THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

INFS 7901 Database Principle

Project Report

Turtle Conservation and Research Database System

Picture from: https://www.adoptananimalkits.com/animal_encyclopedia

Name: Jie Zhang

Aim and Background

Aim: The aim of the Turtle Conservation and Research Database System is to provide a comprehensive platform that facilitates the conservation and study of turtles by collecting, managing, and analysing data concerning individual turtles, their species, habitats, and conservation efforts. The system aims to enable researchers and wildlife organizations to access, manage and analyse data easily, visualize and collaborate to ensure secure access control and user management.

Background: The declining population of turtles due to various factors, including habitat loss, pollution, and overexploitation, highlights the need for a centralized database system that facilitates the management and analysis of data concerning individual turtles, their species, habitats, and conservation efforts. The system's functionalities enable users to manage individual turtles, species, habitats, observations, conservation projects, and researcher profiles while providing secure access control and user management.

The Turtle Conservation and Research Database System has the following main components:

(1) **Data Management:** The system allows users to add, delete, and update data related to all entities, including individual turtles, turtle species, habitats, tags, researchers, marine biologists, and conservationists. Users can also manage observations and conservation projects.

(2) **Search Functionality:** The system includes a simple search function that allows users to search for information related to individual turtles, their species, habitats, researchers, and conservation efforts.

(3) **Data Analysis and Visualization:** The system supports data analysis and visualization, enabling researchers to analyze and visualize data related to turtle populations, habitats, and conservation efforts.

(4) **Secure Access Control and User Management:** The system ensures secure access control and user management, allowing administrators to manage user access and permissions to the system's data and functionalities.

Query Demonstration

1. Join Operation

Table Turtle and Turtle_Species are connected by Species_ID, that is Turtle.Species_ID reference to Turtle_Species. Species_ID.

Result:

Before Join:

```
SELECT * FROM `Turtle`
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Extra options

	Turtle_ID	TName	Date_of_Birth	Gender	Species_ID
Edit Copy Delete	T01	Leo	2018-06-02	Male	3
Edit Copy Delete	T02	Raphael	2019-03-14	Male	5
Edit Copy Delete	T03	Michelangelo	2020-01-01	Male	2
Edit Copy Delete	T04	Donatello	2021-02-28	Male	1
Edit Copy Delete	T05	April	2017-12-15	Female	4

Table: Turtle

```
SELECT * FROM `Turtle_Species`
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Extra options

	Species_ID	Species_Name	Conservation_Status
Edit Copy Delete	1	Hawksbill Turtle	Critically Endangered
Edit Copy Delete	2	Leatherback Turtle	Vulnerable
Edit Copy Delete	3	Olive Ridley Turtle	Vulnerable
Edit Copy Delete	4	Loggerhead Turtle	Endangered
Edit Copy Delete	5	Green Turtle	Endangered

Table: Turtle_Species

After Join:

```
SELECT * FROM Turtle NATURAL JOIN Turtle_Species;
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Extra options

Species_ID	Turtle_ID	TName	Date_of_Birth	Gender	Species_Name	Conservation_Status
3	T01	Leo	2018-06-02	Male	Olive Ridley Turtle	Vulnerable
5	T02	Raphael	2019-03-14	Male	Green Turtle	Endangered
2	T03	Michelangelo	2020-01-01	Male	Leatherback Turtle	Vulnerable
1	T04	Donatello	2021-02-28	Male	Hawksbill Turtle	Critically Endangered
4	T05	April	2017-12-15	Female	Loggerhead Turtle	Endangered

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

The Species_Name and Conservation_Status have been added to Table: Turtle.

2. Aggregation Query

Query and Explanation

Counts the number of Expire_date records which Issue_date after 2022-03-01 from Table Tag_in.

Result:

```
SELECT COUNT(Expire_date) FROM Tag_in WHERE Issue_date >'2022-03-01';
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Extra options

COUNT(Expire_date)
2

Original Tag_in table:

```
SELECT * FROM `Tag_in`
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Extra options

	Turtle_ID	Tag_ID	Issue_date	Expire_date
Edit Copy Delete	T001	1001	2022-01-01	2023-01-01
Edit Copy Delete	T002	1002	2022-02-01	2023-02-01
Edit Copy Delete	T003	1003	2022-03-01	2023-03-01
Edit Copy Delete	T004	1004	2022-04-01	2023-04-01
Edit Copy Delete	T005	1005	2022-05-01	2023-05-01

3. Aggregation with Group-By

Query and Explanation

Using SELECT COUNT () and GROUP BY together.

Count Researcher_ID by level.

Result

