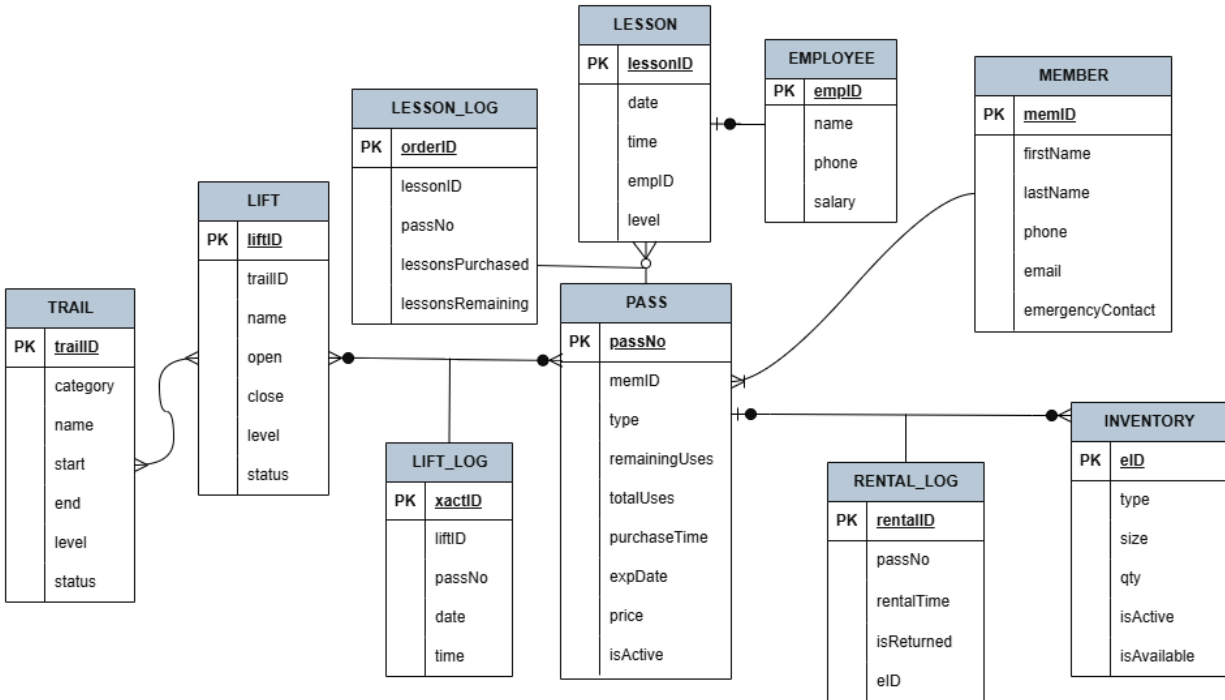# ENTITY RELATIONSHIP DIAGRAM

Entities and Attributes:

1. MEMBER
   a. Represents individuals registered at the resort.
   b. Attributes: memID (PK), firstName, lastName, phone, email, emergencyContact.
   c. Each member is uniquely identified by memID and may purchase multiple passes, rent equipment, and book lessons.
2. PASS
   a. Represents a ski pass associated with a member.
   b. Attributes: passNo (PK), memID (FK), type, remainingUses, totalUses, purchaseTime, expDate, price, isActive
   c. The isActive flag allows for archival without deletion. A pass is valid until uses are exhausted or the expiration date is reached.
3. EMPLOYEE
   a. Represents instructors and staff working at the resort
   b. Attributes: empID (PK), name, phone, salary
   c. Employees are linked to lessons they teach, if applicable.
4. LESSON
   a. Represents a scheduled lesson session.
   b. Attributes: lessonID (PK), date, time, empID (FK), level.

     c. Lessons are assigned an instructor and associated with a skill level (e.g., beginner, intermediate).

5. LESSON_LOG
    a. Tracks lesson purchases and uses by members.
    b. Attributes: orderID (PK), lessonID (FK), passNo (FK), lessonsPurchased, lessonsRemaining.
    c. Reflects a M:N relationship between PASS (via passNo) and LESSON.

6. TRAIL
    a. Represents a ski trail at the resort
    b. Attributes: trailID (PK), category, name, start, end, level, status
    c. Trails are categorized by difficulty level (beginner, intermediate, expert), and category (groomed, park, moguls, and glade skiing).
    d. The status flag indicates whether a trail is currently open or not.

7. LIFT
    a. Represents ski lifts connected to trails.
    b. Attributes: liftID (PK), trailID (FK), name, open, close, level, status.
    c. Lifts operate on specific trails and are categorized by difficulty level.
    d. The status flag again indicates whether a lift is currently operational.

