

Business establishment recommendation system based on country's economic freedom

<https://github.com/gunasekharv6/Business-establishment-recommendation-system-based-on-country-s-economic-freedom>

Team “Northern Lights”

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INTRODUCTION:

What is the focus of the project?

Main aim of the project is to build a database that can help businesses/organizations choose a suitable country for them to start or extend their presence/investment in, considering various economic and other relevant factors for each country.

What is economic freedom?

Economic freedom/Economic liberty is the ability of people of a society to take economic actions. In an economically free society, individuals are free to work, produce, consume, and invest in any way they please.

How do these factors of economic freedom influence the decision making of investors/businesses?

Nations with greater economic freedom have stronger economies, with higher gross domestic product per person. Free trade is a key element of economic freedom.

For example, to establish software/hardware companies in a country, the country needs to have a strong social law and order, whereas for a company that manufactures armaments, a country with conditions leading to civil war is more suitable.

Hence, the factors that determine economic freedom play a very important role in influencing business decisions.

In what ways can this database help investment decisions?

This database provides information on a number of variables, including the GDP of the country, the country's rank in terms of GDP, the industries and businesses that primarily benefit the country, the country's PPP, inbound and outbound remittance, and the labour cost in the specific country and the economic freedom of the country. These factors majorly affect the financial and civil (law & order) health of a country both of which affect businesses running in that country.

Technologies Used:

1) Database Used: MySQL

2) Programming Language Used: Python

3) IDE's Used:

Jupyter Notebook,

Pycharm

4) Libraries Used:

1. Pandas

2. NumPy

3. Seaborn

4. Matplotlib

5. Sql-Alchemy

6. mysql.connector

7. pymysql

DATABASE TABLES:

Examples of some of the tables from the database:

economic_factors:

OVERALL RANK	COUNTRY NAME	YEAR	OVERALL SCORE	SIZE OF GOVERNMENT	LEGAL SYSTEMS & PROPERTY RIGHTS	SOUND MONEY	FREEDOM TO TRADE INTERNATIONALLY
2	Singapore	2020	8.48	7.18	8.29	9.62	8.61
3	Switzerland	2020	8.37	7.52	8.74	9.86	7.63
4	New Zealand	2020	8.27	6.29	8.72	9.58	8.19
5	Denmark	2020	8.09	5.24	8.66	9.7	8.42
6	Australia	2020	8.04	6.09	8.34	9.56	7.92
7	United States	2020	7.97	6.79	7.56	9.63	7.77
8	Estonia	2020	7.95	6.29	7.78	9.16	8.33
9	Mauritius	2020	7.88	7.9	6.94	9.47	7.7
10	Ireland	2020	7.86	6.17	7.74	9.32	7.96
11	Armenia	2020	7.84	7.98	6.24	9.55	7.69
12	Lithuania	2020	7.82	6.6	7.24	9.2	8.33
12	Japan	2020	7.82	5.65	7.71	9.82	7.78
14	Canada	2020	7.81	5.82	8.02	9.52	7.75
15	Georgia	2020	7.78	7.29	6.83	9.06	8.28
16	Latvia	2020	7.77	6.2	7.06	9.19	8.36
17	Netherlands	2020	7.75	4.86	8.35	9.14	8.6

EFW: (Country Code & Location)

Year	ISO Code 3	Countries	Region	World Bank Region
2020	ALB	Albania	Eastern Europe	Europe & Central Asia
2020	DZA	Algeria	Middle East & North Africa	Middle East & North Africa
2020	AGO	Angola	Sub-Saharan Africa	Sub-Saharan Africa
2020	ARG	Argentina	Latin America & the Caribbean	Latin America & the Caribbean
2020	ARM	Armenia	Caucasus & Central Asia	Europe & Central Asia
2020	AUS	Australia	Oceania	East Asia & Pacific
2020	AUT	Austria	Western Europe	Europe & Central Asia
2020	AZE	Azerbaijan	Caucasus & Central Asia	Europe & Central Asia
2020	BHS	Bahamas, The	Latin America & the Caribbean	Latin America & the Caribbean
2020	BHR	Bahrain	Middle East & North Africa	Middle East & North Africa
2020	BGD	Bangladesh	South Asia	South Asia
2020	BRB	Barbados	Latin America & the Caribbean	Latin America & the Caribbean
2020	BLR	Belarus	Eastern Europe	Europe & Central Asia
2020	BEL	Belgium	Western Europe	Europe & Central Asia
2020	BLZ	Belize	Latin America & the Caribbean	Latin America & the Caribbean
2020	BEN	Benin	Sub-Saharan Africa	Sub-Saharan Africa
2020	BTN	Bhutan	South Asia	South Asia

Forbes_data:

Rank	Company	Country/Territory	Sales	Profits	Assets	Market Value	Sector	Industry
626	Omnicom Group	United States	\$14.9 B	\$1.3 B	\$23.7 B	\$12.2 B	Consumer	Advertising
665	WPP	United Kingdom	\$16.9 B	\$702 M	\$41.5 B	\$9.5 B	Consumer	Advertising
769	Publicis Groupe	France	\$12.3 B	\$941.3 M	\$36.7 B	\$7 B	Consumer	Advertising
1144	Interpublic Group	United States	\$10.2 B	\$668.7 M	\$16.4 B	\$6.6 B	Consumer	Advertising
1340	Dentsu	Japan	\$9.6 B	\$-742 M	\$34.9 B	\$5.9 B	Consumer	Advertising
1774	Hakuhodo DY Holdings	Japan	\$13.4 B	\$379.8 M	\$7.7 B	\$4.2 B	Consumer	Advertising
145	Lockheed Martin	United States	\$61.1 B	\$6.2 B	\$49.2 B	\$109.1 B	Industrials	Aerospace
214	General Dynamics	United States	\$38.8 B	\$3.4 B	\$53.7 B	\$37.5 B	Industrials	Aerospace
241	Northrop Grumman	United States	\$34.3 B	\$2.3 B	\$43.2 B	\$55.1 B	Industrials	Aerospace
257	Safran	France	\$28.1 B	\$2.7 B	\$48.1 B	\$36.7 B	Industrials	Aerospace
389	BAE Systems	United Kingdom	\$23.4 B	\$1.9 B	\$34.5 B	\$20.6 B	Industrials	Aerospace
413	Boeing	United States	\$70.6 B	\$-3.4 B	\$143.1 B	\$79.6 B	Industrials	Aerospace
439	AIRBUS	Netherlands	\$76.2 B	\$-2.1 B	\$128.4 B	\$49.6 B	Industrials	Aerospace
487	Thales	France	\$20.6 B	\$1.3 B	\$35 B	\$16.1 B	Industrials	Aerospace
861	Leonardo	Italy	\$15.4 B	\$918.9 M	\$30.2 B	\$4 B	Industrials	Aerospace
895	TransDigm Group	United States	\$6.9 B	\$726 M	\$18.2 B	\$19.5 B	Industrials	Aerospace

forex_reserves:

Countries	Reserves, 2021	Global rank	Available data
China	3427.93	1	1977 - 2021
Japan	1405.75	2	1960 - 2021
Euro area	1196.16	3	1999 - 2021
Switzerland	1109.82	4	1960 - 2021
USA	716.15	5	1960 - 2021
India	638.48	6	1960 - 2021
Russia	632.24	7	1993 - 2021
Hong Kong	496.87	8	1990 - 2021
Saudi Arabia	473.89	9	1960 - 2021
South Korea	463.28	10	1960 - 2021
Singapore	425.1	11	1960 - 2021
Brazil	362.21	12	1960 - 2021
Germany	295.74	13	1960 - 2021
Thailand	246.03	14	1960 - 2021
France	244.28	15	1960 - 2021
Italy	227.48	16	1960 - 2021
Israel	212.93	17	1960 - 2021
Mexico	207.8	18	1960 - 2021

GDP Growth:

Country	2016	2017	2018	2019	2020	2021	2022
Advanced economies	1.8	2.5	2.3	1.7	-4.4	5.2	2.4
Afghanistan	2.2	2.6	1.2	3.9	-2.4	no data	no data
Africa (Region)	2.4	4	3.4	2.9	-1.8	4.8	3.7
Albania	3.3	3.8	4	2.1	-3.5	8.5	4
Algeria	3.2	1.4	1.2	1	-5.1	3.5	4.7
Andorra	3.7	0.3	1.6	2	-11.2	8.9	6.6
Angola	-2.6	-0.2	-1.3	-0.7	-5.8	0.8	2.9
Antigua and Barbuda	5.5	3.1	6.9	4.9	-20.2	5.3	6
Argentina	-2.1	2.8	-2.6	-2	-9.9	10.4	4
Armenia	0.2	7.5	5.2	7.6	-7.4	5.7	7
Aruba	2.1	5.5	5.3	0.6	-18.6	17.2	4
Asia and Pacific	5.4	5.7	5.3	4.1	-0.9	6.6	4
Australia	2.7	2.4	2.8	2	-2.1	4.9	3.8
Australia and New Z...	2.9	2.5	2.9	2.1	-2.1	5	3.6
Austria	2	2.3	2.5	1.5	-6.7	4.6	4.7
Azerbaijan	-3.1	0.2	1.5	2.5	-4.2	5.6	3.7
Bahamas, The	-0.9	3.1	1.8	1.9	-23.8	13.7	8
Bahrain	3.6	4.3	2.1	2.2	-4.9	2.2	3.4

global_climate

rw_country_code	country	cri_rank	cri_score	losses_per_gdp__ran
AFG	Afghanistan	28	43.33	73
AGO	Angola	50	56	87
ALB	Albania	55	58	41
ARE	United Arab Emirates	127	109.17	133
ARG	Argentina	63	63.67	82
ARM	Armenia	113	98.33	74
ATG	Antigua and Barbuda	135	124.5	135
AUS	Australia	20	35.5	30
AUT	Austria	53	57	42
AZE	Azerbaijan	135	124.5	135
BDI	Burundi	15	33	23
BEL	Belgium	46	52.83	108
BEN	Benin	135	124.5	135
BFA	Burkina Faso	60	61	34
BGD	Bangladesh	35	46.17	61
BGR	Bulgaria	27	42.5	20
BHR	Bahrain	135	124.5	135
BHS	The Bahamas	7	22.83	11

