COMS W4111-003/V03 (Fall 2022) Introduction to Databases

Homework 1, Part 2

Note:

- **Please replace the information below with your last name, first name and UNI.**

- **Please delete the track that you are not taking from "Programming, Non-Programming."**

Student Information: Honghao, Liu, hl3630 Track: Programming

Introduction

Overview and Objectives

HW 1 is the first step in the process of incrementally implementing a small project. You will have an executable, demoable project by the end of the semester. We build the project one homework assignment at a time. The non-programming track develops a simple data engineering and data science Jupyter notebook. The programming track builds a simple full stack web application.

There are two sections to HW 1, part 2. There is one section for each track. You only need to complete the section for the track you have chosen.

Submission

1. **Remove `dff9` from the file name and replace with your UNI.**
2. **File > Print Preview > Download as PDF**
3. **Upload .pdf and .ipynb to GradeScope**

This assignment is due 12-October-2022 at 11:59PM EDT.

Collaboration

- **You may use any information found in TA or Prof. Ferguson's office hours, class recordings, slides, ...**
- **You may use information you find on the web, but must provide a link to the information and cite.**
- **You may not copy code or answers verbatim. To can use the web to find information, but must provide your own answers.**
- **You are not allowed to collaborate outside of office hours**
- **You are NOT allowed to collaborate with other students outside of office hours.**

Non-Programming Section

Data Loading

The following sections load the data from files into MySQL. The HW task uses the MySQL tables.

Step 1: Read Episode Information

The zip file for the homework contains a JSON file with information about episodes in Game of Thrones. The following code loads the file into a Pandas data frame.

In [1]:
```
import pandas as pd
```

In [2]:
```
file_name = "./flattened_episodes.json"
df = pd.read_json(file_name)
df
```

Out[2]:

	seasonNum	episodeNum	episodeTitle	episodeLink	episodeAirDate	episodeDescriptio
0	1	1	Winter Is Coming	/title/tt1480055/	2011-04-17	Jon Arryn, th Hand of the Kin is dead. King
1	1	1	Winter Is Coming	/title/tt1480055/	2011-04-17	Jon Arryn, th Hand of the Kin is dead. King
2	1	1	Winter Is Coming	/title/tt1480055/	2011-04-17	Jon Arryn, th Hand of the Kin is dead. King
3	1	1	Winter Is Coming	/title/tt1480055/	2011-04-17	Jon Arryn, th Hand of the Kin is dead. King
4	1	1	Winter Is Coming	/title/tt1480055/	2011-04-17	Jon Arryn, th Hand of the Kin is dead. King
...	...	...	...	...	...	
4160	8	6	The Iron Throne	/title/tt6027920/	2019-05-19	In the aftermath the devastatin attack on
4161	8	6	The Iron Throne	/title/tt6027920/	2019-05-19	In the aftermath the devastatin attack on
4162	8	6	The Iron Throne	/title/tt6027920/	2019-05-19	In the aftermath the devastatin attack on
4163	8	6	The Iron Throne	/title/tt6027920/	2019-05-19	In the aftermath the devastatin attack on
4164	8	6	The Iron Throne	/title/tt6027920/	2019-05-19	In the aftermath the devastatin attack on

4165 rows × 13 columns

Step 2: Save the Episode Information

The following code saves the episode information to a relational database table. You must change the user ID and password for the mySQL database.

In [3]:
```
%load_ext sql
```

In [4]:
```
%sql mysql+pymysql://root:dbuserbdbuser@localhost
```

Danger: The following code will delete any previous work in the database you have done.

In [5]:
```
%sql drop database if exists f22_hw1_got
```

```
 * mysql+pymysql://root:***@localhost
3 rows affected.
```

Out[5]:
```
[]
```

In [6]:
```
%sql create database f22_hw1_got
```

```
 * mysql+pymysql://root:***@localhost
1 rows affected.
```

Out[6]:
```
[]
```

Pandas needs a SQLAlchemy engine to interact with a relational database.

In [7]:
```
from sqlalchemy import create_engine
```

In [8]:
```
engine = create_engine("mysql+pymysql://root:dbuserbdbuser@localhost")
```

In [9]:
```
df.to_sql("episodes_scenes", schema="f22_hw1_got", con=engine, index=False
```

Out[9]:
```
4165
```

The following code is a simple test to see if you have written the data.

In [10]:
```
%sql select seasonNum, episodeNum, count(scene_no) as no_of_scenes from \
        f22_hw1_got.episodes_scenes group by seasonNum, episodeNum \
            order by seasonNum, episodeNum
```

```
 * mysql+pymysql://root:***@localhost
73 rows affected.
```

Out[10]:

seasonNum	episodeNum	no_of_scenes
1	1	36
1	2	31
1	3	25
1	4	28
1	5	28
1	6	19
1	7	25
1	8	37
1	9	25
1	10	32
2	1	30
2	2	31
2	3	30
2	4	33
2	5	38
2	6	47
2	7	38
2	8	43
2	9	133
2	10	45
3	1	50
3	2	49
3	3	42
3	4	50
3	5	37
3	6	26
3	7	48
3	8	50
3	9	71
3	10	47
4	1	56
4	2	82
4	3	55
4	4	44
4	5	50
4	6	38

4	7	27
4	8	34
4	9	86
4	10	45
5	1	47
5	2	46
5	3	55
5	4	51
5	5	48
5	6	39
5	7	46
5	8	59
5	9	53
5	10	64
6	1	44
6	2	45
6	3	37
6	4	46
6	5	85
6	6	60
6	7	47
6	8	53
6	9	71
6	10	89
7	1	40
7	2	59
7	3	50
7	4	86
7	5	54
7	6	75
7	7	104
8	1	86
8	2	69
8	3	292
8	4	113
8	5	220
8	6	91

Step 3: Load the Character Information

In [11]:
```
# This logic is basically the same as above.
file_name = "./flattened_characters.json"
df = pd.read_json(file_name)
df
```