```
SELECT COUNT(Researcher_ID), LEVEL FROM MarineBiologist GROUP BY LEVEL ORDER BY COUNT(Researcher_ID) DESC;
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Show all | Number of rows: 25 Filter rows: Search this table

Extra options

COUNT(Researcher_ID) 1	LEVEL
2	Senior
2	Junior
1	Mid-level

Show all | Number of rows: 25 Filter rows: Search this table

Original table: MarineBiologist shows as following:

```
SELECT * FROM `MarineBiologist`
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Extra options

	Researcher_ID	Level
Edit Copy Delete	R001	Senior
Edit Copy Delete	R002	Junior
Edit Copy Delete	R003	Senior
Edit Copy Delete	R004	Junior
Edit Copy Delete	R005	Mid-level

4. Delete Operation with Cascade

Query and Explanation

Delete the "S4" level records in table: Conservationist with cascade, which means the record in Conservationist_Expertise would be delete as well.

```
DELETE FROM Conservationist WHERE LEVEL='S4';
```

before delete:

```
SELECT * FROM `Conservationist`
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Extra options

	Researcher_ID	Level
Edit Copy Delete	R001	S4
Edit Copy Delete	R002	S1
Edit Copy Delete	R003	S5
Edit Copy Delete	R004	S2
Edit Copy Delete	R005	S3

Check all *With selected:* Edit Copy Delete Export

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Table: Conservationist

```
SELECT * FROM `Conservationist_Expertise`
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Extra options

	Researcher_ID	Expertise
Edit Copy Delete	R001	Wildlife Conservation
Edit Copy Delete	R002	Forestry Management
Edit Copy Delete	R003	Marine Protected Areas
Edit Copy Delete	R004	Climate Change Mitigation
Edit Copy Delete	R005	Sustainable Agriculture

Check all *With selected:* Edit Copy Delete Export

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Table: Conservationist_Expertise

After delete:

```
SELECT * FROM `Conservationist`
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Extra options

	Researcher_ID	Level
Edit Copy Delete	R002	S1
Edit Copy Delete	R003	S5
Edit Copy Delete	R004	S2
Edit Copy Delete	R005	S3

Check all *With selected:* Edit Copy Delete Export

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Table: Conservationist

We can see that the record of Researcher_ID = ‘R001’ were deleted in both tables.

```
SELECT * FROM `Conservationist_Expertise`
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Extra options

	Researcher_ID	Expertise
Edit Copy Delete	R002	Forestry Management
Edit Copy Delete	R003	Marine Protected Areas
Edit Copy Delete	R004	Climate Change Mitigation
Edit Copy Delete	R005	Sustainable Agriculture

Check all *With selected:* Edit Copy Delete Export

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Table: Conservationist_Expertise

5. Update Operation

Query and Explanation

```
UPDATE Habitat SET Description = 'Unkown' WHERE Region = 'Asia';
```

Change the Asia Region Description to ‘Unkown’ in table: Habitat.

Result

before update:

```
SELECT * FROM `Habitat`
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Extra options

