

etlproject29-3

February 17, 2025

```
[1]: import pandas as pd
import numpy as np
```

```
[2]: df_projects_data=pd.read_csv(r"C:\Users\HP\Downloads\etl\projects_data.
↪csv",dtype="str")
```

```
[3]: df_projects_data
```

```
[3]:      id      regionname \
0    P162228      Other
1    P163962      Africa
2    P167672    South Asia
3    P158768    South Asia
4    P161364      Africa
...    ...      ...
18243 P006578 Latin America and Caribbean
18244 P037451      Europe and Central Asia
18245 P037362      Europe and Central Asia
18246 P037452      Europe and Central Asia
18247 P037383      Europe and Central Asia
```

```
      countryname prodline \
0      World;World      RE
1  Democratic Republic of the Congo;Democratic Re...      PE
2  People's Republic of Bangladesh;People's Repub...      PE
3  Islamic Republic of Afghanistan;Islamic Repu...      PE
4  Federal Republic of Nigeria;Federal Republic o...      PE
...    ...      ...
18243      Republic of Chile;Republic of Chile      PE
18244  Grand Duchy of Luxembourg;Grand Duchy of Luxem...      PE
18245      Kingdom of Denmark;Kingdom of Denmark      PE
18246  Kingdom of the Netherlands;Kingdom of the Neth...      PE
18247      French Republic;French Republic      PE
```

```
      lendinginstr lendinginstrtype envassesmentcategorycode \
0  Investment Project Financing      IN      C
1  Investment Project Financing      IN      B
```

2	Investment Project Financing	IN	NaN
3	Investment Project Financing	IN	A
4	Investment Project Financing	IN	B
...
18243	Specific Investment Loan	IN	NaN
18244	Structural Adjustment Loan	AD	NaN
18245	Structural Adjustment Loan	AD	NaN
18246	Structural Adjustment Loan	AD	NaN
18247	Structural Adjustment Loan	AD	NaN

	supplementprojectflg	productlinetype	projectstatusdisplay	...	\
0	N	L	Active	...	
1	N	L	Active	...	
2	Y	L	Active	...	
3	N	L	Active	...	
4	N	L	Active	...	
...
18243	N	L	Closed	...	
18244	N	L	Closed	...	
18245	N	L	Closed	...	
18246	N	L	Closed	...	
18247	N	L	Closed	...	

	mjtheme3name	mjtheme4name	mjtheme5name	\
0	NaN	NaN	NaN	
1	NaN	NaN	NaN	
2	NaN	NaN	NaN	
3	NaN	NaN	NaN	
4	NaN	NaN	NaN	
...	
18243	NaN	NaN	NaN	
18244	NaN	NaN	NaN	
18245	NaN	NaN	NaN	
18246	NaN	NaN	NaN	
18247	NaN	NaN	NaN	

	location	\
0	NaN	
1	NaN	
2	NaN	
3	NaN	
4	0002327546!\$!0gun State!\$!7!\$!3.58333!\$!NG;000...	
...	...	
18243	NaN	
18244	NaN	
18245	NaN	
18246	NaN	

18247	NaN
-------	-----

	GeoLocID \
0	NaN
1	NaN
2	NaN
3	NaN
4	0002327546;0002328925;0002565340;0002565343;00...
...	...
18243	NaN
18244	NaN
18245	NaN
18246	NaN
18247	NaN

	GeoLocName \
0	NaN
1	NaN
2	NaN
3	NaN
4	Ogun State;Niger State;Abia State;Edo;Kebbi St...
...	...
18243	NaN
18244	NaN
18245	NaN
18246	NaN
18247	NaN

	Latitude	Longitude	Country \
0	NaN	NaN	NaN
1	NaN	NaN	NaN
2	NaN	NaN	NaN
3	NaN	NaN	NaN
4	7;10;5.41667;6.5;11.5;8	3.58333;6;7.5;6;4;10.5	NG;NG;NG;NG;NG;NG
...
18243	NaN	NaN	NaN
18244	NaN	NaN	NaN
18245	NaN	NaN	NaN
18246	NaN	NaN	NaN
18247	NaN	NaN	NaN

Unnamed: 56	
0	NaN
1	NaN
2	NaN
3	NaN
4	NaN

```
...
18243      NaN
18244      NaN
18245      NaN
18246      NaN
18247      NaN
```

[18248 rows x 57 columns]

```
[4]: df_population_data=pd.read_csv(r"C:\Users\HP\Downloads\etl\population_data.
↳csv",skiprows=4)
```

```
[5]: df_population_data
```

```
[5]: Country Name Country Code Indicator Name Indicator Code 1960 \
0      Aruba ABW Population, total SP.POP.TOTL 54211.0
1  Afghanistan AFG Population, total SP.POP.TOTL 8996351.0
2      Angola AGO Population, total SP.POP.TOTL 5643182.0
3  Albania ALB Population, total SP.POP.TOTL 1608800.0
4  Andorra AND Population, total SP.POP.TOTL 13411.0
..      ...
259 Kosovo XKX Population, total SP.POP.TOTL 947000.0
260 Yemen, Rep. YEM Population, total SP.POP.TOTL 5172135.0
261 South Africa ZAF Population, total SP.POP.TOTL 17456855.0
262 Zambia ZMB Population, total SP.POP.TOTL 3044846.0
263 Zimbabwe ZWE Population, total SP.POP.TOTL 3747369.0

      1961      1962      1963      1964      1965 ... \
0      55438.0      56225.0      56695.0      57032.0      57360.0 ...
1      9166764.0      9345868.0      9533954.0      9731361.0      9938414.0 ...
2      5753024.0      5866061.0      5980417.0      6093321.0      6203299.0 ...
3      1659800.0      1711319.0      1762621.0      1814135.0      1864791.0 ...
4      14375.0      15370.0      16412.0      17469.0      18549.0 ...
..      ...
259      966000.0      994000.0      1022000.0      1050000.0      1078000.0 ...
260      5260501.0      5351799.0      5446063.0      5543339.0      5643643.0 ...
261      17920673.0      18401608.0      18899275.0      19412975.0      19942303.0 ...
262      3140264.0      3240587.0      3345145.0      3452942.0      3563407.0 ...
263      3870756.0      3999419.0      4132756.0      4269863.0      4410212.0 ...

      2009      2010      2011      2012      2013      2014 \
0      101453.0      101669.0      102053.0      102577.0      103187.0      103795.0
1      28004331.0      28803167.0      29708599.0      30696958.0      31731688.0      32758020.0
2      22549547.0      23369131.0      24218565.0      25096150.0      25998340.0      26920466.0
3      2927519.0      2913021.0      2905195.0      2900401.0      2895092.0      2889104.0
4      84462.0      84449.0      83751.0      82431.0      80788.0      79223.0
..      ...
```

259	1761474.0	1775680.0	1791000.0	1805200.0	1824100.0	1821800.0
260	22974929.0	23606779.0	24252206.0	24909969.0	25576322.0	26246327.0
261	50970818.0	51584663.0	52263516.0	52998213.0	53767396.0	54539571.0
262	13456417.0	13850033.0	14264756.0	14699937.0	15153210.0	15620974.0
263	13810599.0	14086317.0	14386649.0	14710826.0	15054506.0	15411675.0

	2015	2016	2017	Unnamed: 62
0	104341.0	104822.0	105264.0	NaN
1	33736494.0	34656032.0	35530081.0	NaN
2	27859305.0	28813463.0	29784193.0	NaN
3	2880703.0	2876101.0	2873457.0	NaN
4	78014.0	77281.0	76965.0	NaN
..
259	1801800.0	1816200.0	1830700.0	NaN
260	26916207.0	27584213.0	28250420.0	NaN
261	55291225.0	56015473.0	56717156.0	NaN
262	16100587.0	16591390.0	17094130.0	NaN
263	15777451.0	16150362.0	16529904.0	NaN