Out[11]:

	characterName	characterLink	actorName	actorLink	houseName	royal
0	Addam Marbrand	/character/ch0305333/	B.J. Hogg	/name/nm0389698/	NaN	NaN
1	Aegon Targaryen	NaN	NaN	NaN	Targaryen	1.0
2	Aeron Greyjoy	/character/ch0540081/	Michael Feast	/name/nm0269923/	Greyjoy	NaN
3	Aerys II Targaryen	/character/ch0541362/	David Rintoul	/name/nm0727778/	Targaryen	1.0
4	Akho	/character/ch0544520/	Chuku Modu	/name/nm6729880/	NaN	NaN
...	...	...	...	...	...	...
384	Young Nan	/character/ch0305018/	Annette Tierney	/name/nm1519719/	NaN	NaN
385	Young Ned	/character/ch0154681/	Robert Aramayo	/name/nm7075019/	Stark	NaN
386	Young Ned Stark	/character/ch0154681/	Sebastian Croft	/name/nm7509185/	Stark	NaN
387	Young Rodrik Cassel	/character/ch0171391/	Fergus Leathem	/name/nm7509186/	NaN	NaN
388	Zanrush	/character/ch0540870/	Gerald Lepkowski	/name/nm0503319/	NaN	NaN

389 rows × 25 columns

Step 4: Save the Data

In [12]:
```
df.to_sql("characters", schema="f22_hw1_got", con=engine, index=False, if_
```

Out[12]:
```
389
```

In [13]:
```
# Test the load.
%sql select characterName, actorName, actorLink from f22_hw1_got.character
```

```
 * mysql+pymysql://root:***@localhost
5 rows affected.
```

Out[13]:

characterName	actorName	actorLink
Arthur Dayne	Luke Roberts	/name/nm1074361/
Brienne of Tarth	Gwendoline Christie	/name/nm3729225/
Jaime Lannister	Nikolaj Coster-Waldau	/name/nm0182666/
Mandon Moore	James Doran	/name/nm0243696/
Podrick Payne	Daniel Portman	/name/nm4535552/

Once More with Feeling

We are going to do the same thing with locations and subLocations. But this, time we are really going to get excited about data processing. So, "Once More with Feeling!"

In [14]:
```
# This logic is basically the same as above.
file_name = "./flattened_locations.json"
df = pd.read_json(file_name)
df
```

Out[14]:

	location	subLocation
0	North of the Wall	The Lands of Always Winter
1	North of the Wall	Cave Outside Wildling Camp
2	North of the Wall	Wildling Camp
3	North of the Wall	Frostfang Mountains
4	North of the Wall	The Three-Eyed Raven
...	...	...
115	The Red Waste	The Desert
116	Qarth	
117	Qarth	King's Landing
118	Qarth	The Wall
119	Qarth	Vaes Dothrak

120 rows × 2 columns

In [15]:
```
df.to_sql("locations", schema="f22_hw1_got", con=engine, index=False, if_e
```

Out[15]:
```
120
```

Non-Programming Tasks

Complete the tasks in this section if you are on the Non-Programming Track

The basic idea is the following:

- **You have three tables in your database:**
  1. `episodes_scenes`
  2. `characters`

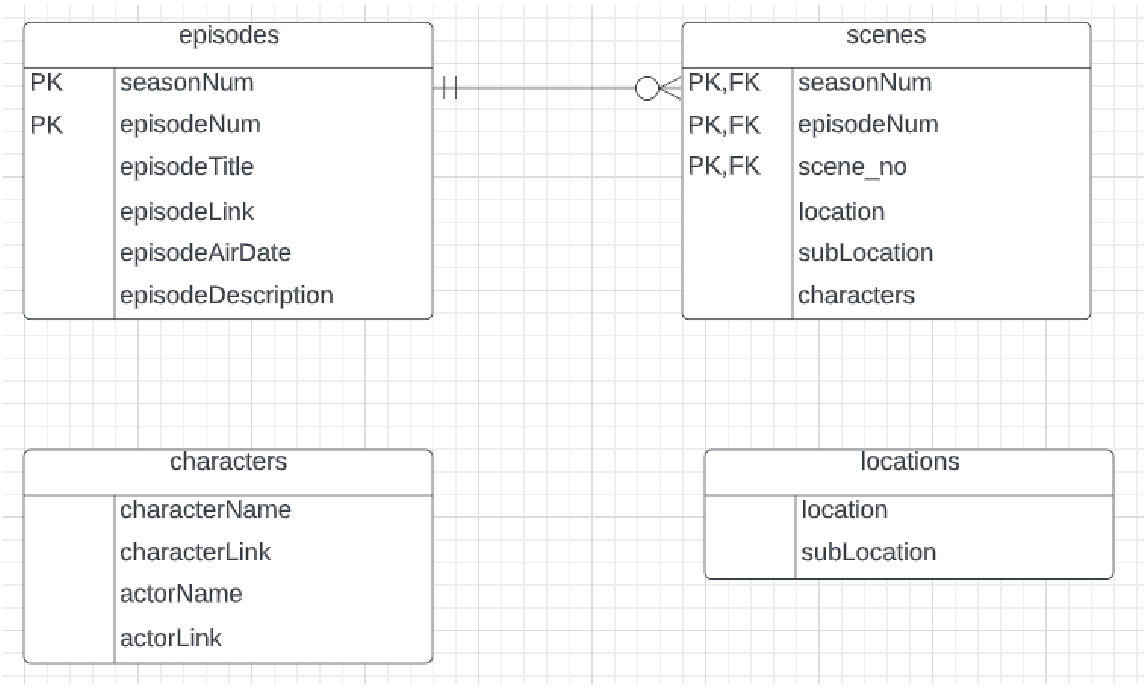
3. `locations`

- The raw data we loaded is kind of "icky," which is a highly technical data engineering term.
- We are going to going to restructure and de-icky the data a little bit, and then do some queries.
- So, you want to have a cool job in data science, AI/ML, IEOR, ... that involves getting insight from data ... ... I have some bad news.

"While it is a commonly held belief that data janitor work is fully automated, many data scientists are employed primarily as data janitors. The Information technology industry has been increasingly turning towards new sources of data gathered on consumers, so data janitors have become more commonplace in recent years." (https://en.wikipedia.org/wiki/Data_janitor)

Task 1: Copy the Data and Create Some Keys

- We are going to keep the original tables and make some copies that we will clean up.
- Your first task is create a new database `f22_hw1_got_clean` that has the following structure.



