1. **Relational Schema**
    1. Patron(patronID: VARCHAR(20) PK, name: VARCHAR(50), email: VARCHAR(50) UNIQUE NOT NULL)
    2. SkiInstructor(employeeID: VARCHAR(20) PK, name: VARCHAR(50), availability: VARCHAR(50))
    3. Class(date: DATE, classLevel: VARCHAR(20), capacity: INT, instructorID: VARCHAR(20) FK, liftNumber: VARCHAR(20) FK, PK(date, classLevel))
    4. Take(patronID: VARCHAR(20) PK, date: DATE, classLevel: VARCHAR(20))
    5. Rental(date: DATE, height: FLOAT, footSize: FLOAT, equipmentType: VARCHAR(20),

       patronID: VARCHAR(20) FK, PK(date, patronID))

    6. SkiLift(liftNumber: VARCHAR(20) PK, capacity: INT, status: VARCHAR(20))
    7. SkiRun(runNumber: VARCHAR(20) PK, difficulty: VARCHAR(20), status:

       VARCHAR(20))

    8. LiftTicket(ticketNo: VARCHAR(20) PK, discountType: VARCHAR(20),

       discountPercentage: INT, patronID: VARCHAR(20) FK)

    9. DayTicket(ticketNo: VARCHAR(20) PK, date: DATE, FK: VARCHAR(20) FK)
    10. SeasonPass(ticketNo: VARCHAR(20) PK, season: VARCHAR(20), FK: VARCHAR(20)

        FK)

    11. Restaurant(name: VARCHAR(50), capacity: INT, timing: VARCHAR(50))
    12. EatsAt(patronID: VARCHAR(20) FK, restaurantName: VARCHAR(20) FK,

        PK(patronID,restaurantName))

    13. Discount(ticketNo: VARCHAR(20) FK, restaurantName: VARCHAR(20) FK, PK(ticketNo,

        restaurantName))

    14. Accesses(runNumber: VARCHAR(20) FK, liftNumber: VARCHAR(20) FK,

        PK(runNumber, liftNumber))

5. Functional Dependencies

Patron:

SkiInstructor: Class:
Take: Rental:

SkiLift: SkiRun: LiftTicket:

DayTicket: SeasonPass:

patronID -> name, email
email -> patronID, name
employeeID -> name, availability
date, classLevel -> capacity, instructorID, liftNumber patronID -> date, classLevel
patronID, date -> height, footSize, equipmentType patronID -> height, footSize
liftNumber -> capacity, status
runNumber -> difficulty, status
ticketNo -> discountType, discountPercentage, patronID discountType -> discountPercentage
ticketNo -> date
ticketNo->season

Restaurant: restaurantID -> name, capacity

6. Normalization

We will normalize to 3NF.

Patron: Already in 3NF.
Patron(patronID: VARCHAR(20) PK, name: VARCHAR(50), email: VARCHAR(50) UNIQUE NOT NULL)

SkiInstructor: Already in 3NF.
SkiInstructor(employeeID: VARCHAR(20) PK, name: VARCHAR(50), availability: VARCHAR(50))

Class: Already in 3NF.
Class(date: DATE, classLevel: VARCHAR(20), capacity: INT, instructorID: VARCHAR(20) FK, liftNumber: VARCHAR(20) FK, PK(date, classLevel))

Take: Already in 3NF.
Take(patronID: VARCHAR(20) PK, date: DATE, classLevel: VARCHAR(20))

Rental:
Rental(date: DATE, height: FLOAT, footSize: FLOAT, equipmentType: VARCHAR(20), patronID: VARCHAR(20) FK, PK(date, patronID))
Minimal Cover:

patronID, date -> equipmentType patronID -> height
patronID -> footSize

(Does not violate 3NF.)

Decomposition to BCNF:
Rental1(date: DATE, patronID, equipmentType, footSize, PK(patronID, date))
Rental2(patronID PK FK, height)
Rental3(date, patronID, equipmentType, PK(patronID, date)) Rental4(patronID PK FK, footSize)

We keep Rental2, Rental3, and Rental4. All FDs are preserved.