8. LIFT_LOG
    a. Tracks lift usage per ski pass.
    b. Attributes: xactID (PK), liftID (FK), passNo (FK), date, time
    c. Records when and where a pass was used.
    d. Reflects a M:N relationship between PASS and LIFT.

9. INVENTORY
    a. Represents available equipment for rent
    b. Attributes: eID (PK), type, size, qty, isActive, isAvailable.
    c. The isActive flag indicates whether equipment is archived. The isAvailable flag is used to check whether a piece of equipment is currently rented out or reserved.

10. RENTAL_LOG
    a. Tracks rental activity.
    b. Attributes: rentalID (PK), passNo (FK), rentalTime, isReturned, eID (FK)
    c. Records when equipment is rented and whether it has been returned.
    d. Implements a 1:M relationship between PASS and INVENTORY

Relationships:

1. MEMBER–PASS
    a. Cardinality: 1:M. A member may own multiple passes.

2. PASS–LIFT_LOG
    a. Cardinality: 1:M. A pass may be used on multiple lifts.

3. PASS–RENTAL_LOG
    a. Cardinality: 1:M. Rentals are tied to specific passes.
4. PASS–LESSON_LOG
    a. Cardinality: 1: M. Lesson purchases are tracked per pass.
5. EMPLOYEE–LESSON
    a. Cardinality: 1:M. An instructor may teach many lessons.
6. LIFT–LIFT_LOG
    a. Cardinality: 1:M. Logs reflect each instance a lift is used.
7. TRAIL–LIFT
    a. Cardinality: 1:M. A trail can have multiple lifts.
8. INVENTORY–RENTAL_LOG
    a. Cardinality: 1:M. Each rental log references a specific item.

Additional Information/Constraints:
1. Deletion:
    a. Members cannot be deleted if they have active passes, rentals, or lessons remaining.
    b. Passes are only deletable (archived) if expired and fully used.
    c. Equipment must not be deleted unless it's not rented or reserved.
2. Additional attribute information:
    a. isActive flags in PASS and INVENTORY are used to archive rather than delete passes and equipment.
    b. isAvailable and isReturned track status of equipment.

Normalization Analysis

All of the relations along with their functional dependencies are listed below. They each have a similar argument for 3NF or BCNF, so for simplicity, I will do the normalization analysis altogether.

1NF: None of the tables contain set-valued attributes; therefore, they are all in 1NF.

2NF: The only prime attribute and candidate key of each table is its primary key. Furthermore, each FD only contains that key on its LHS, so removing it would necessarily destroy the FD. This means that each FD is a full functional dependency, and that the table is in 2NF.

3NF: A relation is in 3NF if, for every non-trivial FD X-> A that holds, either X is a superkey of the relation, or A is a prime attribute. Notice that each relation has only one non-trivial FD. In each FD, X = primary key of the relation, which is also a superkey. Therefore, each table is in 3NF.

BCNF: That each FD meets only the first requirement of 3NF implies that each table is also in **BCNF**, which requires that for each functional dependency X->A, X is a superkey of the underlying relation.

1. MEMBER
   Functional Dependencies:
         memID -> firstName, lastName, phone, email, emergencyContact

2. PASS
   Functional Dependencies:
         passNo -> memID, type, remainingUses, totalUses, purchaseTime, expDate, price, isActive

3. EMPLOYEE
   Functional Dependencies:
         empID -> name, phone, salary

4. LESSON
   Functional Dependencies:
         lessonID -> date, time, empID, level

5. LESSON_LOG
   Functional Dependencies:
         orderID -> memID, lessonID, lessonsPurchased, lessonsRemaining

6. TRAIL
   Functional Dependencies:
          trailID -> name, level, start, end, status, category

7. LIFT
   Functional Dependencies:
          liftID -> name, open, close, trailID, level, status

8. LIFT_LOG
   Functional Dependencies:
          xactID -> liftID, passNo, date, time

9. INVENTORY
   Functional Dependencies:
          eID -> type, size, qty, isActive, isAvailable
          isActive -> isAvailable

10. RENTAL_LOG
    Functional Dependencies:
           rentalID -> passNo, rentalTime, isReturned

Self-designed Query

For a date entered by the user, show all instructors who had scheduled lessons and how many students each taught.

This query can be used to see demand trends for lessons, as well as to assess the distribution and scheduling of instructors. It can help management better understand which instructors are popular and which days are most popular for lessons.This can affect scheduling, pricing, and revenue.