- **Put and execute your SQL statements in the cells below. Note: You have to create the primary keys and foreign keys from the ER diagram.**
- **You can use the `create table xxx as select * from` version of select to create the tables. We provide one example.**

```
In [97]: ## These two cells are the examples - go and run these cells in order!
         %sql CREATE DATABASE f22_hw1_got_clean

 * mysql+pymysql://root:***@localhost
1 rows affected.
Out[97]: []
```

```
In [98]: %%sql
             CREATE TABLE f22_hw1_got_clean.episodes AS
                 SELECT DISTINCT
                  seasonNum,
                  episodeNum,
                  episodeTitle,
                  episodeLink,
                  episodeAirDate,
                  episodeDescription
                 FROM f22_hw1_got.episodes_scenes

 * mysql+pymysql://root:***@localhost
73 rows affected.
Out[98]: []
```

- **Put the rest of your SQL below, which will be `create table` and `alter table` statements. You must execute your statements.**

```
In [27]: %%sql
              CREATE TABLE f22_hw1_got_clean.scenes as
                 SELECT DISTINCT
                  seasonNum,
                  episodeNum,
                  scene_no,
                  location,
                  sublocation,
                  characters
                 FROM f22_hw1_got.episodes_scenes
```

```
 * mysql+pymysql://root:***@localhost
4165 rows affected.
```
Out[27]:
```
[]
```

In [103…
```
%%sql
    CREATE TABLE f22_hw1_got_clean.characters as
        SELECT DISTINCT
         characterName,
         characterLink,
         actorName,
         actorLink
        FROM f22_hw1_got.characters
```

```
 * mysql+pymysql://root:***@localhost
389 rows affected.
```
Out[103]:
```
[]
```

In [124…
```
%%sql
    CREATE TABLE f22_hw1_got_clean.locations as
        SELECT DISTINCT
         location,
         subLocation
        FROM f22_hw1_got.locations
```

```
 * mysql+pymysql://root:***@localhost
120 rows affected.
```
Out[124]:
```
[]
```

In [107…
```
%%sql ALTER TABLE f22_hw1_got_clean.episodes
        ADD PRIMARY KEY NONCLUSTERED (seasonNum, episodeNum)
```

```
 * mysql+pymysql://root:***@localhost
0 rows affected.
```
Out[107]:
```
[]
```

In [28]:
```
%%sql ALTER TABLE f22_hw1_got_clean.scenes
        ADD PRIMARY KEY NONCLUSTERED (seasonNum, episodeNum,scene_no)
```

```
 * mysql+pymysql://root:***@localhost
0 rows affected.
```
Out[28]:
```
[]
```

In [39]:
```
%%sql ALTER TABLE f22_hw1_got_clean.scenes
        ADD FOREIGN KEY (seasonNum,episodeNum) REFERENCES f22_hw1_got_clea
```

```
 * mysql+pymysql://root:***@localhost
4165 rows affected.
```
Out[39]:
```
[]
```

Task 2: Convert to NULL

Ted Codd, who pioneered relational databases, defined 12 rules for RDBs.

A critical rule is Rule 3: Systematic Treatment of NULL Values

The NULL values in a database must be given a systematic and uniform treatment. This is a very important rule because a NULL can be interpreted as one the following – data is missing, data is not known, or data is not applicable.

There are columns that are effectively `NULL` but have some other marker, e.g. "", ";". Your task is to identify these columns and covert the symbol indicating NULL to the value `NULL.`

Put and execute your SQL below.

In [17]:
```
%%sql
UPDATE f22_hw1_got_clean.characters
SET characterName = NULL
WHERE characterName = "" or characterName = ";";
UPDATE f22_hw1_got_clean.characters
SET characterLink = NULL
WHERE characterLink = "" or characterLink = ";";
UPDATE f22_hw1_got_clean.characters
SET actorName = NULL
WHERE actorLink = "" or actorName = ";";
SET actorLink = NULL
WHERE actorName = "" or actorName = ";";# Convert to NULL in the table f22
```

```
 * mysql+pymysql://root:***@localhost
0 rows affected.
0 rows affected.
0 rows affected.
0 rows affected.
```
Out[17]:
```
[]
```

In [20]:
```
%%sql
UPDATE f22_hw1_got_clean.scenes
SET location = NULL
WHERE location = "" or location = ";";
UPDATE f22_hw1_got_clean.scenes
SET sublocation = NULL
WHERE sublocation = "" or sublocation = ";";
UPDATE f22_hw1_got_clean.scenes
SET characters = NULL
WHERE characters = "" or characters = ";";# Convert to NULL in the table f
```

```
 * mysql+pymysql://root:***@localhost
0 rows affected.
0 rows affected.
325 rows affected.
0 rows affected.
```
Out[20]:
```
[]
```

In [21]:
```
%%sql
UPDATE f22_hw1_got_clean.episodes
SET episodeTitle = NULL
WHERE episodeTitle = "" or episodeTitle = ";";
UPDATE f22_hw1_got_clean.episodes
SET episodeLink = NULL
WHERE episodeLink = "" or episodeLink = ";";
UPDATE f22_hw1_got_clean.episodes
SET episodeDescription = NULL
```

```
WHERE episodeDescription = "" or episodeDescription = ";";
UPDATE f22_hw1_got_clean.episodes
SET episodeAirDate = NULL
WHERE episodeAirDate = "" or episodeAirDate = ";";# Convert to NULL in the
```

```
 * mysql+pymysql://root:***@localhost
0 rows affected.
0 rows affected.
0 rows affected.
0 rows affected.
```

Out[21]:
```
[]
```

In [22]:
```
%%sql
UPDATE f22_hw1_got_clean.locations
SET location = NULL
WHERE location = "" or location = ";";
UPDATE f22_hw1_got_clean.locations
SET sublocation = NULL
WHERE sublocation = "" or sublocation = ";";# Convert to NULL in the table
```

```
 * mysql+pymysql://root:***@localhost
0 rows affected.
17 rows affected.
```

Out[22]:
```
[]
```

Task 3: Some not so Simple Queries

- **We saw `JOIN` statements in class. We also saw the `=` comparison operator in class.**
- **Finding out which characters were in which scenes is a little more complicated, however. We have incompletely cleaned up the data. We will do a better job in the future.**
- **In the short term, we can use the LIKE from SQL. The following query shows how to use the operator to find out (approximately) in which scenes a character appeared.**

In [140…
```
%%sql
USE f22_hw1_got_clean;

SELECT
 characterName,
 seasonNum,
 episodeNum,
 scene_no,
 location,
 subLocation
FROM characters
INNER JOIN
 scenes
 ON scenes.characters like concat("%", characters.characterName, "%;")
WHERE
 characterName = "Nymeria";
```

```
 * mysql+pymysql://root:***@localhost
0 rows affected.
26 rows affected.
```