SkiLift: Already in 3NF.
SkiLift(liftNumber: VARCHAR(20) PK, capacity: INT, status: VARCHAR(20))

SkiRun: Already in 3NF.
SkiRun(runNumber: VARCHAR(20) PK, difficulty: VARCHAR(20), status: VARCHAR(20))

LiftTicket:
LiftTicket(ticketNo: VARCHAR(20) PK, discountType: VARCHAR(20), discountPercentage: INT, patronID: VARCHAR(20) FK)
Minimal Cover:

ticketNo -> discountType (Does not violate 3NF.) ticketNo -> discountPercentage (Does not violate 3NF.)

ticketNo -> patronID (Does not violate 3NF.)

discountType -> discountPercentage Decomposition to BCNF:

LiftTicket1(ticketNo: VARCHAR(20) PK, discountType: VARCHAR(20) FK, patronID: VARCHAR(20) FK)

LiftTicket2(discountType VARCHAR(20) PK, discountPercentage: INT) We keep both LiftTicket1 and LiftTicket2. All FDs are preserved.

DayTicket: Already in 3NF.
DayTicket(ticketNo: VARCHAR(20) PK, date: DATE, FK: VARCHAR(20) FK)

SeasonPass: Alreadyin3NF.
SeasonPass(ticketNo: VARCHAR(20) PK, season: VARCHAR(20), FK: VARCHAR(20) FK)

Restaurant: Already in 3NF.
Restaurant(name: VARCHAR(50), capacity: INT, timing: VARCHAR(50))

EatsAt: Already in 3NF.
EatsAt(patronID: VARCHAR(20) FK, restaurantName: VARCHAR(20) FK, PK(patronID,restaurantName))

Discount: Already in 3NF.
Discount(ticketNo: VARCHAR(20) FK, restaurantName: VARCHAR(20) FK, PK(ticketNo, restaurantName))

Accesses: Already in 3NF.
Accesses(runNumber: VARCHAR(20) FK, liftNumber: VARCHAR(20) FK, PK(runNumber, liftNumber))

7. DDL Statements

```
CREATE TABLE Patron (
   patronID VARCHAR(20) PRIMARY KEY,
   name VARCHAR(50),
   email VARCHAR(50) UNIQUE NOT NULL

);

CREATE TABLE SkiInstructor (
   employeeID VARCHAR(20) PRIMARY KEY,
   name VARCHAR(50),
   availability VARCHAR(50)
);
CREATE TABLE Class (


);

date DATE,
classLevel VARCHAR(20),
capacity INT,
instructorID VARCHAR(20),
liftNumber VARCHAR(20),
PRIMARY KEY (date, classLevel),
FOREIGN KEY (instructorID) REFERENCES SkiInstructor(employeeID)
   ON DELETE SET NULL,
FOREIGN KEY (liftNumber) REFERENCES SkiLift(liftNumber)
   ON DELETE SET NULL
CREATE TABLE Take (
   patronID VARCHAR(20),
   date DATE,
   classLevel VARCHAR(20),
   PRIMARY KEY (patronID, date, classLevel),
   FOREIGN KEY (patronID) REFERENCES Patron(patronID)
      ON DELETE CASCADE,
   FOREIGN KEY (date, classLevel) REFERENCES Class(date, classLevel)
```

```
      ON DELETE CASCADE

);

CREATE TABLE Rental2 (
   patronID VARCHAR(20) PRIMARY KEY,
   height FLOAT,
   FOREIGN KEY (patronID) REFERENCES Patron(patronID)
      ON DELETE CASCADE

);

CREATE TABLE Rental3 (
   date DATE,
   patronID VARCHAR(20),
   equipmentType VARCHAR(20),
   PRIMARY KEY (patronID, date),
   FOREIGN KEY (patronID) REFERENCES Patron(patronID)
      ON DELETE CASCADE
CREATE TABLE Rental4 (

);

);

patronID VARCHAR(20) PRIMARY KEY,
footSize FLOAT,
FOREIGN KEY (patronID) REFERENCES Patron(patronID)
   ON DELETE CASCADE
CREATE TABLE SkiLift (
   liftNumber VARCHAR(20) PRIMARY KEY,
   capacity INT,
   status VARCHAR(20)

);

CREATE TABLE SkiRun (
   runNumber VARCHAR(20) PRIMARY KEY,
   diff5culty VARCHAR(20),
   status VARCHAR(20)

);

CREATE TABLE LiftTicket1 (
   ticketNo VARCHAR(20) PRIMARY KEY,
   discountType VARCHAR(20),
   patronID VARCHAR(20),
   FOREIGN KEY (patronID) REFERENCES Patron(patronID)
      ON DELETE CASCADE,
```

```
   FOREIGN KEY (discountType) REFERENCES LiftTicket2(discountType)
      ON DELETE CASCADE

);

CREATE TABLE LiftTicket2 (
   discountType VARCHAR(20) PRIMARY KEY,
   discountPercentage INT

);

CREATE TABLE DayTicket (
   ticketNo VARCHAR(20) PRIMARY KEY,
   date DATE,
   FOREIGN KEY (ticketNo) REFERENCES LiftTicket1(ticketNo)
      ON DELETE CASCADE
CREATE TABLE SeasonPass (

);

);

ticketNo VARCHAR(20) PRIMARY KEY,
season VARCHAR(20),
FOREIGN KEY (ticketNo) REFERENCES LiftTicket1(ticketNo)
   ON DELETE CASCADE
CREATE TABLE Restaurant (
   name VARCHAR(50) PRIMARY KEY,
   capacity INT,
   timing VARCHAR(50)

);

CREATE TABLE EatsAt (
   patronID VARCHAR(20),
   restaurantName VARCHAR(20),
   PRIMARY KEY (patronID, restaurantName),
   FOREIGN KEY (patronID) REFERENCES Patron(patronID)
      ON DELETE CASCADE,
   FOREIGN KEY (restaurantName) REFERENCES Restaurant(name)
      ON DELETE CASCADE

);

CREATE TABLE Discount (
   ticketNo VARCHAR(20),
   restaurantName VARCHAR(20),
   PRIMARY KEY (ticketNo, restaurantName),
   FOREIGN KEY (ticketNo) REFERENCES LiftTicket1(ticketNo)
```

```
    ON DELETE CASCADE,
  FOREIGN KEY (restaurantName) REFERENCES Restaurant(name)
    ON DELETE CASCADE

);

CREATE TABLE Accesses (
  runNumber VARCHAR(20),
  liftNumber VARCHAR(20),
  PRIMARY KEY (runNumber, liftNumber),
  FOREIGN KEY (runNumber) REFERENCES SkiRun(runNumber)
    ON DELETE CASCADE,
  FOREIGN KEY (liftNumber) REFERENCES SkiLift(liftNumber)
    ON DELETE CASCADE

);
```

