Restaurants and Attractions in Popular Destinations

Abstract

This project aims at creating a database which gives us details about Restaurants and Attractions in popular destinations. This project aims at showcasing our knowledge in Database Normalization (1NF, 2NF & 3NF). Through normalization we are able to reduce redundancy in the data as well as allow for smooth data updation, insertion and deletion. We have extracted 2 forms of data by reading csv, Cities and Restaurants. Cities dataset contains details about the city and attractions found in the city. Restaurants dataset contains details about the restaurant including the cuisines served, ratings and price range. The Restaurant dataset has been reduced to 2nd Normal Form and Cities dataset has been reduced to 3rd Normal form.

Data imported:

```
places.csv
restaurants.csv
```

Importing Libraries

```
In [1]: import pandas as pd
        import numpy as np
        from itertools import chain
```

Reading cities dataset

```
In [92]: Cities = pd.read_csv("C:/Users/Arjun/Documents/NEU/DMDD/Assignment 2/Source/places.csv",enc
         oding = 'unicode_escape')
```

```
In [ ]: Cities = Cities[['place_name','place_country','place_maps','place_desc','place_att','place_
        airport']]
```

In [94]:

```
Cities.head()
```

Out[94]:

	place_name	place_country	place_maps	place_desc	
0	Amsterdam	Netherlands	https://maps.google.com/?q=Amsterdam,+Netherla...	Amsterdam â□□ A city rich with heritage and ri...	['A
1	Barcelona	Spain	https://maps.google.com/?q=Barcelona,+Spain&ft...	Barcelona â□□ dive into the Catalan creativity...	[
2	Berlin	Germany	https://maps.google.com/?q=Berlin,+Germany&fti...	Berlin â□□ Germanyâ□□s capital city has had a ...	Gate','R
3	Budapest	Hungary	https://maps.google.com/?q=Budapest,+Hungary&f...	https://www.expedia.com/Budapest.d179994.Desti...	['Parl
4	Copenhagen	Denmark	https://maps.google.com/?q=Copenhagen,+Denmark...	http://www.expedia.com.my/Copenhagen.d178252.T...	['Tivoli (

The above data sample of cities dataset shows that the place_att column which holds the top 10 attractions in each place listed in the dataframe. It can be seen that all 10 attractions are in the same cell. 1st Normal Form principles need to be applied here.

In [44]:

```
city_df = pd.DataFrame(Cities.place_att.str.split(",").tolist(), index=Cities.place_name).s
tack()
city_df = city_df.reset_index([0, 'place_name'])
city_df.columns = ['place_name', 'place_atts']
city_df['place_atts'] = city_df['place_atts'].str.replace('[','').str.replace(']','').str.r
eplace("'","")
Cities = Cities.merge(city_df, left_on = 'place_name', right_on = 'place_name')
Cities = Cities[['place_name','place_country','place_maps','place_desc','place_atts','place
_airport']]
Cities.head()
```

Out[44]:

	place_name	place_country	place_maps	place_desc	place_atts	place_airport
0	Amsterdam	Netherlands	https://maps.google.com/?q=Amsterdam,+Netherla...	Amsterdam â□□ A city rich with heritage and ri...	Amsterdam Free Walking Tour	Amsterdam Schiphol (AMS) Airport
1	Amsterdam	Netherlands	https://maps.google.com/?q=Amsterdam,+Netherla...	Amsterdam â□□ A city rich with heritage and ri...	Heineken Experience	Amsterdam Schiphol (AMS) Airport
2	Amsterdam	Netherlands	https://maps.google.com/?q=Amsterdam,+Netherla...	Amsterdam â□□ A city rich with heritage and ri...	75-Minute Water Colors Cruise	Amsterdam Schiphol (AMS) Airport
3	Amsterdam	Netherlands	https://maps.google.com/?q=Amsterdam,+Netherla...	Amsterdam â□□ A city rich with heritage and ri...	Van Gogh Museum Ticket	Amsterdam Schiphol (AMS) Airport
4	Amsterdam	Netherlands	https://maps.google.com/?q=Amsterdam,+Netherla...	Amsterdam â□□ A city rich with heritage and ri...	Johan Cruijff ArenA Stadium 75-Minute Tour	Amsterdam Schiphol (AMS) Airport

1NF operations were applied and it can be observed that the place_att column is now holding atomic values. We need to now conduct 2NF operations. Attraction details can be split into a new dataframe and additional information about the attractions can be added.

