University of British Columbia, Vancouver
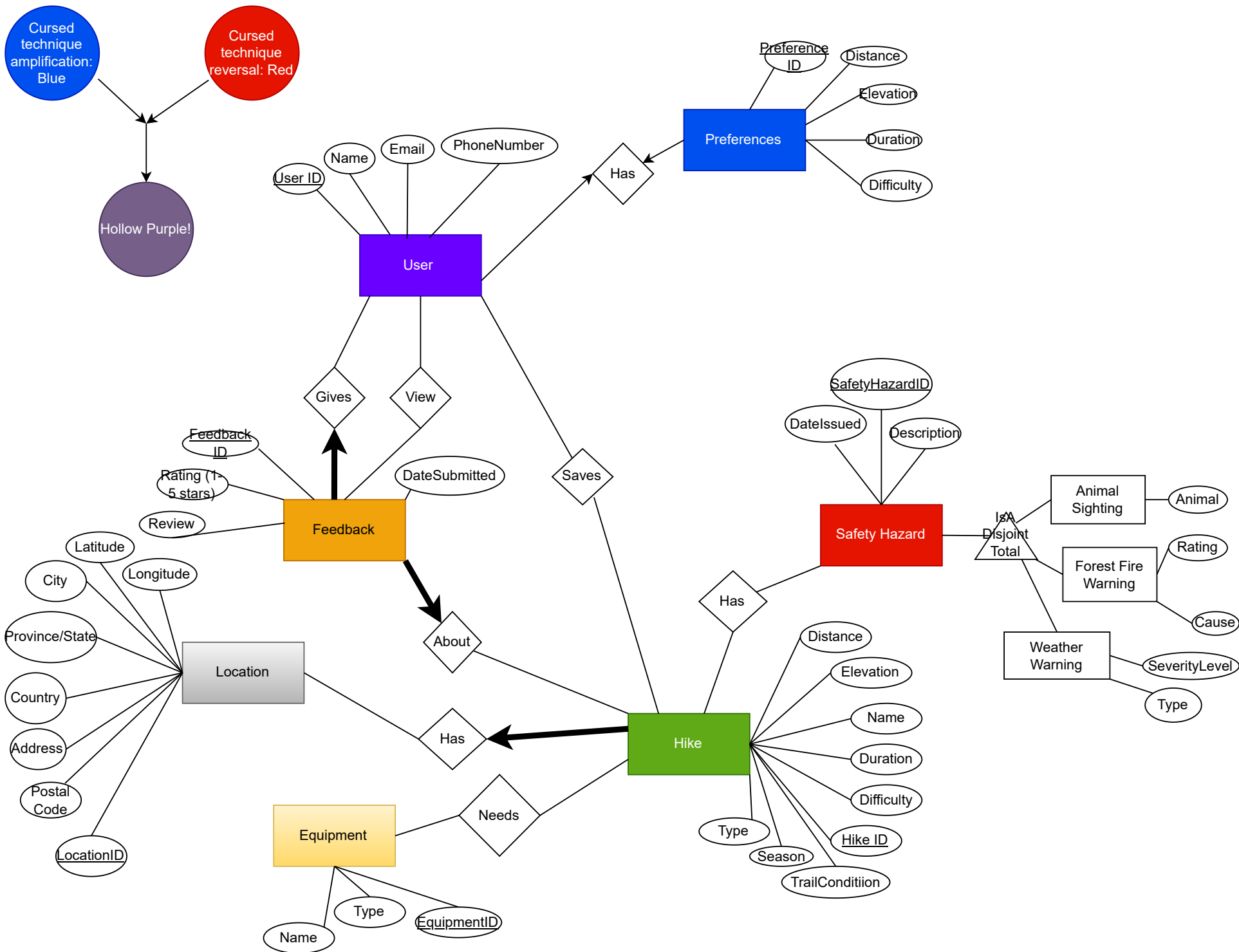Department of Computer Science

CPSC 304 Project Cover Page

Milestone #: 2

Date: Wednesday October 22, 2025

Group Number: 20

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By typing our names and student numbers in the above table, we certify that the work in the attached assignment was performed solely by those whose names and student IDs are included above. (In the case of Project Milestone 0, the main purpose of this page is for you to let us know your e-mail address, and then let us assign you to a TA for your project supervisor.)

In addition, we indicate that we are fully aware of the rules and consequences of plagiarism, as set forth by the Department of Computer Science and the University of British Columbia

Project Summary:

Our project allows users to find hikes/trails in Canada/the U.S. based on their preferences. Users can also read and write reviews and give ratings to the hikes/trails.

