

2. CSDP Step 5

Step 5: Add mandatory role constraints and check for logical derivations.

Mandatory and Optional Roles

Mandatory roles are represented by placing a dot on the role line closest to the object type. If a role is mandatory, it means that the object type must play that role. On the other hand, optional roles do not have a dot on the role line, indicating that the object type may or may not play that role.

Let's consider an example of a hospital system with patients. Each patient is identified by a unique patient number, and they must have a patient name.

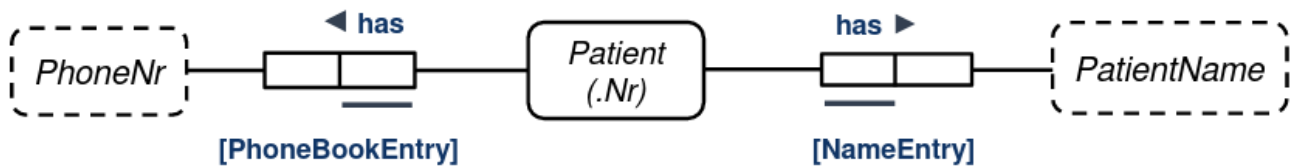
Example: Hospital Patients

Patient Nr.	Patient Name	Phone
001	Adams C	2057642
002	Brown S	?
003	Collins T	8853020

We record each patient's name, but it is optional whether we record a phone number.

The question mark "?" denotes a **NULL**, indicating that an actual value is not recorded.

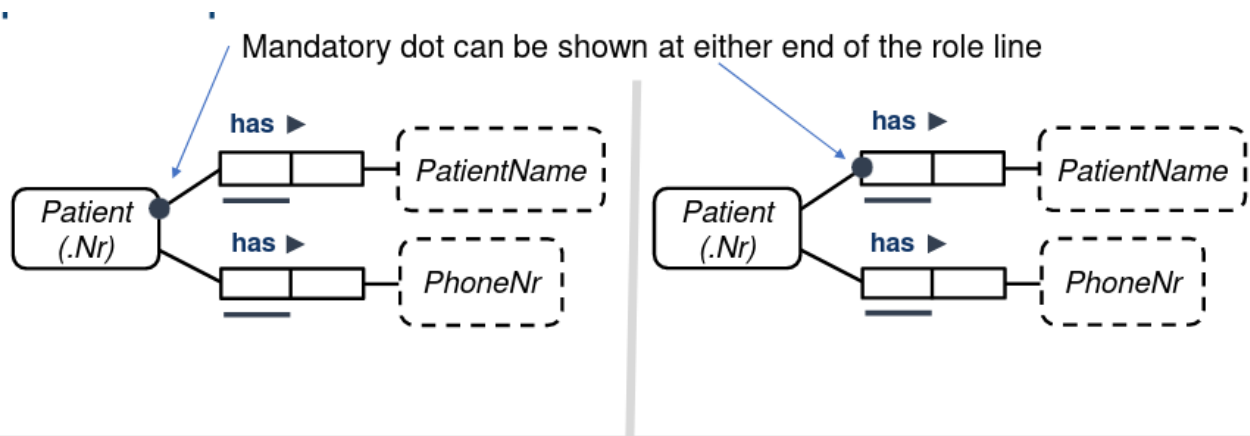
Therefore, the patient name is mandatory. When drawing the diagram, we place a mandatory dot on the role line connecting the Patient entity type to the patient name value type.



2057642	001
8853020	003

001
002
003

001	Adams C
002	Brown S
003	Collins T



Uniqueness constraints:

Each Patient has **at most one** PatientName.

Each Patient has **at most one** PhoneNr.

Mandatory constraints:

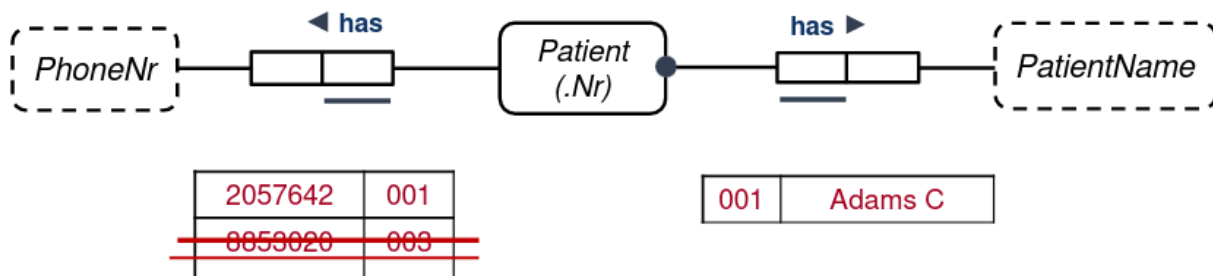
Each Patient has **some** PatientName.