8. Insert Statements

1.Patron

```
INSERT INTO Patron (patronID, name, email) VALUES ('P001', 'Jake
John', 'jjohn2@gmail.com');
INSERT INTO Patron (patronID, name, email) VALUES ('P002', 'Lili
Henrik', 'lilihenn@gmail.com');
INSERT INTO Patron (patronID, name, email) VALUES ('P003', 'Jasper
Deasey', 'jasperstezy@gmail.com');
INSERT INTO Patron (patronID, name, email) VALUES ('P004', 'Ella
Krav', 'ellakrav@gmail.com');
INSERT INTO Patron (patronID, name, email) VALUES ('P005', 'Blake
Smith', 'smithblake@gmail.com');
INSERT INTO Patron (patronID, name, email) VALUES ('P006', 'Emily
Johnson', 'emily.j@gmail.com');
INSERT INTO Patron (patronID, name, email) VALUES ('P007', 'Sarah
Brown', 'sbrown@gmail.com');
INSERT INTO Patron (patronID, name, email) VALUES ('P008', 'David
Wilson', 'dave.r.wilson@gmail.com');
INSERT INTO Patron (patronID, name, email) VALUES ('P009', 'Jessica
Martinez', 'jess.mrtnz@gmail.com');
```

2.Ski Instructor

```
INSERT INTO SkiInstructor (employeeID, name, availability) VALUES
('E001', 'Instructor One', 'Available');
INSERT INTO SkiInstructor (employeeID, name, availability) VALUES
('E002', 'Instructor Two', 'Available');
INSERT INTO SkiInstructor (employeeID, name, availability) VALUES
('E003', 'Instructor Three', 'Available');
INSERT INTO SkiInstructor (employeeID, name, availability) VALUES
('E004', 'Instructor Four', 'Available');
INSERT INTO SkiInstructor (employeeID, name, availability) VALUES
```

('E005', 'Instructor Five', 'Unavailable');