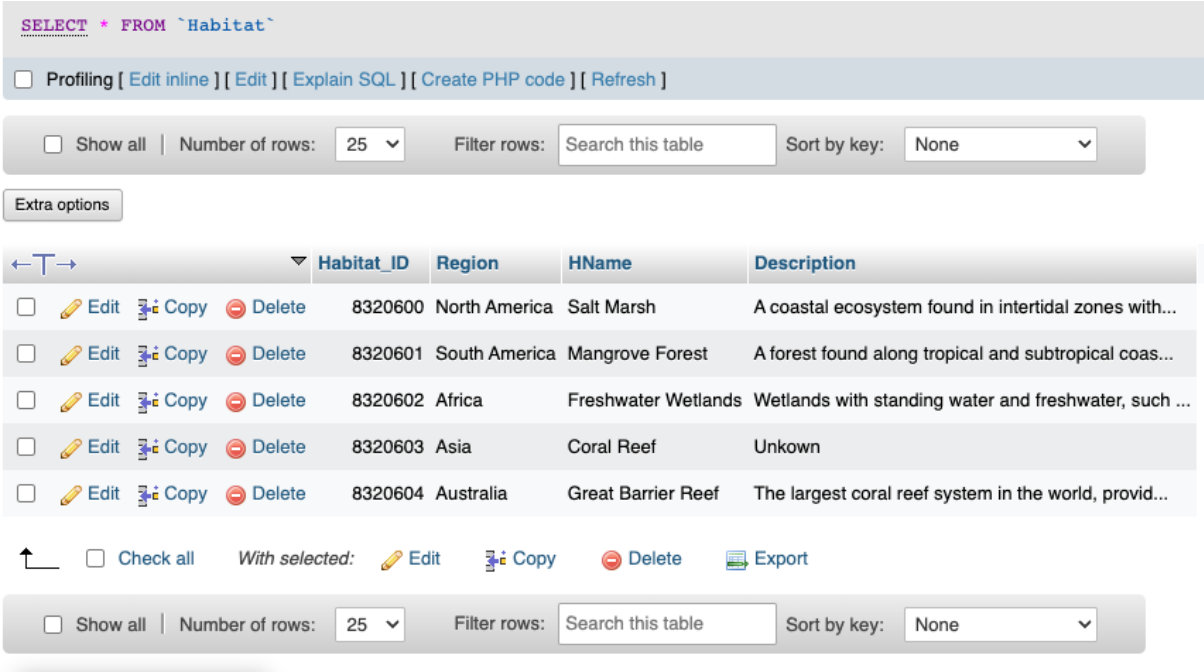
	Habitat_ID	Region	HName	Description
Edit Copy Delete	8320600	North America	Salt Marsh	A coastal ecosystem found in intertidal zones with...
Edit Copy Delete	8320601	South America	Mangrove Forest	A forest found along tropical and subtropical coas...
Edit Copy Delete	8320602	Africa	Freshwater Wetlands	Wetlands with standing water and freshwater, such ...
Edit Copy Delete	8320603	Asia	Coral Reef	A marine ecosystem with diverse coral formations, ...
Edit Copy Delete	8320604	Australia	Great Barrier Reef	The largest coral reef system in the world, provid...

Check all *With selected:* Edit Copy Delete Export

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

After update:

The Description has been changed into ‘Unkown’.



Conclusion:

I dedicated approximately 50 hours to complete this project. Most of the time was spent designing the E/R diagram and completing the SQL Dump. The schema, functional dependencies, and normalized schema took no more than 4 hours each, and the remaining time was spent sporadically on completing the report.

Designing the E/R diagram and mapping them to schema were my favorite parts of the project. It was a meaningful process that allowed me to bring my ideas to real project step by step. While using "draw.io" to draw the diagram was a bit challenging, it helped me to become familiar with the tool, and I believe it will benefit me in the future. On the other hand, SQL Dump was my least favorite part as it was a repetitive process that could be tedious but was necessary to perform meaningful queries. Fortunately, Phpmyadmin was very convenient and powerful, which saved me a lot of trouble overall.

The most helpful aspect of completing this project was the professor's slides, which were detailed and covered most of the knowledge I needed. Additionally, the tutor was very

helpful and patient to answer my questions. Also, ED forum helps a lot when I posted one question.

My advice to beginners is to follow the steps of database design strictly. It's essential to solve problems as they arise and not to carry them over to the next step as they may trigger a chain reaction. I recommend the following steps in database design:

(1) Determine the purpose of your database.

(2) Find and organize the necessary information.

(3) Divide the information into tables.

(4) Turn information items into columns.

(5) Specify primary keys, Functional Dependencies and Foreign Keys.

(6) Create table relationships.

(7) Refine the design.

(8) Apply normalization rules.

And when was doing the SQL DDL part, better to create table first, then add constraints like Foreign Key later by using Alter method, because the referencing table maybe not exist yet.