Each Patient has **exactly one** PatientName.

If an entity type or value type plays only one role in a schema, it can be implied that this role is already mandatory (implied mandatory). However, it's preferable to explicitly state the

mandatory role by showing the dot at the appropriate point on the entity type.



Add: Patient 001 has PatientName 'Adams C'. → **accept**

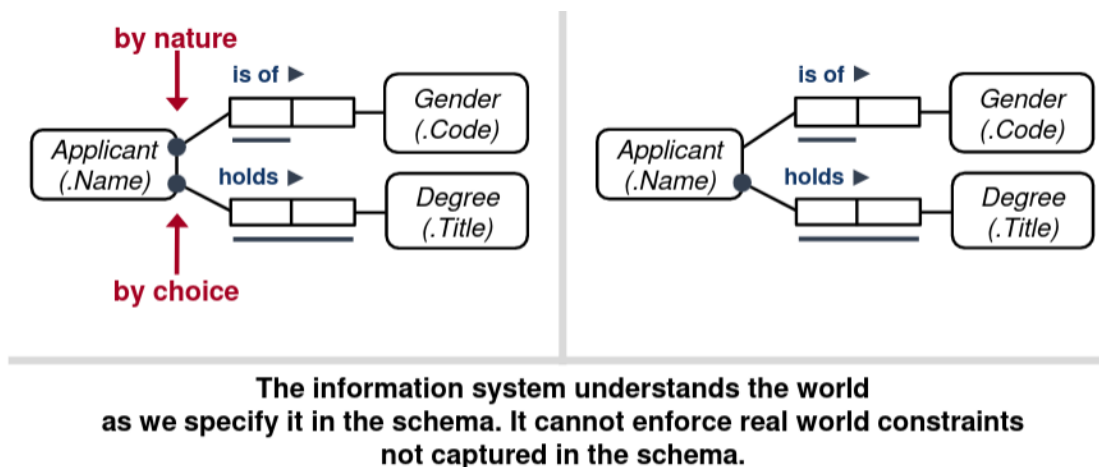
Add: Patient 001 has PhoneNr '2057642'. → **accept**

Add: Patient 003 has PhoneNr '8853020'. → **reject**

Violates mandatory constraint:
Each Patient has **some** PatientName.