In [45]:

```python
Attraction = Cities[['place_atts','place_name']]
Attraction = Attraction.rename(columns={'place_atts':'att_name'})
Attraction['att_id'] = Attraction.index
Attraction = Attraction[['att_id','att_name','place_name']]
price_list = ['$','$$','$$$','$$$$','Free']
Attraction['att_cost'] = np.random.choice(price_list,size=len(Attraction))
Attraction.head()
```

Out[45]:

	att_id	att_name	place_name	att_cost
0	0	Amsterdam Free Walking Tour	Amsterdam	$$
1	1	Heineken Experience	Amsterdam	Free
2	2	75-Minute Water Colors Cruise	Amsterdam	Free
3	3	Van Gogh Museum Ticket	Amsterdam	$$$
4	4	Johan Cruijff ArenA Stadium 75-Minute Tour	Amsterdam	$

In [95]:

```python
Cities = Cities[['place_name','place_country','place_maps','place_desc','place_airport']]
Cities = Cities.drop_duplicates()
```

Since we have separated the Attraction details from the cities dataframe, we need to restructure the cities dataframe and remove the attractions from it in order to avoid redundancy. We are conducting 2NF on the Cities data as well.

In [41]:

```python
Cities.head()
```

Out[41]:

	place_name	place_country	place_maps	place_desc	place_
0	Amsterdam	Netherlands	https://maps.google.com/?q=Amsterdam,+Netherla...	Amsterdam â□□ A city rich with heritage and ri...	Ams S (AMS
10	Barcelona	Spain	https://maps.google.com/?q=Barcelona,+Spain&ft...	Barcelona â□□ dive into the Catalan creativity...	Tar Barce Pra
20	Berlin	Germany	https://maps.google.com/?q=Berlin,+Germany&fti...	Berlin â□□ Germanyâ□□s capital city has had a ...	Berl
30	Budapest	Hungary	https://maps.google.com/?q=Budapest,+Hungary&f...	https://www.expedia.com/Budapest.d179994.Desti...	Bu (BUD
40	Copenhagen	Denmark	https://maps.google.com/?q=Copenhagen,+Denmark...	http://www.expedia.com.my/Copenhagen.d178252.T...	Bo

It can be noticed that in the Attraction dataframe, the cost attribute is something that can change. In order to introduce flexibility in changing the cost without affecting other attraction details, we did a 3NF transformation dividing the dataframe into 2. One containing the attraction details and the other the attraction costs.

In [47]:
```
Attraction_Details = Attraction[['att_id','att_name','place_name']]
Attraction_Details.head()
```

Out[47]:

	att_id	att_name	place_name
0	0	Amsterdam Free Walking Tour	Amsterdam
1	1	Heineken Experience	Amsterdam
2	2	75-Minute Water Colors Cruise	Amsterdam
3	3	Van Gogh Museum Ticket	Amsterdam
4	4	Johan Cruijff ArenA Stadium 75-Minute Tour	Amsterdam

In [48]:
```
Attraction_Cost = Attraction[['att_id','att_cost']]
Attraction_Cost.head()
```

Out[48]:

	att_id	att_cost
0	0	$$
1	1	Free
2	2	Free
3	3	$$$
4	4	$

Reading the Restaurants dataset

In [75]:
```
Restaurant = pd.read_csv("C:/Users/Arjun/Documents/NEU/DMDD/Assignment 2/Source/restaurants.csv", encoding = 'unicode_escape')
```