Out[140]:

characterName	seasonNum	episodeNum	scene_no	location	subLocation
Nymeria	1	1	15	The North	Outside Winterfell
Nymeria	1	2	5	The North	Winterfell
Nymeria	1	2	21	The Riverlands	Crossroads Inn
Nymeria	1	2	22	The Riverlands	Crossroads Inn
Nymeria	5	4	31	Dorne	
Nymeria	5	4	32	Dorne	
Nymeria	5	6	19	Dorne	The Water Gardens
Nymeria	5	6	20	Dorne	The Water Gardens
Nymeria	5	6	22	Dorne	The Water Gardens
Nymeria	5	6	23	Dorne	The Water Gardens
Nymeria	5	7	30	Dorne	The Water Gardens
Nymeria	5	9	22	Dorne	The Water Gardens
Nymeria	5	9	23	Dorne	The Water Gardens
Nymeria	5	9	35	Dorne	The Water Gardens
Nymeria	5	10	38	Dorne	
Nymeria	5	10	40	Dorne	
Nymeria	6	1	26	The Crownlands	Blackwater Bay
Nymeria	6	10	70	Dorne	The Water Gardens
Nymeria	6	10	71	Dorne	The Water Gardens
Nymeria	7	2	33	The Riverlands	To The Twins
Nymeria	7	2	36	The Narrow Sea	
Nymeria	7	2	45	The Narrow Sea	
Nymeria	7	2	47	The Narrow Sea	
Nymeria	7	2	48	The Narrow Sea	
Nymeria	7	2	55	The Narrow Sea	
Nymeria	7	2	57	The Narrow Sea	

Task 3.1: Find the Starks

- **Write a query that returns the `characters` whose last name is Stark. The basic form of a `characterName` in `characters` is `"firstName lastName`.**

In [142…

```
%sql SELECT  *  FROM characters WHERE characterName LIKE '% Stark'
```

```
 * mysql+pymysql://root:***@localhost
14 rows affected.
```

Out[142]:

characterName	characterLink	actorName	actorLink
Arya Stark	/character/ch0158604/	Maisie Williams	/name/nm3586035/
Benjen Stark	/character/ch0153996/	Joseph Mawle	/name/nm1152798/
Brandon Stark	None	None	None
Bran Stark	/character/ch0234897/	Isaac Hempstead Wright	/name/nm3652842/
Catelyn Stark	/character/ch0145135/	Michelle Fairley	/name/nm0265610/
Eddard Stark	/character/ch0154681/	Sean Bean	/name/nm0000293/
Lyanna Stark	/character/ch0543804/	Aisling Franciosi	/name/nm4957233/
Rickard Stark	None	None	None
Rickon Stark	/character/ch0233141/	Art Parkinson	/name/nm3280686/
Robb Stark	/character/ch0158596/	Richard Madden	/name/nm0534635/
Sansa Stark	/character/ch0158137/	Sophie Turner	/name/nm3849842/
Young Benjen Stark	/character/ch0153996/	Matteo Elezi	/name/nm5502295/
Young Lyanna Stark	/character/ch0543804/	Cordelia Hill	/name/nm8108764/
Young Ned Stark	/character/ch0154681/	Sebastian Croft	/name/nm7509185/

Task 3.2: An Aggregations

- **Using the hint on how to `JOIN` the tables `characters` and `scenes,` Produce a table that returns:**
  - `characterName`
  - `location`
  - `subLocation`
  - `no_of_scenes` **, which is the count of the number of `scenes` in which the character appeared in the `location, subLocation`**
  - **sorted by `no_of_scenes` descending.**
  - **Only include results with `no_of_scenes >= 100`**

In [188…

```
%%sql CREATE TABLE aggre AS
        SELECT
         characterName,
         location,
         subLocation,
         COUNT(*) AS no_of_scenes
        FROM characters
        INNER JOIN
         scenes
        ON scenes.characters LIKE concat("%", characters.characterName, "%
        GROUP BY location,subLocation HAVING no_of_scenes >= 100
        ORDER BY no_of_scenes desc
```

```
 * mysql+pymysql://root:***@localhost
20 rows affected.
```

Out[188]:

```
[]
```

In [191…

```
%sql SELECT * FROM aggre
```

```
 * mysql+pymysql://root:***@localhost
20 rows affected.
```

Out[191]:

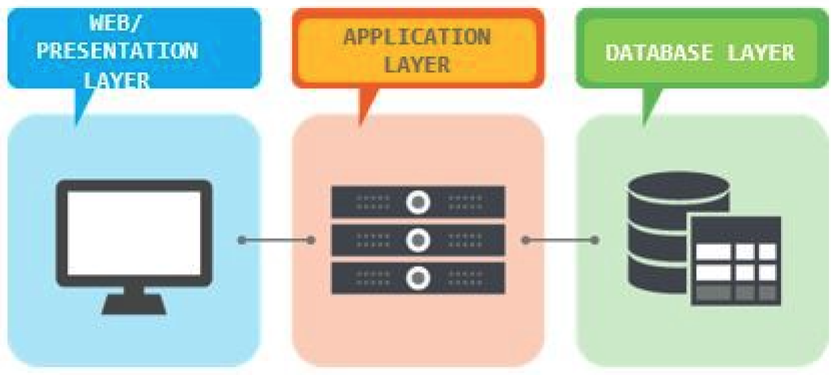
characterName	location	subLocation	no_of_scenes
Jon Arryn	The Crownlands	King's Landing	3072
Will	The North	Winterfell	2012
Will	The Wall	Castle Black	935
Missandei	Meereen		506
Stannis Baratheon	The Crownlands	Dragonstone	427
Will	North of the Wall	The Haunted Forest	337
Stannis Baratheon	Braavos		273
Olenna Tyrell	The Crownlands	Outside King's Landing	236
Samwell Tarly	North of the Wall	Craster's Keep	222
Will	The North	Outside Winterfell	201
Theon Greyjoy	The Riverlands	The Twins	190
Hot Pie	The Riverlands	Harrenhal	141
Viserys Targaryen	Vaes Dothrak		136
Trystane Martell	Dorne	The Water Gardens	129
Summer	North of the Wall	The Three-Eyed Raven	128
Rodrik Cassel	The Riverlands	Riverrun	124
Ygritte	North of the Wall	The Wall	118
Jaime Lannister	The Crownlands	Blackwater Rush	118
Xaro Xhoan Daxos	Qarth		116
Samwell Tarly	The North	The Gift	100

Programming Track

Concept

- Most "databases" have a common core set of operations: Create, Retrieve, Update, Delete.
- In the relational model, the matching operations are: `INSERT, SELECT, UPDATE, DELETE.`
- Full stack web applications are typically a 3-tier application architecture.