[264 rows x 63 columns]

```
[6]: df_gdp_data=pd.read_csv(r"C:\Users\HP\Downloads\etl\gdp_data.csv",skiprows=4)
```

```
[7]: df_gdp_data
```

```
[7]:
```

	Country Name	Country Code	Indicator Name	Indicator Code	\
0	Aruba	ABW	GDP (current US\$)	NY.GDP.MKTP.CD	
1	Afghanistan	AFG	GDP (current US\$)	NY.GDP.MKTP.CD	
2	Angola	AGO	GDP (current US\$)	NY.GDP.MKTP.CD	
3	Albania	ALB	GDP (current US\$)	NY.GDP.MKTP.CD	
4	Andorra	AND	GDP (current US\$)	NY.GDP.MKTP.CD	
..	
259	Kosovo	KXX	GDP (current US\$)	NY.GDP.MKTP.CD	
260	Yemen, Rep.	YEM	GDP (current US\$)	NY.GDP.MKTP.CD	
261	South Africa	ZAF	GDP (current US\$)	NY.GDP.MKTP.CD	
262	Zambia	ZMB	GDP (current US\$)	NY.GDP.MKTP.CD	
263	Zimbabwe	ZWE	GDP (current US\$)	NY.GDP.MKTP.CD	

	1960	1961	1962	1963	1964	\
0	NaN	NaN	NaN	NaN	NaN	
1	5.377778e+08	5.488889e+08	5.466667e+08	7.511112e+08	8.000000e+08	
2	NaN	NaN	NaN	NaN	NaN	
3	NaN	NaN	NaN	NaN	NaN	
4	NaN	NaN	NaN	NaN	NaN	
..	
259	NaN	NaN	NaN	NaN	NaN	
260	NaN	NaN	NaN	NaN	NaN	

261	7.575248e+09	7.972841e+09	8.497830e+09	9.423212e+09	1.037379e+10
262	7.130000e+08	6.962857e+08	6.931429e+08	7.187143e+08	8.394286e+08
263	1.052990e+09	1.096647e+09	1.117602e+09	1.159512e+09	1.217138e+09

	1965	...	2009	2010	2011	\
0	NaN	...	2.498933e+09	2.467704e+09	2.584464e+09	
1	1.006667e+09	...	1.248694e+10	1.593680e+10	1.793024e+10	
2	NaN	...	7.549239e+10	8.252614e+10	1.041158e+11	
3	NaN	...	1.204421e+10	1.192695e+10	1.289087e+10	
4	NaN	...	3.660531e+09	3.355695e+09	3.442063e+09	
..	
259	NaN	...	5.653793e+09	5.829934e+09	6.686683e+09	
260	NaN	...	2.513027e+10	3.090675e+10	3.272642e+10	
261	1.133417e+10	...	2.972167e+11	3.752981e+11	4.168782e+11	
262	1.082857e+09	...	1.532834e+10	2.026556e+10	2.346010e+10	
263	1.311436e+09	...	8.621574e+09	1.014186e+10	1.209845e+10	

	2012	2013	2014	2015	2016	\
0	NaN	NaN	NaN	NaN	NaN	
1	2.053654e+10	2.026425e+10	2.061610e+10	1.921556e+10	1.946902e+10	
2	1.139232e+11	1.249125e+11	1.267302e+11	1.026212e+11	9.533720e+10	
3	1.231978e+10	1.277628e+10	1.322824e+10	1.138693e+10	1.188368e+10	
4	3.164615e+09	3.281585e+09	3.350736e+09	2.811489e+09	2.877312e+09	
..	
259	6.500193e+09	7.073420e+09	7.386891e+09	6.439947e+09	6.715487e+09	
260	3.540133e+10	4.041524e+10	4.322858e+10	3.460248e+10	1.821333e+10	
261	3.963327e+11	3.668294e+11	3.509046e+11	3.177410e+11	2.957627e+11	
262	2.550337e+10	2.804546e+10	2.715063e+10	2.115439e+10	2.095475e+10	
263	1.424249e+10	1.545177e+10	1.589105e+10	1.630467e+10	1.661996e+10	

	2017	Unnamed: 62
0	NaN	NaN
1	2.081530e+10	NaN
2	1.242094e+11	NaN
3	1.303935e+10	NaN
4	3.012914e+09	NaN
..
259	7.128691e+09	NaN
260	NaN	NaN
261	3.494193e+11	NaN
262	2.580867e+10	NaN
263	1.784582e+10	NaN

[264 rows x 63 columns]

```
[8]: df_mystery=pd.read_csv(r"C:\Users\HP\Downloads\etl\mystery.
↳csv",encoding="utf16")
```

```
[9]: df_mystery
```

```
[9]:      Unnamed: 0  Country Name Country Code  Indicator Name Indicator Code \
0            0      Aruba      ABW  Population, total  SP.POP.TOTL
1            1  Afghanistan  AFG  Population, total  SP.POP.TOTL
2            2    Angola    AGO  Population, total  SP.POP.TOTL
3            3    Albania  ALB  Population, total  SP.POP.TOTL
4            4    Andorra  AND  Population, total  SP.POP.TOTL
..          ...      ...      ...      ...      ...
259          259      Kosovo  XKX  Population, total  SP.POP.TOTL
260          260  Yemen, Rep.  YEM  Population, total  SP.POP.TOTL
261          261  South Africa  ZAF  Population, total  SP.POP.TOTL
262          262    Zambia  ZMB  Population, total  SP.POP.TOTL
263          263    Zimbabwe  ZWE  Population, total  SP.POP.TOTL

      1960      1961      1962      1963      1964  ... \
0      54211.0      55438.0      56225.0      56695.0      57032.0  ...
1      8996351.0      9166764.0      9345868.0      9533954.0      9731361.0  ...
2      5643182.0      5753024.0      5866061.0      5980417.0      6093321.0  ...
3      1608800.0      1659800.0      1711319.0      1762621.0      1814135.0  ...
4      13411.0      14375.0      15370.0      16412.0      17469.0  ...
..          ...      ...      ...      ...      ...
259      947000.0      966000.0      994000.0      1022000.0      1050000.0  ...
260      5172135.0      5260501.0      5351799.0      5446063.0      5543339.0  ...
261      17456855.0      17920673.0      18401608.0      18899275.0      19412975.0  ...
262      3044846.0      3140264.0      3240587.0      3345145.0      3452942.0  ...
263      3747369.0      3870756.0      3999419.0      4132756.0      4269863.0  ...

      2008      2009      2010      2011      2012      2013 \
0      101353.0      101453.0      101669.0      102053.0      102577.0      103187.0
1      27294031.0      28004331.0      28803167.0      29708599.0      30696958.0      31731688.0
2      21759420.0      22549547.0      23369131.0      24218565.0      25096150.0      25998340.0
3      2947314.0      2927519.0      2913021.0      2905195.0      2900401.0      2895092.0
4      83861.0      84462.0      84449.0      83751.0      82431.0      80788.0
..          ...      ...      ...      ...      ...
259      1747383.0      1761474.0      1775680.0      1791000.0      1805200.0      1824100.0
260      22356391.0      22974929.0      23606779.0      24252206.0      24909969.0      25576322.0
261      50412129.0      50970818.0      51584663.0      52263516.0      52998213.0      53767396.0
262      13082517.0      13456417.0      13850033.0      14264756.0      14699937.0      15153210.0
263      13558469.0      13810599.0      14086317.0      14386649.0      14710826.0      15054506.0

      2014      2015      2016      2017
0      103795.0      104341.0      104822.0      105264.0
1      32758020.0      33736494.0      34656032.0      35530081.0
2      26920466.0      27859305.0      28813463.0      29784193.0
3      2889104.0      2880703.0      2876101.0      2873457.0
4      79223.0      78014.0      77281.0      76965.0
```

```

..      ...      ...      ...      ...
259    1821800.0    1801800.0    1816200.0    1830700.0
260    26246327.0    26916207.0    27584213.0    28250420.0
261    54539571.0    55291225.0    56015473.0    56717156.0
262    15620974.0    16100587.0    16591390.0    17094130.0
263    15411675.0    15777451.0    16150362.0    16529904.0