3. Class

```
INSERT INTO Class (date, classLevel, capacity, instructorID,
liftNumber) VALUES ('2024-12-20', 'Beginner', 5, 'E001', 'L001');
INSERT INTO Class (date, classLevel, capacity, instructorID,
liftNumber) VALUES ('2024-12-20', 'Intermediate', 10, 'E001', 'L002');
INSERT INTO Class (date, classLevel, capacity, instructorID,
liftNumber) VALUES ('2024-12-21', 'Advanced', 10, 'E001', 'L004');
INSERT INTO Class (date, classLevel, capacity, instructorID,
liftNumber) VALUES ('2024-12-22', 'Beginner', 10, 'E001', 'L001');
INSERT INTO Class (date, classLevel, capacity, instructorID,
liftNumber) VALUES ('2024-12-22', 'Intermediate', 10, 'E001', 'L002');
```

4. Take

```
INSERT INTO Take (patronID, date, classLevel) VALUES ('P001',
'2024-12-20', 'Beginner');
INSERT INTO Take (patronID, date, classLevel) VALUES ('P001',
'2024-07-22', 'Beginner');
INSERT INTO Take (patronID, date, classLevel) VALUES ('P002',
'2024-12-21', 'Advanced');
INSERT INTO Take (patronID, date, classLevel) VALUES ('P004',
'2024-12-20', 'Intermediate');
INSERT INTO Take (patronID, date, classLevel) VALUES ('P005',
'2024-12-22', 'Intermediate');
```

5. Rental

```
INSERT INTO Rental3 (date, patronID, equipmentType) VALUES
('2024-12-20', 'P001', 'Skis+Boots');
INSERT INTO Rental3 (date, patronID, equipmentType) VALUES
('2024-12-22', 'P001', 'Skis+Boots');
INSERT INTO Rental3 (date, patronID, equipmentType) VALUES
('2024-12-20', 'P004', 'Skis+Boots');
INSERT INTO Rental3 (date, patronID, equipmentType) VALUES
('2024-12-22', 'P005', 'Boots');
INSERT INTO Rental3 (date, patronID, equipmentType) VALUES
('2024-12-27', 'P005', 'Boots');
INSERT INTO Rental2 (patronID, height) VALUES ('P001', 5.8);
INSERT INTO Rental2 (patronID, height) VALUES ('P004', 6.1);
INSERT INTO Rental2 (patronID, height) VALUES ('P005', 5.8);
INSERT INTO Rental4 (patronID, footSize) VALUES ('P001', 9.5);
INSERT INTO Rental4 (patronID, footSize) VALUES ('P004', 12.0);
INSERT INTO Rental4 (patronID, footSize) VALUES ('P005', 8.0);
```

6. SkiLift

```
INSERT INTO SkiLift (liftNumber, capacity, status) VALUES ('L001', 4,
'Operational');
INSERT INTO SkiLift (liftNumber, capacity, status) VALUES ('L002', 6,
'Operational');
INSERT INTO SkiLift (liftNumber, capacity, status) VALUES ('L003', 4,
'Under Maintenance');
INSERT INTO SkiLift (liftNumber, capacity, status) VALUES ('L004', 4,
'Operational');
INSERT INTO SkiLift (liftNumber, capacity, status) VALUES ('L005', 6,
'Operational');
```

7. SkiRun

```
INSERT INTO SkiRun (runNumber, diff9culty, status) VALUES ('R001',
'Green', 'Open');
INSERT INTO SkiRun (runNumber, diff9culty, status) VALUES ('R002',
'Green', 'Open');
INSERT INTO SkiRun (runNumber, diff9culty, status) VALUES ('R003',
'Black', 'Closed');
INSERT INTO SkiRun (runNumber, diff9culty, status) VALUES ('R004',
'Double Black', 'Open');
INSERT INTO SkiRun (runNumber, diff9culty, status) VALUES ('R005',
'Blue', 'Open');
```