Let us walk through a three tier architecture :



A typical representation of three tier architecture

- **There interface/protocol between the presentation layer and application later is typically REST.**
- **To get started with our application, we are going to focus on just some code that reads the database and returns information. Professor Ferguson will provide code that completes the stack to implement your first web application.**
- **The following "get started" code will help with some of your work.**

In [92]:
```
import pymysql
import pandas as pd
import numpy as np


def get_connection():
    """
    This function connects to a database and returns the connection.
    :return: The connection
    """

    # TODO Replace the user and password with the information for your MyS
    conn = pymysql.connect(
        user="root",
        password="dbuserbdbuser",
        host="localhost",
        autocommit=True,
        cursorclass=pymysql.cursors.DictCursor
    )

    return conn


def run_query(sql, args, fetch=True):
    """
    Runs a query. The SQL contains "%s" placeholders for parameters for th
    result set.

    :param sql: An SQL string with "%s" please holders for parameters.
    :param args: A list of values to insert into the query for the paramet
    :param fetch: If true, return the result set.
    :return: The result set or the number of rows affected.
    """

    result = None

    conn = get_connection()
    cursor = conn.cursor()

    result = cursor.execute(sql, args)
    if fetch:
        result = cursor.fetchall()

    return result
```

- **And this is a simple test.**

In [17]:
```
sql = "select characterName, actorName from f22_hw1_got.characters where c
res = run_query(sql, ("Arya Stark"))
res
```

Out[17]:
```
[{'characterName': 'Arya Stark', 'actorName': 'Maisie Williams'}]
```

Tasks

Task 1: Load the Data

- **The following statements create a schema and some tables.**

In [153…
```
%sql create database f22_hw1_got_programming
```

```
 * mysql+pymysql://root:***@localhost
1 rows affected.
```

Out[153]:
```
[]
```

In [18]:
```
%%sql

create table if not exists f22_hw1_got_programming.characters
(
    characterName       text   null,
    characterLink       text   null,
    actorName           text   null,
    actorLink           text   null,
    houseName           text   null,
    royal               double null,
    parents             text   null,
    siblings            text   null,
    killedBy            text   null,
    characterImageThumb text   null,
    characterImageFull  text   null,
    nickname            text   null,
    killed              text   null,
    servedBy            text   null,
    parentOf            text   null,
    marriedEngaged      text   null,
    serves              text   null,
    kingsguard          double null,
    guardedBy           text   null,
    actors              text   null,
    guardianOf          text   null,
    allies              text   null,
    abductedBy          text   null,
    abducted            text   null,
    sibling             text   null
);

create table if not exists f22_hw1_got_programming.episodes_scenes
(
    seasonNum                 bigint null,
    episodeNum                bigint null,
    episodeTitle              text   null,
    episodeLink               text   null,
    episodeAirDate            text   null,
    episodeDescription        text   null,
    openingSequenceLocations text   null,
    sceneStart                text   null,
    sceneEnd                  text   null,
    location                  text   null,
    subLocation               text   null,
    characters                text   null,
    scene_no                  bigint null
);
```

```
 * mysql+pymysql://root:***@localhost
0 rows affected.
0 rows affected.
```

Out[18]:
```
[]
```

- **You can load information from JSON files using `pandas.` I like lists, so I convert to a list.**

In [19]:
```
df = pd.read_json('flattened_characters.json')
df
```

Out[19]:

	characterName	characterLink	actorName	actorLink	houseName	royal
0	Addam Marbrand	/character/ch0305333/	B.J. Hogg	/name/nm0389698/	NaN	NaN
1	Aegon Targaryen	NaN	NaN	NaN	Targaryen	1.0
2	Aeron Greyjoy	/character/ch0540081/	Michael Feast	/name/nm0269923/	Greyjoy	NaN
3	Aerys II Targaryen	/character/ch0541362/	David Rintoul	/name/nm0727778/	Targaryen	1.0
4	Akho	/character/ch0544520/	Chuku Modu	/name/nm6729880/	NaN	NaN
...	...	...	...	...	...	...
384	Young Nan	/character/ch0305018/	Annette Tierney	/name/nm1519719/	NaN	NaN
385	Young Ned	/character/ch0154681/	Robert Aramayo	/name/nm7075019/	Stark	NaN
386	Young Ned Stark	/character/ch0154681/	Sebastian Croft	/name/nm7509185/	Stark	NaN
387	Young Rodrik Cassel	/character/ch0171391/	Fergus Leathem	/name/nm7509186/	NaN	NaN
388	Zanrush	/character/ch0540870/	Gerald Lepkowski	/name/nm0503319/	NaN	NaN

