

Data and Applications

# Relational Model and Normal Forms for Afterlife Management System

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## Stage 1: Mapping ER to Relational Model

**Step 1:** Converting Strong Entity types to Relations

- Souls [Caretaker\_Id FK references Caretaker]
- Caretakers [Manager\_ID FK to Caretakers]
- Species
- Punishments
- Composite attributes flattened (Name)

**Step 2:** Converting Weak Entity types to Relations

- Lives\_On\_Earth [Soul\_ID: FK→Souls, Species\_ID: FK→Species, Name flattened, PK: (Soul\_Id, DOB)]
- Deeds [Soul\_ID: FK→Souls, Description, Time flattened, Location flattened, Status. Score], we introduce a new Deed\_ID (partial key) attribute as the previous partial key (time) will be complicated to use.
- Punishment\_Assigned: [Soul\_ID: FK→Souls, Deed\_ID: FK→Deeds, Supervisor:FK→Caretakers, PK: (Soul\_ID, Deed\_Id, Punishment\_Action, Punishment\_ID)]

**Step 3:** Mapping of Binary 1:1 relationship types→None

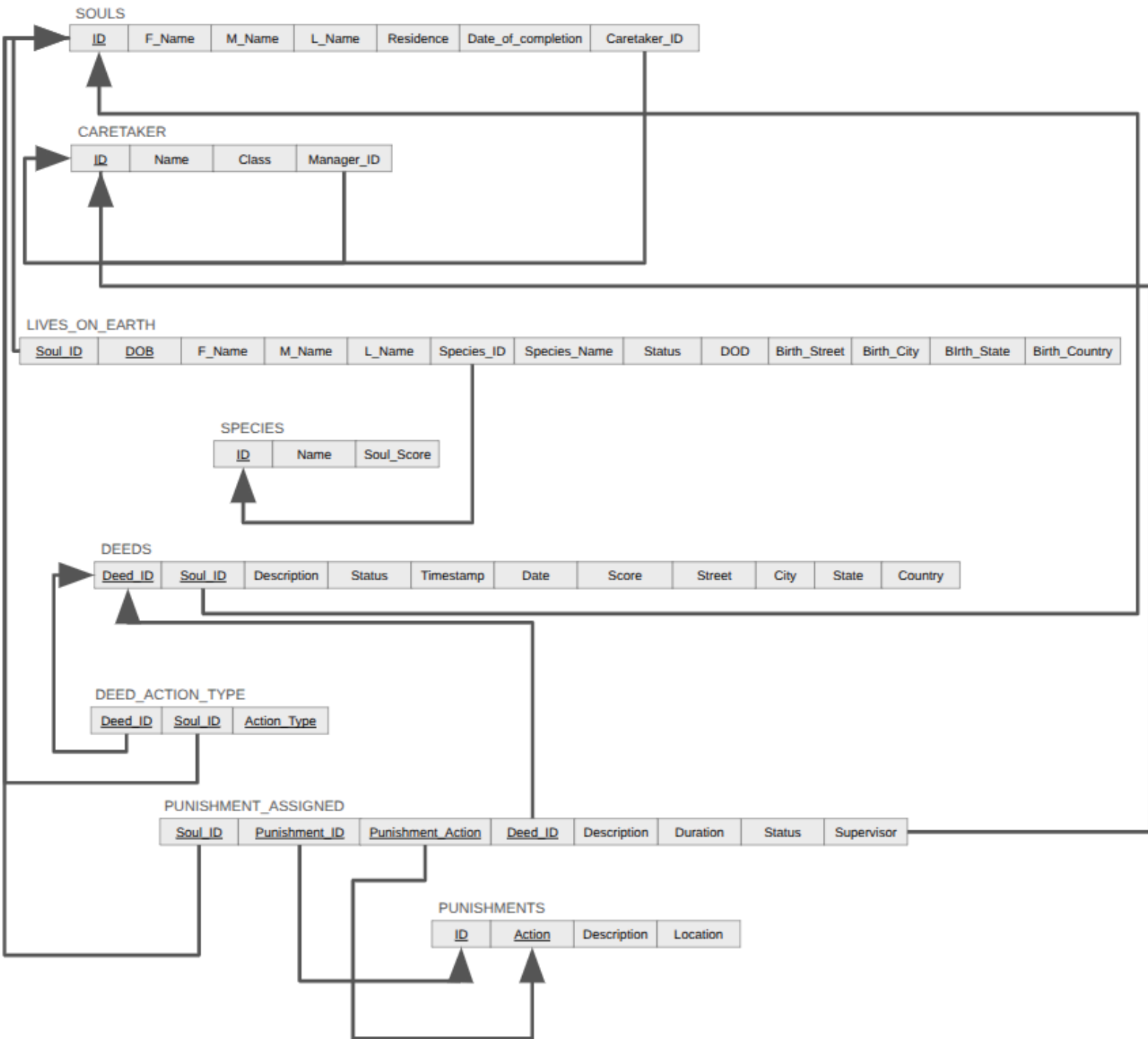
**Step 4:** Mapping Binary 1:N relationships: MANAGES, DEEDS\_DONE, SUPERVISION, SUPERVISES\_PUNISHMENT, ON\_EARTH all managed through foreign key approach.