```

[264 rows x 63 columns]

```
[10]: df_rural_population_percent=pd.read_csv(r"C:
↪\Users\HP\Downloads\etl\rural_population_percent.csv",skiprows=4)
```

```
[11]: df_rural_population_percent
```

```
[11]:
```

	Country Name	Country Code	Indicator Name \
0	Aruba	ABW	Rural population (% of total population)
1	Afghanistan	AFG	Rural population (% of total population)
2	Angola	AGO	Rural population (% of total population)
3	Albania	ALB	Rural population (% of total population)
4	Andorra	AND	Rural population (% of total population)
..
259	Kosovo	XKX	Rural population (% of total population)
260	Yemen, Rep.	YEM	Rural population (% of total population)
261	South Africa	ZAF	Rural population (% of total population)
262	Zambia	ZMB	Rural population (% of total population)
263	Zimbabwe	ZWE	Rural population (% of total population)

	Indicator Code	1960	1961	1962	1963	1964	1965	...	\
0	SP.RUR.TOTL.ZS	49.224	49.239	49.254	49.270	49.285	49.300	...	
1	SP.RUR.TOTL.ZS	91.779	91.492	91.195	90.890	90.574	90.250	...	
2	SP.RUR.TOTL.ZS	89.565	89.202	88.796	88.376	87.942	87.496	...	
3	SP.RUR.TOTL.ZS	69.295	69.057	68.985	68.914	68.842	68.770	...	
4	SP.RUR.TOTL.ZS	41.550	39.017	36.538	34.128	31.795	29.555	...	
..	
259	SP.RUR.TOTL.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	
260	SP.RUR.TOTL.ZS	90.900	90.541	90.169	89.784	89.386	88.974	...	
261	SP.RUR.TOTL.ZS	53.381	53.207	53.094	52.980	52.866	52.752	...	
262	SP.RUR.TOTL.ZS	81.855	81.049	80.215	79.288	77.985	76.628	...	
263	SP.RUR.TOTL.ZS	87.392	87.179	86.918	86.422	85.908	85.380	...	

	2009	2010	2011	2012	2013	2014	2015	2016	2017	\
0	56.579	56.941	57.302	57.636	57.942	58.221	58.472	58.696	58.893	
1	75.687	75.311	74.926	74.532	74.129	73.718	73.297	72.868	72.430	
2	60.701	59.903	59.100	58.301	57.510	56.726	55.950	55.181	54.422	
3	48.924	47.837	46.753	45.670	44.617	43.591	42.593	41.624	40.684	
4	11.648	12.183	12.740	13.292	13.835	14.367	14.885	15.388	15.873	
..	

259	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
260	68.835	68.268	67.698	67.126	66.550	65.973	65.394	64.813	64.231
261	38.313	37.782	37.254	36.728	36.212	35.702	35.199	34.705	34.218
262	61.701	61.275	60.847	60.413	59.973	59.528	59.078	58.621	58.160
263	66.622	66.804	66.985	67.166	67.346	67.499	67.624	67.723	67.793

Unnamed: 62

0	NaN
1	NaN
2	NaN
3	NaN
4	NaN
..	...
259	NaN
260	NaN
261	NaN
262	NaN
263	NaN

[264 rows x 63 columns]

```
[12]: df_electricity_access_percentage=pd.read_csv(r"C:
↳\Users\HP\Downloads\etl\electricity_access_percent.csv",skiprows=4)
```

```
[13]: df_electricity_access_percentage
```

```
[13]: Country Name Country Code Indicator Name \
0 Aruba ABW Access to electricity (% of population)
1 Afghanistan AFG Access to electricity (% of population)
2 Angola AGO Access to electricity (% of population)
3 Albania ALB Access to electricity (% of population)
4 Andorra AND Access to electricity (% of population)
.. ...
259 Kosovo KXX Access to electricity (% of population)
260 Yemen, Rep. YEM Access to electricity (% of population)
261 South Africa ZAF Access to electricity (% of population)
262 Zambia ZMB Access to electricity (% of population)
263 Zimbabwe ZWE Access to electricity (% of population)
```

	Indicator Code	1960	1961	1962	1963	1964	1965	...	2009	\
0	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	93.354546	
1	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	44.854885	
2	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	32.382469	
3	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	100.000000	
4	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	100.000000	
..	
259	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	98.377060	

260	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	61.751400
261	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	82.700000
262	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	23.235649
263	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	43.369082

	2010	2011	2012	2013	2014	2015	\
0	93.356292	93.942375	94.255814	94.578262	94.906723	95.238182	
1	42.700000	43.222019	69.100000	67.259552	89.500000	71.500000	
2	33.514950	34.600000	35.821964	36.990490	32.000000	42.000000	
3	100.000000	100.000000	100.000000	100.000000	100.000000	100.000000	
4	100.000000	100.000000	100.000000	100.000000	100.000000	100.000000	
..	
259	0.000000	99.430435	99.773651	99.942505	99.993134	100.000000	
260	63.134281	64.532181	65.942101	75.600000	66.100000	70.213905	
261	82.900000	84.700000	85.300000	85.400000	86.000000	85.500000	
262	22.000000	24.328644	24.894667	25.469702	27.900000	31.100000	
263	36.063057	36.900000	36.728878	37.076813	32.300000	33.700000	

	2016	2017	Unnamed: 62
0	95.570145	NaN	NaN
1	84.137138	NaN	NaN
2	40.520607	NaN	NaN
3	100.000000	NaN	NaN
4	100.000000	NaN	NaN
..
259	100.000000	NaN	NaN
260	71.642349	NaN	NaN
261	84.200000	NaN	NaN
262	27.219337	NaN	NaN
263	38.145138	NaN	NaN

[264 rows x 63 columns]

```
[14]: df_population_data_json=pd.read_json(r"C:
↪\Users\HP\Downloads\etl\population_data.json")
```

```
[15]: df_population_data_json
```

```
[15]:
```

	Country Name	Country Code	Indicator Name	Indicator Code	1960	\
0	Aruba	ABW	Population, total	SP.POP.TOTL	54211.0	
1	Afghanistan	AFG	Population, total	SP.POP.TOTL	8996351.0	
2	Angola	AGO	Population, total	SP.POP.TOTL	5643182.0	
3	Albania	ALB	Population, total	SP.POP.TOTL	1608800.0	
4	Andorra	AND	Population, total	SP.POP.TOTL	13411.0	
..	
259	Kosovo	XKX	Population, total	SP.POP.TOTL	947000.0	
260	Yemen, Rep.	YEM	Population, total	SP.POP.TOTL	5172135.0	

261	South Africa	ZAF	Population, total	SP.POP.TOTL	17456855.0
262	Zambia	ZMB	Population, total	SP.POP.TOTL	3044846.0
263	Zimbabwe	ZWE	Population, total	SP.POP.TOTL	3747369.0

	1961	1962	1963	1964	1965	...	\
0	55438.0	56225.0	56695.0	57032.0	57360.0	...	
1	9166764.0	9345868.0	9533954.0	9731361.0	9938414.0	...	
2	5753024.0	5866061.0	5980417.0	6093321.0	6203299.0	...	
3	1659800.0	1711319.0	1762621.0	1814135.0	1864791.0	...	
4	14375.0	15370.0	16412.0	17469.0	18549.0	...	
..	
259	966000.0	994000.0	1022000.0	1050000.0	1078000.0	...	
260	5260501.0	5351799.0	5446063.0	5543339.0	5643643.0	...	
261	17920673.0	18401608.0	18899275.0	19412975.0	19942303.0	...	
262	3140264.0	3240587.0	3345145.0	3452942.0	3563407.0	...	
263	3870756.0	3999419.0	4132756.0	4269863.0	4410212.0	...	

