Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

CS4041 – Database SQL Project

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Application Description

The database I have created is based upon the “Harry Potter” series by J.K. Rowling.

In the novels and films, the world of “Harry Potter” is a magical world that consists of many educational institutes to help train and prepare witches/wizards all over the world for what they will face in this strange world. Each school offers many types of different subjects which prepare the students in all the different aspects of magic. The school also employs a wide variety of staff members such as professors and care-takers. Every student must possess a wand to perform magic and a pet to help them deliver messages to home and to other students.

This application contains 6 different entities; “School”, “Subject”, “Staff”, “Student”, “Wand” and “Pet”. It also has 6 different relationships; “Offers”, “Has”, “Teaches”, “Enrolled by”, “Owns” and “Employs” which show how the different entities share information in the database.

The “School” entity offers many subjects for the students such as “Potions” and employs many staff members such as professors. It has 4 attributes; the ID number of the school, the name of the school, the location of the school and the number of students enrolled with the school.

The “Subject” entity is enrolled by many students. It has 4 attributes; the subject ID number, the PPS number of the professor teaching the class, the name of the subject and the room number in which the subject is taught.

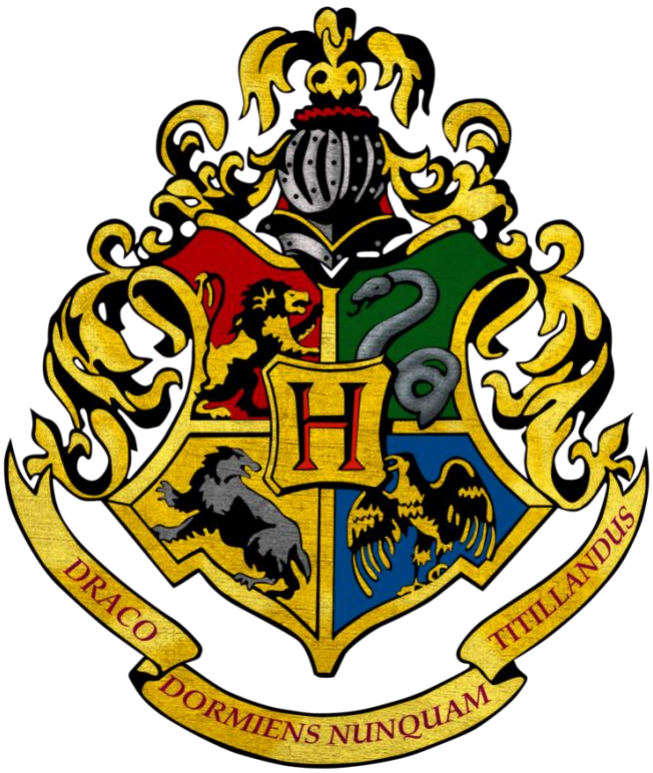
The “Staff” entity teaches a subject if it happens to be a professor, and also has a wand if it happens to be a witch/wizard. It has the most attributes with a total of 9; the staff PPS number, the first and last name of the staff member, the magical species the staff member belongs to (e.g. wizard, giant, goblin etc…), the job title such as professor or headmaster, the ID number and room number of the subject they teach, the ID number of the school in which they are employed and lastly their wand ID number.

The “Student” entity has a wand and also owns a pet. It contains 7 attributes; the student ID number, the first and last name of the student, the magical species the student is associated with, their wand ID number, their pet