Responsive Web Design (GUI)

The following are screen shots of GUI display: in my project, two parts are handling the GUI and SQL assertions (GUI part): app/templates/index.html (SQL part):app/views.py

Turtle Tracking Information ▾ Researcher Information ▾

Turtle Summary

Conservation_Status	Date_of_Birth	Gender	Species_ID	Species_Name	TName	Turtle_ID
Vulnerable	Sat, 02 Jun 2018 00:00:00 GMT	Male	3	Olive Ridley Turtle	Leo	T01
Endangered	Thu, 14 Mar 2019 00:00:00 GMT	Male	5	Green Turtle	Raphael	T02
Vulnerable	Wed, 01 Jan 2020 00:00:00 GMT	Male	2	Leatherback Turtle	Michelangelo	T03
Critically Endangered	Sun, 28 Feb 2021 00:00:00 GMT	Male	1	Hawksbill Turtle	Donatello	T04
Endangered	Fri, 15 Dec 2017 00:00:00 GMT	Female	4	Loggerhead Turtle	April	T05

-1- Total web shows Turtle Tracking Information and Research Information

Turtle Tracking Information | Researcher Information

Turtle Summary
Species Information
Habitat Information

ary

	Date_of_Birth	Gender	Species_ID	Species_Name	TName	Turtle_ID
	Sat, 02 Jun 2018 00:00:00 GMT	Male	3	Olive Ridley Turtle	Leo	T01
Endangered	Thu, 14 Mar 2019 00:00:00 GMT	Male	5	Green Turtle	Raphael	T02
Vulnerable	Wed, 01 Jan 2020 00:00:00 GMT	Male	2	Leatherback Turtle	Michelangelo	T03
Critically Endangered	Sun, 28 Feb 2021 00:00:00 GMT	Male	1	Hawksbill Turtle	Donatello	T04
Endangered	Fri, 15 Dec 2017 00:00:00 GMT	Female	4	Loggerhead Turtle	April	T05

-2- Turtle Summary, Species Information, Habitat Information are sub-information.

Turtle Tracking Information | Researcher Information

Species Information

Conservation_Status	Species_ID	Species_Name
Critically Endangered	1	Hawksbill Turtle
Vulnerable	2	Leatherback Turtle
Vulnerable	3	Olive Ridley Turtle
Endangered	4	Loggerhead Turtle
Endangered	5	Green Turtle

-3- Species Information display.

Turtle Tracking Information | Researcher Information

Marine Biologist

Level	Researcher_ID
Senior	R001
Junior	R002
Senior	R003
Junior	R004
Mid-level	R005

-4- Marine Biologist Information display.

Turtle Tracking Information | Researcher Information

Conservationist

Level	Researcher_ID
S1	R002
S5	R003
S2	R004
S3	R005

-5- Marine Biologist Information display.

Turtle Tracking Information ▾ Researcher Information ▾

Habitat Informati

Marine Biologist

Conservationist

Description	HName	Habitat_ID	Region
A coastal ecosystem found in intertidal zones with brackish water and high salinity.	Salt Marsh	8320600	North America
A forest found along tropical and subtropical coastlines, with a unique ecosystem adapted to saltwater environments.	Mangrove Forest	8320601	South America
Wetlands with standing water and freshwater, such as ponds, swamps, and marshes.	Freshwater Wetlands	8320602	Africa
Unkown	Coral Reef	8320603	Asia
The largest coral reef system in the world, providing habitats for numerous marine animals, including turtles.	Great Barrier Reef	8320604	Australia

-6- Researcher's Sub Information display.

The following screenshots show SQL assertions and/or triggers functionalities with GUI

```
@app.route('/view2-tab')
def view2():
    return query("SELECT * FROM Turtle_Species")

@app.route('/view3-tab')
def view3():
    return query("SELECT * FROM Habitat")

@app.route('/view4-tab')
def view4():
    return query("SELECT * FROM MarineBiologist")

@app.route('/view5-tab')
def view5():
    return query("SELECT * FROM Conservationist")

@app.route('/view1-tab')
def view1():
    return query("SELECT * FROM Turtle NATURAL JOIN Turtle_Species")
```