	2008	2009	2010	2011	2012	2013	\
0	101353.0	101453.0	101669.0	102053.0	102577.0	103187.0	
1	27294031.0	28004331.0	28803167.0	29708599.0	30696958.0	31731688.0	
2	21759420.0	22549547.0	23369131.0	24218565.0	25096150.0	25998340.0	
3	2947314.0	2927519.0	2913021.0	2905195.0	2900401.0	2895092.0	
4	83861.0	84462.0	84449.0	83751.0	82431.0	80788.0	
..	
259	1747383.0	1761474.0	1775680.0	1791000.0	1805200.0	1824100.0	
260	22356391.0	22974929.0	23606779.0	24252206.0	24909969.0	25576322.0	
261	50412129.0	50970818.0	51584663.0	52263516.0	52998213.0	53767396.0	
262	13082517.0	13456417.0	13850033.0	14264756.0	14699937.0	15153210.0	
263	13558469.0	13810599.0	14086317.0	14386649.0	14710826.0	15054506.0	

	2014	2015	2016	2017
0	103795.0	104341.0	104822.0	105264.0
1	32758020.0	33736494.0	34656032.0	35530081.0
2	26920466.0	27859305.0	28813463.0	29784193.0
3	2889104.0	2880703.0	2876101.0	2873457.0
4	79223.0	78014.0	77281.0	76965.0
..
259	1821800.0	1801800.0	1816200.0	1830700.0
260	26246327.0	26916207.0	27584213.0	28250420.0
261	54539571.0	55291225.0	56015473.0	56717156.0
262	15620974.0	16100587.0	16591390.0	17094130.0
263	15411675.0	15777451.0	16150362.0	16529904.0

[264 rows x 62 columns]

```
[16]: pip install lxml
```

Requirement already satisfied: lxml in c:\users\hp\anaconda3\lib\site-packages (4.9.2)

Note: you may need to restart the kernel to use updated packages.

```
[17]: df=pd.read_xml(r"C:\Users\HP\Downloads\etl\population_data.xml")
```

```
[18]: df
```

```
[18]: Empty DataFrame  
      Columns: [record]  
      Index: []
```

```
[ ]:
```

```
[19]: pip install bs4
```

Requirement already satisfied: bs4 in c:\users\hp\anaconda3\lib\site-packages (0.0.2)

Requirement already satisfied: beautifulsoup4 in c:\users\hp\anaconda3\lib\site-packages (from bs4) (4.12.2)

Requirement already satisfied: soupsieve>1.2 in c:\users\hp\anaconda3\lib\site-packages (from beautifulsoup4->bs4) (2.4)

Note: you may need to restart the kernel to use updated packages.

```
[20]: from bs4 import BeautifulSoup  
  
with open(r"C:\Users\HP\Downloads\etl\population_data.xml") as fp:  
    soup = BeautifulSoup(fp,"lxml")  
i=0  
for record in soup.find_all('record'):  
    i+=1  
    for record in record.find_all('field'):  
        print(record['name']+":"+record.text)  
    print  
    if i==5:  
        break
```

```
Country or Area:Aruba  
Item:Population, total  
Year:1960  
Value:54211  
Country or Area:Aruba  
Item:Population, total  
Year:1961  
Value:55438  
Country or Area:Aruba  
Item:Population, total  
Year:1962
```

```
Value:56225
Country or Area:Aruba
Item:Population, total
Year:1963
Value:56695
Country or Area:Aruba
Item:Population, total
Year:1964
Value:57032
```

```
[21]: pip install pymysql
```

```
Requirement already satisfied: pymysql in c:\users\hp\anaconda3\lib\site-
packages (1.1.1)
Note: you may need to restart the kernel to use updated packages.
```

```
[22]: pip install sqlalchemy
```

```
Requirement already satisfied: sqlalchemy in c:\users\hp\anaconda3\lib\site-
packages (1.4.39)
Requirement already satisfied: greenlet!=0.4.17 in
c:\users\hp\anaconda3\lib\site-packages (from sqlalchemy) (2.0.1)
Note: you may need to restart the kernel to use updated packages.
```

```
[23]: from sqlalchemy import create_engine
import pandas as pd

username="root"
password="Cybrom#1123"
host="localhost"
port="3306"
database="dummy"

conn=create_engine(f'mysql+pymysql://{username}:{password}@{host}:{port}/
↳{database}')
df_dummy=pd.read_sql("select * from customers",conn)
df_dummy.head()
```

```
[23]:
```

	customerNumber	customerName	contactLastName	\
0	103	Atelier graphique	Schmitt	
1	112	Signal Gift Stores	King	
2	114	Australian Collectors, Co.	Ferguson	
3	119	La Rochelle Gifts	Labrune	
4	121	Baane Mini Imports	Bergulfsen	

	contactFirstName	phone	addressLine1	addressLine2	\
0	Carine	40.32.2555	54, rue Royale	None	
1	Jean	7025551838	8489 Strong St.	None	

2	Peter	03 9520 4555	636 St Kilda Road	Level 3
3	Janine	40.67.8555	67, rue des Cinquante Otages	None
4	Jonas	07-98 9555	Erling Skakkes gate 78	None

	city	state	postalCode	country	salesRepEmployeeNumber \
0	Nantes	None	44000	France	1370.0
1	Las Vegas	NV	83030	USA	1166.0
2	Melbourne	Victoria	3004	Australia	1611.0
3	Nantes	None	44000	France	1370.0
4	Stavern	None	4110	Norway	1504.0

	creditLimit
0	21000.0
1	71800.0
2	117300.0
3	118200.0
4	81700.0

```
[24]: import sqlite3
```

```
[25]: import pandas as pd
```

```
[26]: conn=sqlite3.connect(r"C:\Users\HP\Downloads\etl\population_data.db")
df1=pd.read_sql("select * from population_data",conn)
df1
```

```
[26]:
```

	index	Country_Name	Country_Code	Indicator_Name	Indicator_Code \
0	0	Aruba	ABW	Population, total	SP.POP.TOTL
1	1	Afghanistan	AFG	Population, total	SP.POP.TOTL
2	2	Angola	AGO	Population, total	SP.POP.TOTL
3	3	Albania	ALB	Population, total	SP.POP.TOTL
4	4	Andorra	AND	Population, total	SP.POP.TOTL
..
259	259	Kosovo	XXK	Population, total	SP.POP.TOTL
260	260	Yemen, Rep.	YEM	Population, total	SP.POP.TOTL
261	261	South Africa	ZAF	Population, total	SP.POP.TOTL
262	262	Zambia	ZMB	Population, total	SP.POP.TOTL
263	263	Zimbabwe	ZWE	Population, total	SP.POP.TOTL

	1960	1961	1962	1963	1964 ... \
0	54211.0	55438.0	56225.0	56695.0	57032.0 ...
1	8996351.0	9166764.0	9345868.0	9533954.0	9731361.0 ...
2	5643182.0	5753024.0	5866061.0	5980417.0	6093321.0 ...
3	1608800.0	1659800.0	1711319.0	1762621.0	1814135.0 ...
4	13411.0	14375.0	15370.0	16412.0	17469.0 ...
..
259	947000.0	966000.0	994000.0	1022000.0	1050000.0 ...

260	5172135.0	5260501.0	5351799.0	5446063.0	5543339.0	...
261	17456855.0	17920673.0	18401608.0	18899275.0	19412975.0	...
262	3044846.0	3140264.0	3240587.0	3345145.0	3452942.0	...
263	3747369.0	3870756.0	3999419.0	4132756.0	4269863.0	...

