**ER Diagram and Relational Schema Requirements**

**Entities and Relations:**

1. **Student**
   * **Relation**: Student (Reg\_ID, First\_Name, Last\_Name, Email\_ID, Mobile\_No, Attempt1\_Session, Attempt2\_Session)
   * **Primary Key (PK)**: Reg\_ID
   * Each student has basic information like name, email, mobile number, and session attempts.
2. **Test\_Session**
   * **Relation**: Test\_Session (Session\_ID, Batch\_ID, Session\_Date, Math\_Marks, Phy\_Marks, Chem\_Marks, Total\_Marks)
   * **Primary Key (PK)**: Session\_ID
   * **Foreign Key (FK)**: Batch\_ID (from **Exam\_Batch**)
   * This table holds the marks and session information for each test session.
3. **Percentile\_Rank**
   * **Relation**: Percentile\_Rank (Percentile\_ID, Reg\_ID, Total\_Percentile, Math\_Percentile, Phy\_Percentile, Chem\_Percentile, Final\_Rank)
   * **Primary Key (PK)**: Percentile\_ID
   * **Foreign Key (FK)**: Reg\_ID (from **Student**)
   * This stores the percentile and final rank of each student across sessions.
4. **Exam\_Batch**
   * **Relation**: Exam\_Batch (Batch\_ID, Batch\_Name, Start\_Date, End\_Date)
   * **Primary Key (PK)**: Batch\_ID
   * This holds the information about different exam batches, including start and end dates.
5. **Exam\_Registration** (Weak Entity)
   * **Relation**: Exam\_Registration (Registration\_ID, Reg\_ID, Batch\_ID, Session\_ID, Status)
   * **Primary Key (PK)**: Registration\_ID
   * **Foreign Keys (FK)**:
     + Reg\_ID (from **Student**)
     + Batch\_ID (from **Exam\_Batch**)
     + Session\_ID (from **Test\_Session**)
   * This is a weak entity that links students to their respective exam batches and test sessions.

**Relationships and Cardinality:**

1. **Student registers for Exam\_Batch**:
   * **Relationship**: Many-to-Many
   * **Relation**: The **Exam\_Registration** weak entity manages the **Many-to-Many** relationship between **Student** and **Exam\_Batch**.
   * **Cardinality**: Each student can register for multiple exam batches, and each batch can have many students.

**Relation Example**:  
Exam\_Registration (Registration\_ID, Reg\_ID, Batch\_ID, Session\_ID, Status)

1. **Student participates in Test\_Session**:
   * **Relationship**: Many-to-Many
   * **Relation**: The **Exam\_Registration** table also manages the **Many-to-Many** relationship between **Student** and **Test\_Session**. A student can participate in multiple test sessions.
   * **Cardinality**: Each test session can have multiple students, and each student can participate in multiple test sessions.

**Relation Example**:  
Exam\_Registration (Registration\_ID, Reg\_ID, Batch\_ID, Session\_ID, Status)

1. **Test\_Session contributes to Percentile\_Rank**:
   * **Relationship**: One-to-One
   * **Relation**: Each **Test\_Session** contributes to the computation of a student’s **Percentile\_Rank**. Each student gets a unique percentile based on the best session performance.
   * **Cardinality**: One student is assigned one final rank.

**Relation Example**:  
Percentile\_Rank (Percentile\_ID, Reg\_ID, Total\_Percentile, Math\_Percentile, Phy\_Percentile, Chem\_Percentile, Final\_Rank)

1. **Exam\_Batch contains Test\_Sessions**:
   * **Relationship**: One-to-Many
   * **Relation**: Each **Exam\_Batch** contains multiple **Test\_Session** records, but each **Test\_Session** is linked to only one **Exam\_Batch**.
   * **Cardinality**: One exam batch has multiple test sessions, but each session belongs to one batch.

**Relation Example**:  
Test\_Session (Session\_ID, Batch\_ID, Session\_Date, Math\_Marks, Phy\_Marks, Chem\_Marks, Total\_Marks)

**Complete Set of Relations for the ER Diagram:**

1. **Student**  
   (Reg\_ID, First\_Name, Last\_Name, Email\_ID, Mobile\_No, Attempt1\_Session, Attempt2\_Session)
2. **Test\_Session**  
   (Session\_ID, Batch\_ID, Session\_Date, Math\_Marks, Phy\_Marks, Chem\_Marks, Total\_Marks)
3. **Percentile\_Rank**  
   (Percentile\_ID, Reg\_ID, Total\_Percentile, Math\_Percentile, Phy\_Percentile, Chem\_Percentile, Final\_Rank)
4. **Exam\_Batch**  
   (Batch\_ID, Batch\_Name, Start\_Date, End\_Date)
5. **Exam\_Registration**  
   (Registration\_ID, Reg\_ID, Batch\_ID, Session\_ID, Status)

**Cardinality Summary:**

* **Student ↔ Exam\_Batch**: Many-to-Many (managed through **Exam\_Registration**)
* **Student ↔ Test\_Session**: Many-to-Many (managed through **Exam\_Registration**)
* **Test\_Session ↔ Percentile\_Rank**: One-to-One (Each student gets one percentile)
* **Exam\_Batch ↔ Test\_Session**: One-to-Many (Each batch can have many sessions)