PPP_value:

LOCATION	INDICATOR	TIME	Value
AUS	PPP	1960	0.700946
AUS	PPP	1961	0.701324
AUS	PPP	1962	0.68799
AUS	PPP	1963	0.698321
AUS	PPP	1964	0.708346
AUS	PPP	1965	0.705945
AUS	PPP	1966	0.70894
AUS	PPP	1967	0.711321
AUS	PPP	1968	0.70353
AUS	PPP	1969	0.70688
AUS	PPP	1970	0.684104
AUS	PPP	1971	0.693022
AUS	PPP	1972	0.711627
AUS	PPP	1973	0.763348
AUS	PPP	1974	0.823389
AUS	PPP	1975	0.859681
AUS	PPP	1976	0.920686
AUS	PPP	1977	0.950946

Data Cleaning, Munging and Exploratory Data Analysis

STEPS TO RUN THE FILE:

Steps to run python file for exploratory data analysis and data visualization:

8. Install Pycharm.

9. Set up the IDE and console.

Create a project to run the required files.

10. Install all the necessary packages/libraries as listed

below: Pandas

Numpy

Seaborn

Matplotlib

Sql-Alchemy

mysql.connector

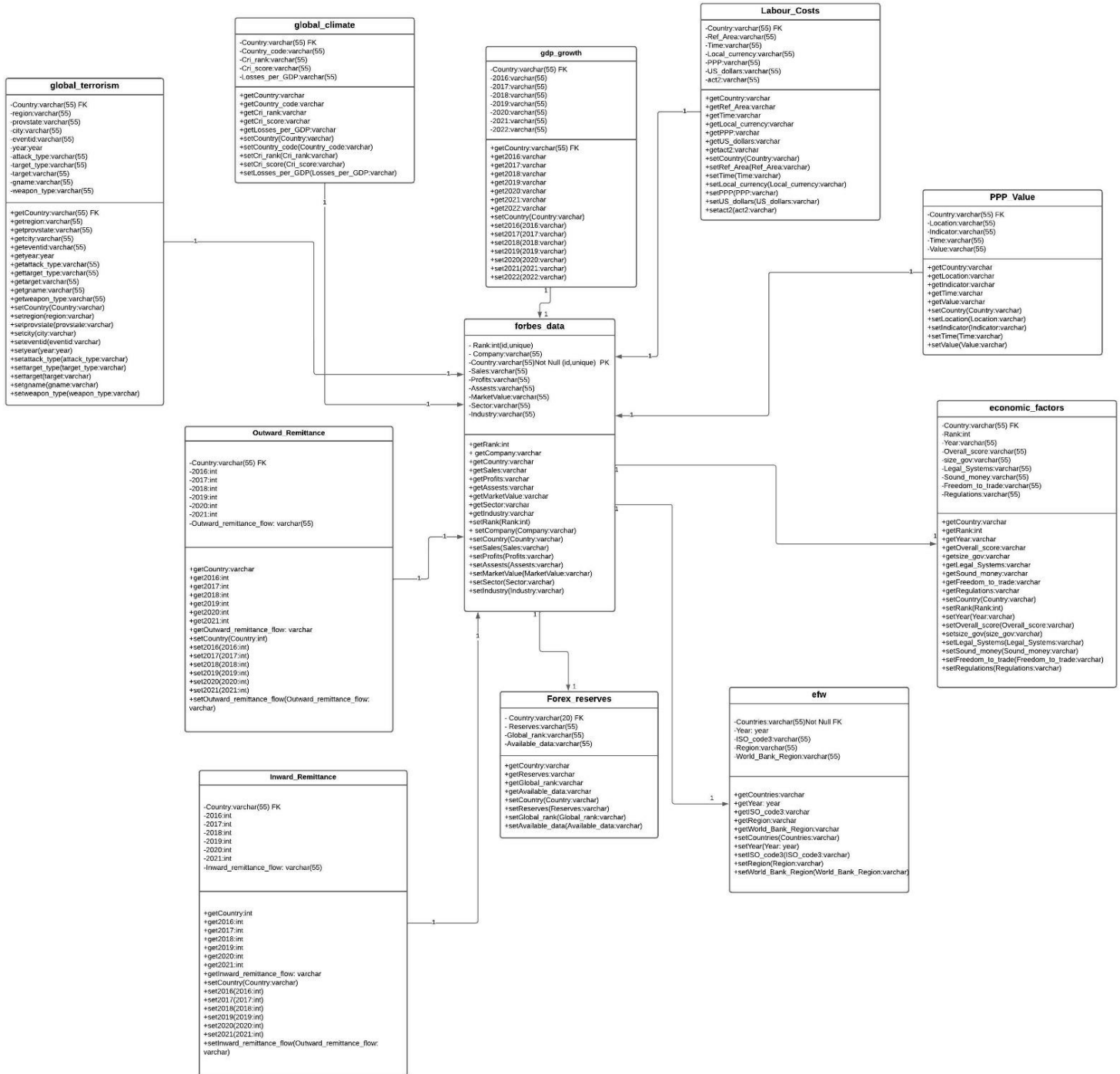
pymysql

11. Export the EDA_Assignment3_DMDD.py file and run it on

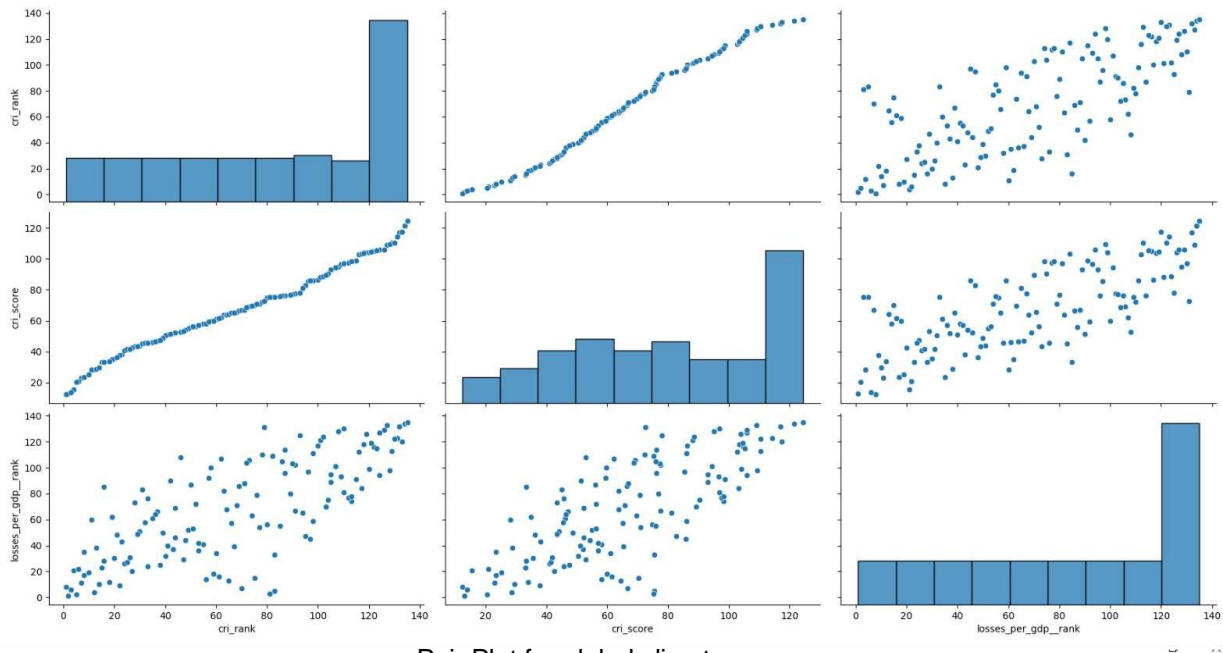
pycharm. Note:

Some visualizations might take up more time to display depending on the size of the data being plotted.