	2008	2009	2010	2011	2012	2013 \
0	101353.0	101453.0	101669.0	102053.0	102577.0	103187.0
1	27294031.0	28004331.0	28803167.0	29708599.0	30696958.0	31731688.0
2	21759420.0	22549547.0	23369131.0	24218565.0	25096150.0	25998340.0
3	2947314.0	2927519.0	2913021.0	2905195.0	2900401.0	2895092.0
4	83861.0	84462.0	84449.0	83751.0	82431.0	80788.0
..
259	1747383.0	1761474.0	1775680.0	1791000.0	1805200.0	1824100.0
260	22356391.0	22974929.0	23606779.0	24252206.0	24909969.0	25576322.0
261	50412129.0	50970818.0	51584663.0	52263516.0	52998213.0	53767396.0
262	13082517.0	13456417.0	13850033.0	14264756.0	14699937.0	15153210.0
263	13558469.0	13810599.0	14086317.0	14386649.0	14710826.0	15054506.0

	2014	2015	2016	2017
0	103795.0	104341.0	104822.0	105264.0
1	32758020.0	33736494.0	34656032.0	35530081.0
2	26920466.0	27859305.0	28813463.0	29784193.0
3	2889104.0	2880703.0	2876101.0	2873457.0
4	79223.0	78014.0	77281.0	76965.0
..
259	1821800.0	1801800.0	1816200.0	1830700.0
260	26246327.0	26916207.0	27584213.0	28250420.0
261	54539571.0	55291225.0	56015473.0	56717156.0
262	15620974.0	16100587.0	16591390.0	17094130.0
263	15411675.0	15777451.0	16150362.0	16529904.0

[264 rows x 63 columns]

```
[27]: df_electricity_access_percentage.drop(['Unnamed: 62'],axis=1,inplace=True)
```

```
[28]: df_rural_population_percent.drop(['Unnamed: 62'],axis=1,inplace=True)
```

```
[29]: df_rural_population_percent
```

```
[29]:
```

	Country Name	Country Code	Indicator Name \
0	Aruba	ABW	Rural population (% of total population)
1	Afghanistan	AFG	Rural population (% of total population)
2	Angola	AGO	Rural population (% of total population)
3	Albania	ALB	Rural population (% of total population)
4	Andorra	AND	Rural population (% of total population)
..
259	Kosovo	XKX	Rural population (% of total population)

260	Yemen, Rep.	YEM	Rural population (% of total population)
261	South Africa	ZAF	Rural population (% of total population)
262	Zambia	ZMB	Rural population (% of total population)
263	Zimbabwe	ZWE	Rural population (% of total population)

	Indicator Code	1960	1961	1962	1963	1964	1965	...	\
0	SP.RUR.TOTL.ZS	49.224	49.239	49.254	49.270	49.285	49.300	...	
1	SP.RUR.TOTL.ZS	91.779	91.492	91.195	90.890	90.574	90.250	...	
2	SP.RUR.TOTL.ZS	89.565	89.202	88.796	88.376	87.942	87.496	...	
3	SP.RUR.TOTL.ZS	69.295	69.057	68.985	68.914	68.842	68.770	...	
4	SP.RUR.TOTL.ZS	41.550	39.017	36.538	34.128	31.795	29.555	...	
..	
259	SP.RUR.TOTL.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	
260	SP.RUR.TOTL.ZS	90.900	90.541	90.169	89.784	89.386	88.974	...	
261	SP.RUR.TOTL.ZS	53.381	53.207	53.094	52.980	52.866	52.752	...	
262	SP.RUR.TOTL.ZS	81.855	81.049	80.215	79.288	77.985	76.628	...	
263	SP.RUR.TOTL.ZS	87.392	87.179	86.918	86.422	85.908	85.380	...	

	2008	2009	2010	2011	2012	2013	2014	2015	2016	\
0	56.217	56.579	56.941	57.302	57.636	57.942	58.221	58.472	58.696	
1	76.054	75.687	75.311	74.926	74.532	74.129	73.718	73.297	72.868	
2	61.491	60.701	59.903	59.100	58.301	57.510	56.726	55.950	55.181	
3	50.009	48.924	47.837	46.753	45.670	44.617	43.591	42.593	41.624	
4	11.133	11.648	12.183	12.740	13.292	13.835	14.367	14.885	15.388	
..	
259	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
260	69.398	68.835	68.268	67.698	67.126	66.550	65.973	65.394	64.813	
261	38.846	38.313	37.782	37.254	36.728	36.212	35.702	35.199	34.705	
262	62.125	61.701	61.275	60.847	60.413	59.973	59.528	59.078	58.621	
263	66.440	66.622	66.804	66.985	67.166	67.346	67.499	67.624	67.723	

	2017
0	58.893
1	72.430
2	54.422
3	40.684
4	15.873
..	...
259	NaN
260	64.231
261	34.218
262	58.160
263	67.793

[264 rows x 62 columns]

[30]: df_electricity_access_percentage


```

[30]:      Country Name Country Code      Indicator Name \
0          Aruba          ABW Access to electricity (% of population)
1    Afghanistan          AFG Access to electricity (% of population)
2          Angola          AGO Access to electricity (% of population)
3        Albania          ALB Access to electricity (% of population)
4        Andorra          AND Access to electricity (% of population)
..          ...          ...          ...
259        Kosovo          XKX Access to electricity (% of population)
260    Yemen, Rep.          YEM Access to electricity (% of population)
261    South Africa          ZAF Access to electricity (% of population)
262          Zambia          ZMB Access to electricity (% of population)
263        Zimbabwe          ZWE Access to electricity (% of population)

      Indicator Code 1960 1961 1962 1963 1964 1965 ... 2008 \
0    EG.ELC.ACCS.ZS  NaN  NaN  NaN  NaN  NaN  NaN ... 93.086166
1    EG.ELC.ACCS.ZS  NaN  NaN  NaN  NaN  NaN  NaN ... 42.400000
2    EG.ELC.ACCS.ZS  NaN  NaN  NaN  NaN  NaN  NaN ... 31.268013
3    EG.ELC.ACCS.ZS  NaN  NaN  NaN  NaN  NaN  NaN ... 100.000000
4    EG.ELC.ACCS.ZS  NaN  NaN  NaN  NaN  NaN  NaN ... 100.000000
..          ...  ...  ...  ...  ...  ...  ...
259    EG.ELC.ACCS.ZS  NaN  NaN  NaN  NaN  NaN  NaN ... 97.794670
260    EG.ELC.ACCS.ZS  NaN  NaN  NaN  NaN  NaN  NaN ... 60.386539
261    EG.ELC.ACCS.ZS  NaN  NaN  NaN  NaN  NaN  NaN ... 81.900000
262    EG.ELC.ACCS.ZS  NaN  NaN  NaN  NaN  NaN  NaN ... 22.714685
263    EG.ELC.ACCS.ZS  NaN  NaN  NaN  NaN  NaN  NaN ... 35.457310

      2009      2010      2011      2012      2013      2014 \
0    93.354546  93.356292  93.942375  94.255814  94.578262  94.906723
1    44.854885  42.700000  43.222019  69.100000  67.259552  89.500000
2    32.382469  33.514950  34.600000  35.821964  36.990490  32.000000
3    100.000000  100.000000  100.000000  100.000000  100.000000  100.000000
4    100.000000  100.000000  100.000000  100.000000  100.000000  100.000000
..          ...  ...  ...  ...  ...  ...
259    98.377060  0.000000  99.430435  99.773651  99.942505  99.993134
260    61.751400  63.134281  64.532181  65.942101  75.600000  66.100000
261    82.700000  82.900000  84.700000  85.300000  85.400000  86.000000
262    23.235649  22.000000  24.328644  24.894667  25.469702  27.900000
263    43.369082  36.063057  36.900000  36.728878  37.076813  32.300000

      2015      2016 2017
0    95.238182  95.570145 NaN
1    71.500000  84.137138 NaN
2    42.000000  40.520607 NaN
3    100.000000  100.000000 NaN
4    100.000000  100.000000 NaN
..          ...  ...  ...
259    100.000000  100.000000 NaN

