**Lab: Data Modeling Review & Enhancement**

**Objective:**  
Perform a structured modeling lab covering ERD and star schema peer review, grain/SCD validation, model refactoring, logical to physical mapping, and lab fixes.

**Step 1: ERD and Star Schema Peer Review**

**Goal:** Ensure correctness and completeness of ERD and star schema.

**Tasks:**

1. Review ERD:
   * Each entity must have a primary key.
   * All relationships must use valid foreign keys.
   * Verify attribute naming consistency.
2. Review star schema:
   * Confirm denormalized dimension structure.
   * Check fact table links to dimension tables.
   * Ensure no unnecessary snowflaking.
   * Surrogate keys must exist in dimension tables.

**Output:** Annotated ERD and star schema with review comments.

**Step 2: Grain and SCD Checklist**

**Goal:** Define fact table grain and evaluate SCD implementation in dimensions.

**Tasks:**

1. Define the grain of each fact table:
   * Example: "1 row per invoice line"
   * Ensure grain is uniform across associated dimensions.
2. Review each dimension for SCD applicability:
   * Type 0: No changes allowed
   * Type 1: Overwrite changes
   * Type 2: Track historical changes (add start\_date, end\_date, is\_current)
   * Type 3: Limited history in same row
3. Ensure dimensions using Type 2 have:
   * Surrogate keys
   * Change detection mechanism (hash, audit fields)

**Output:** Grain definition and SCD type documentation per table.

**Step 3: Refactor Based on Feedback**

**Goal:** Apply improvements to schema from review observations.

**Tasks:**

1. Rename columns or tables for clarity and consistency.
2. Introduce or correct surrogate keys.
3. Normalize/denormalize structures based on performance and access patterns.
4. Remove redundancy and circular relationships.
5. Adjust column types, null constraints, and default values.

**Output:** Refactored ERD and updated star schema.

**Step 4: Logical to Physical Mapping**

**Goal:** Implement a physical schema from the logical model.

**Tasks:**

1. Map entities and attributes to physical tables and columns.
2. Generate CREATE TABLE statements:
   * Define primary/foreign keys
   * Choose appropriate data types
3. Add physical-level elements:
   * Indexes on keys and lookup fields
   * Table partitioning strategy (if applicable)
   * Computed columns (where necessary)

**Output:** SQL file with physical schema.

**Step 5: Apply Mini-Lab Fixes**

**Goal:** Correct specific issues in the mini-lab data model.

**Tasks:**

1. Fix incorrect cardinality in ERD relationships.
2. Reassign grain definitions for misaligned fact tables.
3. Add surrogate keys to dimensions missing them.
4. Rename tables or attributes for clarity.
5. Enforce proper nullability and constraints.

**Output:** Corrected ERD and revised schema script.

**Final Checklist:**

* ERD and Star Schema reviewed
* Grain and SCD strategy documented
* Feedback incorporated in model
* Physical model implemented
* Mini-lab issues fixed