In [76]:
```
Restaurant = Restaurant[['res_name','res_place_name','res_cuisine','res_rating','res_price']]
Restaurant.head()
```

Out[76]:

	res_name	res_place_name	res_cuisine	res_rating	res_price
0	Martine of Martine's Table	Amsterdam	['French', 'Dutch', 'European']	5.0	$$$
1	De Silveren Spiegel	Amsterdam	['Dutch', 'European', 'Vegetarian Friendly', '...	4.5	
2	La Rive	Amsterdam	['Mediterranean', 'French', 'International', '...	4.5	
3	Vinkeles	Amsterdam	['French', 'European', 'International', 'Conte...	5.0	
4	Librije's Zusje Amsterdam	Amsterdam	['Dutch', 'European', 'International', 'Vegeta...	4.5	

res_cuisine column in the above dataframe has multiple values in a single cell. Before doing 1NF operations, we conducted operations to fix the NaN values in the dataframe. We replaced some of the NaN values in the cuisine column and dropped any additional Na values in the dataframe.

In [77]:

```python
Restaurant['res_cuisine'] = Restaurant['res_cuisine'].fillna("['Gourmet']")
Restaurant['res_id'] = Restaurant.index + 1
Restaurant = Restaurant[['res_id','res_name','res_place_name','res_cuisine','res_rating','res_price']]
Restaurant = Restaurant.dropna()
Restaurant['res_cuisine']
```

Out[77]:

```
0                           ['French', 'Dutch', 'European']
1         ['Dutch', 'European', 'Vegetarian Friendly', '...
2         ['Mediterranean', 'French', 'International', '...
3         ['French', 'European', 'International', 'Conte...
4         ['Dutch', 'European', 'International', 'Vegeta...
                                ...                        
88864                                         ['Gourmet']
88865                                            ['Cafe']
88866                                         ['Gourmet']
88867                                       ['Fast Food']
88868        ['Italian', 'Pizza', 'Mediterranean', 'Diner']
Name: res_cuisine, Length: 88869, dtype: object
```

Below are the operations for the 1NF transformation.

In [78]:

```python
new_df = pd.DataFrame(Restaurant.res_cuisine.str.split(",").tolist(), index=Restaurant.res_id).stack()
new_df = new_df.reset_index([0, 'res_id'])
new_df.columns = ['res_id', 'res_cuisines']
new_df
new_df['res_cuisines'] = new_df['res_cuisines'].str.replace('[','').str.replace(']','').str.replace("'","")
new_df
Restaurant = Restaurant.merge(new_df, left_on = 'res_id', right_on = 'res_id')
Restaurant = Restaurant[['res_id','res_name','res_place_name','res_cuisines','res_rating','res_price']]
```

In [79]:

```python
Restaurant.isna().sum()
```

Out[79]:

```
res_id            0
res_name          0
res_place_name    0
res_cuisines      0
res_rating        0
res_price         0
dtype: int64
```

In [80]:

```python
Restaurant.head()
```

Out[80]:

	res_id	res_name	res_place_name	res_cuisines	res_rating	res_price
0	1	Martine of Martine's Table	Amsterdam	French	5.0	$$$
1	1	Martine of Martine's Table	Amsterdam	Dutch	5.0	$$$
2	1	Martine of Martine's Table	Amsterdam	European	5.0	$$$
3	2	De Silveren Spiegel	Amsterdam	Dutch	4.5	
4	2	De Silveren Spiegel	Amsterdam	European	4.5	

2NF operations have been undertaken in order to separate the cuisine information from restaurant information.