Relational Schema:

Underline is a primary key

Bold is a foreign key

Italic is candidate key

- User(*UserID: CHAR(5)*, Name: VARCHAR(20), *Email*: VARCHAR(30), *PhoneNumber*: VARCHAR(20), **PreferenceID: CHAR(5)**) (PreferenceID, Email, and PhoneNumber needs to be unique)

- Preference(*PreferenceID: CHAR(5)*, Distance: INT, Duration: INT, Elevation: INT, Difficulty: INT)

- AnimalSighting(*SafetyHazardID: CHAR(5)*, Description: VARCHAR(500), Animal: VARCHAR(20), **DateIssued**: DATE)

- ForestFireWarning(*SafetyHazardID: CHAR(5)*, Description: VARCHAR(500), Rating: INT, **DateIssued**: DATE, Cause: VARCHAR(500))

- WeatherWarning(*SafetyHazardID: CHAR(5)*, Description: VARCHAR(500), Type: VARCHAR(20), **DateIssued**: DATE, SeverityLevel: INT)

- Location(*LocationID: CHAR(5)*, Address: VARCHAR(20), PostalCode: VARCHAR(20), Country: VARCHAR(20), Province/State: VARCHAR(20), City: VARCHAR(20), Latitude: DECIMAL(10, 8), Longitude: DECIMAL(11, 8))

- Equipment(*EquipmentID: CHAR(5)*, Name: VARCHAR(20), Type: VARCHAR(20))

- Hike(*HikeID: CHAR(5)*, **LocationID: CHAR(5)**, Type: VARCHAR(20), Distance: INT, Elevation: INT, Name: VARCHAR(20), Duration: INT, Difficulty: INT, TrailCondition: INT, Season: VARCHAR(20)) **(**LocationID cannot be null)

- Feedback(*FeedbackID: CHAR(5)*, Rating: INT, Review: VARCHAR(1000), DateSubmitted: DATE, **UserID: CHAR(5)**, **HikeID: CHAR(5)**) (UserID and HikeID cannot be null and must be unique)

Functional Dependencies:

User

UserID → Name, Email, PhoneNumber, PreferenceID
Email → UserID, Name, PhoneNumber, PerferenceID
PhoneNumber → UserID, Name, Email, PerferenceID
<u>Preference</u>
PreferenceID → Distance, Duration, Elevation, Difficulty, UserID, Name
<u>AnimalSighting</u>
SafetyHazardID → Description, Animal, DateIssued
<u>ForestFireWarning</u>
SafetyHazardID → Description, Rating, DateIssued, Cause

<u>WeatherWarning</u>
SafetyHazardID → Description, Type, DateIssued, SeverityLevel
<u>Location</u>
LocationID → Address, PostalCode, Country, Province/State, City, Latitude, Longitude
PostalCode, Country → Province/State, City
Latitude, Longitude → Address, PostalCode, Country, Province/State, City
<u>Equipment</u>
EquipmentID → Name, Type
<u>Hike</u>
HikeID → LocationID, Type, Distance, Elevation, Name, Duration, Difficulty, TrailCondition, Season
LocationID, Name → HikeID
Type, Distance, Elevation, Duration → Difficulty
<u>Feedback</u>
FeedbackID → Rating, Review, UserID, HikeID, DateSubmitted
UserID, HikeID → FeedbackID, Rating, Review, DateSubmitted

Normalization:

The only relations that have functional dependencies that violate BCNF are Location and Hike. This is because for every other functional dependency for all the other relations,

<u>Location</u>
The functional dependency PostalCode, Country → Province/State, City violates BCNF because the LHS is not a superkey for the relation.

Location(LocationID, Address, PostalCode, Country, Province/State, City, Latitude, Longitude)
Decomposed on functional dependency: PostalCode, Country → Province/State, City

Location1(<u>*PostalCode*</u>: VARCHAR(20), <u>*Country*</u>: VARCHAR(20), Province/State: VARCHAR(20), City: VARCHAR(20))
Location2(<u>*LocationID: CHAR(5)*</u>, Address: VARCHAR(20), PostalCode: VARCHAR(20), Country: VARCHAR(20), Latitude: DECIMAL(10, 8), Longitude: DECIMAL(11,8))

Hike
The functional dependency Type, Distance, Elevation, Duration → Difficulty violates BCNF because the LHS is not a superkey for the relation.

