Normalization and Schema Refinement

***1NF***

***We have the following schema:-***

**tbl\_animal**(animal\_id, name, height, age, color, weight, gender, sci\_name, life\_span, category\_name, sub\_category\_name, city\_name, state\_name, population)

***Candidate Key:*** {animal\_id, city\_name, category\_name}

***Functional Dependencies:***

* {animal\_id} 🡪 {name, height, age, color, weight, gender, sci\_name, life\_span}
* {name} 🡪 {sub\_category\_name}
* {city\_name} 🡪 {state\_name}

**Anomalies**

***Insertion***: If a new species is found, then it will take time to assign that in which category and sub-category it belongs and unless that is decided it cannot be inserted in the Database.

***Updation***: If any animal’s age, height or weight is updated then we have to reflect it in all the tuples that animal’s data is repeated due to redundancy. Therefore, if in any tuple that update is not made there will be data inconsistency.

***BCNF***

***There are 2 partial dependencies in the above 1NF:***

* {animal\_id} 🡪 {name, height, age, color, weight, gender, sci\_name, life\_span}
* {city\_name} 🡪 {state\_name}

Now for removing the above partial dependency and reducing the redundancy that above 1NF have, we have come up with the following schema:

* animal(animal\_id, name, height, weight, sci\_name, age, life\_span, color, gender)
* category(category\_id, category\_name)
* sub\_category(sub\_category\_id, sub\_category\_name)
* main\_category(main\_category\_id, sub\_category\_id, category\_id, animal\_id)
* animal\_details(animal\_id, city\_id, population)
* city(city\_id ,city\_name, state\_id)
* state(state\_id,state\_name)

The above tables are in BCNF. After removing the partial dependency there was excess use of data storage and to reduce that, 5 more schemas {category, sub\_category, main\_category, animal\_details, state} are built. This new schemas reduce the usage of data storage to a larger extent.

***Normalised DDL Statements***

CREATE TABLE animal(

animal\_id number(8) PRIMARY KEY,

name varchar(30) NOT NULL,

height varchar(6) NOT NULL,

weight number(5) NOT NULL,

sci\_name varchar(30) NOT NULL,

life\_span number(3) NOT NULL,

age number(3) NOT NULL,

color varchar(50) NOT NULL,

gender varchar(6) NOT NULL

);

CREATE TABLE category(

category\_id number(1) PRIMARY KEY,

category\_name varchar(50) NOT NULL

);

CREATE TABLE sub\_category(

sub\_category\_id number(1) PRIMARY KEY,

sub\_category\_name varchar(50) NOT NULL

);

CREATE TABLE main\_category(

main\_category\_id number(2) PRIMARY KEY,

sub\_category\_id number(1) REFERENCES sub\_category(sub\_category\_id)

ON DELETE RESTRICT NOT NULL,

category\_id number(1) REFERENCES category(category\_id)

ON DELETE RESTRICT NOT NULL,

animal\_id number(8) REFERENCES animal(animal\_id)

ON DELETE RESTRICT NOT NULL

);

CREATE TABLE animal\_details(

animal\_id number(8) REFERENCES animal(animal\_id)

ON DELETE RESTRICT NOT NULL ,

city\_id number(3) REFERENCES city(city\_id)

ON DELETE RESTRICT NOT NULL ,

population number(7) NOT NULL

);

CREATE TABLE state(

state\_id number(2) PRIMARY KEY,

state\_name varchar(50) NOT NULL

);

CREATE TABLE city(

city\_id number(3) PRIMARY KEY,

city\_name varchar(50) NOT NULL,

state\_id number(2) REFERENCES state(state\_id)

ON DELETE RESTRICT NOT NULL

);