In [81]:

```
Cuisine = Restaurant[['res_cuisines','res_id']]
Cuisine = Cuisine.rename(columns={'res_cuisines':'cuisine'})
Cuisine['cuisine_res_id'] = Cuisine.index+1
Cuisine = Cuisine[['cuisine_res_id','cuisine','res_id']]
Cuisine
```

Out[81]:

	cuisine_res_id	cuisine	res_id
0	1	French	1
1	2	Dutch	1
2	3	European	1
3	4	Dutch	2
4	5	European	2
...	...	...	...
235702	235703	Fast Food	88868
235703	235704	Italian	88869
235704	235705	Pizza	88869
235705	235706	Mediterranean	88869
235706	235707	Diner	88869

235707 rows × 3 columns

In [82]:

```
Restaurant = Restaurant[['res_id','res_name','res_place_name','res_rating','res_price']].drop_duplicates()
Restaurant = Restaurant.rename(columns = {'res_place_name':'place_name'})
Restaurant.head()
```

Out[82]:

	res_id	res_name	place_name	res_rating	res_price
0	1	Martine of Martine's Table	Amsterdam	5.0	$$$
3	2	De Silveren Spiegel	Amsterdam	4.5	
7	3	La Rive	Amsterdam	4.5	
13	4	Vinkeles	Amsterdam	5.0	
20	5	Librije's Zusje Amsterdam	Amsterdam	4.5	

Below are the final DataFrames for the database design:

In [97]:
```
Cities.to_csv("C:/Users/Arjun/Documents/NEU/DMDD/Assignment 2/cities.csv")
Cities.head()
```

Out[97]:

	place_name	place_country	place_maps	place_desc	place_a
0	Amsterdam	Netherlands	https://maps.google.com/?q=Amsterdam,+Netherla...	Amsterdam â□□ A city rich with heritage and ri...	Amst Sc (AMS) .
1	Barcelona	Spain	https://maps.google.com/?q=Barcelona,+Spain&ft...	Barcelona â□□ dive into the Catalan creativity...	Tarra Barcel Prat .
2	Berlin	Germany	https://maps.google.com/?q=Berlin,+Germany&fti...	Berlin â□□ Germanyâ□□s capital city has had a ...	Berlir
3	Budapest	Hungary	https://maps.google.com/?q=Budapest,+Hungary&f...	https://www.expedia.com/Budapest.d179994.Desti...	Bu (BUD) .
4	Copenhagen	Denmark	https://maps.google.com/?q=Copenhagen,+Denmark...	http://www.expedia.com.my/Copenhagen.d178252.T...	Bor .

In [98]:
```
Attraction_Details.to_csv("C:/Users/Arjun/Documents/NEU/DMDD/Assignment 2/attraction_detail
s.csv")
Attraction_Details.head()
```

Out[98]:

	att_id	att_name	place_name
0	0	Amsterdam Free Walking Tour	Amsterdam
1	1	Heineken Experience	Amsterdam
2	2	75-Minute Water Colors Cruise	Amsterdam
3	3	Van Gogh Museum Ticket	Amsterdam
4	4	Johan Cruijff ArenA Stadium 75-Minute Tour	Amsterdam

In [99]:
```
Attraction_Cost.to_csv("C:/Users/Arjun/Documents/NEU/DMDD/Assignment 2/attaction_cost.csv")
Attraction_Cost.head()
```

Out[99]:

	att_id	att_cost
0	0	$$
1	1	Free
2	2	Free
3	3	$$$
4	4	$

In [100]:
```
Restaurant.to_csv("C:/Users/Arjun/Documents/NEU/DMDD/Assignment 2/restaurant.csv")
Restaurant.head()
```

Out[100]:

	res_id	res_name	place_name	res_rating	res_price
0	1	Martine of Martine's Table	Amsterdam	5.0	$$$
3	2	De Silveren Spiegel	Amsterdam	4.5	
7	3	La Rive	Amsterdam	4.5	
13	4	Vinkeles	Amsterdam	5.0	
20	5	Librije's Zusje Amsterdam	Amsterdam	4.5	