SQL Dump:

```
-- phpMyAdmin SQL Dump

-- version 5.2.0

-- https://www.phpmyadmin.net/

--

-- Host: localhost

-- Generation Time: May 03, 2023 at 01:17 PM

-- Server version: 8.0.32

-- PHP Version: 8.2.2


SET SQL_MODE = "NO_AUTO_VALUE_ON_ZERO";

START TRANSACTION;

SET time_zone = "+00:00";



/*!40101 SET @OLD_CHARACTER_SET_CLIENT=@@CHARACTER_SET_CLIENT */;

/*!40101 SET @OLD_CHARACTER_SET_RESULTS=@@CHARACTER_SET_RESULTS */;

/*!40101 SET @OLD_COLLATION_CONNECTION=@@COLLATION_CONNECTION */;

/*!40101 SET NAMES utf8mb4 */;


--

-- Database: `Turtle_Research`

--


-- --------------------------------------------------------


--

-- Table structure for table `Association`
```

```
--

CREATE TABLE `Association` (
  `Association_ID` decimal(10,0) NOT NULL,
  `Association` varchar(255) DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;

--
-- Dumping data for table `Association`
--

INSERT INTO `Association` (`Association_ID`, `Association`) VALUES
('101', 'Marine Biological Association of the United Kingdom'),
('102', 'American Association of Marine Laboratories'),
('103', 'Society for Conservation Biology'),
('104', 'International Union for Conservation of Nature'),
('105', 'Marine Conservation Institute');

-- --------------------------------------------------------

--
-- Table structure for table `Conservationist`
--

CREATE TABLE `Conservationist` (
  `Researcher_ID` varchar(10) NOT NULL,
  `Level` char(10) DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;
```

```
--
-- Dumping data for table `Conservationist`
--

INSERT INTO `Conservationist` (`Researcher_ID`, `Level`) VALUES
('R001', 'S4'),
('R002', 'S1'),
('R003', 'S5'),
('R004', 'S2'),
('R005', 'S3');

-- ----------------------------------------------------------

--
-- Table structure for table `Conservationist_Expertise`
--

CREATE TABLE `Conservationist_Expertise` (
  `Researcher_ID` varchar(10) NOT NULL,
  `Expertise` varchar(50) NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;

--
-- Dumping data for table `Conservationist_Expertise`
--

INSERT INTO `Conservationist_Expertise` (`Researcher_ID`, `Expertise`) VALUES
('R001', 'Wildlife Conservation'),
('R002', 'Forestry Management'),
```

```
('R003', 'Marine Protected Areas'),

('R004', 'Climate Change Mitigation'),

('R005', 'Sustainable Agriculture');


-- ----------------------------------------------------------


--

-- Table structure for table `Habitat`

--


CREATE TABLE `Habitat` (

  `Habitat_ID` int NOT NULL,

  `Region` varchar(255) DEFAULT NULL,

  `HName` varchar(255) DEFAULT NULL,

  `Description` varchar(1000) DEFAULT NULL

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;


--

-- Dumping data for table `Habitat`

--


INSERT INTO `Habitat` (`Habitat_ID`, `Region`, `HName`, `Description`) VALUES

(8320600, 'North America', 'Salt Marsh', 'A coastal ecosystem found in intertidal zones with brackish water and high salinity.'),

(8320601, 'South America', 'Mangrove Forest', 'A forest found along tropical and subtropical coastlines, with a unique ecosystem adapted to saltwater environments.'),

(8320602, 'Africa', 'Freshwater Wetlands', 'Wetlands with standing water and freshwater, such as ponds, swamps, and marshes.'),

(8320603, 'Asia', 'Coral Reef', 'A marine ecosystem with diverse coral formations, providing habitats for various marine animals, including turtles.'),

(8320604, 'Australia', 'Great Barrier Reef', 'The largest coral reef system in the world, providing habitats for numerous marine animals, including turtles.');
```

```
-- ----------------------------------------------------------

--
-- Table structure for table `Live_in`
--

CREATE TABLE `Live_in` (
  `Species_ID` int NOT NULL,