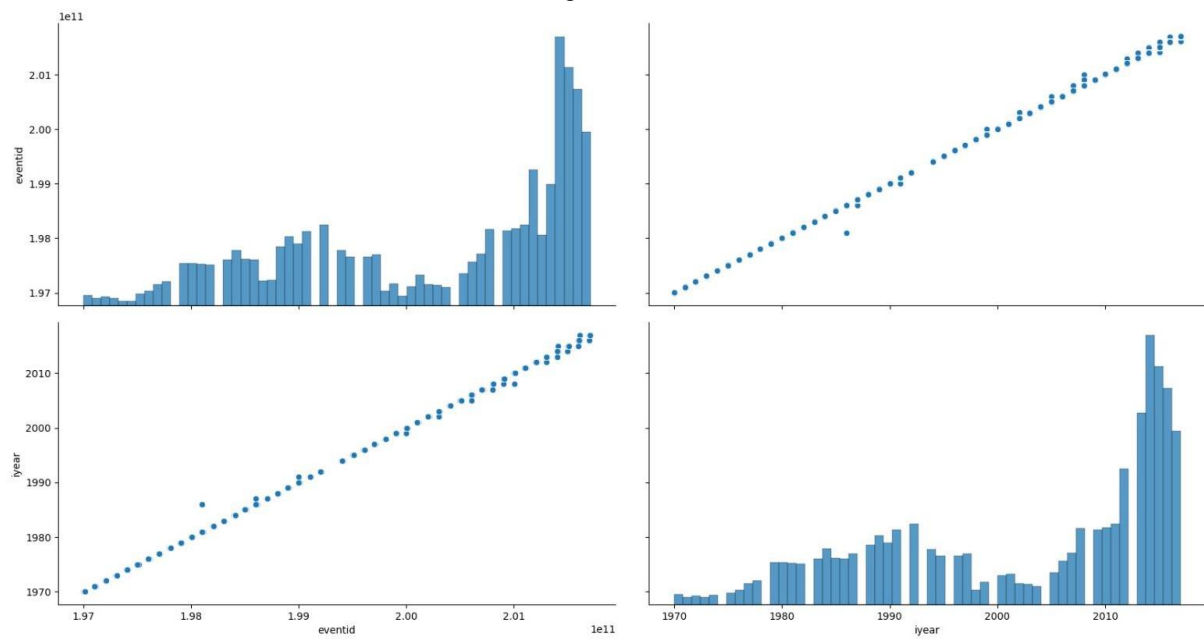
ERD:



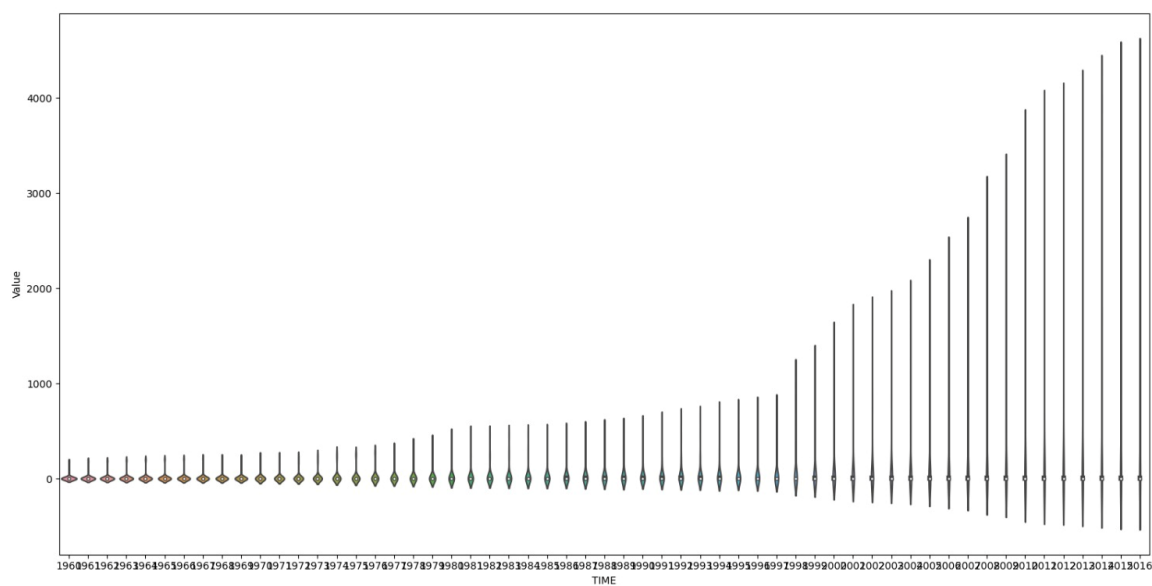
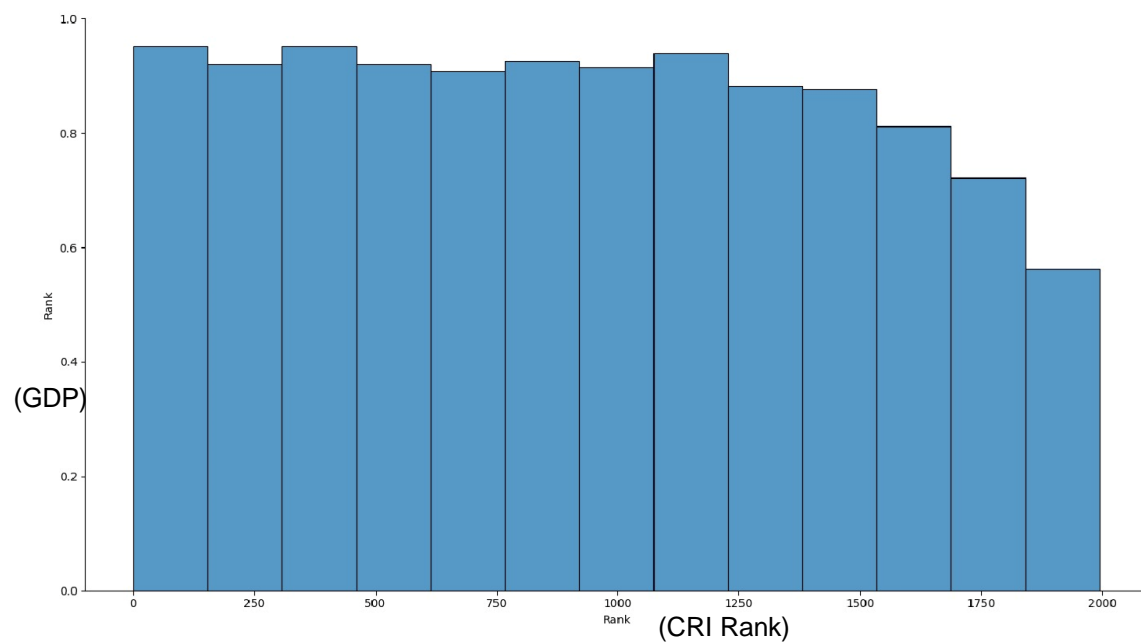
Visualization of Data:



Pair Plot for global climate



Pair Plot for entire table global_terrorism



Note: "Refer to the .py file for more visualizations"

USE CASES WITH SQL QUERIES:

1. **Use Case:** Find country with particular sector and get the GDP rank associated with it

Description: User views the countries with respect to sector and their associated gdp

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries with sector and their gdp

System Responses: the list of countries with sector and gdp are displayed

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
SELECT * from((select * from yellow.forbes_data
where Company in ('JPMorgan Chase', 'Agricultural Bank of China', 'Charles Schwab') )A
Inner Join
(select * from yellow.gdp_growth)B
on A.`Country/Territory`=B.Country) ;
```

2. **Use Case:** Find country with top cri rank and their associated PPP value

Description: User views the countries with respect to cri rank and their associated PPP value

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries with cri rank and their PPP value

System Responses: the list of countries with cri rank and PPP are displayed

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
SELECT * from((select * from yellow.global_climate
where cri_rank=63)A
Inner Join
(select LOCATION, Value from yellow.ppp_value)B
on A.rw_country_code=B.LOCATION) LIMIT 1;
```

3. **Use Case:** Find countries with Financial sector and their associated Forex Reserves

Description: User views the countries with Financial sector and their associated Forex Reserves

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries Financial sector and their associated Forex Reserves

System Responses: the list of countries with Financial sector and their associated Forex Reserves

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
SELECT * from((select * from yellow.forbes_data
where Sector in ('Health Care', 'Financials', 'Materials'))A
Inner Join
(select * from yellow.Forex_Reserves)B
on A.`Country/Territory`=B.Countries );
```

4. **Use Case:** Find countries with cri_rank more than 130 and their associated profits with sector

Description: User views the countries with with cri_rank more than 130 and their associated profits with sector

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries with with cri_rank more than 130 and their associated profits with sector

System Responses: the list of countries with with cri_rank more than 130 and their associated profits with sector

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
SELECT A.country, A.cri_rank, B.Company, B.Sector, B.Industry, B.Sales, B.Profits from(
(select * from yellow.global_climate
where cri_rank>130)A
Inner Join
(select `Country/Territory`,Company, Sector, Industry, Sales, Profits from
yellow.forbes_data)B
on A.country=B.`Country/Territory`);
```

5. **Use Case:** Find companies with rank less than 20 with associated PPP, dollars and sector

Description: User views the companies with rank less than 20 with associated PPP, dollars and sector

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the companies with rank less than 20 with associated PPP, dollars and sector

System Responses: the list of companies with rank less than 20 with associated PPP, dollars and sector

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
Select * from
```



```

(SELECT country, Value from(
(select rw_country_code, country from yellow.global_climate)A
Inner Join
(select LOCATION, Value from yellow.ppp_value)B
on A.rw_country_code=B.LOCATION))C
Inner Join
(select * from yellow.forbes_data
where `Rank`<50)D
On C.country=D.`Country/Territory`;

```

6. **Use Case:** Find country named United States and itsGDP growth

Description: User views the country named United States and itsGDP growth

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the country named United States and itsGDP growth

System Responses: the list of country named United States and itsGDP growth

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```

Select * from(
(select * from yellow.gdp_growth)A
Inner join
(select `Country/Territory`,Company, Sector, Industry, Sales, Profits from
yellow.forbes_data)B
On A.Country= B.`Country/Territory`)
Where Sector='Energy';

```

7. **Use Case:** Find countries with sales more than \$150B with profits greater than \$10B get remittance.