In [102]:
```
Cuisine.to_csv("C:/Users/Arjun/Documents/NEU/DMDD/Assignment 2/cuisine.csv")
Cuisine.head()
```

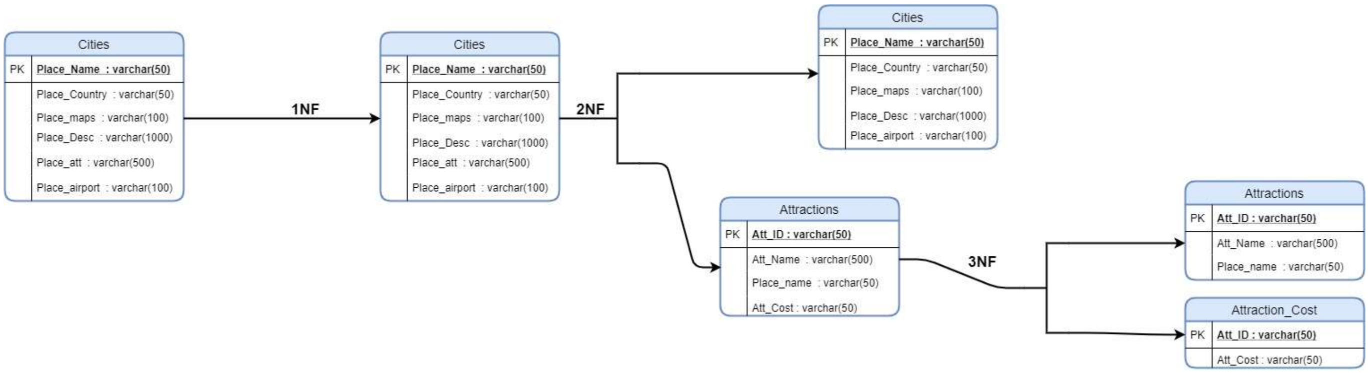
Out[102]:

	cuisine_res_id	cuisine	res_id
0	1	French	1
1	2	Dutch	1
2	3	European	1
3	4	Dutch	2
4	5	European	2

UML Diagrams:

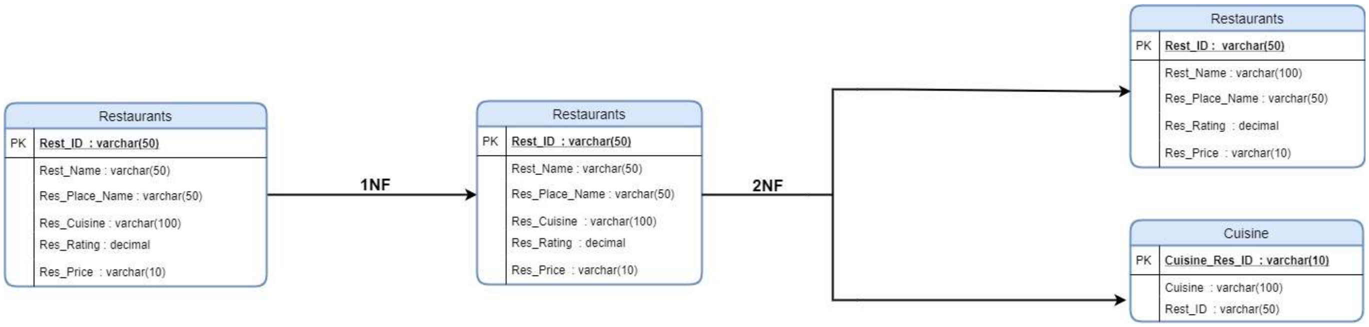
In [107]:
```
from IPython.display import Image
Image("C:/Users/Arjun/Documents/NEU/DMDD/Assignment 2/Cities.jpg")
```

Out[107]:



In [108]:
```
Image("C:/Users/Arjun/Documents/NEU/DMDD/Assignment 2/Restaurants_UML.jpg")
```

Out[108]:

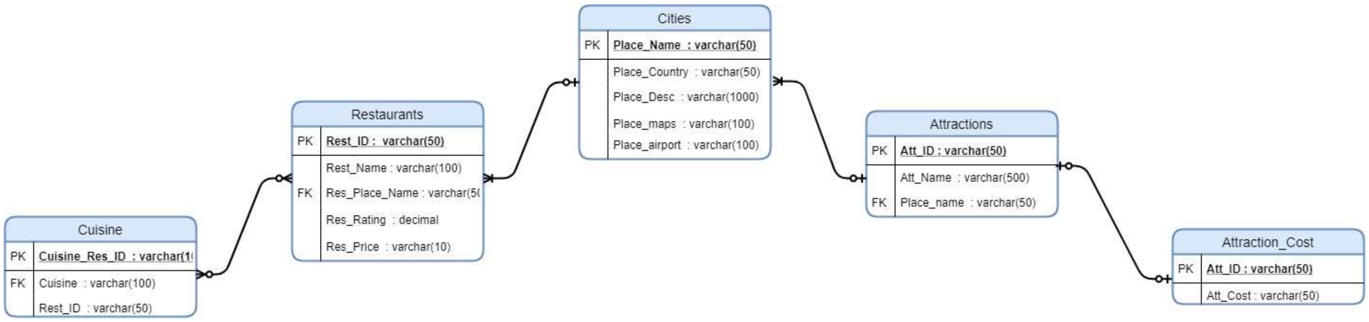


ER Diagram

In [109]:

```
Image("C:/Users/Arjun/Documents/NEU/DMDD/Assignment 2/ERD.jpg")
```

Out[109]:



Questions you must answer about your conceptual model:

1. What are the ranges, data types and format of all of the attributes in your entities?

Ans. Cities: 1) place_name: varchar 2) place_country: varchar 3) place_maps: varchar 4) place_desc: varchar 5) place_airport: varchar

Attraction_Details: 1) att_id: int 2) att_name: varchar 3) place_name: varchar

Attraction_Cost: 1) att_id: int 2) att_cost: varchar

Restaurant: 1) res_id: int 2) res_name: varchar 3) place_name: varchar 4) res_rating: int 5) res_price: varchar

Cuisine: 1) cuisine_res_id: int 2) cuisine: varchar 3) res_id: int

1. When should you use an entity versus attribute? (Example: address of a person could be modeled as either)

Ans. Entity is used to define a real world object or the subject for the attribute values. Attributes are values which describ the stated entity and gives us information about the entity. In this project, entities are the place names, restaurants and attractions. The other fields are attributes to these entities.

1. When should you use an entity or relationship, and placement of attributes? (Example: a manager could be modeled as either)

Ans. Entity should be used as the primary key or the primary subject of a table. Relationships are formed when there is a dependency between 2 entities. In the example of a Manager, Manager is related to an employee in a table where employee is the entity but in a manager table, the Manager will be considered the entity and the employee woud be a relationship. In ths project, the place_name and the restaurant are interchangebaly the entity and the relationship.

1. How did you choose your keys? Which are unique?

Ans. The keys were chosen by looking at which field could uniquely identify the records in the table. This could be in the form of primary or composite keys. Foreign keys were set to link one table to the primary key of another table. Place_name is a primary key in the cities table and is used as a foreign key in the restaurant and attractions tables.

1. Did you model hierarchies using the “ISA” design element? Why or why not?

Ans. Our data has been structered based on a simple hierarchy. The restaurants and attractions tables inherits the city details from the cities table.

1. Were there design alternatives? What are their tradeoffs: entity vs. attribute, entity vs. relationship, binary vs. ternary relationships?

Ans. There were no design alternatives because based on the extracted data, the attractions dataset and restaurants dataset could only be linked through cities dataset.

1. Where are you going find real-world data populate your model?

Ans. Real world data was found using APIs and web-scraping in the previous assignment. The NF procedures were applied on the data extracted in Assignment 1.