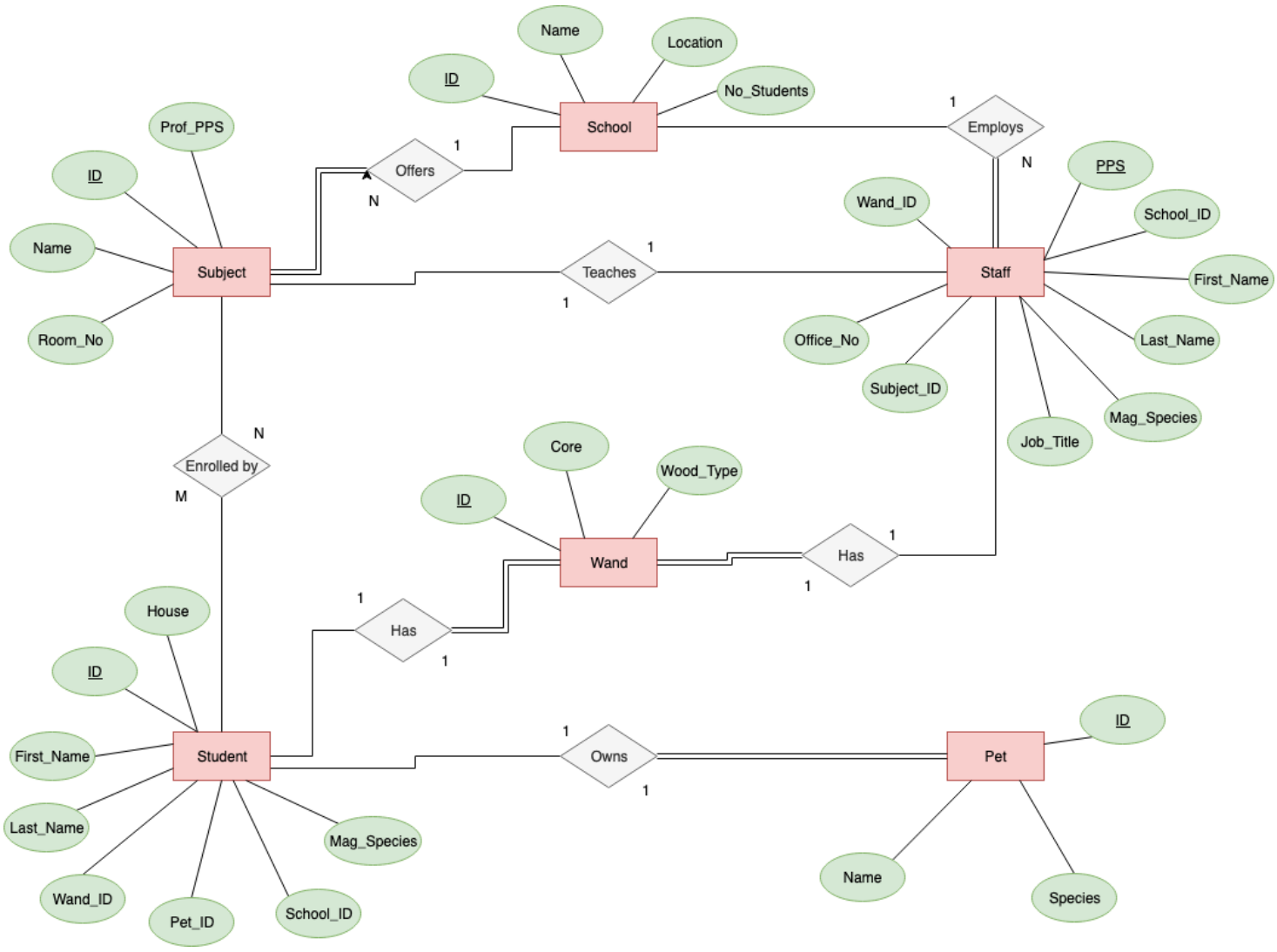
ID number, the ID number of the school they attend and the house they belong to (e.g. Gryffindor, Ravenclaw etc…).

The “Wand” entity has 3 attributes; the ID number of the wand, the core of the wand (this is a magical object that is infused with the wand e.g. phoenix feather) and the type of wood the wand is made from.