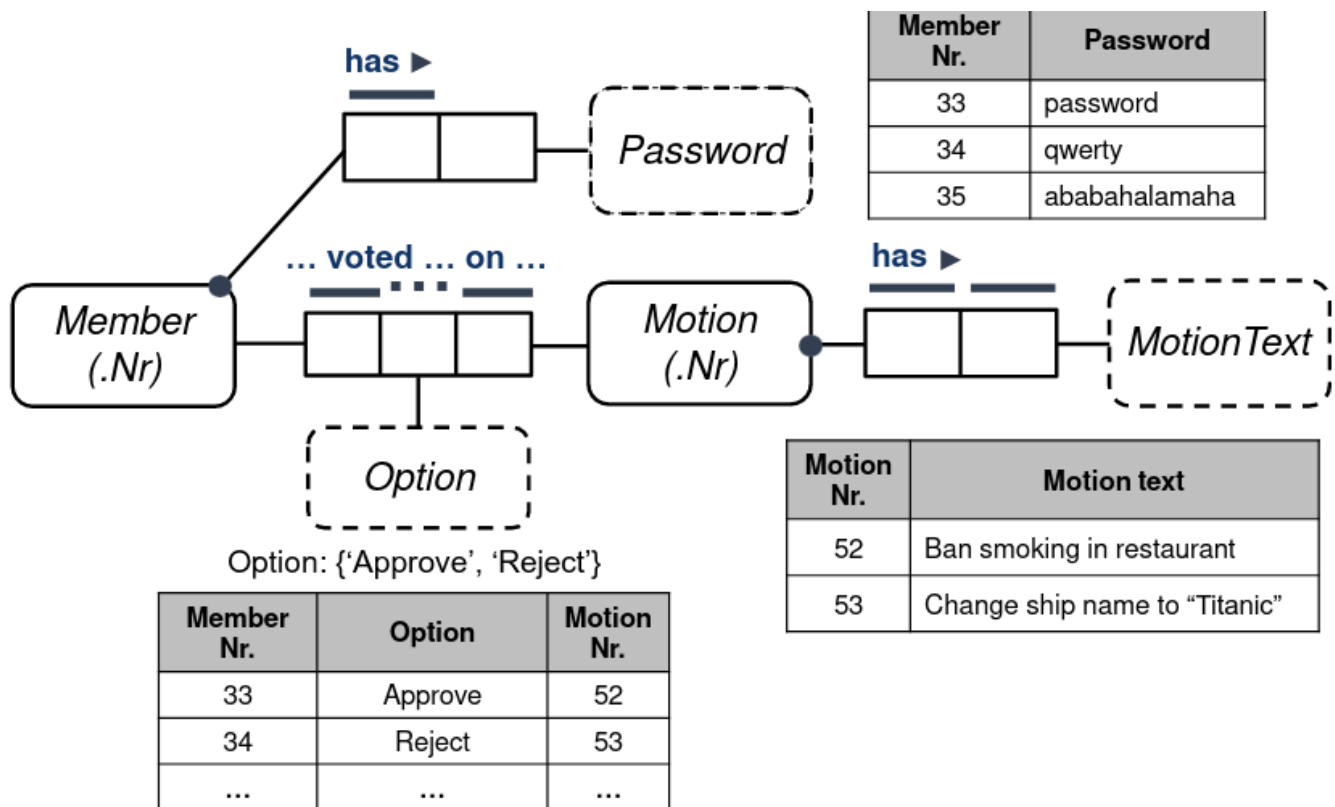
Disjunctive Mandatory Role Constraints

A disjunctive mandatory role constraint is represented by a circle with a dot inside it, placed on the roles. This constraint indicates that an object type must play at least one of the roles connected to the constraint.