```

```

260    70.213905    71.642349    NaN
261    85.500000    84.200000    NaN
262    31.100000    27.219337    NaN
263    33.700000    38.145138    NaN

```

[264 rows x 62 columns]

```
[ ]:
```

```
[31]: df_con=pd.concat([df_electricity_access_percentage,df_rural_population_percent])
```

```
[32]: df_con
```

```

[32]:      Country Name Country Code      Indicator Name \
0      Aruba      ABW  Access to electricity (% of population)
1  Afghanistan      AFG  Access to electricity (% of population)
2    Angola      AGO  Access to electricity (% of population)
3    Albania      ALB  Access to electricity (% of population)
4    Andorra      AND  Access to electricity (% of population)
..      ...      ...      ...
259    Kosovo      XKX  Rural population (% of total population)
260  Yemen, Rep.      YEM  Rural population (% of total population)
261  South Africa      ZAF  Rural population (% of total population)
262    Zambia      ZMB  Rural population (% of total population)
263    Zimbabwe      ZWE  Rural population (% of total population)

      Indicator Code      1960      1961      1962      1963      1964      1965      ... \
0  EG.ELC.ACCS.ZS      NaN      NaN      NaN      NaN      NaN      NaN      ...
1  EG.ELC.ACCS.ZS      NaN      NaN      NaN      NaN      NaN      NaN      ...
2  EG.ELC.ACCS.ZS      NaN      NaN      NaN      NaN      NaN      NaN      ...
3  EG.ELC.ACCS.ZS      NaN      NaN      NaN      NaN      NaN      NaN      ...
4  EG.ELC.ACCS.ZS      NaN      NaN      NaN      NaN      NaN      NaN      ...
..      ...      ...      ...      ...      ...      ...      ...
259  SP.RUR.TOTL.ZS      NaN      NaN      NaN      NaN      NaN      NaN      ...
260  SP.RUR.TOTL.ZS  90.900  90.541  90.169  89.784  89.386  88.974      ...
261  SP.RUR.TOTL.ZS  53.381  53.207  53.094  52.980  52.866  52.752      ...
262  SP.RUR.TOTL.ZS  81.855  81.049  80.215  79.288  77.985  76.628      ...
263  SP.RUR.TOTL.ZS  87.392  87.179  86.918  86.422  85.908  85.380      ...

      2008      2009      2010      2011      2012      2013 \
0  93.086166  93.354546  93.356292  93.942375  94.255814  94.578262
1  42.400000  44.854885  42.700000  43.222019  69.100000  67.259552
2  31.268013  32.382469  33.514950  34.600000  35.821964  36.990490
3  100.000000  100.000000  100.000000  100.000000  100.000000  100.000000
4  100.000000  100.000000  100.000000  100.000000  100.000000  100.000000
..      ...      ...      ...      ...      ...      ...
259      NaN      NaN      NaN      NaN      NaN      NaN

```

260	69.398000	68.835000	68.268000	67.698000	67.126000	66.550000
261	38.846000	38.313000	37.782000	37.254000	36.728000	36.212000
262	62.125000	61.701000	61.275000	60.847000	60.413000	59.973000
263	66.440000	66.622000	66.804000	66.985000	67.166000	67.346000

	2014	2015	2016	2017
0	94.906723	95.238182	95.570145	NaN
1	89.500000	71.500000	84.137138	NaN
2	32.000000	42.000000	40.520607	NaN
3	100.000000	100.000000	100.000000	NaN
4	100.000000	100.000000	100.000000	NaN
..
259	NaN	NaN	NaN	NaN
260	65.973000	65.394000	64.813000	64.231
261	35.702000	35.199000	34.705000	34.218
262	59.528000	59.078000	58.621000	58.160
263	67.499000	67.624000	67.723000	67.793

[528 rows x 62 columns]

```
[33]: df_merge=pd.
      ↪merge(df_electricity_access_percentage,df_rural_population_percent,on="Country_
      ↪Name",how="outer")
df_merge
```

```
[33]: Country Name Country Code_x Indicator Name_x \
0      Aruba ABW Access to electricity (% of population)
1  Afghanistan AFG Access to electricity (% of population)
2      Angola AGO Access to electricity (% of population)
3      Albania ALB Access to electricity (% of population)
4      Andorra AND Access to electricity (% of population)
..      ... ..
259      Kosovo KXX Access to electricity (% of population)
260  Yemen, Rep. YEM Access to electricity (% of population)
261 South Africa ZAF Access to electricity (% of population)
262      Zambia ZMB Access to electricity (% of population)
263      Zimbabwe ZWE Access to electricity (% of population)
```

	Indicator Code_x	1960_x	1961_x	1962_x	1963_x	1964_x	1965_x	...	\
0	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	
1	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	
2	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	
3	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	
4	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	
..	
259	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	
260	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...	

261	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...
262	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...
263	EG.ELC.ACCS.ZS	NaN	NaN	NaN	NaN	NaN	NaN	...

	2008_y	2009_y	2010_y	2011_y	2012_y	2013_y	2014_y	2015_y	2016_y	\
0	56.217	56.579	56.941	57.302	57.636	57.942	58.221	58.472	58.696	
1	76.054	75.687	75.311	74.926	74.532	74.129	73.718	73.297	72.868	
2	61.491	60.701	59.903	59.100	58.301	57.510	56.726	55.950	55.181	
3	50.009	48.924	47.837	46.753	45.670	44.617	43.591	42.593	41.624	
4	11.133	11.648	12.183	12.740	13.292	13.835	14.367	14.885	15.388	
..	
259	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
260	69.398	68.835	68.268	67.698	67.126	66.550	65.973	65.394	64.813	
261	38.846	38.313	37.782	37.254	36.728	36.212	35.702	35.199	34.705	
262	62.125	61.701	61.275	60.847	60.413	59.973	59.528	59.078	58.621	
263	66.440	66.622	66.804	66.985	67.166	67.346	67.499	67.624	67.723	

	2017_y
0	58.893
1	72.430
2	54.422
3	40.684
4	15.873
..	...
259	NaN
260	64.231
261	34.218
262	58.160
263	67.793

