available that meets all requirements
   1. System notifies Staff of error and requests modifications to requirements
   2. Resume 3.
6. Staff cancels
   1. Fail

[10%]

Draw a state transition diagram that captures the possible states of a customer at ATM machine that contains

- Authentication state,
- Withdraw money state, and
- Rejected state

Your diagram should include transitions through these states and any appropriate triggers, guards and activities on those transitions.


Customer at ATM
Authentication
do/CheckPIN
entry/maskScreen
exit/unmaskScreen
Request withdraw transaction
[Authentication is successful]
WithdrawMoney
Request withdraw transaction
[amount <= balance]
Authentication is not successful
[Errorcount<Max]increase Errorcount
Customer finished
[confirmation is done]
Authentication is not successful
[Errorcount>Max] Authentication failed
Rejected

3. (a) List three aspects of *Wicked* problems that distinguish them from `Tame` problems.

[5%]

(b) Explain the main disadvantage of the bottom-up structured design strategy and describe the kind of situation in which this strategy would be more appropriate than a top-down strategy.

[5%]

(c) In the Rational Unified Process, what are the main outputs from the elaboration phase and what must be accomplished for this phase to be considered complete?

[5%]

3. (a)
- Problem is not understood until a solution has been built.
- Typically no clear point at which to stop work on the problem:
- Solutions to wicked problems do not have an absolute, black or white, right or wrong nature.
- A wicked problem is novel and unique.
- Evaluating proposed solutions is hard, and may involve subjective judgements.
- Wicked problems have no standard set of alternative solutions from which one can pick.

[5%]

(b) Disadvantage is the difficulty of obtaining a consistent integrated final design, often requiring backtracking in the design process, sometimes even major backtracks quite late in the design process.

This strategy is most useful when the requirements are particularly complicated or fuzzy, as the process naturally leads to extracting deeper understanding of requirements as they are needed.

[5%]

(c) Main outputs are conceptual model and a full set of use cases.

What must be accomplished are clear estimates of the length of time required to implement each use case (and hence a clear understanding of the use cases), and all significant risks have been identified and the major risks are well enough understood that reliable strategies to deal with them have been prepared. **[5%]**