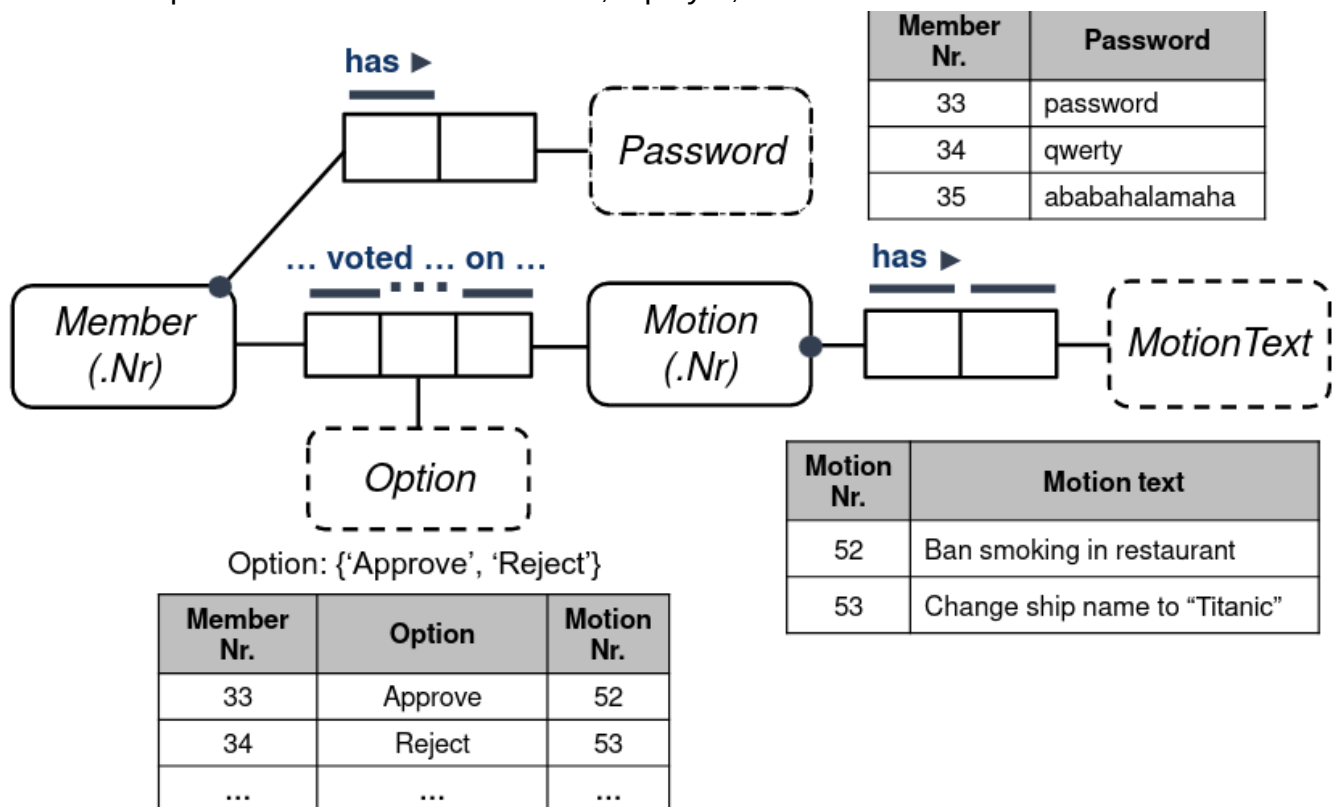


Towards checking mandatory role constraints:

- For each mandatory role: Is it mandatory in the real world? If not, make it optional.
- For each optional role: Is it optional in the real world? If not, what are the reasons for making it optional?



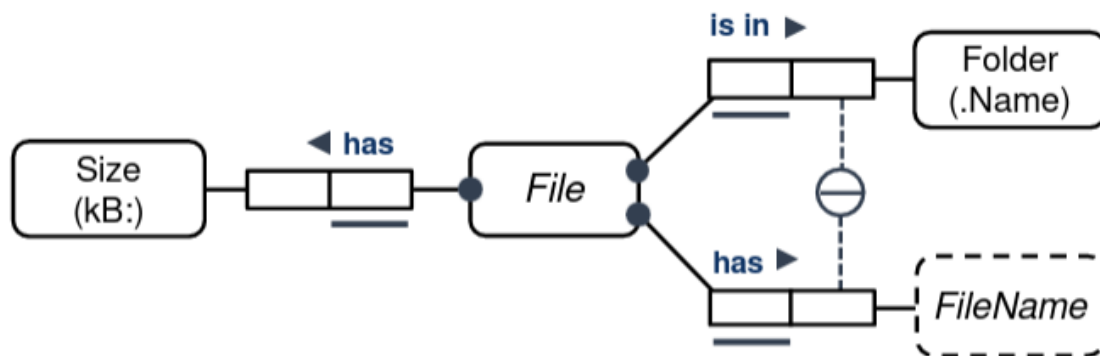
For example, consider a scenario where a person can be a coach, a player, or both a coach and a player for a team. In this case, we would use a disjunctive mandatory role constraint to show that a person must be either a coach, a player, or both.



Compound Reference Schemes

File		Size (kB)
Folder	Filename	
MyDocs	flag.vsd	35
MyDocs	orm1.doc	1324
OzWork	flag.vsd	40

Compound reference schemes involve using multiple roles to uniquely identify an object type. We represent this using an external uniqueness constraint, shown as a double bar connecting the roles.



**For each Folder and FileName
at most one File is in that Folder and has that FileName.**

In the example provided, we have a compound reference scheme where at most one file is in a folder and has a specific file name. The double bar indicates that the combination of folder and

file name is the preferred identifier for the File entity type.

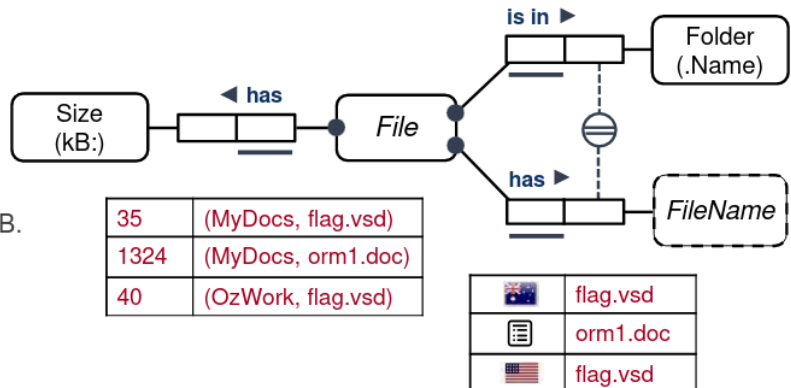
Compound Reference Schemes

Reference scheme:

- File (is in Folder, has FileName)

Fact instances:

- File ('MyDocs', 'flag.vsd') has Size 35kB.
- File ('MyDocs', 'orm1.doc') has Size 1324kB.
- File ('OzWork', 'flag.vsd') has Size 40kB.



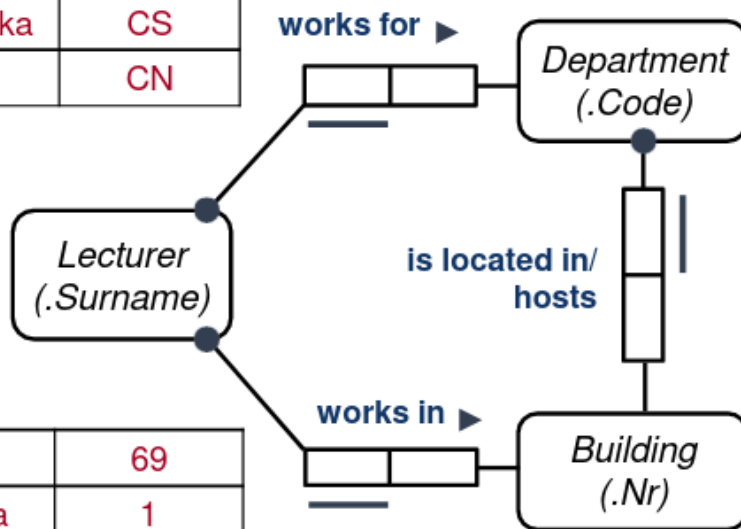
Logical Derivations

Logical derivations occur when a role can be derived from the existence of other roles in the schema. In the given example, the role "works in" between Lecturer and Building is derivable because if a lecturer works in a building if and only if the lecturer works in some department that is located in that building.

Lecturer	Department	Building
Halpin	CS	69
Okimura	JA	1
Orlowska	CS	69
Wang	CN	1

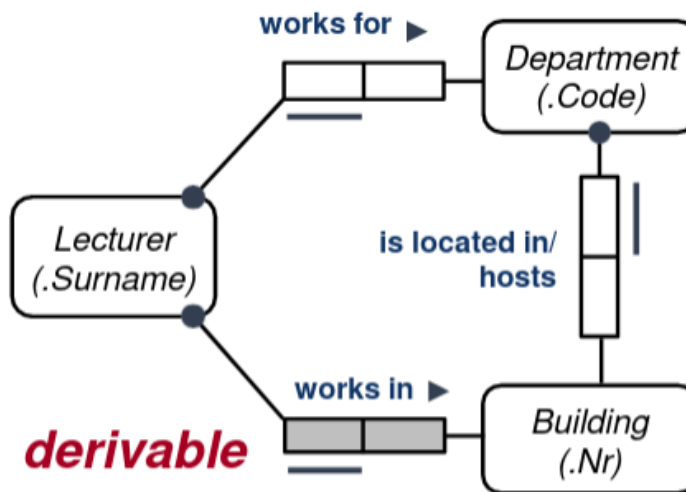
To identify logical derivations, we need to examine the relationships between entity types and look for roles that can be inferred from the presence of other roles.

Halpin	CS
Okimura	JA
Orlowska	CS
Wang	CN



CS	69
JA	1
CN	1

Halpin	69
Okimura	1
Orlowska	69
Wang	1



Lecturer works in Building
if and only if

Lecturer works for some Department that is located in that Building.

Key Points

- ◆ Mandatory roles are represented by a dot on the role line, while optional roles do not have a dot.
- ◆ Disjunctive mandatory role constraints indicate that an object type must play at least one of the connected roles.

- ◆ Compound reference schemes use multiple roles to uniquely identify an object type, represented by an external uniqueness constraint (double bar).
- ◆ Logical derivations occur when a role can be derived from the existence of other roles in the schema.

3. CSDP Step 6