[264 rows x 123 columns]

```
[34]: df_electricity_access_percentage.nunique()
```

```
[34]: Country Name      264
Country Code      264
Indicator Name      1
Indicator Code      1
1960                0
...
2013                176
2014                170
2015                162
2016                139
2017                0
Length: 62, dtype: int64
```

```
[35]: df_electricity_access_percentage["Country Name"].unique()
```

```
[35]: array(['Aruba', 'Afghanistan', 'Angola', 'Albania', 'Andorra',  
        'Arab World', 'United Arab Emirates', 'Argentina', 'Armenia',  
        'American Samoa', 'Antigua and Barbuda', 'Australia', 'Austria',  
        'Azerbaijan', 'Burundi', 'Belgium', 'Benin', 'Burkina Faso',  
        'Bangladesh', 'Bulgaria', 'Bahrain', 'Bahamas, The',  
        'Bosnia and Herzegovina', 'Belarus', 'Belize', 'Bermuda',  
        'Bolivia', 'Brazil', 'Barbados', 'Brunei Darussalam', 'Bhutan',  
        'Botswana', 'Central African Republic', 'Canada',  
        'Central Europe and the Baltics', 'Switzerland', 'Channel Islands',  
        'Chile', 'China', 'Cote d'Ivoire', 'Cameroon', 'Congo, Dem. Rep.',  
        'Congo, Rep.', 'Colombia', 'Comoros', 'Cabo Verde', 'Costa Rica',  
        'Caribbean small states', 'Cuba', 'Curacao', 'Cayman Islands',  
        'Cyprus', 'Czech Republic', 'Germany', 'Djibouti', 'Dominica',  
        'Denmark', 'Dominican Republic', 'Algeria',  
        'East Asia & Pacific (excluding high income)',  
        'Early-demographic dividend', 'East Asia & Pacific',  
        'Europe & Central Asia (excluding high income)',  
        'Europe & Central Asia', 'Ecuador', 'Egypt, Arab Rep.',  
        'Euro area', 'Eritrea', 'Spain', 'Estonia', 'Ethiopia',  
        'European Union', 'Fragile and conflict affected situations',  
        'Finland', 'Fiji', 'France', 'Faroe Islands',  
        'Micronesia, Fed. Sts.', 'Gabon', 'United Kingdom', 'Georgia',  
        'Ghana', 'Gibraltar', 'Guinea', 'Gambia, The', 'Guinea-Bissau',  
        'Equatorial Guinea', 'Greece', 'Grenada', 'Greenland', 'Guatemala',  
        'Guam', 'Guyana', 'High income', 'Hong Kong SAR, China',  
        'Honduras', 'Heavily indebted poor countries (HIPC)', 'Croatia',  
        'Haiti', 'Hungary', 'IBRD only', 'IDA & IBRD total', 'IDA total',  
        'IDA blend', 'Indonesia', 'IDA only', 'Isle of Man', 'India',  
        'Not classified', 'Ireland', 'Iran, Islamic Rep.', 'Iraq',  
        'Iceland', 'Israel', 'Italy', 'Jamaica', 'Jordan', 'Japan',  
        'Kazakhstan', 'Kenya', 'Kyrgyz Republic', 'Cambodia', 'Kiribati',  
        'St. Kitts and Nevis', 'Korea, Rep.', 'Kuwait',  
        'Latin America & Caribbean (excluding high income)', 'Lao PDR',  
        'Lebanon', 'Liberia', 'Libya', 'St. Lucia',  
        'Latin America & Caribbean',  
        'Least developed countries: UN classification', 'Low income',  
        'Liechtenstein', 'Sri Lanka', 'Lower middle income',  
        'Low & middle income', 'Lesotho', 'Late-demographic dividend',  
        'Lithuania', 'Luxembourg', 'Latvia', 'Macao SAR, China',  
        'St. Martin (French part)', 'Morocco', 'Monaco', 'Moldova',  
        'Madagascar', 'Maldives', 'Middle East & North Africa', 'Mexico',  
        'Marshall Islands', 'Middle income', 'Macedonia, FYR', 'Mali',  
        'Malta', 'Myanmar',  
        'Middle East & North Africa (excluding high income)', 'Montenegro',  
        'Mongolia', 'Northern Mariana Islands', 'Mozambique', 'Mauritania',
```

```
'Mauritius', 'Malawi', 'Malaysia', 'North America', 'Namibia',
'New Caledonia', 'Niger', 'Nigeria', 'Nicaragua', 'Netherlands',
'Norway', 'Nepal', 'Nauru', 'New Zealand', 'OECD members', 'Oman',
'Other small states', 'Pakistan', 'Panama', 'Peru', 'Philippines',
'Palau', 'Papua New Guinea', 'Poland', 'Pre-demographic dividend',
'Puerto Rico', 'Korea, Dem. People's Rep.', 'Portugal', 'Paraguay',
'West Bank and Gaza', 'Pacific island small states',
'Post-demographic dividend', 'French Polynesia', 'Qatar',
'Romania', 'Russian Federation', 'Rwanda', 'South Asia',
'Saudi Arabia', 'Sudan', 'Senegal', 'Singapore', 'Solomon Islands',
'Sierra Leone', 'El Salvador', 'San Marino', 'Somalia', 'Serbia',
'Sub-Saharan Africa (excluding high income)', 'South Sudan',
'Sub-Saharan Africa', 'Small states', 'Sao Tome and Principe',
'Suriname', 'Slovak Republic', 'Slovenia', 'Sweden', 'Swaziland',
'Sint Maarten (Dutch part)', 'Seychelles', 'Syrian Arab Republic',
'Turks and Caicos Islands', 'Chad',
'East Asia & Pacific (IDA & IBRD countries)',
'Europe & Central Asia (IDA & IBRD countries)', 'Togo', 'Thailand',
'Tajikistan', 'Turkmenistan',
'Latin America & the Caribbean (IDA & IBRD countries)',
'Timor-Leste', 'Middle East & North Africa (IDA & IBRD countries)',
'Tonga', 'South Asia (IDA & IBRD)',
'Sub-Saharan Africa (IDA & IBRD countries)', 'Trinidad and Tobago',
'Tunisia', 'Turkey', 'Tuvalu', 'Tanzania', 'Uganda', 'Ukraine',
'Upper middle income', 'Uruguay', 'United States', 'Uzbekistan',
'St. Vincent and the Grenadines', 'Venezuela, RB',
'British Virgin Islands', 'Virgin Islands (U.S.)', 'Vietnam',
'Vanuatu', 'World', 'Samoa', 'Kosovo', 'Yemen, Rep.',
'South Africa', 'Zambia', 'Zimbabwe'], dtype=object)
```

```
[36]: df_projects_data.columns
```

```
[36]: Index(['id', 'regionname', 'countryname', 'prodline', 'lendinginstr',
'lendinginstrtype', 'envassesmentcategorycode', 'supplementprojectflg',
'productlinetype', 'projectstatusdisplay', 'status', 'project_name',
'boardapprovaldate', 'board_approval_month', 'closingdate',
'lendprojectcost', 'ibrdcommamt', 'idacommamt', 'totalamt', 'grantamt',
'borrower', 'impagency', 'url', 'projectdoc ', 'majorsector_percent ',
'sector1', 'sector2', 'sector3', 'sector4', 'sector5', 'sector',
'mjsector1', 'mjsector2', 'mjsector3', 'mjsector4', 'mjsector5',
'mjsector', 'theme1', 'theme2', 'theme3', 'theme4', 'theme5', 'theme ',
'goal', 'financier', 'mjtheme1name', 'mjtheme2name', 'mjtheme3name',
'mjtheme4name', 'mjtheme5name', 'location', 'GeoLocID', 'GeoLocName',
'Latitude', 'Longitude', 'Country', 'Unnamed: 56'],
dtype='object')
```

```
[37]: df_projects_data["countryname"].unique()
```

```
[37]: array(['World;World',
'Democratic Republic of the Congo;Democratic Republic of the Congo',
'People's Republic of Bangladesh;People's Republic of Bangladesh',
'Islamic Republic of Afghanistan;Islamic Republic of Afghanistan',
'Federal Republic of Nigeria;Federal Republic of Nigeria',
'Republic of Tunisia;Republic of Tunisia',
'Lebanese Republic;Lebanese Republic',
'Democratic Socialist Republic of Sri Lan;Democratic Socialist Republic
of Sri Lan',
'Nepal;Nepal', 'Kyrgyz Republic;Kyrgyz Republic',
'Hashemite Kingdom of Jordan;Hashemite Kingdom of Jordan',
'Republic of the Union of Myanmar;Republic of the Union of Myanmar',
'Arab Republic of Egypt;Arab Republic of Egypt',
'United Republic of Tanzania;United Republic of Tanzania',
'Federal Democratic Republic of Ethiopia;Federal Democratic Republic of
Ethiopia',
'Burkina Faso;Burkina Faso',
'Republic of Uzbekistan;Republic of Uzbekistan', 'Romania;Romania',
'Republic of Ghana;Republic of Ghana',
'Republic of Ecuador;Republic of Ecuador',
'Socialist Republic of Vietnam;Socialist Republic of Vietnam',
'People's Republic of China;People's Republic of China',
'Republic of Senegal;Republic of Senegal', 'Grenada;Grenada',
'Co-operative Republic of Guyana;Co-operative Republic of Guyana',
'Central Africa;Central Africa',
'Republic of Indonesia;Republic of Indonesia',
'Republic of Kenya;Republic of Kenya',
'Kingdom of Cambodia;Kingdom of Cambodia',
'Republic of Angola;Republic of Angola',
'Republic of India;Republic of India', 'Africa;Africa',
'Republic of Zambia;Republic of Zambia',
'Republic of Panama;Republic of Panama',
'Kingdom of Tonga;Kingdom of Tonga',
'Islamic Republic of Pakistan;Islamic Republic of Pakistan',
'Republic of Niger;Republic of Niger',
'Republic of Uganda;Republic of Uganda',
'Republic of Madagascar;Republic of Madagascar',
'Plurinational State of Bolivia;Plurinational State of Bolivia',
'Kingdom of Morocco;Kingdom of Morocco',
'Republic of Djibouti;Republic of Djibouti',
'Somali Democratic Republic;Somali Democratic Republic',
'Republic of Maldives;Republic of Maldives',
'Central African Republic;Central African Republic',
'Western Africa;Western Africa',
'Republic of Cabo Verde;Republic of Cabo Verde',
'Republic of Cote d'Ivoire;Republic of Cote d'Ivoire',
'Montenegro;Montenegro', 'West Bank and Gaza;West Bank and Gaza',
```