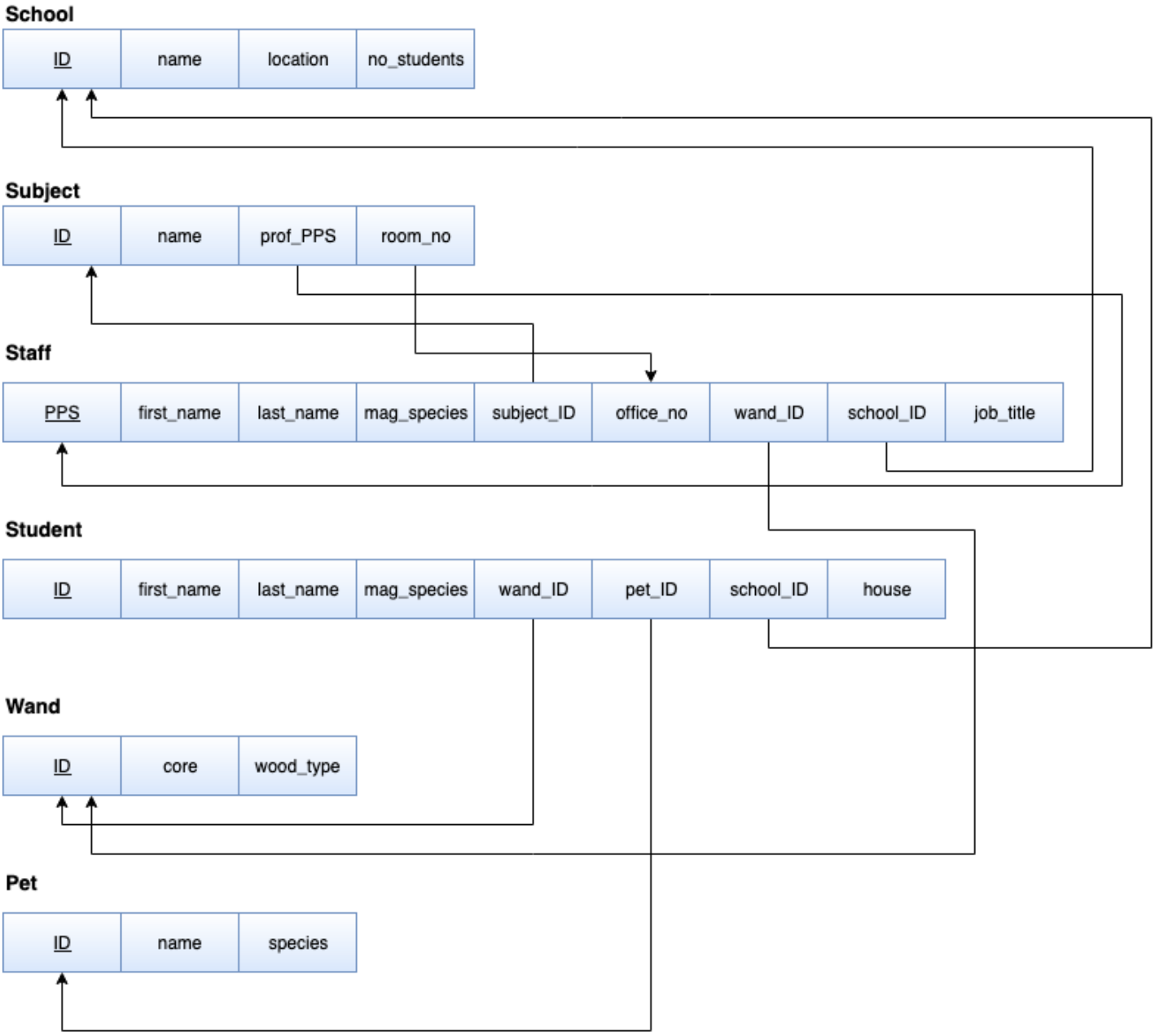
The “Pet” entity has 3 attributes; the ID number of the pet, the name of the pet and the species of the pet.



Entity Relationship Diagram:

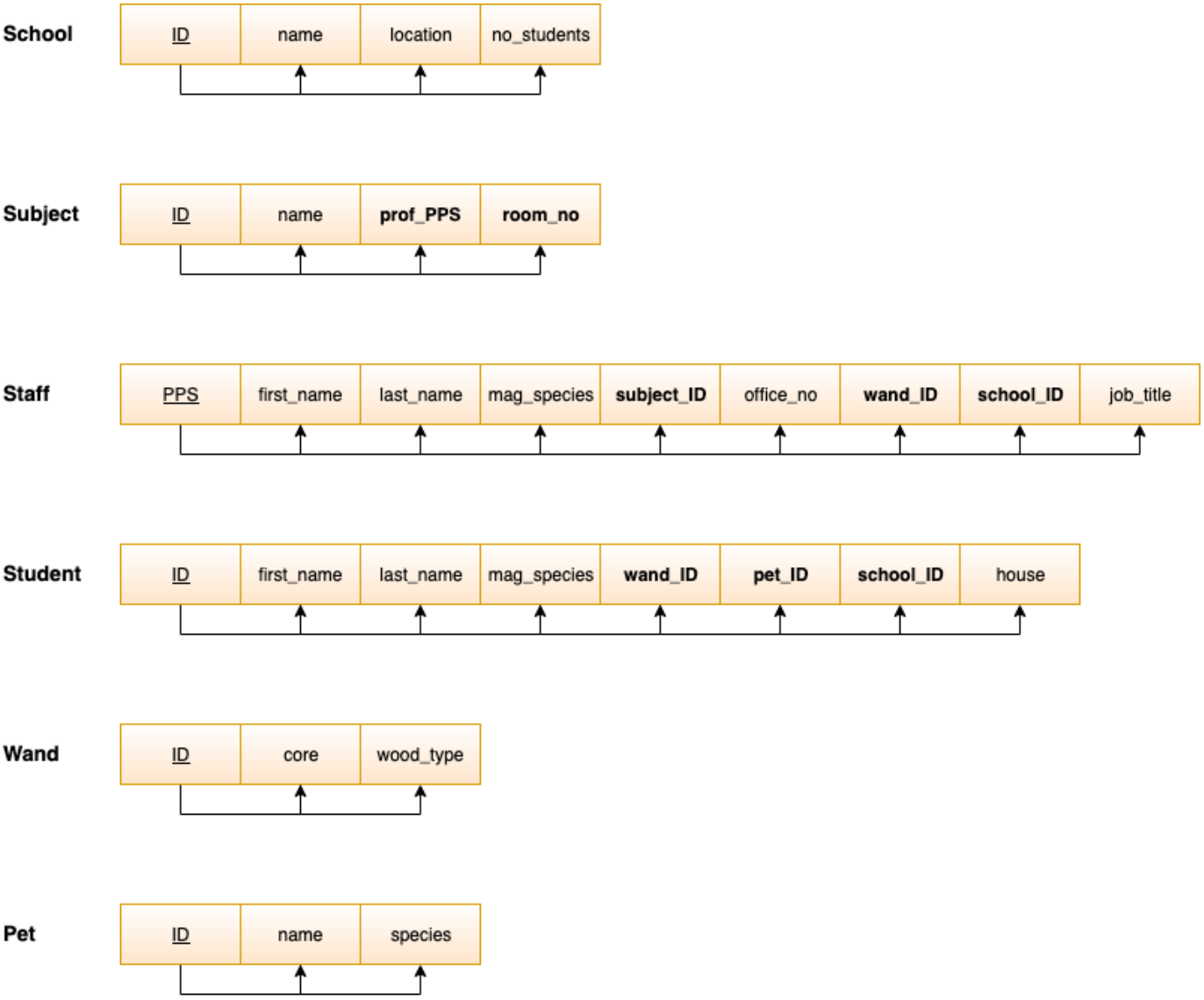


Relational Schema:



*Underlined attribute indicates a primary key.

Functional Dependency Diagram:



*Underlined attributes indicate a primary key.
*Bold attributes indicate a foreign key.

Normalisation

The tables I used were generally already normalised, however I normalised them further by giving each attribute a primary key and foreign keys to link each attribute.

Semantic Constraints

I have applied many semantic constraints to this database to ensure the consistency of data. The most basic of which is the ID/PPS numbers of each attribute.

- For the School entity, I made ID 4 digits ranging from 5000 to 9999.
- The Subject entity has an ID number of 5 digits and always begins with 11 (i.e. ranging from 11000 to 11999).
- The Staff entity has a PPS number of 8 digits and always begins with the digits 1234 (i.e. ranging from 12340000 to 12349999).
- The Student entity has an ID number of 8 digits that always begins with the digits 17 (i.e. ranging from 17000000 to 17999999). This entity also has another constraint on the House attribute. In the school of Hogwarts in the Harry Potter series, there are only 4 houses; “Gryffindor”, “Slytherin”, “Ravenclaw” and “Hufflepuff”. Therefore this attribute is only limited to these 4 values or null (if from another school).
- The Wand entity has an ID number of 6 digits ranging from 100000 to 199999.
- The Pet entity has an ID number of 4 digits ranging from 1000 to 4999. It also has another constraint limiting it to only 4 values; “Owl”, “Rat”, “Toad” and “Cat”. This is due the fact that students may only possess these 4 species of animals as pets.

I also included constraints in the form of foreign keys. These foreign keys can be seen as outlined in the above Relational Schema.

Code

Altered tables to include checks.

```
ALTER TABLE School ADD CHECK(ID > 4999 AND ID < 10000);
ALTER TABLE Subject ADD CHECK(ID > 10999 AND ID < 12000);
ALTER TABLE Staff ADD CHECK(PPS > 12339999 AND PPS < 12350000);
ALTER TABLE Student ADD CHECK(ID > 16999999 AND ID < 18000000);
ALTER TABLE Student ADD CHECK(House IN ('Gryffindor', 'Slytherin', 'Ravenclaw', 'Hufflepuff'));
ALTER TABLE Wand ADD CHECK(ID > 99999 AND ID < 1000000);
ALTER TABLE Pet ADD CHECK(ID > 999 AND ID < 4999);
ALTER TABLE Pet ADD CHECK(Species IN ('Owl', 'Rat', 'Toad', 'Cat'));
```