389 rows × 25 columns

In [20]:
```
character_list = df.to_dict('records')
character_list[0:4]
```

```
Out[20]: [{'characterName': 'Addam Marbrand',
           'characterLink': '/character/ch0305333/',
           'actorName': 'B.J. Hogg',
           'actorLink': '/name/nm0389698/',
           'houseName': nan,
           'royal': nan,
           'parents': nan,
           'siblings': nan,
           'killedBy': nan,
           'characterImageThumb': nan,
           'characterImageFull': nan,
           'nickname': nan,
           'killed': nan,
           'servedBy': nan,
           'parentOf': nan,
           'marriedEngaged': nan,
           'serves': nan,
           'kingsguard': nan,
           'guardedBy': nan,
           'actors': nan,
           'guardianOf': nan,
           'allies': nan,
           'abductedBy': nan,
           'abducted': nan,
           'sibling': nan},
          {'characterName': 'Aegon Targaryen',
           'characterLink': nan,
           'actorName': nan,
           'actorLink': nan,
           'houseName': 'Targaryen',
           'royal': 1.0,
           'parents': 'Elia Martell;Rhaegar Targaryen',
           'siblings': 'Rhaenys Targaryen;Jon Snow',
           'killedBy': 'Gregor Clegane',
           'characterImageThumb': nan,
           'characterImageFull': nan,
           'nickname': nan,
           'killed': nan,
           'servedBy': nan,
           'parentOf': nan,
           'marriedEngaged': nan,
           'serves': nan,
           'kingsguard': nan,
           'guardedBy': nan,
           'actors': nan,
           'guardianOf': nan,
           'allies': nan,
           'abductedBy': nan,
           'abducted': nan,
           'sibling': nan},
          {'characterName': 'Aeron Greyjoy',
           'characterLink': '/character/ch0540081/',
           'actorName': 'Michael Feast',
           'actorLink': '/name/nm0269923/',
           'houseName': 'Greyjoy',
           'royal': nan,
           'parents': nan,
           'siblings': 'Balon Greyjoy;Euron Greyjoy',
           'killedBy': nan,
           'characterImageThumb': 'https://images-na.ssl-images-amazon.com/images/
         M/MV5BNzI5MDg0ZDAtN2Y2ZC00MzU1LTgyYjQtNTBjYjEzODczZDVhXkEyXkFqcGdeQXVyNTg
         0Nzg4NTE@._V1._SX100_SY140_.jpg',
           'characterImageFull': 'https://images-na.ssl-images-amazon.com/images/
         M/MV5BNzI5MDg0ZDAtN2Y2ZC00MzU1LTgyYjQtNTBjYjEzODczZDVhXkEyXkFqcGdeQXVyNTg
ONzg4NTE@._V1_.jpg',
  'nickname': 'Damphair',
  'killed': nan,
  'servedBy': nan,
  'parentOf': nan,
  'marriedEngaged': nan,
  'serves': nan,
  'kingsguard': nan,
  'guardedBy': nan,
  'actors': nan,
  'guardianOf': nan,
  'allies': nan,
  'abductedBy': nan,
  'abducted': nan,
  'sibling': nan},
 {'characterName': 'Aerys II Targaryen',
  'characterLink': '/character/ch0541362/',
  'actorName': 'David Rintoul',
  'actorLink': '/name/nm0727778/',
  'houseName': 'Targaryen',
  'royal': 1.0,
  'parents': nan,
  'siblings': 'Rhaella Targaryen',
  'killedBy': 'Jaime Lannister',
  'characterImageThumb': 'https://images-na.ssl-images-amazon.com/images/
M/MV5BMWQzOWViN2ItNDZhOS00MmZlLTkxZTYtZDg5NGUwMGRmYWZjL2ltYWdlL2ltYWdlXkE
yXkFqcGdeQXVyMjk3NTUyOTc@._V1._SX100_SY140_.jpg',
  'characterImageFull': 'https://images-na.ssl-images-amazon.com/images/
M/MV5BMWQzOWViN2ItNDZhOS00MmZlLTkxZTYtZDg5NGUwMGRmYWZjL2ltYWdlL2ltYWdlXkE
yXkFqcGdeQXVyMjk3NTUyOTc@._V1_.jpg',
  'nickname': 'The Mad King',
  'killed': 'Brandon Stark;Rickard Stark',
  'servedBy': 'Arthur Dayne;Jaime Lannister',
  'parentOf': 'Daenerys Targaryen;Rhaegar Targaryen;Viserys Targaryen',
  'marriedEngaged': 'Rhaella Targaryen',
  'serves': nan,
  'kingsguard': nan,
  'guardedBy': nan,
  'actors': nan,
  'guardianOf': nan,
  'allies': nan,
  'abductedBy': nan,
  'abducted': nan,
  'sibling': nan}]
```

- **The task is to:**
  1. **Write a function that will insert a dictionary into a table.**
  2. **Use the function to load the `characters` and `episodes_scenes` tables.**
  3. **The data is in the files `flattened_characters.json` and `flattened_episodes.json`**

- **Implement the functions below.**

In [36]:
```
%sql insert into f22_hw1_got_programming.characters values ("""Rattleshirt
```

```
 * mysql+pymysql://root:***@localhost
1 rows affected.
```

Out[36]:
```
[]
```

In [55]:
```
def insert_row_table(database_name, table_name, row_dict):
    """
    Insert a dictionary into a table.
    :param database_name: Name of the database.
    :param table_name: Name of the table.
    :param row_dict: A dictionary of column names and values.
    :return: 1 of the insert occurred and 0 otherwise.
    """

    # your code goes here

    sql = "insert into "+database_name+"."+table_name+" values ("
    for value in row_dict.values():
        sql+="%s,"
    sql=sql[:-1]+')'
    run_query(sql,tuple(row_dict.values()),fetch=True)

    pass


def load_table_programming(list_of_dicts, database_name, table_name):
    """

    :param list_of_dicts: List of dictionaries to insert
    :param database_name: Database name
    :param table_name: Table name
    :return: No of rows inserted
    """

    # your code goes here

    for row_dict in list_of_dicts:
        insert_row_table(database_name, table_name, row_dict)

    pass
```

- **You can test your functions with the following cells.**

In [56]:
```
%sql delete from f22_hw1_got_programming.characters
%sql delete from f22_hw1_got_programming.episodes_scenes
```

```
 * mysql+pymysql://root:***@localhost
389 rows affected.
 * mysql+pymysql://root:***@localhost
4165 rows affected.
```

Out[56]:
```
[]
```

In [57]:
```
df = pd.read_json('flattened_episodes.json')
episodes_list = df.to_dict('records')
load_table_programming(episodes_list, "f22_hw1_got_programming", "episodes

df = pd.read_json('flattened_characters.json')
df = df.replace({np.nan: None})
episodes_list = df.to_dict('records')
load_table_programming(episodes_list, "f22_hw1_got_programming", "characte
```

In [58]:
```
%sql select distinct seasonNum, episodeNum, episodeTitle, episodeAirDate f
```

```
 * mysql+pymysql://root:***@localhost
73 rows affected.
```

Out[58]:

seasonNum	episodeNum	episodeTitle	episodeAirDate
1	1	Winter Is Coming	2011-04-17
1	2	The Kingsroad	2011-04-24
1	3	Lord Snow	2011-05-01
1	4	Cripples, Bastards, and Broken Things	2011-05-08
1	5	The Wolf and the Lion	2011-05-15
1	6	A Golden Crown	2011-05-22
1	7	You Win or You Die	2011-05-29
1	8	The Pointy End	2011-06-05
1	9	Baelor	2011-06-12
1	10	Fire and Blood	2011-06-19
2	1	The North Remembers	2012-04-01
2	2	The Night Lands	2012-04-08
2	3	What Is Dead May Never Die	2012-04-15
2	4	Garden of Bones	2012-04-22
2	5	The Ghost of Harrenhal	2012-04-29
2	6	The Old Gods and the New	2012-05-06
2	7	A Man Without Honor	2012-05-13
2	8	The Prince of Winterfell	2012-05-20
2	9	Blackwater	2012-05-27
2	10	Valar Morghulis	2012-06-03
3	1	Valar Dohaeris	2013-03-31
3	2	Dark Wings, Dark Words	2013-04-07
3	3	Walk of Punishment	2013-04-14
3	4	And Now His Watch Is Ended	2013-04-21
3	5	Kissed by Fire	2013-04-28
3	6	The Climb	2013-05-05
3	7	The Bear and the Maiden Fair	2013-05-12
3	8	Second Sons	2013-05-19
3	9	The Rains of Castamere	2013-06-02
3	10	Mhysa	2013-06-09
4	1	Two Swords	2014-04-06
4	2	The Lion and the Rose	2014-04-13
4	3	Breaker of Chains	2014-04-20
4	4	Oathkeeper	2014-04-27
4	5	First of His Name	2014-05-04
4	6	The Laws of Gods and Men	2014-05-11