8. LiftTicket

```
INSERT INTO LiftTicket2 (discountType, discountPercentage) VALUES
('None', 0);
INSERT INTO LiftTicket2 (discountType, discountPercentage) VALUES
('Student', 25);
INSERT INTO LiftTicket2 (discountType, discountPercentage) VALUES
('Senior', 30);
INSERT INTO LiftTicket1 (ticketNo, discountType, patronID, liftNumber)
VALUES ('D001', 'None', 'P001', NULL);
INSERT INTO LiftTicket1 (ticketNo, discountType, patronID, liftNumber)
VALUES ('D002', 'None', 'P002', NULL);
INSERT INTO LiftTicket1 (ticketNo, discountType, patronID, liftNumber)
VALUES ('D003', 'Student', 'P003', NULL);
INSERT INTO LiftTicket1 (ticketNo, discountType, patronID, liftNumber)
VALUES ('D004', 'None', 'P004', NULL);
INSERT INTO LiftTicket1 (ticketNo, discountType, patronID, liftNumber)
VALUES ('D005', 'Senior', 'P005', NULL);
INSERT INTO LiftTicket1 (ticketNo, discountType, patronID, liftNumber)
VALUES ('S001', 'Student', 'P006', NULL);
INSERT INTO LiftTicket1 (ticketNo, discountType, patronID, liftNumber)
VALUES ('S002', 'None', 'P007', NULL);
INSERT INTO LiftTicket1 (ticketNo, discountType, patronID, liftNumber)
VALUES ('S003', 'Senior', 'P008', NULL);
INSERT INTO LiftTicket1 (ticketNo, discountType, patronID, liftNumber)
VALUES ('S004', 'None', 'P009', NULL);
INSERT INTO LiftTicket1 (ticketNo, discountType, patronID, liftNumber)
VALUES ('S005', 'None', 'P004', NULL);
```

9. DayTicket

```
INSERT INTO DayTicket (ticketNo, date) VALUES ('D001', '2024-12-20');
INSERT INTO DayTicket (ticketNo, date) VALUES ('D002', '2024-12-21');
INSERT INTO DayTicket (ticketNo, date) VALUES ('D003', '2024-12-22');
INSERT INTO DayTicket (ticketNo, date) VALUES ('D004', '2024-12-20');
INSERT INTO DayTicket (ticketNo, date) VALUES ('D005', '2024-12-21');
```

10. SeasonPass

```
INSERT INTO SeasonPass (ticketNo, season) VALUES ('S001',
'2024-2025');
INSERT INTO SeasonPass (ticketNo, season) VALUES ('S002',
'2024-2025');
INSERT INTO SeasonPass (ticketNo, season) VALUES ('S003',
'2024-2025');
INSERT INTO SeasonPass (ticketNo, season) VALUES ('S004',
'2023-2024');
INSERT INTO SeasonPass (ticketNo, season) VALUES ('S005',
'2023-2024');
```

11. Restaurant

```
INSERT INTO Restaurant (restaurantID, name, capacity, timing) VALUES
('R001', 'Mountain Top', 100, '091000-211000');
INSERT INTO Restaurant (restaurantID, name, capacity, timing) VALUES
('R002', 'Creekside', 75, '111000-201000');
INSERT INTO Restaurant (restaurantID, name, capacity, timing) VALUES
('R003', 'Glacier Hut', 50, '091000-151000');
INSERT INTO Restaurant (restaurantID, name, capacity, timing) VALUES
('R004', 'Peak View', 50, '091000-151000');
INSERT INTO Restaurant (restaurantID, name, capacity, timing) VALUES
('R005', 'Round House', 250, '071000-171000');
```

12. EatsAt

```
INSERT INTO EatsAt (patronID, restaurantID) VALUES ('P002', 'R005');
INSERT INTO EatsAt (patronID, restaurantID) VALUES ('P003', 'R002');
INSERT INTO EatsAt (patronID, restaurantID) VALUES ('P004', 'R001');
INSERT INTO EatsAt (patronID, restaurantID) VALUES ('P005', 'R002');
INSERT INTO EatsAt (patronID, restaurantID) VALUES ('P003', 'R003');
```

13. Discount

```
INSERT INTO Discount (ticketNo, restaurantID) VALUES ('S002', 'R001');
INSERT INTO Discount (ticketNo, restaurantID) VALUES ('S002', 'R002');
INSERT INTO Discount (ticketNo, restaurantID) VALUES ('S002', 'R003');
INSERT INTO Discount (ticketNo, restaurantID) VALUES ('S003', 'R001');
INSERT INTO Discount (ticketNo, restaurantID) VALUES ('S003', 'R002');
INSERT INTO Discount (ticketNo, restaurantID) VALUES ('S003', 'R003');
```

14. Accesses

```
INSERT INTO Accesses (runNumber, liftNumber) VALUES ('R001', 'L001');
INSERT INTO Accesses (runNumber, liftNumber) VALUES ('R002', 'L002');
INSERT INTO Accesses (runNumber, liftNumber) VALUES ('R003', 'L003');
INSERT INTO Accesses (runNumber, liftNumber) VALUES ('R004', 'L004');
INSERT INTO Accesses (runNumber, liftNumber) VALUES ('R005', 'L005');
```