Altered tables to include foreign keys.

```
ALTER TABLE Subject ADD FOREIGN KEY(Prof_PPS) REFERENCES Staff(PPS);
ALTER TABLE Subject ADD FOREIGN KEY(Room_No) REFERENCES Staff(Office_No);

ALTER TABLE Staff ADD FOREIGN KEY(Wand_ID) REFERENCES Wand(ID);
ALTER TABLE Staff ADD FOREIGN KEY(School_ID) REFERENCES School(ID);
ALTER TABLE Staff ADD FOREIGN KEY(Subject_ID) REFERENCES Subject(ID);

ALTER TABLE Student ADD FOREIGN KEY(Wand_ID) REFERENCES Wand(ID);
ALTER TABLE Student ADD FOREIGN KEY(Pet_ID) REFERENCES Pet(ID);
ALTER TABLE Student ADD FOREIGN KEY(School_ID) REFERENCES School(ID);
```

Security

Security can be implemented in this database for the use of the Student table by the headmaster of a school. Since the Student table may consist of many students even from other schools, it would not be right to allow any headmaster to edit the students records of another school. To solve this issue, it is possible to create a view of the students only in the headmaster's school and then grant the headmaster rights to delete, update and select data from the view table.
I created an example using the headmaster of Hogwarts; Albus Dumbledore.

Code

Creating the view of all students attending Hogwarts.

```
CREATE VIEW hogwarts_students(Student_ID, First_Name, Last_Name)
    AS SELECT Student.ID, Student.First_Name, Student.Last_Name FROM Student WHERE Student.School_ID = 5490;
```

Granting delete, update and select privileges to Albus Dumbledore.

```
GRANT DELETE ON hogwarts_students TO Albus_Dumbledore;
GRANT UPDATE ON hogwarts_students TO Albus_Dumbledore;
GRANT SELECT ON hogwarts_students TO Albus_Dumbledore WITH GRANT OPTION;
```

View Creation

I created 5 views in this application; each uses the SELECT statement to perform table joins. The first is called Gryffindor_students and it creates a view of all the students from the Student table that belong to the have the House attribute with the value “Gryffindor”. I also created 3 more views for the other houses; Slytherin_students, Ravenclaw_students and Hufflepuff_students.

The 5th view I created was mentioned above in Security which is a view of all of the students attending Hogwarts (i.e. Students with the attribute School_ID value of 5490).

Code

```
CREATE VIEW Gryffindor_students (Student_ID, First_Name, Last_Name)
    AS SELECT Student.ID, Student.First_Name, Student.Last_Name FROM Student WHERE Student.House = 'Gryffindor';
CREATE VIEW Slytherin_students (Student_ID, First_Name, Last_Name)
    AS SELECT Student.ID, Student.First_Name, Student.Last_Name FROM Student WHERE Student.House = 'Slytherin';
CREATE VIEW Ravenclaw_students (Student_ID, First_Name, Last_Name)
    AS SELECT Student.ID, Student.First_Name, Student.Last_Name FROM Student WHERE Student.House = 'Ravenclaw';
CREATE VIEW Hufflepuff_students (Student_ID, First_Name, Last_Name)
    AS SELECT Student.ID, Student.First_Name, Student.Last_Name FROM Student WHERE Student.House = 'Hufflepuf›';
CREATE VIEW hogwarts_students(Student_ID, First_Name, Last_Name)
    AS SELECT Student.ID, Student.First_Name, Student.Last_Name FROM Student WHERE Student.School_ID = 5490;
```