Description: User views the countries with sales more than \$150B with profits greater than \$10B get remittance

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries with sales more than \$150B with profits greater than \$10B get remittance

System Responses: the list of countries with sales more than \$150B with profits greater than \$10B get remittance

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
select * from(
(select `Country/Territory`,Company, Sector, Industry, Sales, Profits from yellow.forbes_data
where Profits>'$10B')A
Inner Join
(select * from yellow.outward_remittance)B
on A.`Country/Territory` = B.`Outward remittance flows (US$ million)`);
```

8. **Use Case:** Find country named Japan get freedom to trade internationally their companies and market value of same

Description: User views the countries named Japan get freedom to trade internationally their companies and market value of same

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries named Japan get freedom to trade internationally their companies and market value of same

System Responses: the list of countries named Japan get freedom to trade internationally their companies and market value of same

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
select * from(  
(select `Country/Territory`,Company, Sector, Industry, Sales, Profits from yellow.forbes_data  
where Profits>'$10B'  
and Industry in ('Regional Banks', 'Recreational Products'))A  
Inner Join  
(select * from yellow.labor_costs)B  
on A.`Country/Territory` = B.`Reference area`);
```

9. **Use Case:** Find countries with financial sector with assets and associated legal systems and property rights with companies

Description: User views the countries with financial sector with assets and associated legal systems and property rights with companies

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries with financial sector with assets and associated legal systems and property rights with companies

System Responses: the list of countries with financial sector with assets and associated legal systems and property rights with companies

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
select * from(  
(select `Country/Territory`,Company, Sector, Industry, Sales, Profits from yellow.forbes_data
```

where Profits>'\$10B'

and Industry in ('Regional Banks', 'Recreational Products'))A

Inner Join

(select * from yellow.economic_factors)B

on A.`Country/Territory` = B.`COUNTRY NAME `);

10. **Use Case:** Find countries with sound money more than 1.4 and profits of the companies in the associated country

Description: User views the countries with sound money more than 1.4 and profits of the companies in the associated country

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries with sound money more than 1.4 and profits of the companies in the associated country

System Responses: the list of countries with sound money more than 1.4 and profits of the companies in the associated country

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

select * from(

(select `Country/Territory`,Company, Sector, Industry, Sales, Profits from yellow.forbes_data
where Profits>'\$1.3B')A

Inner Join

(select * from yellow.economic_factors

where REGULATION >=8.3)B

on A.`Country/Territory` = B.`COUNTRY NAME `);

11. **Use Case:** Find country named India with outward remittance flow and companies in the country with government size

Description: User views the country named India with outward remittance flow and companies in the country with government size

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries named India with outward remittance flow and companies in the country with government size

System Responses: the list of country named India with outward remittance flow and companies in the country with government size

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
select * from(  
(select * from yellow.outward_remittance)A  
Inner Join  
(select * from yellow.economic_factors  
where REGULATION >=8.3)B  
on A.`Outward remittance flows (US$ million)` = B.`COUNTRY NAME `);
```

12. **Use Case:** Find country named Canada and find PPP for the country and get associated international trade, regulations with profits made in which industry sector

Description: User views the country named Canada and find PPP for the country and get associated international trade, regulations with profits made in which industry sector

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the named Canada and find PPP for the country and get associated international trade, regulations with profits made in which industry sector

System Responses: the list of country named Canada and find PPP for the country and get associated international trade, regulations with profits made in which industry sector

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
SELECT Distinct A.country, A.cri_score, A.losses_per_gdp_rank from(
(select * from yellow.global_climate
where cri_score>=43.2)A
Inner Join
(select LOCATION, Value from yellow.ppp_value)B
on A.rw_country_code=B.LOCATION);
```

- 13 Use Case:** Find countries with PPP value greater than 1 and year greater than 2000 with the sector, company and industry parameters associated with that country

Description: User views the countries with PPP value greater than 1 and year greater than 2000 with the sector, company and industry parameters associated with that country

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the named Canada and find PPP for the country and get associated international trade, regulations with profits made in which industry sector

System Responses: the list of country named Canada and find PPP for the country and get associated international trade, regulations with profits made in which industry sector

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
SELECT Distinct A.country, A.cri_score, A.losses_per_gdp_rank from(
(select * from yellow.global_climate
where cri_score>=43.2)A
Inner Join
(select LOCATION, Value from yellow.ppp_value)B
on A.rw_country_code=B.LOCATION);
```

14 Use Case: Find countries with local currency greater than 5 with associated industry, company and sector

Description: User views the countries with local currency greater than 5 with associated industry, company and sector

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the the countries with local currency greater than 5 with associated industry, company and sector

System Responses: the list of countries with local currency greater than 5 with associated industry, company, and sector

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
SELECT * from (  
(select * from yellow.forbes_data)A  
Inner Join  
(select * from yellow.labor_costs  
where `Local currency`>5) B  
on A.`Country/Territory`=B.`Reference area`);
```

15 Use Case: Find country named Italy and company, sector and industry with profits, legal systems & property rights associated with it

Description: User views the country named Italy and company, sector and industry with profits, legal systems & property rights associated with it

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the country named Italy and company, sector and industry with profits, legal systems & property rights associated with it

System Responses: the list of countries named Italy and company, sector and industry with profits, legal systems & property rights associated with it

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
SELECT * from (  
(select * from yellow.forbes_data)A  
Inner Join  
(select * from yellow.economic_factors)B  
on A.`Country/Territory`=B.`COUNTRY NAME`)  
Where `Country/Territory` = 'Italy';
```

16 Use Case: Find country with maximum forex reserves and its gdp data

Description: User views the country with maximum forex reserves and its gdp data

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the country with maximum forex reserves and its gdp data

System Responses: the country with maximum forex reserves and its gdp data is populated

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
SELECT * from (  
(select * from yellow.forex_reserves)A  
Inner Join  
(select * from yellow.gdp_growth)B  
on A.`Countries`=B.`Country`)  
order by A.`Global rank` LIMIT 1;
```

17 Use Case: Select the country with max inward remittance in 2021 and their gdp

Description: User views the countries with max inward remittance in 2021 and their gdp

Actor: User

Precondition: User must have access to data

Steps:

Actor action: countries with max inward remittance in 2021 and their gdp

System Responses: countries with max inward remittance in 2021 and their gdp

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
SELECT * from (  
(select * from yellow.outward_remittance)A  
Inner Join  
(select * from yellow.gdp_growth)B  
on A.`Outward remittance flows (US$ million)`=B.Country)  
order by B.`2022` Desc Limit 10 ;
```

18 Use Case: View the country with top 10 gdp in 2021 and their corresponding forex reserves

Description: User views the countries with top 10 gdp in 2021 and their corresponding forex reserves

Actor: User

Precondition: User must have access to data

Steps:

Actor action: countries with top 10 gdp in 2021 and their corresponding forex reserves

System Responses: countries with top 10 gdp in 2021 and their corresponding forex reserves

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```

SELECT * from(
(select * from yellow.forex_reserves)A
Inner Join
(select * from yellow.gdp_growth)B
on A.`Countries`=B.Country)
WHERE B.Country in ('China', 'India', 'France', 'Germany')
order by B.`2022` DESC LIMIT 5;

```

19 Use Case: User makes a search for country with lowest labor cost along with their gdp

Description: User views the countries with lowest labor cost along with their gdp

Actor: User

Precondition: User must have access to data

Steps:

Actor action: countries with lowest labor cost along with their gdp

System Responses: with lowest labor cost along with their gdp

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```

SELECT * from(
(select * from yellow.labor_costs)A
Inner Join
(select * from yellow.gdp_growth)B
on A.`Reference area`=B.Country)
order by A.`U.S. dollars` LIMIT 1;

```

20 Use Case: User makes a search for country with maximum terror attacks their gdp

Description: User views the countries with maximum terror attacks their gdp

Actor: User

Precondition: User must have access to data

Steps:

