1. Similar objects are grouped into entity sets
2. Determine the attributes (or properties) of objects in the sets. Usually choose one of the attributes of an entity or relationship set to be the identifier
3. Model all interactions between the objects in the entity sets by relationship and relationship sets
4. Model relationship cardinality
5. Model relationship participation
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Attributes

- Attribute - property or characteristic of an entity type

- Classifications of attributes:
  - Required versus Optional Attributes
  - Simple versus Composite Attribute (e.g. name)
  - Single-Valued versus Multi-valued Attribute (e.g. Qualifications)
  - Stored versus Derived Attributes (e.g. Age & DoB)
  - Identifier Attributes
    - Identifier - An attribute (or combination of attributes) that uniquely identifies individual instances of an entity type
    - Simple Key versus Composite Key
1. Similar objects are grouped into entity sets
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Relationships

- Relationship Types vs. Relationship Instances
  - The relationship type is modelled as the diamond and lines between entity types...the instance is between specific entity instances

- Relationships can have attributes
  - These describe features pertaining to the association between the entities in the relationship

- Two entities can have more than one type of relationship between them (multiple relationships)

- Associative Entity – combination of relationship and entity
ERD Example

MOVIE
- MovieID
- Title
- Duration
- Rating
- directed

CUSTOMER
- CustomerID
- FirstName
- LastName
- Address
- BirthDate
- PhoneNumber

PRODUCER
- companyId
- CompanyName
- Country

rent
- Date_Rented
- Due_Date

companyID
1. Similar objects are grouped into entity sets.
2. Determine the attributes (or properties) of objects in the sets. Usually, choose one of the attributes of an entity or relationship set to be the identifier.
3. Model all interactions between the objects in the entity sets by relationship and relationship sets.
4. **Model relationship cardinality**
5. Model relationship participation.
Cardinality of Relationships

- **One-to-One**
  - Each entity in the relationship will have exactly one related entity

- **One-to-Many**
  - An entity on one side of the relationship can have many related entities, but an entity on the other side will have a maximum of one related entity

- **Many-to-Many**
  - Entities on both sides of the relationship can have many related entities on the other side
1. Similar objects are grouped into entity sets
2. Determine the attributes (or properties) of objects in the sets. Usually choose one of the attributes of an entity or relationship set to be the identifier
3. Model all interactions between the objects in the entity sets by relationship and relationship sets
4. Model relationship cardinality
5. Model relationship participation
Mapping Rules (Simplified)

- Map Regular Entities
- Map Binary Relationships
  - One-to-many Relationships
  - Many-to-many relationships
MOVIE

<table>
<thead>
<tr>
<th>MovieID</th>
<th>Title</th>
<th>Duration</th>
<th>Rating</th>
</tr>
</thead>
</table>

Mapping Regular Entities
Mapping One-to-many relationships

- MOVIE
  - MovieID
  - Title
  - Duration
  - Rating
  - Rating
  - DirectorID

- PRODUCER
  - CompanyID
  - CompanyName
  - Country

- directed

- CompanyName
- Country
Mapping Many-to-many relationships

**MOVIE**
- MovieID
- Title
- Rating
- Duration

**CUSTOMER**
- CustomerID
- FirstName
- LastName
- Address
- PhoneNumber
- BirthDate
- Phone
- DoB

**RENTAL**
- MovieID
- CustomerID
- Due_Rented
- Due_Date
Resulting 4 Tables

<table>
<thead>
<tr>
<th>MOVIE</th>
<th>MovieID (PK)</th>
<th>Title</th>
<th>Audience</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIRECTOR</td>
<td>DirectorID (FK)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CUSTOMER</td>
<td>CustomerID (PK)</td>
<td>FName</td>
<td>LName</td>
<td>Address</td>
</tr>
<tr>
<td>RENTAL</td>
<td>CustomerID (FK)</td>
<td>MovieID (FK)</td>
<td>Date_Rented</td>
<td>Date_Due</td>
</tr>
<tr>
<td>COMPANY</td>
<td>CompanyID (PK)</td>
<td>CompanyName</td>
<td>Country</td>
<td></td>
</tr>
</tbody>
</table>

Any problems with Rental Table?
Metadata for Customer

- **Customer**
  - **FirstName** Character 30 First name
  - **LastName** Character 30 Last name
  - **Address** Character 60 Location
  - **PhoneNumber** Character 10 Telephone
  - **BirthDate** Date DD-MM-YY
  - **CustomerID** Character 8 Unique ID