Appendix

Create

```
CREATE TABLE IF NOT EXISTS School (
   ID INT NOT NULL ,
   Name VARCHAR(50) NOT NULL,
   Location VARCHAR(20) NOT NULL,
   No_Students INT NOT NULL,
   PRIMARY KEY(ID)
);

CREATE TABLE IF NOT EXISTS Subject (
   ID INT NOT NULL,
   Name VARCHAR(50) NOT NULL,
   Prof_PPS INT NOT NULL,
   Room_No INT UNIQUE,
   PRIMARY KEY(ID)
);

CREATE TABLE IF NOT EXISTS Staff (
         PPS INT NOT NULL,
   First_Name VARCHAR(20) NOT NULL,
   Last_Name VARCHAR(20) NOT NULL,
   Mag_Species VARCHAR(20) NOT NULL,
   Subject_ID INT,
   Office_No INT UNIQUE,
   Wand_ID INT,
   School_ID INT NOT NULL,
   Job_Title VARCHAR(20) NOT NULL,
   PRIMARY KEY(PPS)
);

CREATE TABLE IF NOT EXISTS Student (
         ID INT NOT NULL,
   First_Name VARCHAR(20) NOT NULL,
   Last_Name VARCHAR(20) NOT NULL,
   Mag_Species VARCHAR(20) NOT NULL,
   Wand_ID INT NOT NULL,
   Pet_ID INT,
   School_ID INT NOT NULL,
   House VARCHAR(15),
   PRIMARY KEY(ID)
);
```

```
CREATE TABLE IF NOT EXISTS Wand (
        ID INT NOT NULL,
   Core VARCHAR(30) NOT NULL,
   Wood_Type VARCHAR(20) NOT NULL,
   PRIMARY KEY(ID)
);

CREATE TABLE IF NOT EXISTS Pet (
        ID INT NOT NULL,
   Name VARCHAR(20),
   Species VARCHAR(20) NOT NULL,
   PRIMARY KEY(ID)
);
```