Actor action: countries with maximum terror attacks their gdp

System Responses: countries with maximum terror attacks their gdp

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
SELECT * from(  
(select country_txt,Count(eventid) Total_attacks from yellow.global_terrorism  
group by country_txt)A  
Inner Join  
(select * from yellow.gdp_growth)B  
on A.country_txt=B.Country)  
order by Total_attacks Desc;
```

AUDITING:

Audited all the data sets with individual auditing of each file that can be found below

Output10: audited the contents of file with no duplicate contents

And also ensure that all the parameters result are out of 10

Output9: audited the contents of the data ensuring that all the figures are in million dollars

Output7: audited the contents of the data ensuring that the figures are consistent as per million dollars

Output6: verified all the content of the data. All the currency parameters are in dollars (that is money is not in Euros or rupees)

Output5: verified all the parameters and found data consistent

Output4: verified the consistency of data and data is consistent with respect to currency exchange rates

Output3: Deleted unnecessary column rank in output 3

Output2: audited date all the parameter consistent with data

NORMALIZATION

1st Normal Form:

Table Name	Primary Key Column Name	1st Normal Form
economic_factors	OVERALL_RANK	N
efw	ISO_CODE3	Y
forbes_data	Rank	N
forex_reserves	Countries	Y
global_terrorism	eventID	N
gdp_growth	Country	Y
global_climate	rw_country_code	Y
inward_remittance	Inward_Remittance_Flows	Y
labor_costs	Reference_Area	Y
outward_remittance	Outward_Remittance_Flows	Y
ppp_value	Location	Y

- Each table has a primary key: minimal set of attributes which can uniquely identify a record

Out of all the 11 tables in the dataset, every table has a primary key satisfying this condition. The primary keys in our table are country names, country codes, rankings of countries with respect to various aspects and event IDs.

Table Name	Primary Key Column Name
economic_factors	OVERALL_RANK
efw	ISO_CODE3
forbes_data	Rank
forex_reserves	Countries
global_terrorism	eventID
gdp_growth	Country
global_climate	rw_country_code
inward_remittance	Inward_Remittance_Flows
labor_costs	Reference_Area
outward_remittance	Outward_Remittance_Flows
ppp_value	Location

- The values in each column of a table are atomic (No multi-value attributes allowed).

There are three tables in our dataset which aren't in the first normal form.

The snapshots of the tables before and after they are normalized into 1st Normal form are shown below:

In the global_terrorism table the columns attactype1_txt and targetype1_txt has 5 multiple values as shown below:

country_txt	region_txt	provstate	city	eventid	year	attactype1_txt	targetype1_txt	target1	gname	weaptype1_txt
Afghanistan	South Asia	Helmand	Sangin	201107000000	2011	Bombing/Explosion	Transportation	A mini-bus	Unknown	Explosives
Afghanistan	South Asia	Farah	Bakwa district	201409000000	2014	Hostage Taking (Kidnapping)	Government (General)	District Coun...	Taliban	Firearms
Afghanistan	South Asia	Helmand	Nahri Saraj district	201302000000	2013	Bombing/Explosion	Military	Vehicles	Taliban	Explosives
Afghanistan	South Asia	Parwan	Qala Sehra	201701000000	2017	Hostage Taking (Kidnapping)	Government (General)	Public Health...	Unknown	Firearms
Afghanistan	South Asia	Kabul	Gul Bagh	201411000000	2014	Bombing/Explosion	Military	Vehicle	Taliban	Explosives
Afghanistan	South Asia	Unknown	Unknown	201409000000	2014	Bombing/Explosion	Unknown	Unknown	Unknown	Explosives
Afghanistan	South Asia	Kabul	Kabul	201411000000	2014	Bombing/Explosion	Unknown	Unknown	Unknown	Explosives
Afghanistan	South Asia	Unknown	Unknown	201409000000	2014	Bombing/Explosion	Military	Soldiers	Unknown	Explosives
Afghanistan	South Asia	Kandahar	Kandahar	201107000000	2011	Bombing/Explosion	Religious Figures/Instituti...	A mosque	Taliban	Explosives
Afghanistan	South Asia	Nangarhar	Pachir Wa Agam	201107000000	2011	Unknown	Private Citizens & Property	Civilians	Khorasa...	Unknown
Afghanistan	South Asia	Faryab	Bilchiragh district	201607000000	2016	Unknown	Private Citizens & Property	District	Taliban	Unknown
Afghanistan	South Asia	Uruzgan	Shahidi Hassas di...	201311000000	2013	Bombing/Explosion	Private Citizens & Property	Civilian	Taliban	Explosives
Afghanistan	South Asia	Herat	Farsi	201407000000	2014	Bombing/Explosion	Police	Vehicle	Taliban	Explosives
Afghanistan	South Asia	Kunduz	Lala Maydan	201407000000	2014	Armed Assault	Police	Officers	Taliban	Explosives

After normalizing:

attactype1_txt	targetype1_txt
Bombing	Political
Bombing	Religious Figures
Bombing	Religious Figures
Bombing	Religious Figures
Bombing	Religious Figures
Bombing	Religious Figures
Bombing	Religious Figures
Bombing	Political
Bombing	Religious Figures
Bombing	Religious Figures
Bombing	Religious Figures
Bombing	Religious Figures
Bombing	Political
Bombing	Religious Figures

Similarly, the table Forbes_data has a multi valued column in Industry and Sector columns as shown below:

Rank	Company	Country/Territory	Sales	Profits	Assets	Market Value	Sector	Industry
665	WPP	United Kingdom	\$16.9 B	\$702 M	\$41.5 B	\$9.5 B	Consumer Discretionary	Advertising
1340	Dentsu	Japan	\$9.6 B	\$-742 M	\$34.9 B	\$5.9 B	Consumer Discretionary	Advertising
769	Publicis Groupe	France	\$12.3 B	\$941.3 M	\$36.7 B	\$7 B	Consumer Discretionary	Advertising
1144	Interpublic Group	United States	\$10.2 B	\$668.7 M	\$16.4 B	\$6.6 B	Consumer Discretionary	Advertising
1774	Hakuhodo DY Holdings	Japan	\$13.4 B	\$379.8 M	\$7.7 B	\$4.2 B	Consumer Discretionary	Advertising
626	Omnicom Group	United States	\$14.9 B	\$1.3 B	\$23.7 B	\$12.2 B	Consumer Discretionary	Advertising
145	Lockheed Martin	United States	\$61.1 B	\$6.2 B	\$49.2 B	\$109.1 B	Industrials	Aerospace & Defense
487	Thales	France	\$20.6 B	\$1.3 B	\$35 B	\$16.1 B	Industrials	Aerospace & Defense
214	General Dynamics	United States	\$38.8 B	\$3.4 B	\$53.7 B	\$37.5 B	Industrials	Aerospace & Defense
413	Boeing	United States	\$70.6 B	\$-3.4 B	\$143.1 B	\$79.6 B	Industrials	Aerospace & Defense
913	Motorola Solutions	United States	\$7.9 B	\$869 M	\$10.6 B	\$24.7 B	Industrials	Aerospace & Defense
1341	Bombardier	Canada	\$15.8 B	\$-1.8 B	\$25 B	\$860 M	Industrials	Aerospace & Defense
241	Northrop Grumman	United States	\$34.3 B	\$2.3 B	\$43.2 B	\$55.1 B	Industrials	Aerospace & Defense

After normalizing into 1st normal form for the table Forbes_data:

Rank	Company	Country/Territory	Sales	Profits	Assets	Market Value	Sector	Industry
626	Omnicom Group	United States	\$14.9 B	\$1.3 B	\$23.7 B	\$12.2 B	Consumer	Advertising
665	WPP	United Kingdom	\$16.9 B	\$702 M	\$41.5 B	\$9.5 B	Consumer	Advertising
769	Publicis Groupe	France	\$12.3 B	\$941.3 M	\$36.7 B	\$7 B	Consumer	Advertising
1144	Interpublic Group	United States	\$10.2 B	\$668.7 M	\$16.4 B	\$6.6 B	Consumer	Advertising
1340	Dentsu	Japan	\$9.6 B	\$-742 M	\$34.9 B	\$5.9 B	Consumer	Advertising
1774	Hakuhodo DY Holdings	Japan	\$13.4 B	\$379.8 M	\$7.7 B	\$4.2 B	Consumer	Advertising
241	Northrop Grumman	United States	\$34.3 B	\$2.3 B	\$43.2 B	\$55.1 B	Industrials	Aerospace
257	Safran	France	\$28.1 B	\$2.7 B	\$48.1 B	\$36.7 B	Industrials	Aerospace
389	BAE Systems	United Kingdom	\$23.4 B	\$1.9 B	\$34.5 B	\$20.6 B	Industrials	Aerospace
413	Boeing	United States	\$70.6 B	\$-3.4 B	\$143.1 B	\$79.6 B	Industrials	Aerospace
439	AIRBUS	Netherlands	\$76.2 B	\$-2.1 B	\$128.4 B	\$49.6 B	Industrials	Aerospace
487	Thales	France	\$20.6 B	\$1.3 B	\$35 B	\$16.1 B	Industrials	Aerospace

And finally for the table economic_factors, the below picture shows the table after normalizing the country name column:

OVERALL RANK	COUNTRY NAME	YEAR	OVERALL SCORE	SIZE OF GOVERNMENT	LEGAL SYSTEMS & PROPERTY RIGHTS	SOUND MONEY	FREEDOM TO TRADE INTERNATIONALLY	REGULATION
2	Singapore	2020	8.48	7.18	8.29	9.62	8.61	8.72
3	Switzerland	2020	8.37	7.52	8.74	9.86	7.63	8.1
4	New Zealand	2020	8.27	6.29	8.72	9.58	8.19	8.57
5	Denmark	2020	8.09	5.24	8.66	9.7	8.42	8.43
6	Australia	2020	8.04	6.09	8.34	9.56	7.92	8.27
7	United States	2020	7.97	6.79	7.56	9.63	7.77	8.11
8	Estonia	2020	7.95	6.29	7.78	9.16	8.33	8.21
9	Mauritius	2020	7.88	7.9	6.94	9.47	7.7	7.39
10	Ireland	2020	7.86	6.17	7.74	9.32	7.96	8.14
11	Armenia	2020	7.84	7.98	6.24	9.55	7.69	7.76
12	Lithuania	2020	7.82	6.6	7.24	9.2	8.33	7.72
12	Japan	2020	7.82	5.65	7.71	9.82	7.78	8.12
14	Canada	2020	7.81	5.82	8.02	9.52	7.75	7.96

- There are no repeating groups: two columns do not store similar information in the same table.

Every table in the database has its own unique columns representing variety of values, satisfying this condition.

2nd Normal Form:

- All requirements for 1st NF must be met.
- No partial dependencies and No Calculated Data

Partial Dependency occurs when a non-prime attribute is functionally dependent on part of a candidate key.

Calculated data is creating new data from your existing data in your table.

Below is an example of Table GDP_growth. This table satisfies the 1st Normal form condition and has no dependencies between any of its columns as each column represents data from different years. The below table also shows no calculated data by the same argument provided above.

Country	2016	2017	2018	2019	2020	2021	2022
South Asia	7.6	6.6	6.4	3.8	-4.8	8.1	6.4
South America	-2.4	0.8	0.5	0	-6.6	7.3	3.6
South Africa	0.7	1.2	1.5	0.3	-6.3	4.9	2.1
Somalia	4.7	2.2	3.7	2.7	-0.3	2.9	1.9
Solomon Islands	5.6	3.1	2.7	1.7	-3.4	-0.2	-4.5
Slovenia	3.2	4.8	4.5	3.5	-4.3	8.2	5.7
Slovak Republic	1.9	3	3.8	2.6	-4.4	3	1.8
Singapore	3.6	4.7	3.7	1.1	-4.1	7.6	3
Sierra Leone	6.4	3.8	3.5	5.3	-2	4.1	2.4
Seychelles	5.4	4.5	3.2	3.1	-7.7	7.9	10.9
Serbia	3.3	2.1	4.5	4.3	-0.9	7.4	3.5
Senegal	6.4	7.4	6.2	4.6	1.3	6.1	4.7
Saudi Arabia	1.7	-0.7	2.5	0.3	-4.1	3.2	7.6

Similarly, the rest of the tables show no partial dependencies with any of their columns and neither do they have any calculated data which might create a dependency on other columns within a table.

Below are a few more evidence from the database for the proof of 2nd Normal Form:

Table global_climate:

rw_country_code	country	cri_rank	cri_score	losses_per_gdp_rank
AFG	Afghanistan	28	43.33	73
AGO	Angola	50	56	87
ALB	Albania	55	58	41