Hike(HikeID, LocationID, Type, Distance, Elevation, Name, Duration, Difficulty, TrailCondition, Season**)**
Decomposed on functional dependency: Type, Distance, Elevation, Duration → Difficulty

Hike1(*Type*: VARCHAR(20), *Distance*: INT, *Elevation*: INT, *Duration*: INT, Difficulty: INT)
Hike2(*HikeID*: CHAR(5), **LocationID**: CHAR(5), Type: VARCHAR(20), Distance: INT, Elevation: INT, Name: VARCHAR(20), Duration: INT, TrailCondition: INT, Season: VARCHAR(20))

After normalization, below are all of the relations listed:

- User(*UserID*: CHAR(5), Name: VARCHAR(20), *Email*: VARCHAR(30), *PhoneNumber*: VARCHAR(20), **PreferenceID**: CHAR(5)) (PreferenceID, Email, and PhoneNumber needs to be unique)

- Preference(*PreferenceID*: CHAR(5), Distance: INT, Duration: INT, Elevation: INT, Difficulty: INT)

- AnimalSighting(*SafetyHazardID*: CHAR(5), Description: VARCHAR(500), Animal: VARCHAR(20), **DateIssued**: DATE)

- ForestFireWarning(*SafetyHazardID*: CHAR(5), Description: VARCHAR(500), Rating: INT, **DateIssued**: DATE, Cause: VARCHAR(500))

- WeatherWarning(*SafetyHazardID*: CHAR(5), Description: VARCHAR(500), Type: VARCHAR(20), **DateIssued**: DATE, SeverityLevel: INT)

- Location1(*PostalCode*: VARCHAR(20), *Country*: VARCHAR(20), Province/State: VARCHAR(20), City: VARCHAR(20))

- Location2(*LocationID*: CHAR(5), Address: VARCHAR(20), PostalCode: VARCHAR(20), Country: VARCHAR(20), Latitude: DECIMAL(10, 8), Longitude: DECIMAL(11, 8))

- Equipment(*EquipmentID*: CHAR(5), Name: VARCHAR(20), Type: VARCHAR(20))

- Hike1(*Type*: VARCHAR(20), *Distance*: INT, *Elevation*: INT, *Duration*: INT, Difficulty: INT)

- Hike2(*HikeID*: CHAR(5), **LocationID**: CHAR(5), Type: VARCHAR(20), Distance: INT, Elevation: INT, Name: VARCHAR(20), Duration: INT, TrailCondition: INT, Season: VARCHAR(20)) (LocationID cannot be null)

- Feedback(*FeedbackID*: CHAR(5), Rating: INT, Review: VARCHAR(1000), DateSubmitted: DATE, **UserID**: CHAR(5), **HikeID**: CHAR(5)) (UserID and HikeID cannot be null and must be unique)

SQL DDL statements:

```sql
CREATE TABLE User {
  UserID CHAR(5) PRIMARY KEY,
  Name VARCHAR(20),
  PreferenceID CHAR(5) UNIQUE,
  Email VARCHAR(30) UNIQUE,
  PhoneNumber VARCHAR(20) UNIQUE,
  FOREIGN KEY (PreferenceID) REFERENCES Preference(PreferenceID)
};

CREATE TABLE Equipment {
  EquipmentID CHAR(5) PRIMARY KEY,
  Name VARCHAR(20),
  Type VARCHAR(20)
};

CREATE TABLE Preference {
  PreferenceID CHAR(5) PRIMARY KEY,
  Distance INT,
  Duration INT,
  Elevation INT,
  Difficulty INT CHECK (Difficulty BETWEEN 1 AND 10)
};

CREATE TABLE SafetyHazard {
  SafetyHazardID CHAR(5) PRIMARY KEY,
  Description VARCHAR(500),
  DateIssued DATE
};

CREATE TABLE  WeatherWarning {
  SafetyHazardID CHAR(5) PRIMARY KEY,
  SeverityLevel INT CHECK (SeverityLevel BETWEEN 1 AND 10),
  Type VARCHAR(20),
  FOREIGN KEY (SafetyHazardID) REFERENCES
SafetyHazard(SafetyHazardID)
};
```

```sql
CREATE TABLE AnimalSighting {
  SafetyHazardID CHAR(5) PRIMARY KEY,
  Animal VARCHAR(20)
  FOREIGN KEY (SafetyHazardID) REFERENCES
SafetyHazard(SafetyHazardID)
};

CREATE TABLE ForestFireWarning {
  SafetyHazardID CHAR(5) PRIMARY KEY,
  Rating INT CHECK (Rating BETWEEN 1 AND 4),
  Cause VARCHAR(500)
  FOREIGN KEY (SafetyHazardID) REFERENCES
SafetyHazard(SafetyHazardID)
};

CREATE TABLE Feedback {
  FeedbackID CHAR(5) PRIMARY KEY,
  Rating INT CHECK (Rating BETWEEN 1 AND 5),
  Review VARCHAR(1000),
  DateSubmitted DATE,
  UserID CHAR(5) NOT NULL,
  HikeID CHAR(5) NOT NULL,
  UNIQUE (UserID, HikeID),
  FOREIGN KEY (UserID) REFERENCES User(UserID),
  FOREIGN KEY (HikeID) REFERENCES Hike2(HikeID)
};

CREATE TABLE Hike1 {
  Type VARCHAR(20) PRIMARY KEY,
  Distance INT PRIMARY KEY,
  Elevation INT PRIMARY KEY,
  Duration INT PRIMARY KEY,
  Difficulty INT CHECK (Rating BETWEEN 1 AND 10)
};
```

```
CREATE TABLE Hike2 {
  HikeID CHAR(5) PRIMARY KEY,
  LocationID CHAR(5) NOT NULL,
  Name VARCHAR(20),
  Type VARCHAR(20),
  Season VARCHAR(20),
  TrailCondition INT CHECK (TrailCondition BETWEEN 1 AND 10),
  Duration INT,
  Elevation INT,
  Distance INT,
  FOREIGN KEY (LocationID) REFERENCES Location2(LocationID)
};

CREATE TABLE Location1 {
  PostalCode VARCHAR(20) PRIMARY KEY,
  Country VARCHAR(20) PRIMARY KEY,
  Province_State VARCHAR(20),
  City VARCHAR(20),
};

CREATE TABLE Location2 {
  LocationID CHAR(5) PRIMARY KEY,
  Address VARCHAR(20),
  PostalCode VARCHAR(20),
  Country VARCHAR(20),
  Latitude DECIMAL(10, 8),
  Longitude DECIMAL(11, 8)
};
```