Insert

```
INSERT INTO School VALUES ( 5490, 'Hogwarts School of Witchcraft and Wizardry',
'Scotland', 283);
INSERT INTO School VALUES ( 5500, 'Beauxbatons Academy of Magic', 'France', 332);
INSERT INTO School VALUES ( 5510, 'Castelobruxo', 'Central Brazil', 432);
INSERT INTO School VALUES ( 5520, 'Durmstrang Institute', 'Northern Europe', 280);
INSERT INTO School VALUES ( 5530, 'Ilvermorny', 'North America', 414);
INSERT INTO School VALUES ( 5540, 'Mahoutokoro School of Magic', 'Japan', 683);
INSERT INTO School VALUES ( 5550, 'Uagadou School of Magic', 'Uganda', 456);
INSERT INTO School VALUES ( 5560, 'Koldovstoretz', 'Russia', 298);

INSERT INTO Subject VALUES (11123, 'Charms', '12348000', 1); /*Filius Flitwick*/
INSERT INTO Subject VALUES (11135, 'Defence Against the Dark Arts', '12348010', 6 );
/*Alastor Moody*/
INSERT INTO Subject VALUES (11147, 'Flying', '12348020', 4); /*Rolanda Hooch*/
INSERT INTO Subject VALUES (11159, 'Herbology', '12348030', 12); /*Pomona Sprout*/
INSERT INTO Subject VALUES (11171, 'History of Magic', '12348040', 7); /*Cuthbert Binns*/
INSERT INTO Subject VALUES (11183, 'Potions', '12348050', 18); /*Severus Snape*/
INSERT INTO Subject VALUES (11195, 'Transfiguration', '12348060', 21); /*Minerva
McGonagall*/
INSERT INTO Subject VALUES (11207, 'Arithmancy', '12348070', 16); /*Septima Vector*/
INSERT INTO Subject VALUES (11219, 'Care of Magical Creatures', '12348080', 41);
/*Wilhelmina Grubbly-Plank*/
INSERT INTO Subject VALUES (11231, 'Divination', '12348090', 32); /*Sybill Trelawney*/
INSERT INTO Subject VALUES (11243, 'Apparition', '12348100', 17); /*Wilkie Twycross*/

INSERT INTO Staff VALUES (12347990, 'Albus', 'Dumbledore', 'Wizard', null, 0, 987619, 5490,
'Headmaster');
```

```
INSERT INTO Staff VALUES (12348000, 'Filius', 'Flitwick', 'Goblin-Wizard', 11123, 1, 987631, 5490, 'Professor');
INSERT INTO Staff VALUES (12348010, 'Alastor', 'Moody', 'Wizard', 11135, 6, 987643, 5490, 'Professor');
INSERT INTO Staff VALUES (12348020, 'Rolanda', 'Hooch', 'Witch', 11147, 4, 987655, 5490, 'Professor');
INSERT INTO Staff VALUES (12348030, 'Pomona', 'Sprout', 'Witch', 11159, 12, 987667, 5490, 'Professor');
INSERT INTO Staff VALUES (12348040, 'Cuthbert', 'Binns', 'Wizard', 11171, 7, 987679, 5490, 'Professor');
INSERT INTO Staff VALUES (12348050, 'Severus', 'Snape', 'Wizard', 11183, 18, 987691, 5490, 'Professor');
INSERT INTO Staff VALUES (12348060, 'Minerva', 'McGonagall', 'Witch', 11195, 21, 987703, 5490, 'Professor');
INSERT INTO Staff VALUES (12348070, 'Septima', 'Vector', 'Witch', 11207, 16, 987715, 5490, 'Professor');
INSERT INTO Staff VALUES (12348080, 'Wilhelmina', 'Grubbly-Plank', 'Witch', 11219, 41, 987727, 5490, 'Professor');
INSERT INTO Staff VALUES (12348090, 'Sybill', 'Trelawney', 'Witch', 11231, 32, 987739, 5490, 'Professor');
INSERT INTO Staff VALUES (12348100, 'Wilkie', 'Twycross', 'Wizard', 11243, 17, 987751, 5490, 'Professor');
INSERT INTO Staff VALUES (12348110, 'Rubius', 'Hagrid', 'Wizard-Giant', NULL, 34, 987763, 5490, 'Gate-keeper');
INSERT INTO Staff VALUES (12348120, 'Argus', 'Filch', 'Squib', NULL, NULL, NULL, 5490, 'Care-taker');
INSERT INTO Staff VALUES (12348130, 'Olympe', 'Maxime', 'Witch-Giant', NULL, 67, 987907, 5500, 'Headmaster');


INSERT INTO Student VALUES (17339999, 'Harry', 'Potter', 'Wizard', 987775, 1010, 5490, 'Gryffindor');
INSERT INTO Student VALUES (17339998, 'Hermione', 'Granger', 'Witch', 987787, 1021, 5490, 'Gryffindor');
INSERT INTO Student VALUES (17339997, 'Ronald', 'Weasley', 'Wizard', 987799, 1032, 5490, 'Gryffindor');
INSERT INTO Student VALUES (17339996, 'Neville', 'Longbottom', 'Wizard', 987811, 1043, 5490, 'Gryffindor');
INSERT INTO Student VALUES (17339995, 'Draco', 'Malfoy', 'Wizard', 987823, 1054, 5490, 'Slytherin');
INSERT INTO Student VALUES (17339994, 'Vincent', 'Crabbe', 'Wizard', 987835, 1065, 5490, 'Slytherin');
INSERT INTO Student VALUES (17339993, 'Gregory', 'Goyle', 'Wizard', 987847, 1076, 5490, 'Slytherin');
INSERT INTO Student VALUES (17339992, 'Ernie', 'Macmillan', 'Wizard', 987859, 1087, 5490, 'Hufflepuff');
```

```
INSERT INTO Student VALUES (17339991, 'Cedric', 'Diggory', 'Wizard', 987871, 1098, 5490, 'Hufflepuff');
INSERT INTO Student VALUES (17339990, 'Luna', 'Lovegood', 'Witch', 987883, 1110, 5490, 'Ravenclaw');
INSERT INTO Student VALUES (17339989, 'Cho', 'Chang', 'Witch', 987895, 1121, 5490, 'Ravenclaw');
INSERT INTO Student VALUES (17339988, 'Viktor', 'Krum', 'Wizard', 987919, null, 5520, null);


INSERT INTO Wand VALUES (987619, 'Thestral Tail Hair', 'Elder');
INSERT INTO Wand VALUES (987631, 'Unicorn Hair', 'Ash');
INSERT INTO Wand VALUES (987643, 'Dragon Heartstring', 'Oak');
INSERT INTO Wand VALUES (987655, 'Unicorn hair', 'Willow');
INSERT INTO Wand VALUES (987667, 'Dragon Heartstring', 'Yew');
INSERT INTO Wand VALUES (987679, 'Phoenix Feather', 'Mahogany');
INSERT INTO Wand VALUES (987691, 'Dragon Heartstring', 'Bog-wood');
INSERT INTO Wand VALUES (987703, 'Unicorn Hair', 'Sycamore');
INSERT INTO Wand VALUES (987715, 'Unicorn Hair', 'Oak');
INSERT INTO Wand VALUES (987727, 'Unicorn Hair', 'Beech');
INSERT INTO Wand VALUES (987739, 'Unicorn Hair', 'Elm');
INSERT INTO Wand VALUES (987751, 'Unicorn Hair', 'Cherry');
INSERT INTO Wand VALUES (987763, 'Unicorn Hair', 'Ash');
INSERT INTO Wand VALUES (987775, 'Unicorn Hair', 'Willow');
INSERT INTO Wand VALUES (987787, 'Phoenix Feather', 'Holly');
INSERT INTO Wand VALUES (987799, 'Dragon Heartstring', 'Vine');
INSERT INTO Wand VALUES (987811, 'Unicorn Hair', 'Willow');
INSERT INTO Wand VALUES (987823, 'Unicorn Hair', 'Cherry');
INSERT INTO Wand VALUES (987835, 'Unicorn Hair', 'Hawthorn');
INSERT INTO Wand VALUES (987847, 'Dragon Heartstring', 'Ash');
INSERT INTO Wand VALUES (987859, 'Unicorn Hair', 'Oak');
INSERT INTO Wand VALUES (987871, 'Unicorn Hair', 'Mahogany');
INSERT INTO Wand VALUES (987883, 'Unicorn Hair', 'Ash');
INSERT INTO Wand VALUES (987895, 'Unicorn Hair', 'Holly');
INSERT INTO Wand VALUES (987907, 'Unicorn Hair', 'Oak');
INSERT INTO Wand VALUES (987919, 'Dragon Heartstring', 'Mahogany');

INSERT INTO Pet VALUES (1010, 'Hedwig', 'Owl');
INSERT INTO Pet VALUES (1021, 'Crookshanks', 'Cat');
INSERT INTO Pet VALUES (1032, 'Scabbers', 'Rat');
INSERT INTO Pet VALUES (1043, 'Trevor', 'Toad');
INSERT INTO Pet VALUES (1054, null, 'Owl');
INSERT INTO Pet VALUES (1065, null, 'Toad');
INSERT INTO Pet VALUES (1076, null, 'Rat');
INSERT INTO Pet VALUES (1087, null, 'Owl');
INSERT INTO Pet VALUES (1098, null, 'Owl');
INSERT INTO Pet VALUES (1110, null, 'Cat');
INSERT INTO Pet VALUES (1121, null, 'Cat');
```