4	7	Mockingbird	2014-05-18
4	8	The Mountain and the Viper	2014-06-01
4	9	The Watchers on the Wall	2014-06-08
4	10	The Children	2014-06-15
5	1	The Wars to Come	2015-03-29
5	2	The House of Black and White	2015-04-19
5	3	High Sparrow	2015-04-26
5	4	Sons of the Harpy	2015-05-03
5	5	Kill the Boy	2015-05-10
5	6	Unbowed, Unbent, Unbroken	2015-05-17
5	7	The Gift	2015-05-24
5	8	Hardhome	2015-05-31
5	9	The Dance of Dragons	2015-06-07
5	10	Mother's Mercy	2015-06-14
6	1	The Red Woman	2016-04-24
6	2	Home	2016-05-01
6	3	Oathbreaker	2016-05-08
6	4	Book of the Stranger	2016-05-15
6	5	The Door	2016-05-22
6	6	Blood of My Blood	2016-05-29
6	7	The Broken Man	2016-06-05
6	8	No One	2016-06-12
6	9	Battle of the Bastards	2016-06-19
6	10	The Winds of Winter	2016-06-26
7	1	Dragonstone	2017-07-16
7	2	Stormborn	2017-07-23
7	3	The Queen's Justice	2017-07-30
7	4	The Spoils of War	2017-08-06
7	5	Eastwatch	2017-08-13
7	6	Beyond the Wall	2017-08-20
7	7	The Dragon and the Wolf	2017-08-27
8	1	Winterfell	2019-04-14
8	2	A Knight of the Seven Kingdoms	2019-04-21
8	3	The Long Night	2019-04-28
8	4	The Last of the Starks	2019-05-05
8	5	The Bells	2019-05-12
8	6	The Iron Throne	2019-05-19

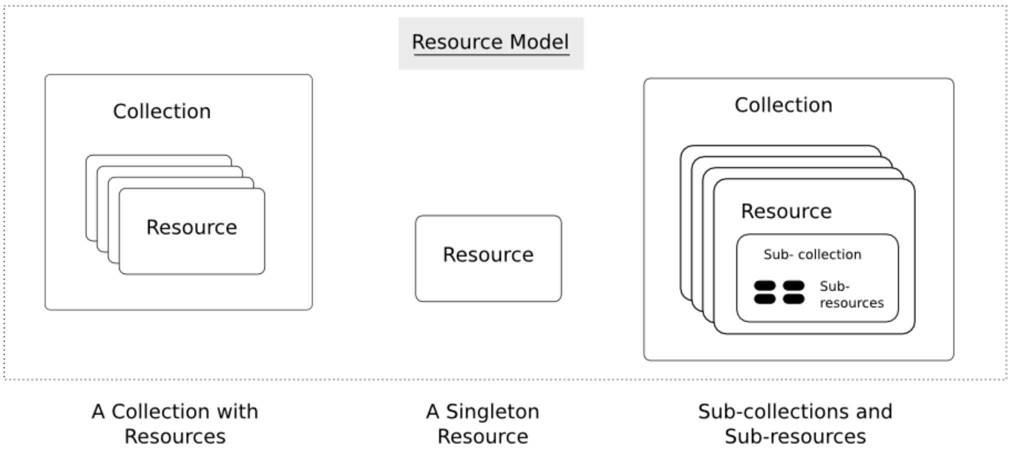
```
In [63]: %sql select characterName, actorName from f22_hw1_got_programming.characte
```

```
 * mysql+pymysql://root:***@localhost
14 rows affected.
```

Out[63]:

characterName	actorName
Arya Stark	Maisie Williams
Benjen Stark	Joseph Mawle
Brandon Stark	None
Bran Stark	Isaac Hempstead Wright
Catelyn Stark	Michelle Fairley
Eddard Stark	Sean Bean
Lyanna Stark	Aisling Franciosi
Rickard Stark	None
Rickon Stark	Art Parkinson
Robb Stark	Richard Madden
Sansa Stark	Sophie Turner
Young Benjen Stark	Matteo Elezi
Young Lyanna Stark	Cordelia Hill
Young Ned Stark	Sebastian Croft

Query the Data



REST Collections and Resources

- **REST is by definition resource oriented. A core concept is that there are resources that are collections containing other resources.**
- **A "path" identifies a resource. In our model/data,**
  - **The path `/characters` would represent all characters in the `characters` table.**

        - **The path `/characters/Arya Stark` would represent the character named "Ary Stark," assuming that `characterName` is the primary key for the table.**

- **REST and URLs also define the concept of a query string. The query string is similar to a `WHERE` clause in SQL.**

- **A `GET` on the path `/episodes_scenes?seasonNum=1&location=The Wall` is logically equivalent to:**

`select * from f22_got_hw1_programming.episodes_scenes where seasonNum='1' and location='The Wall'`

- **A simple way to represent a query string in Python is a dictionary. In the example, the corresponding dictionary would be:**

```
{
    "seasonNum": "1",
    "location": "The Wall"
}
```

- **The final task is to write a function `retrieve` that we can later use to implement queries on REST collections.**

- **The template for the functions is:**

In [95]:
```
def retrieve(database_name, table_name, field_list, query_dict):
    """
    Maps a query on a resource collection to an SQL statement and returns

    :param database_name: Name of the database.
    :param table_name: Name of the table.
    :param field_list: List of columns to return.
    :param query_dict: Dictionary of name, value pairs to form a where cla
    :return: The result set as a list of dictionaries.


    Calling this function with

        retrieve(
            'f22_hw1_got_programming', 'episodes_scenes',
            ['seasonNum', 'episodeNum', 'episodeTitle', 'scene_no', 'locat
            {
                'seasonNum': '1',
                'subLocation': 'The Wall'
            }
        )

        would map to the SQL statement

        select seasonNum, episodeNum, episodeTitle, scene_no, location
            from f22_hw1_got_programming.episodes_scenes where
                seasonNum='1' and subLocation='The Wall'
    """

    # Your code goes here
    sql='select'+str(field_list)
    sql=sql.replace('[',' ').replace(']',' ').replace("'",'')
    sql+='from '+database_name+'.'+table_name+' where '
    for key,value in query_dict.items():
        sql+=str(key)+'='+"'"+str(value)+"'"+' and '
    sql=sql[:-4]
    print(sql)
    return run_query(sql,None,fetch=True)
```