  `Habitat_ID` int NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;

--
-- Dumping data for table `Live_in`
--

INSERT INTO `Live_in` (`Species_ID`, `Habitat_ID`) VALUES
(1, 8320600),
(2, 8320601),
(3, 8320602),
(4, 8320601),
(5, 8320600);

-- ----------------------------------------------------------

--
-- Table structure for table `MarineBiologist`
--
```

```
CREATE TABLE `MarineBiologist` (
  `Researcher_ID` varchar(10) NOT NULL,
  `Level` char(10) DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;

--
-- Dumping data for table `MarineBiologist`
--

INSERT INTO `MarineBiologist` (`Researcher_ID`, `Level`) VALUES
('R001', 'Senior'),
('R002', 'Junior'),
('R003', 'Senior'),
('R004', 'Junior'),
('R005', 'Mid-level');

-- --------------------------------------------------------

--
-- Table structure for table `MarineBiologist_Expertise`
--

CREATE TABLE `MarineBiologist_Expertise` (
  `Researcher_ID` varchar(10) NOT NULL,
  `Expertise` varchar(50) NOT NULL,
  `Experience` varchar(20) DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;

--
```

```
-- Dumping data for table `MarineBiologist_Expertise`
--

INSERT INTO `MarineBiologist_Expertise` (`Researcher_ID`, `Expertise`, `Experience`) VALUES
('R001', 'Marine Mammals', '10 years'),
('R002', 'Coral Reefs', '5 years'),
('R003', 'Deep-Sea Ecology', '8 years'),
('R004', 'Fisheries Science', '3 years'),
('R005', 'Marine Microbiology', '6 years');

-- --------------------------------------------------------

--
-- Table structure for table `Researcher`
--

CREATE TABLE `Researcher` (
  `Researcher_ID` varchar(50) NOT NULL,
  `RName` varchar(255) DEFAULT NULL,
  `Association_ID` decimal(10,0) DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;

--
-- Dumping data for table `Researcher`
--

INSERT INTO `Researcher` (`Researcher_ID`, `RName`, `Association_ID`) VALUES
('R001', 'John Doe', '101'),
('R002', 'Jane Smith', '102'),
```

```
('R003', 'David Lee', '103'),
('R004', 'Emily Davis', '102'),
('R005', 'Michael Johnson', '104');

-- --------------------------------------------------------

--
-- Table structure for table `Research_in`
--

CREATE TABLE `Research_in` (
  `Turtle_ID` varchar(255) NOT NULL,
  `Researcher_ID` varchar(50) DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;

--
-- Dumping data for table `Research_in`
--

INSERT INTO `Research_in` (`Turtle_ID`, `Researcher_ID`) VALUES
('T01', 'R001'),
('T05', 'R001'),
('T02', 'R002'),
('T04', 'R002'),
('T03', 'R003');

-- --------------------------------------------------------

--
```

```
-- Table structure for table `Tag_in`
--

CREATE TABLE `Tag_in` (
  `Turtle_ID` varchar(50) NOT NULL,
  `Tag_ID` decimal(10,0) NOT NULL,
  `Issue_date` date DEFAULT NULL,
  `Expire_date` date DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;

--
-- Dumping data for table `Tag_in`
--

INSERT INTO `Tag_in` (`Turtle_ID`, `Tag_ID`, `Issue_date`, `Expire_date`) VALUES
('T001', '1001', '2022-01-01', '2023-01-01'),
('T002', '1002', '2022-02-01', '2023-02-01'),
('T003', '1003', '2022-03-01', '2023-03-01'),
('T004', '1004', '2022-04-01', '2023-04-01'),
('T005', '1005', '2022-05-01', '2023-05-01');

-- --------------------------------------------------------

--
-- Table structure for table `Turtle`
--

CREATE TABLE `Turtle` (
  `Turtle_ID` varchar(10) NOT NULL,
```

```
  `TName` varchar(50) DEFAULT NULL,
  `Date_of_Birth` date DEFAULT NULL,
  `Gender` varchar(10) DEFAULT NULL,
  `Species_ID` int DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;

--
-- Dumping data for table `Turtle`
--

INSERT INTO `Turtle` (`Turtle_ID`, `TName`, `Date_of_Birth`, `Gender`, `Species_ID`) VALUES
('T01', 'Leo', '2018-06-02', 'Male', NULL),
('T02', 'Raphael', '2019-03-14', 'Male', NULL),
('T03', 'Michelangelo', '2020-01-01', 'Male', NULL),