Questions you must answer about your physical model:

1. Are all the tables in 1NF?

Ans. Yes all the data in each of the tables in the physical model are in 1NF form as all the data are atomic in nature.

1. Are all the tables in 2NF?

Ans. All the tables in the physical model are in 2NF because the data in each of the tables do not have any partial dependency.

1. Are all the tables in 3NF?

Ans. All physical models are in 3NF because any transitive dependencies were taken care off by slpitting tables accordingly.

Report

files used: restaurants.csv, places.csv files renerated: attraction_cost.csv, attraction_details.csv, cities.csv, cuisine.csv, restaurant.csv

Data can been reformatted to fit the design conceptualized for the database and its components.

Code explained:

```
1. Importing places.csv
     Pandas created to store cities dataset
     1NF performed due to multiple values in cells of city attractions
     2NF performed to split attraction details and city details
     3NF performed to split attraction cost and attraction details
2. Importing restaurants.csv
     Pandas created to store restaurant dataset
     1NF done due to multiple values in the cuisine column
     2NF done to split the types of cuisine and restaurant details in order to avoid the primary
  key repetition.
```

Conclusion

It was noticed that the data imported was not structured in an efficient manner. NF operations were necessary to optiize the structure. Cities dataset was too large and lacked atomicity of data. 1NF operations solved this problem. We also separated the dataset using 2NF to hold attarction details and city details in different dataframes in order to allow for updation of attraction and city details independently. Cost for the attraction is an attribute that can be changed and to facilitate this without affecting the attraction details, 3NF was done.

Resturants dataset was also not atomic. Multiple cuisine values are in the same cell and this required 1NF transformations. Since this created a repetition of primary key in the transformed dataframe, 2NF was implemented to counter this and restaurant details was seperated from cuisines.

Contribution

Your contribution towards project. How much code did you write and how much you took from other site or some other source

I contributed By Own: 40%

By External source: 60%

Citations

Sources from where you have gained knowledge or used codes, data. It may include Web links, github links, code taken from somewhere etc.

https://www.geeksforgeeks.org/python-replace-multiple-characters-at-once/ (https://www.geeksforgeeks.org/python-replace-multiple-characters-at-once/) https://medium.com/@sureshssarda/pandas-splitting-exploding-a-column-into-multiple-rows-b1b1d59ea12e (https://medium.com/@sureshssarda/pandas-splitting-exploding-a-column-into-multiple-rows-b1b1d59ea12e) https://stackoverflow.com/questions/54367361/how-to-assign-random-values-from-a-list-to-a-column-in-a-pandas-dataframe (https://stackoverflow.com/questions/54367361/how-to-assign-random-values-from-a-list-to-a-column-in-a-pandas-dataframe) https://pandas.pydata.org/pandas-docs/stable/reference/api/pandas.DataFrame.rename.html (https://pandas.pydata.org/pandas-docs/stable/reference/api/pandas.DataFrame.rename.html) https://cmdlinetips.com/2018/03/how-to-change-column-names-and-row-indexes-in-pandas/ (https://cmdlinetips.com/2018/03/how-to-change-column-names-and-row-indexes-in-pandas/) https://stackoverflow.com/questions/17978133/python-pandas-merge-only-certain-columns (https://stackoverflow.com/questions/17978133/python-pandas-merge-only-certain-columns)

GitHub Links

Nikhil Nijhawan: https://github.com/nikhil-nijhawan/DMDD-INFO6210-Assignment2 (https://github.com/nikhil-nijhawan/DMDD-INFO6210-Assignment2)

Arjun Acharya: https://github.com/ArjunAcharya0311/INFO6210_08_Assignment_2 (https://github.com/ArjunAcharya0311/INFO6210_08_Assignment_2)

Sumedha Hunagund: https://github.com/Sumedha1496/6210_08_A_2 (https://github.com/Sumedha1496/6210_08_A_2)

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