ARE	United Arab Emirates	127	109.17	133
ARG	Argentina	63	63.67	82
ARM	Armenia	113	98.33	74
ATG	Antigua and Barbuda	135	124.5	135
AUS	Australia	20	35.5	30
AUT	Austria	53	57	42
AZE	Azerbaijan	135	124.5	135
BDI	Burundi	15	33	23
BEL	Belgium	46	52.83	108
BEN	Benin	135	124.5	135
BFA	Burkina Faso	60	61	34
BGD	Bangladesh	35	46.17	61

The above table has a primary key(rw_country_code) and all its columns have atomic values proving it to be in 1st Normal Form.

Further analyzing the data, the columns are all unique and represent values about gdp losses and climatic ranks and scores for each country. There is no calculated data in any of the columns for the above table.

Note: rank and scores are not dependent as they depict values for different aspects of climate.

Therefore, the table global_climate is in 2nd Normal Form.

Table outward_remittance:

Outward remittance flows (US\$ million)	2016	2017	2018	2019	2020	2021
Albania	147.15675738801318	106.33098291276124	114.87933694313206	119.6796407694807	124.63037566919685	140.34430970129853
Angola	1176.11031356	961.4152762399999	681.6270154922674	549.0820425510593	576.4714367789888	445.40014382405803
Antigua and Barbuda	54.74292749629629	55.44539011111111	54.17426754814814	47.77273321741111	44.829214246165556	49.01598946069802
Argentina	769.2420579867332	1060.484529955312	1010.3755356443319	694.8990630521067	545.1515252350846	588.5597441915966
Armenia	358.0155071149378	367.4964437645902	341.2568554004423	362.6937850598563	304.365569428434	352.90410845466477
Aruba	98	108.04552036978181	111.65095692643361	112.62759755060499	101.76256721989665	110.6649177238104
Australia	6179.374297708557	6793.253706781762	7267.729293558821	7439.097688915976	4358.562385292666	3804.2128168561417
Austria	4885.123590773506	5369.093592332496	6206.351378910267	6230.833829031395	6203.753775794593	7015.676479004321
Azerbaijan	740.236	603.318	579.5	621.549	731.8779999999999	812.858
Bangladesh	41.21354068927695	46.83824451161324	56.93218462115269	82.79258832592859	94.82781418366169	101.34708991231379
Belarus	123.8	137.8	159.9	185.89999999999998	245.2	242.62724052
Belgium	4564.818715749373	4747.435274462947	5612.494418479864	5336.033787959965	6223.370195498894	7794.416023953816
Bolivia	222.25046434047852	232.927804367505	251.81564331512732	286.4299872677772	215.67993157125693	293.7313824572384

The above table has a primary key(country name(Outward remittance flows)) and all its columns have atomic values proving it to be in 1st Normal Form.

Further analyzing the data, the columns are all unique and represent values about the outward remittance flow in USD for each country over the span of the last 5 years represented in different columns. As can be identified from the data present in the above table, there is no calculated data in any of the columns.

Therefore, the table outward_remittance is in 2nd Normal Form.

3rd Normal Form

- All requirements for 2nd NF must be met.

As discussed above all the tables satisfy the requirements of 2nd Normal Form and therefore all the tables in the database are in 2nd Normal Form.

- Eliminate fields that do not directly depend on the primary key; that is no transitive dependencies.

Whenever some indirect relationship happens to cause functional dependency, it is known as Transitive Dependency.

There is no table in the database displaying transitive dependency, i.e., there are no fields in any of the tables which don't depend on the primary key. As discussed above each table gives data for each country or ranking of a country or an event occurred in a country, i.e., the primary keys. Therefore, every column of information in each table is directly for that particular primary key, meaning the tables have no transitive dependencies making all the tables satisfy the requirements of 3rd Normal Form.

Below are a few examples:

Table outward_remittance:

Outward remittance flows (US\$ million)	2016	2017	2018	2019	2020	2021
Albania	147.15675738801318	106.33098291276124	114.87933694313206	119.6796407694807	124.63037566919685	140.34430970129853
Angola	1176.11031356	961.4152762399999	681.6270154922674	549.0820425510593	576.4714367789888	445.40014382405803
Antigua and Barbuda	54.74292749629629	55.44539011111111	54.17426754814814	47.77273321741111	44.829214246165556	49.01598946069802
Argentina	769.2420579867332	1060.484529955312	1010.3755356443319	694.8990630521067	545.1515252350846	588.5597441915966
Armenia	358.0155071149378	367.4964437645902	341.2568554004423	362.6937850598563	304.365569428434	352.90410845466477
Aruba	98	108.04552036978181	111.65095692643361	112.62759755060499	101.76256721989665	110.6649177238104
Australia	6179.374297708557	6793.253706781762	7267.729293558821	7439.097688915976	4358.562385292666	3804.2128168561417
Austria	4885.123590773506	5369.093592332496	6206.351378910267	6230.833829031395	6203.753775794593	7015.676479004321
Azerbaijan	740.236	603.318	579.5	621.549	731.8779999999999	812.858
Bangladesh	41.21354068927695	46.83824451161324	56.93218462115269	82.79258832592859	94.82781418366169	101.34708991231379
Belarus	123.8	137.8	159.9	185.89999999999998	245.2	242.62724052
Belgium	4564.818715749373	4747.435274462947	5612.494418479864	5336.033787959965	6223.370195498894	7794.416023953816
Bolivia	222.25046434047852	232.927804367505	251.81564331512732	286.4299872677772	215.67993157125693	293.7313824572384

Here as seen above, the table has values of outward remittance for the last five years for each country showing that all the columns are linked to the primary key and hence it is in 3rd Normal Form.

Table forex_reserves:

Countries	Reserves, 2021	Global rank
China	3427.93	1
Japan	1405.75	2
Euro area	1196.16	3
Switzerland	1109.82	4
USA	716.15	5
India	638.48	6
Russia	632.24	7
Hong Kong	496.87	8
Saudi Arabia	473.89	9
South Korea	463.28	10
Singapore	425.1	11
Brazil	362.21	12
Germany	295.74	13
Thailand	246.03	14

The above table satisfies the requirements of 2nd Normal Form. Each country and its corresponding data for reserve values and rank, therefore there are no transitive dependencies for any of the columns. Therefore, it is in 3rd normal form.

Table Inward_remittance:

Netherlands	10484.244241405155	11295.433035501575	12933.52969538464	14058.971209794392	13560.994131984284	15242.005032467514
Qatar	11981.868131868132	12759.340659340658	11557.967032967032	11963.736263736266	10112.08791208791	10997.802197802197
Malaysia	10105.146887538314	9393.881493644209	10915.511979301122	11397.960819849792	9089.686975643479	8597.858989020486
United Kingdom	10190.899107285286	9801.235337375241	10410.04112353596	10360.300796885422	9382.380085412888	10083.316857474136
Italy	8677.587198877718	8841.573147745445	9906.85158773809	9577.332780600536	10197.024412197958	12194.999542568547
Canada	5255.722464641915	6482.765219330161	7578.422449323885	8763.218444024726	6784.862776675918	7192.980565442047
Poland	3732	6344	7501	8007	7915	9419
Australia	6179.374297708557	6793.253706781762	7267.729293558821	7439.097688915976	4358.562385292666	3804.2128168561417
India	5622.636934737198	6958.929627681167	6781.570846837902	7531.590149758273	7010.825358501104	8181.397793024899
Austria	4885.123590773506	5369.093592332496	6206.351378910267	6230.833829031395	6203.753775794593	7015.676479004321
Japan	5066.8696850594615	5282.863264345608	6150.517742849173	6827.885453325267	8245.330486376846	6133.373890610373
Belgium	4564.818715749373	4747.435274462947	5612.494418479864	5336.033787959965	6223.370195498894	7794.416023953816
Indonesia	5150.593774537164	5177.356261761918	5148.052050626533	5070.875384270985	4546.939545852018	4343.3832143252475
Thailand	4155.202827766987	4396.7688578478665	4923.627285386763	8912.892000244643	7878.509446599466	7046.351495766055
Czech Republic	1658.6047482293836	2055.5104478686976	2786.2000904471424	3447.0703544776293	3251.663148542569	4069.2206489777536

The above table satisfies the requirements of 2nd Normal Form. Each country and its corresponding data for inward remittance values in USD over the last five years, therefore there are no transitive dependencies for any of the columns. Therefore, it is in 3rd normal form.

Similarly, the rest of the tables in the database all satisfy the requirements of 3rd Normal Form.

Table Name	Primary Key Column Name	1st Normal Form	2nd Normal Form	3rd Normal Form
economic_factors	OVERALL_RANK	Y	Y	Y
efw	ISO_CODE3	Y	Y	Y
forbes_data	Rank	Y	Y	Y
forex_reserves	Countries	Y	Y	Y
global_terrorism	eventID	Y	Y	Y
gdp_growth	Country	Y	Y	Y
global_climate	rw_country_code	Y	Y	Y
inward_remittance	Inward_Remittance_Flows	Y	Y	Y
labor_costs	Reference_Area	Y	Y	Y
outward_remittance	Outward_Remittance_Flows	Y	Y	Y
ppp_value	Location	Y	Y	Y

USE CASES AND VIEWS:

1. **Use Case:** Find country with particular sector and get the GDP rank associated with it

Description: User views the countries with respect to sector and their associated gdp

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries with sector and their gdp

System Responses: the list of countries with sector and gdp are displayed

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

CREATE VIEW yellow.view1 AS

SELECT * from((select * from yellow.forbes_data

where Company in ('JPMorgan Chase', 'Agricultural Bank of China', 'Charles Schwab'))A

Inner Join

(select * from yellow.gdp_growth)B

on A.`Country/Territory`=B.Country) ;

output:

Rank	Company	Country/Territory	Sales	Profits	Assets	Market Value	Sector	Industry
224	Charles Schwab	United States	\$11.5 B	\$3.5 B	\$370.8 B	\$48.6 B	Financials	Investment Services
3	JPMorgan Chase	United States	\$142.9 B	\$30 B	\$3,139.4 B	\$291.7 B	Financials	Major Banks

2. **Use Case:** Find country with top cri rank and their associated PPP value

Description: User views the countries with respect to cri rank and their associated PPP value

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries with cri rank and their PPP value

System Responses: the list of countries with cri rank and PPP are displayed

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view2 AS
SELECT * from((select * from yellow.global_climate
where cri_rank=63)A
Inner Join
(select LOCATION, Value from yellow.ppp_value)B
on A.rw_country_code=B.LOCATION) LIMIT 1;
```