**Step 5:** Mapping of Binary M:N relationship types→None

**Step 6:** Managing Multivalued attributes: Created another relation: Deeds\_Action\_Type

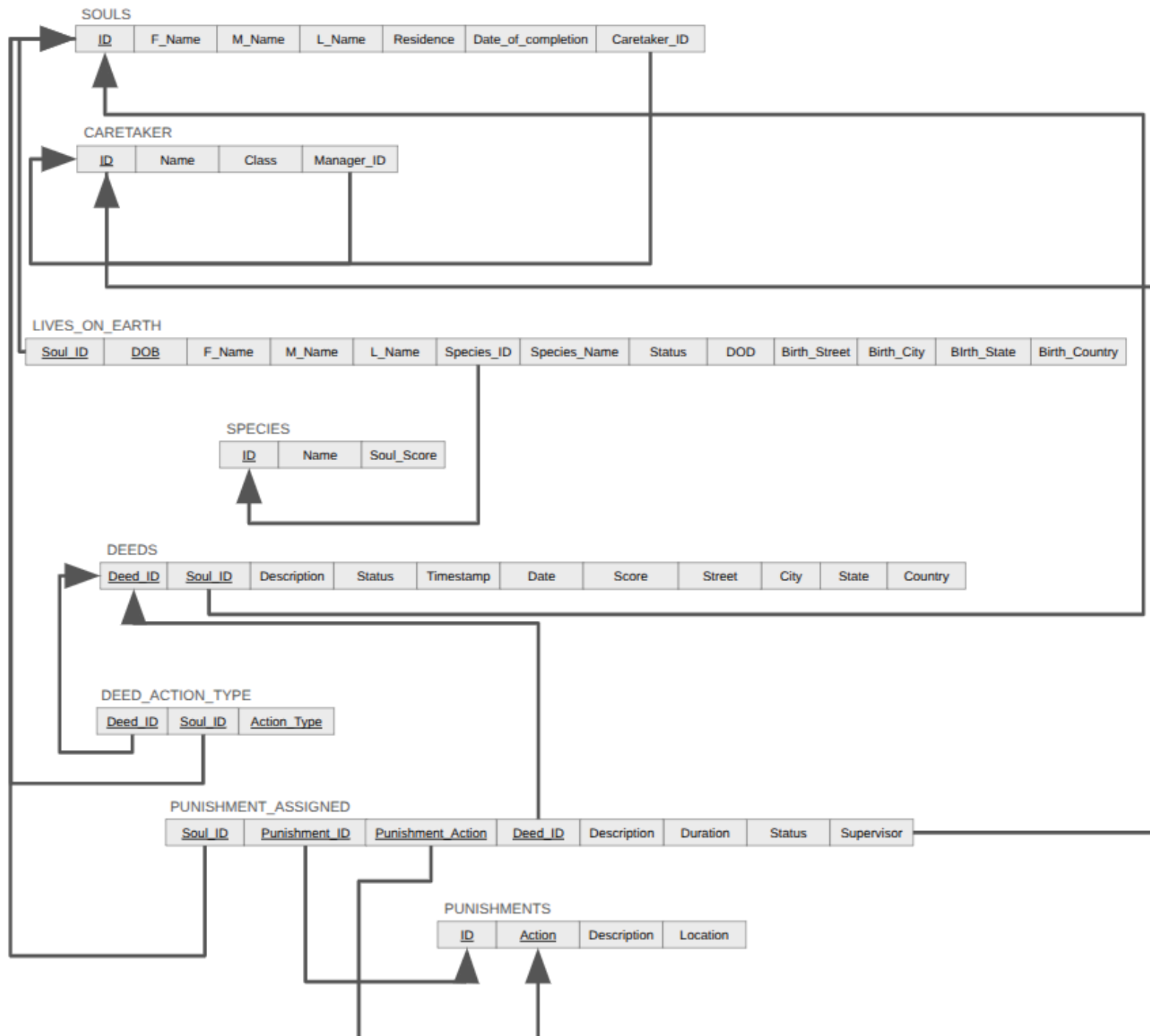
**Step 7:** Mapping of N-ary relationship types: ASSIGNMENT mapped as Punishment\_Assigned (added Deeds\_ID) relation and REBIRTH mapped as Lives\_On\_Earth