('T04', 'Donatello', '2021-02-28', 'Male', NULL),
('T05', 'April', '2017-12-15', 'Female', NULL);

-- --------------------------------------------------------

--
-- Table structure for table `Turtle_Species`
--

CREATE TABLE `Turtle_Species` (
  `Species_ID` int NOT NULL,
  `Species_Name` varchar(255) DEFAULT NULL,
  `Conservation_Status` varchar(50) DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;
```

```
--
-- Dumping data for table `Turtle_Species`
--

INSERT INTO `Turtle_Species` (`Species_ID`, `Species_Name`, `Conservation_Status`) VALUES
(1, 'Hawksbill Turtle', 'Critically Endangered'),
(2, 'Leatherback Turtle', 'Vulnerable'),
(3, 'Olive Ridley Turtle', 'Vulnerable'),
(4, 'Loggerhead Turtle', 'Endangered'),
(5, 'Green Turtle', 'Endangered');

--
-- Indexes for dumped tables
--

--
-- Indexes for table `Association`
--
ALTER TABLE `Association`
  ADD PRIMARY KEY (`Association_ID`);

--
-- Indexes for table `Conservationist`
--
ALTER TABLE `Conservationist`
  ADD PRIMARY KEY (`Researcher_ID`);

--
-- Indexes for table `Conservationist_Expertise`
```

```
--
ALTER TABLE `Conservationist_Expertise`
  ADD PRIMARY KEY (`Researcher_ID`,`Expertise`);

--
-- Indexes for table `Habitat`
--
ALTER TABLE `Habitat`
  ADD PRIMARY KEY (`Habitat_ID`);

--
-- Indexes for table `Live_in`
--
ALTER TABLE `Live_in`
  ADD PRIMARY KEY (`Species_ID`,`Habitat_ID`);

--
-- Indexes for table `MarineBiologist`
--
ALTER TABLE `MarineBiologist`
  ADD PRIMARY KEY (`Researcher_ID`);

--
-- Indexes for table `MarineBiologist_Expertise`
--
ALTER TABLE `MarineBiologist_Expertise`
  ADD PRIMARY KEY (`Researcher_ID`,`Expertise`);

--
```

```
-- Indexes for table `Researcher`
--
ALTER TABLE `Researcher`
  ADD PRIMARY KEY (`Researcher_ID`),
  ADD KEY `Association_ID` (`Association_ID`);

--
-- Indexes for table `Research_in`
--
ALTER TABLE `Research_in`
  ADD PRIMARY KEY (`Turtle_ID`),
  ADD KEY `Researcher_ID` (`Researcher_ID`);

--
-- Indexes for table `Tag_in`
--
ALTER TABLE `Tag_in`
  ADD PRIMARY KEY (`Turtle_ID`,`Tag_ID`);

--
-- Indexes for table `Turtle`
--
ALTER TABLE `Turtle`
  ADD PRIMARY KEY (`Turtle_ID`),
  ADD KEY `Species_ID` (`Species_ID`);

--
-- Indexes for table `Turtle_Species`
--
```

```
ALTER TABLE `Turtle_Species`

  ADD PRIMARY KEY (`Species_ID`);



--

-- Constraints for dumped tables

--



--

-- Constraints for table `Researcher`

--

ALTER TABLE `Researcher`

  ADD CONSTRAINT `Researcher_ibfk_1` FOREIGN KEY (`Association_ID`) REFERENCES `Association`
(`Association_ID`);



--

-- Constraints for table `Research_in`

--

ALTER TABLE `Research_in`

  ADD CONSTRAINT `Research_in_ibfk_1` FOREIGN KEY (`Researcher_ID`) REFERENCES `Researcher`
(`Researcher_ID`),

  ADD CONSTRAINT `Research_in_ibfk_2` FOREIGN KEY (`Turtle_ID`) REFERENCES `Turtle` (`Turtle_ID`),

  ADD CONSTRAINT `Research_in_ibfk_3` FOREIGN KEY (`Researcher_ID`) REFERENCES `Researcher`
(`Researcher_ID`),

  ADD CONSTRAINT `Research_in_ibfk_4` FOREIGN KEY (`Turtle_ID`) REFERENCES `Turtle` (`Turtle_ID`),

  ADD CONSTRAINT `Research_in_ibfk_5` FOREIGN KEY (`Researcher_ID`) REFERENCES `Researcher`
(`Researcher_ID`),

  ADD CONSTRAINT `Research_in_ibfk_6` FOREIGN KEY (`Turtle_ID`) REFERENCES `Turtle` (`Turtle_ID`),

  ADD CONSTRAINT `Research_in_ibfk_7` FOREIGN KEY (`Turtle_ID`) REFERENCES `Turtle` (`Turtle_ID`);



--

-- Constraints for table `Turtle`
```

```
--

ALTER TABLE `Turtle`

  ADD CONSTRAINT `Turtle_ibfk_1` FOREIGN KEY (`Species_ID`) REFERENCES `Turtle_Species`
(`Species_ID`);

COMMIT;



/*!40101 SET CHARACTER_SET_CLIENT=@OLD_CHARACTER_SET_CLIENT */;

/*!40101 SET CHARACTER_SET_RESULTS=@OLD_CHARACTER_SET_RESULTS */;

/*!40101 SET COLLATION_CONNECTION=@OLD_COLLATION_CONNECTION */;
```