SQL INSERT statements that we can test in a file:

INSERT INTO User (UserID, Name, PreferenceID, Email, PhoneNumber)
VALUES   ('00000', 'Jerico Martinez', '00000', 'jerico@example.com', 1234567890),
            ('00001', 'Chester Wong', '00001', 'chester@example.com', 1234567891),
            ('00002', 'Dilreet Raju', '00002', 'dilreet@example.com', 1234567892),
            ('00003', 'Mark Zuck', '00003', 'mark@example.com', 1234567893),
            ('00004', 'Gregor Kiczales', '00004', 'gregor@example.com', 1234567894);

INSERT INTO Preference (PreferenceID, Distance, Duration, Elevation, Difficulty)
VALUES   ('00000', 30, 3, 1567, 8),
            ('00001', 2, 1, 50, 1),
            ('00002', 45, 8, 2402, 10),

```
                    ('00003', 10, 2, 200, 5),
                    ('00004', 6, 2, 27, 3);

INSERT INTO SafetyHazard (SafetyHazardID, Description, DateIssued)
VALUES        ('00000', 'Forest fire on trail.', '2025-06-10'),
              ('00001', 'Moose spotted 5 km into trail.', '2025-06-20'),
              ('00002', 'Extreme temperature expected to reach 40°C.', '2025-07-21'),
              ('00003', 'Forest fire 50 km away causing decreased vision and air quality.',
        '2025-07-25'),
              ('00004', 'Coyotes spotted on trails.', '2025-08-19'),
              ('00005', 'Black bear spotted.', '2025-09-01'),
              ('00006', 'Forest fire 10 km from trail causing decreased vision and air quality.',
              '2025-09-21'),
              ('00007', 'Forest fire 2 km from trail causing decreased vision and air quality.',
              '2025-09-30'),
              ('00008', 'Heavy rain expecting to cause flash floods.', '2025-10-15'),
              ('00009', 'Black bear spotted munching on berries.', '2025-10-16'),
              ('00010', 'Harsh winds with speeds reaching 80 km/h.', '2025-10-17'),
              ('00011', 'Heavy snowfall expected to reach 6 inches.', '2025-10-18'),
              ('00012', 'Forest fire causing decreased air quality.', '2025-10-19'),
              ('00013', 'Mother brown bear and cub.', '2025-10-20'),
              ('00014', 'Heavy rain causing potential mudslides.', '2025-10-22');

INSERT INTO WeatherWarning (SafetyHazardID, SeverityLevel, Type)
VALUES        ('00008', 3, 'Rainfall'),
              ('00010', 4, 'Wind'),
              ('00011', 5, 'Snowfall'),
              ('00014', 4, 'Rainfall'),
              ('00002', 5, 'Extreme Heat');

INSERT INTO AnimalSighting (SafetyHazardID, Animal)
VALUES        ('00001', 'Moose'),
              ('00004', 'Coyote'),
              ('00005', 'Black Bear'),
              ('00009', 'Black Bear'),
              ('00013', 'Brown Bear');

INSERT INTO ForestFireWarning (SafetyHazardID, Rating, Cause)
VALUES        ('00000', 5, 'Lightning strike and dry vegetation'),
              ('00003', 4, 'Prolonged heatwave and drought'),
              ('00006', 3, 'Nearby human activity'),
              ('00007', 4, 'Rekindled fire from camp area'),
              ('00012', 3, 'Airborne embers from distant wildfire');

INSERT INTO Feedback (FeedbackID, Rating, Review, DateSubmitted, UserID, HikeID)
```