Alter

```
ALTER TABLE Subject ADD FOREIGN KEY(Prof_PPS) REFERENCES Staff(PPS);
ALTER TABLE Subject ADD FOREIGN KEY(Room_No) REFERENCES Staff(Office_No);

ALTER TABLE Staff ADD FOREIGN KEY(Wand_ID) REFERENCES Wand(ID);
ALTER TABLE Staff ADD FOREIGN KEY(School_ID) REFERENCES School(ID);
ALTER TABLE Staff ADD FOREIGN KEY(Subject_ID) REFERENCES Subject(ID);

ALTER TABLE Student ADD FOREIGN KEY(Wand_ID) REFERENCES Wand(ID);
ALTER TABLE Student ADD FOREIGN KEY(Pet_ID) REFERENCES Pet(ID);
ALTER TABLE Student ADD FOREIGN KEY(School_ID) REFERENCES School(ID);


ALTER TABLE School ADD CHECK(ID > 4999 AND ID < 10000);
ALTER TABLE Subject ADD CHECK(ID > 10999 AND ID < 12000);
ALTER TABLE Staff ADD CHECK(PPS > 12339999 AND PPS < 12350000);
ALTER TABLE Student ADD CHECK(ID > 16999999 AND ID < 18000000);
ALTER TABLE Student ADD CHECK(House IN ('Gryffindor', 'Slytherin', 'Ravenclaw',
'Hufflepuff'));
ALTER TABLE Wand ADD CHECK(ID > 99999 AND ID < 1000000);
ALTER TABLE Pet ADD CHECK(ID > 999 AND ID < 4999);
ALTER TABLE Pet ADD CHECK(Species IN ('Owl', 'Rat', 'Toad', 'Cat'));
```

View

```
CREATE VIEW Gryffindor_students (Student_ID, First_Name, Last_Name)
        AS SELECT Student.ID, Student.First_Name, Student.Last_Name FROM Student
WHERE Student.House = 'Gryffindor';
CREATE VIEW Slytherin_students (Student_ID, First_Name, Last_Name)
        AS SELECT Student.ID, Student.First_Name, Student.Last_Name FROM Student
WHERE Student.House = 'Slytherin';
CREATE VIEW Ravenclaw_students (Student_ID, First_Name, Last_Name)
        AS SELECT Student.ID, Student.First_Name, Student.Last_Name FROM Student
WHERE Student.House = 'Ravenclaw';
CREATE VIEW Hufflepuff_students (Student_ID, First_Name, Last_Name)
        AS SELECT Student.ID, Student.First_Name, Student.Last_Name FROM Student
WHERE Student.House = 'Hufflepuf›';
CREATE VIEW hogwarts_students(Student_ID, First_Name, Last_Name)
        AS SELECT Student.ID, Student.First_Name, Student.Last_Name FROM Student
WHERE Student.School_ID = 5490;
```