**Step 8:** For showing subclass hierarchy we have attribute **class** that acts as type attribute (option 8C)



## Stage 2: Conversion to 1NF

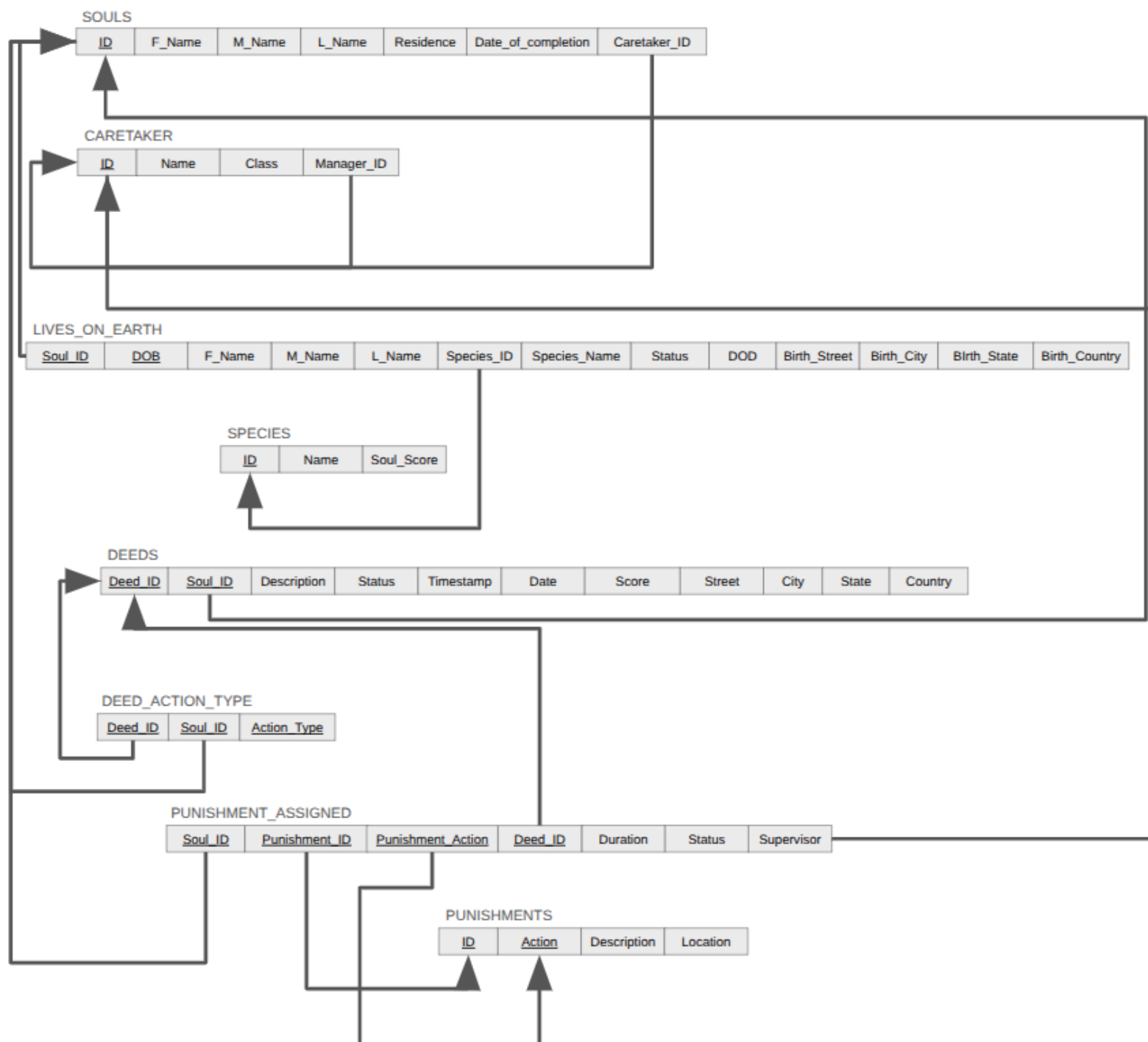
In 1NF, Relation should have no multivalued attributes or nested relations. Our current relational model is already in 1NF, there are no nested relations and the multivalued attribute Action\_Type was made into another relation.



## Stage 3 : Conversion to 2NF

In 2NF, For relations where the primary key contains multiple attributes, no nonkey attribute should be functionally dependent on a part of the primary key.

- In Punishments\_Assigned, Description is fully functionally dependent on (Punishment\_Id, Punishment\_Action) which is part of the primary key. Hence we split it into two Relations: Punishments\_Assigned (with Description removed) and Punishments (already exists).



## Stage 4: Conversion to 3NF

In 3NF, Relation should not have a nonkey attribute functionally determined by another nonkey attribute (or by a set of nonkey attributes). That is, there should be no transitive dependency of a nonkey attribute on the primary key.

- Lives\_On\_Earth: Removed Species\_Name which is dependent on Species\_Id