- **Write a couple of tests for your functions below.**

In [96]:
```
retrieve('f22_hw1_got_programming', 'episodes_scenes',['seasonNum', 'episo
```

```
select seasonNum, episodeNum, episodeTitle, scene_no, location from f22_h
w1_got_programming.episodes_scenes where seasonNum='1' and Location='The
Wall'
```

```
Out[96]: [{'seasonNum': 1,
           'episodeNum': 1,
           'episodeTitle': 'Winter Is Coming',
           'scene_no': 0,
           'location': 'The Wall'},
          {'seasonNum': 1,
           'episodeNum': 2,
           'episodeTitle': 'The Kingsroad',
           'scene_no': 14,
           'location': 'The Wall'},
          {'seasonNum': 1,
           'episodeNum': 3,
           'episodeTitle': 'Lord Snow',
           'scene_no': 8,
           'location': 'The Wall'},
          {'seasonNum': 1,
           'episodeNum': 3,
           'episodeTitle': 'Lord Snow',
           'scene_no': 11,
           'location': 'The Wall'},
          {'seasonNum': 1,
           'episodeNum': 3,
           'episodeTitle': 'Lord Snow',
           'scene_no': 17,
           'location': 'The Wall'},
          {'seasonNum': 1,
           'episodeNum': 3,
           'episodeTitle': 'Lord Snow',
           'scene_no': 18,
           'location': 'The Wall'},
          {'seasonNum': 1,
           'episodeNum': 3,
           'episodeTitle': 'Lord Snow',
           'scene_no': 21,
           'location': 'The Wall'},
          {'seasonNum': 1,
           'episodeNum': 3,
           'episodeTitle': 'Lord Snow',
           'scene_no': 23,
           'location': 'The Wall'},
          {'seasonNum': 1,
           'episodeNum': 4,
           'episodeTitle': 'Cripples, Bastards, and Broken Things',
           'scene_no': 4,
           'location': 'The Wall'},
          {'seasonNum': 1,
           'episodeNum': 4,
           'episodeTitle': 'Cripples, Bastards, and Broken Things',
           'scene_no': 12,
           'location': 'The Wall'},
          {'seasonNum': 1,
           'episodeNum': 4,
           'episodeTitle': 'Cripples, Bastards, and Broken Things',
           'scene_no': 19,
           'location': 'The Wall'},
          {'seasonNum': 1,
           'episodeNum': 4,
           'episodeTitle': 'Cripples, Bastards, and Broken Things',
           'scene_no': 20,
           'location': 'The Wall'},
          {'seasonNum': 1,
           'episodeNum': 4,
           'episodeTitle': 'Cripples, Bastards, and Broken Things',
           'scene_no': 21,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 4,
  'episodeTitle': 'Cripples, Bastards, and Broken Things',
  'scene_no': 23,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 7,
  'episodeTitle': 'You Win or You Die',
  'scene_no': 4,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 7,
  'episodeTitle': 'You Win or You Die',
  'scene_no': 5,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 7,
  'episodeTitle': 'You Win or You Die',
  'scene_no': 13,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 7,
  'episodeTitle': 'You Win or You Die',
  'scene_no': 14,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 7,
  'episodeTitle': 'You Win or You Die',
  'scene_no': 17,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 8,
  'episodeTitle': 'The Pointy End',
  'scene_no': 10,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 8,
  'episodeTitle': 'The Pointy End',
  'scene_no': 11,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 8,
  'episodeTitle': 'The Pointy End',
  'scene_no': 18,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 8,
  'episodeTitle': 'The Pointy End',
  'scene_no': 19,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 8,
  'episodeTitle': 'The Pointy End',
  'scene_no': 20,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 8,
  'episodeTitle': 'The Pointy End',
  'scene_no': 26,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 9,
  'episodeTitle': 'Baelor',
  'scene_no': 4,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 9,
  'episodeTitle': 'Baelor',
  'scene_no': 5,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 9,
  'episodeTitle': 'Baelor',
  'scene_no': 6,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 9,
  'episodeTitle': 'Baelor',
  'scene_no': 10,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 10,
  'episodeTitle': 'Fire and Blood',
  'scene_no': 17,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 10,
  'episodeTitle': 'Fire and Blood',
  'scene_no': 28,
  'location': 'The Wall'},
 {'seasonNum': 1,
  'episodeNum': 10,
  'episodeTitle': 'Fire and Blood',
  'scene_no': 29,
  'location': 'The Wall'}]
```

In [91]:
```
%sql select seasonNum, episodeNum, episodeTitle, scene_no, location from f
```

```
 * mysql+pymysql://root:***@localhost
32 rows affected.
```

Out[91]:

seasonNum	episodeNum	episodeTitle	scene_no	location
1	1	Winter Is Coming	0	The Wall
1	2	The Kingsroad	14	The Wall
1	3	Lord Snow	8	The Wall
1	3	Lord Snow	11	The Wall
1	3	Lord Snow	17	The Wall
1	3	Lord Snow	18	The Wall
1	3	Lord Snow	21	The Wall
1	3	Lord Snow	23	The Wall
1	4	Cripples, Bastards, and Broken Things	4	The Wall
1	4	Cripples, Bastards, and Broken Things	12	The Wall
1	4	Cripples, Bastards, and Broken Things	19	The Wall
1	4	Cripples, Bastards, and Broken Things	20	The Wall
1	4	Cripples, Bastards, and Broken Things	21	The Wall
1	4	Cripples, Bastards, and Broken Things	23	The Wall
1	7	You Win or You Die	4	The Wall
1	7	You Win or You Die	5	The Wall
1	7	You Win or You Die	13	The Wall
1	7	You Win or You Die	14	The Wall
1	7	You Win or You Die	17	The Wall
1	8	The Pointy End	10	The Wall
1	8	The Pointy End	11	The Wall
1	8	The Pointy End	18	The Wall
1	8	The Pointy End	19	The Wall
1	8	The Pointy End	20	The Wall
1	8	The Pointy End	26	The Wall
1	9	Baelor	4	The Wall
1	9	Baelor	5	The Wall
1	9	Baelor	6	The Wall
1	9	Baelor	10	The Wall
1	10	Fire and Blood	17	The Wall
1	10	Fire and Blood	28	The Wall
1	10	Fire and Blood	29	The Wall

```
In [ ]:
```