VALUES   ('00000', 5, 'Incredible views and well-maintained path.', '2025-08-01', '00000', '00000'),

              ('00001', 4, 'Beautiful trail but slightly muddy.', '2025-08-02', '00001', '00001'),
              ('00002', 3, 'Too crowded on weekends.', '2025-08-05', '00002', '00000'),
              ('00003', 5, 'Amazing hike, great for beginners.', '2025-09-10', '00003', '00002'),
              ('00004', 4, 'Challenging climb but rewarding summit.', '2025-09-15', '00004', '00004');

INSERT INTO Hike1 (Type, Distance, Elevation, Duration, Difficulty)
VALUES   ('Loop', 12, 400, 180, 3),
              ('Out-and-Back', 8, 250, 120, 2),
              ('Summit', 15, 800, 240, 4),
              ('Coastal', 25, 500, 360, 5),
              ('Forest Trail', 6, 150, 90, 1);

INSERT INTO Hike2 (HikeID, LocationID, Name, Type, Season, TrailCondition, Duration, Elevation, Distance)
VALUES   ('00000', '00000', 'Eagle Ridge Trail', 'Loop', 'Summer', 4, 180, 400, 12),
              ('00001', '00001', 'Maple Peak Trail', 'Out-and-Back', 'Spring', 3, 120, 250, 8),
              ('00002', '00002', 'Riverside Path', 'Coastal', 'Fall', 5, 240, 500, 25),
              ('00003', '00003', 'Victoria Bluff Trail', 'Summit', 'Winter', 2, 300, 800, 15),
              ('00004', '00004', 'Glacier Point Trail', 'Loop', 'Summer', 4, 360, 1000, 20);

INSERT INTO Location1 (PostalCode, Country, Province_State, City)
VALUES   ('V5A1S6', 'Canada', 'British Columbia', 'Burnaby'),
              ('V6B1L4', 'Canada', 'British Columbia', 'Vancouver'),
              ('V9T2M1', 'Canada', 'British Columbia', 'Nanaimo'),
              ('V8P1Y2', 'Canada', 'British Columbia', 'Victoria'),
              ('V2L4W1', 'Canada', 'British Columbia', 'Prince George');

INSERT INTO Location2 (LocationID, Address, PostalCode, Country, Latitude, Longitude)
VALUES   ('00000', '123 Mountain Rd', 'V5A1S6', 'Canada', 49.27891234, -122.91987321),
              ('00001', '88 Summit Trail', 'V6B1L4', 'Canada', 49.28234567, -123.11578912),
              ('00002', '42 Riverbend Way', 'V9T2M1', 'Canada', 49.16482718, -123.93561429),
              ('00003', '75 Valley Loop', 'V8P1Y2', 'Canada', 48.45671235, -123.35456783),
              ('00004', '10 Glacier Ave', 'V2L4W1', 'Canada', 53.91706455, -122.74966927);

ER Diagram Changes:

- We changed the IsA relationship with safety hazard by adding attributes to the different types of safety hazard entities as suggested by our TA since the iteration on milestone 1 wasn't very meaningful.
  - Added AnimalSighting entity with Animal attribute
  - Added ForestFireWarning entity with Rating attribute
  - Added WeatherWarning entity with Type attribute

- We removed the IsA for the hike entity and turned it into an attribute as suggested by our TA since the iteration on milestone 1 wasn't very meaningful.
- We added participation constraints for feedback on "Gives" and "About" since if it did not exist, feedback wouldn't exist.
- We made the location entity's key just LocationID as having Address and Postal Code along with LocationID as the key felt redundant.
- The following attributes were added so that we can create more FDs:
    - User: Email, PhoneNumber
    - AnimalSighting, ForestFireWarning, WeatherWarning: DateIssued
    - ForestFireWarning: Cause
    - WeatherWarning: SeverityLevel
    - Location: Latitude, Longitude
    - Hike: TrailCondition, Season
    - Feedback: DateSubmitted

AI Declaration:
We did not use AI for milestone 2.