3. **Use Case:** Find countries with Financial sector and their associated Forex Reserves

Description: User views the countries with Financial sector and their associated Forex Reserves

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries Financial sector and their associated Forex Reserves

System Responses: the list of countries with Financial sector and their associated Forex Reserves

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view3 AS
SELECT * from((select * from yellow.forbes_data
where Sector in ('Health Care', 'Financials', 'Materials'))A
Inner Join
(select * from yellow.Forex_Reserves)B
on A.`Country/Territory`=B.Countries );
```

Output:

Sales	Profits	Assets	Market Value	Sector	Industry	Countries	Reserves, 2021	Global rank	Available data
\$18.6 B	\$785.7 M	\$21.5 B	\$3.9 B	Materials	Aluminum	India	638.48	6	1960 - 2021
\$12.2 B	\$879.6 M	\$25.8 B	\$4.3 B	Materials	Aluminum	China	3427.93	1	1977 - 2021
\$27.5 B	\$93 M	\$29.2 B	\$3.6 B	Materials	Aluminum	China	3427.93	1	1977 - 2021
\$17 B	\$-205.6 M	\$18.7 B	\$5.2 B	Materials	Aluminum	Norway	84.27	30	1960 - 2021
\$8.9 B	\$2 B	\$14.1 B	\$92 B	Health Care	Biotechs	Australia	57.88	36	1960 - 2021
\$5.7 B	\$699.7 M	\$17.4 B	\$23.3 B	Health Care	Biotechs	Spain	92.2	29	1960 - 2021
\$2.2 B	\$486.9 M	\$3 B	\$13.8 B	Health Care	Biotechs	Denmark	82.24	31	1960 - 2021
\$3.5 B	\$392.8 M	\$8.4 B	\$18.3 B	Health Care	Biotechs	Hong Kong	496.87	8	1990 - 2021
\$968 M	\$255.2 M	\$3.4 B	\$23.1 B	Health Care	Biotechs	South Korea	463.28	10	1960 - 2021
\$26.9 B	\$2.2 B	\$60.2 B	\$25.5 B	Materials	Construction Materials	Switzerland	1109.82	4	1960 - 2021
\$22.7 B	\$4.9 B	\$25.7 B	\$41.7 B	Materials	Construction Materials	China	3427.93	1	1977 - 2021
\$28.1 B	\$1.9 B	\$41.9 B	\$23.8 B	Materials	Construction Materials	Ireland	13.25	68	1960 - 2021
\$47.7 B	\$1.6 B	\$56.1 B	\$14.4 B	Materials	Construction Materials	France	244.28	15	1960 - 2021

4. **Use Case:** Find countries with cri_rank more than 130 and their associated profits with sector

Description: User views the countries with with cri_rank more than 130 and their associated profits with sector

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries with with cri_rank more than 130 and their associated profits with sector

System Responses: the list of countries with with cri_rank more than 130 and their associated profits with sector

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view4 AS
```

```
SELECT A.country, A.cri_rank, B.Company, B.Sector, B.Industry, B.Sales, B.Profits from(  
(select * from yellow.global_climate
```

```
where cri_rank>130)A
```

```
Inner Join
```

```
(select `Country/Territory`,Company, Sector, Industry, Sales, Profits from  
yellow.forbes_data)B
```

```
on A.country=B.`Country/Territory`);
```

Output:

country	cri_rank	Company	Sector	Industry	Sales	Profits
Singapore	135	Singapore Airlines	Industrials	Airline	\$12.4 B	\$530 M
Luxembourg	135	RTL Group	Consumer Discretionary	Broadcasting & Cable	\$7.7 B	\$788.1 M
Malaysia	132	Genting	Consumer Discretionary	Casinos & Gaming	\$5.2 B	\$481.7 M
Finland	135	Nokia	Information Technology	Communications Equipment	\$25.8 B	\$391 M
Singapore	135	Keppel	Industrials	Conglomerates	\$5.8 B	\$484.4 M
Finland	135	Kone	Industrials	Construction Services	\$11.1 B	\$1 B
Finland	135	Sampo	Financials	Diversified Insurance	\$12.7 B	\$1.3 B
Malaysia	132	Tenaga Nasional	Utilities	Electric Utilities	\$12.3 B	\$1.1 B
Finland	135	Fortum	Utilities	Electric Utilities	\$6.1 B	\$1.7 B
Singapore	135	Flex	Information Technology	Electronics	\$25 B	\$-25 M

5. **Use Case:** Find companies with rank less than 20 with associated PPP, dollars and sector

Description: User views the companies with rank less than 20 with associated PPP, dollars and sector

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the companies with rank less than 20 with associated PPP, dollars and sector

System Responses: the list of companies with rank less than 20 with associated PPP, dollars and sector

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view5 AS
Select * from
(SELECT country, Value from(
(select rw_country_code, country from yellow.global_climate)A
Inner Join
(select LOCATION, Value from yellow.ppp_value)B
on A.rw_country_code=B.LOCATION))C
Inner Join
(select * from yellow.forbes_data
where `Rank`<50)D
On C.country=D.`Country/Territory`;
```

Output:

country	Value	Rank	Company
Canada	0.953324	46	TD Bank Group
Canada	0.953324	35	RBC
Canada	0.94867	46	TD Bank Group
Canada	0.94867	35	RBC
Canada	0.941626	46	TD Bank Group
Canada	0.941626	35	RBC
Canada	0.948107	46	TD Bank Group
Canada	0.948107	35	RBC
Canada	0.957314	46	TD Bank Group
Canada	0.957314	35	RBC
Canada	0.963874	46	TD Bank Group
Canada	0.963874	35	RBC

6. **Use Case:** Find country named United States and itsGDP growth

Description: User views the country named United States and itsGDP growth

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the country named United States and itsGDP growth

System Responses: the list of country named United States and itsGDP growth

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view6 AS
```

```
Select * from(
```

```
(select * from yellow.gdp_growth)A
```

```
Inner join
```

```
(select `Country/Territory`,Company, Sector, Industry, Sales, Profits from  
yellow.forbes_data)B
```

```
On A.Country= B.`Country/Territory`)
```

```
Where Sector='Energy';
```

7. **Use Case:** Find countries with sales more than \$150B with profits greater than \$10B get remittance.

Description: User views the countries with sales more than \$150B with profits greater than \$10B get remittance

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries with sales more than \$150B with profits greater than \$10B get remittance

System Responses: the list of countries with sales more than \$150B with profits greater than \$10B get remittance

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view7 AS
select * from(
(select `Country/Territory`,Company, Sector, Industry, Sales, Profits from yellow.forbes_data
where Profits>'$10B')A
Inner Join
(select * from yellow.outward_remittance)B
on A.`Country/Territory` = B.`Outward remittance flows (US$ million)`);
```

8. **Use Case:** Find country named Japan get freedom to trade internationally their companies and market value of same

Description: User views the countries named Japan get freedom to trade internationally their companies and market value of same

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries named Japan get freedom to trade internationally their companies and market value of same

System Responses: the list of countries named Japan get freedom to trade internationally their companies and market value of same

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view8 AS
select * from(
(select `Country/Territory`,Company, Sector, Industry, Sales, Profits from yellow.forbes_data
where Profits>'$10B'
and Industry in ('Regional Banks', 'Recreational Products'))A
Inner Join
(select * from yellow.labor_costs)B
on A.`Country/Territory` = B.`Reference area`);
```

9. **Use Case:** Find countries with financial sector with assets and associated legal systems and property rights with companies

Description: User views the countries with financial sector with assets and associated legal systems and property rights with companies

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries with financial sector with assets and associated legal systems and property rights with companies

System Responses: the list of countries with financial sector with assets and associated legal systems and property rights with companies

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view9 AS
select * from(
(select `Country/Territory`,Company, Sector, Industry, Sales, Profits from yellow.forbes_data
```

where Profits>'\$10B'

and Industry in ('Regional Banks', 'Recreational Products'))A

Inner Join

(select * from yellow.economic_factors)B

on A.`Country/Territory` = B.`COUNTRY NAME `);

10. **Use Case:** Find countries with sound money more than 1.4 and profits of the companies in the associated country

Description: User views the countries with sound money more than 1.4 and profits of the companies in the associated country

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries with sound money more than 1.4 and profits of the companies in the associated country

System Responses: the list of countries with sound money more than 1.4 and profits of the companies in the associated country

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

CREATE VIEW yellow.view10 AS

select * from(

(select `Country/Territory`,Company, Sector, Industry, Sales, Profits from yellow.forbes_data
where Profits>'\$1.3B')A

Inner Join

(select * from yellow.economic_factors

where REGULATION >=8.3)B

on A.`Country/Territory` = B.`COUNTRY NAME `);

11. **Use Case:** Find country named India with outward remittance flow and companies in the country with government size

Description: User views the country named India with outward remittance flow and companies in the country with government size

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the countries named India with outward remittance flow and companies in the country with government size

System Responses: the list of country named India with outward remittance flow and companies in the country with government size

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view11 AS
select * from(
(select * from yellow.outward_remittance)A
Inner Join
(select * from yellow.economic_factors
where REGULATION >=8.3)B
on A.`Outward remittance flows (US$ million)` = B.`COUNTRY NAME`);
```

12. **Use Case:** Find country named Canada and find PPP for the country and get associated international trade, regulations with profits made in which industry sector

Description: User views the country named Canada and find PPP for the country and get associated international trade, regulations with profits made in which industry sector

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the named Canada and find PPP for the country and get associated international trade, regulations with profits made in which industry sector

System Responses: the list of country named Canada and find PPP for the country and get associated international trade, regulations with profits made in which industry sector

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view12 AS
SELECT Distinct A.country, A.cri_score, A.losses_per_gdp_rank from(
(select * from yellow.global_climate
where cri_score>=43.2)A
Inner Join
(select LOCATION, Value from yellow.ppp_value)B
on A.rw_country_code=B.LOCATION);
```

- 13 Use Case:** Find countries with PPP value greater than 1 and year greater than 2000 with the sector, company and industry parameters associated with that country

Description: User views the countries with PPP value greater than 1 and year greater than 2000 with the sector, company and industry parameters associated with that country

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the named Canada and find PPP for the country and get associated international trade, regulations with profits made in which industry sector

System Responses: the list of country named Canada and find PPP for the country and get associated international trade, regulations with profits made in which industry sector

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view13 AS
SELECT Distinct A.country, A.cri_score, A.losses_per_gdp_rank from(
(select * from yellow.global_climate
```


where cri_score>=43.2)A

Inner Join

(select LOCATION, Value from yellow.ppp_value)B

on A.rw_country_code=B.LOCATION);

- 14 Use Case:** Find countries with local currency greater than 5 with associated industry, company and sector

Description: User views the countries with local currency greater than 5 with associated industry, company and sector

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the the countries with local currency greater than 5 with associated industry, company and sector

System Responses: the list of countries with local currency greater than 5 with associated industry, company and sector

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

CREATE VIEW yellow.view14 AS

SELECT * from(

(select * from yellow.forbes_data)A

Inner Join

(select * from yellow.labor_costs

where `Local currency`>5)B

on A.`Country/Territory`=B.`Reference area`);

- 15 Use Case:** Find country named Italy and company, sector and industry with profits, legal systems & property rights associated with it

Description: User views the country named Italy and company, sector and industry with profits, legal systems & property rights associated with it

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the country named Italy and company, sector and industry with profits, legal systems & property rights associated with it

System Responses: the list of countries named Italy and company, sector and industry with profits, legal systems & property rights associated with it

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view15 AS
SELECT * from(
(select * from yellow.forbes_data)A
Inner Join
(select * from yellow.economic_factors)B
on A.`Country/Territory`=B.`COUNTRY NAME`)
Where `Country/Territory` = 'Italy';
```

16 Use Case: Find country with maximum forex reserves and its gdp data

Description: User views the country with maximum forex reserves and its gdp data

Actor: User

Precondition: User must have access to data

Steps:

Actor action: User views the country with maximum forex reserves and its gdp data

System Responses: the country with maximum forex reserves and its gdp data is populated

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view16 AS
SELECT * from(
(select * from yellow.forex_reserves)A
Inner Join
(select * from yellow.gdp_growth)B
on A.`Countries`=B.Country)
order by A.`Global rank` LIMIT 1;
```

17 Use Case: Select the country with max inward remittance in 2021 and their gdp

Description: User views the countries with max inward remittance in 2021 and their gdp

Actor: User

Precondition: User must have access to data

Steps:

Actor action: countries with max inward remittance in 2021 and their gdp

System Responses: countries with max inward remittance in 2021 and their gdp

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view17 AS
SELECT * from(
(select * from yellow.outward_remittance)A
Inner Join
(select * from yellow.gdp_growth)B
on A.`Outward remittance flows (US$ million)`=B.Country)
order by B.`2022` Desc Limit 10 ;
```

18 Use Case: View the country with top 10 gdp in 2021 and their corresponding forex reserves

Description: User views the countries with top 10 gdp in 2021 and their corresponding forex reserves

Actor: User

Precondition: User must have access to data

Steps:

Actor action: countries with top 10 gdp in 2021 and their corresponding forex reserves

System Responses: countries with with top 10 gdp in 2021 and their corresponding forex reserves

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view18 AS
SELECT * from(
(select * from yellow.forex_reserves)A
Inner Join
(select * from yellow.gdp_growth)B
on A.`Countries`=B.Country)
WHERE B.Country in ('China', 'India', 'France', 'Germany')
order by B.`2022` DESC LIMIT 5;
```

19 Use Case: User makes a search for country with lowest labor cost along with their gdp

Description: User views the countries with lowest labor cost along with their gdp

Actor: User

Precondition: User must have access to data

Steps:

Actor action: countries with lowest labor cost along with their gdp

System Responses: with lowest labor cost along with their gdp

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view19 AS
SELECT * from(
(select * from yellow.labor_costs)A
Inner Join
(select * from yellow.gdp_growth)B
on A.`Reference area`=B.Country)
order by A.`U.S. dollars` LIMIT 1;
```

20 Use Case: User makes a search for country with maximum terror attacks their gdp

Description: User views the countries with maximum terror attacks their gdp

Actor: User

Precondition: User must have access to data

Steps:

Actor action: countries with maximum terror attacks their gdp

System Responses: countries with maximum terror attacks their gdp

Post Condition: system displays the list of countries for the condition

Error: No country available

SQL Query:

```
CREATE VIEW yellow.view20 AS
SELECT * from(
(select country_txt,Count(eventid) Total_attacks from yellow.global_terrorism
group by country_txt)A
Inner Join
(select * from yellow.gdp_growth)B
on A.country_txt=B.Country)
order by Total_attacks Desc;
```