'Republic of Haiti;Republic of Haiti',
 'Republic of Guinea-Bissau;Republic of Guinea-Bissau',
 'Samoa;Samoa', 'Republic of Congo;Republic of Congo',
 'Federated States of Micronesia;Federated States of Micronesia',
 'Republic of the Marshall Islands;Republic of the Marshall Islands',
 'Republic of Rwanda;Republic of Rwanda',
 'Republic of Albania;Republic of Albania',
 'Republic of Burundi;Republic of Burundi',
 'Argentine Republic;Argentine Republic',
 'Pacific Islands;Pacific Islands',
 'Republic of Turkey;Republic of Turkey',
 'Democratic Republic of Sao Tome and Prin;Democratic Republic of Sao Tome
 and Prin',
 'Republic of The Gambia;Republic of The Gambia',
 'Lao People's Democratic Republic;Lao People's Democratic Republic",
 'Republic of Liberia;Republic of Liberia',
 'Republic of Benin;Republic of Benin',
 'Republic of Mozambique;Republic of Mozambique',
 'Kingdom of Bhutan;Kingdom of Bhutan',
 'Republic of Cameroon;Republic of Cameroon',
 'Republic of Chad;Republic of Chad',
 'Republic of Guinea;Republic of Guinea',
 'Republic of Yemen;Republic of Yemen',
 'Commonwealth of Dominica;Commonwealth of Dominica',
 'Republic of Palau;Republic of Palau',
 'Republic of Malawi;Republic of Malawi',
 'Republic of Serbia;Republic of Serbia',
 'Republic of Iraq;Republic of Iraq',
 'Republic of the Philippines;Republic of the Philippines',
 'Solomon Islands;Solomon Islands',
 'Republic of Fiji;Republic of Fiji',
 'United Mexican States;United Mexican States',
 'Republic of Colombia;Republic of Colombia',
 'Republic of Peru;Republic of Peru',
 'Republic of Mali;Republic of Mali',
 'Islamic Republic of Mauritania;Islamic Republic of Mauritania',
 'Republic of Nicaragua;Republic of Nicaragua',
 'Republic of Belarus;Republic of Belarus', 'Jamaica;Jamaica',
 'Ukraine;Ukraine', 'Republic of Togo;Republic of Togo',
 'Republic of Guatemala;Republic of Guatemala',
 'Republic of Sierra Leone;Republic of Sierra Leone',
 'Republic of Moldova;Republic of Moldova',
 'Republic of Armenia;Republic of Armenia',
 'Republic of Costa Rica;Republic of Costa Rica',
 'Republic of Tajikistan;Republic of Tajikistan',
 'Latin America;Latin America',
 'Federative Republic of Brazil;Federative Republic of Brazil',

'Bosnia and Herzegovina;Bosnia and Herzegovina',
 'Republic of Suriname;Republic of Suriname', 'Mongolia;Mongolia',
 'Oriental Republic of Uruguay;Oriental Republic of Uruguay',
 'Republic of Kiribati;Republic of Kiribati',
 'Kingdom of Lesotho;Kingdom of Lesotho', 'Tuvalu;Tuvalu',
 'Southern Africa;Southern Africa', 'Georgia;Georgia',
 'Gabonese Republic;Gabonese Republic',
 'Republic of Chile;Republic of Chile',
 'Republic of Kosovo;Republic of Kosovo',
 'Dominican Republic;Dominican Republic',
 'Organization of Eastern Caribbean States;Organization of Eastern
 Caribbean States',
 'Caribbean;Caribbean', 'Republic of Zimbabwe;Republic of Zimbabwe',
 'Republic of Mauritius;Republic of Mauritius',
 'The Independent State of Papua New Guine;The Independent State of Papua
 New Guine',
 'Republic of Vanuatu;Republic of Vanuatu',
 'Eastern Africa;Eastern Africa',
 'St. Vincent and the Grenadines;St. Vincent and the Grenadines',
 'Republic of Honduras;Republic of Honduras',
 'Republic of South Sudan;Republic of South Sudan',
 'Republic of Croatia;Republic of Croatia',
 'Democratic Republic of Timor-Leste;Democratic Republic of Timor-Leste',
 'Republic of South Africa;Republic of South Africa',
 'Republic of Botswana;Republic of Botswana',
 'Republic of Kazakhstan;Republic of Kazakhstan',
 'Republic of Azerbaijan;Republic of Azerbaijan',
 'Kingdom of Swaziland;Kingdom of Swaziland',
 'Union of the Comoros;Union of the Comoros',
 'Turkmenistan;Turkmenistan',
 'Europe and Central Asia;Europe and Central Asia',
 'South Asia;South Asia',
 'Macedonia; former Yugoslav Republic of;Macedonia; former Yugoslav
 Republic of',
 'St. Lucia;St. Lucia', 'Belize;Belize',
 'Republic of Namibia;Republic of Namibia',
 'Republic of the Sudan;Republic of the Sudan',
 'Republic of Paraguay;Republic of Paraguay',
 'Western Balkans;Western Balkans',
 'East Asia and Pacific;East Asia and Pacific',
 'Republic of Bulgaria;Republic of Bulgaria',
 'Central Asia;Central Asia',
 'Republic of Seychelles;Republic of Seychelles',
 'Kingdom of Thailand;Kingdom of Thailand',
 'Republic of Poland;Republic of Poland',
 'Multi-Regional;Multi-Regional',
 'Republic of El Salvador;Republic of El Salvador',

'Caucasus;Caucasus', 'Russian Federation;Russian Federation',
 'Middle East and North Africa;Middle East and North Africa',
 'Antigua and Barbuda;Antigua and Barbuda',
 'Central America;Central America',
 'Commonwealth of The Bahamas;Commonwealth of The Bahamas',
 'Republic of Trinidad and Tobago;Republic of Trinidad and Tobago',
 "Socialist People's Libyan Arab Jamahiriyy;Socialist People's Libyan Arab
 Jamahiriyy",
 'Czech Republic;Czech Republic',
 'Republic of Latvia;Republic of Latvia', 'Mekong;Mekong',
 'American Samoa;American Samoa',
 'Syrian Arab Republic;Syrian Arab Republic', 'Asia;Asia',
 'Andean Countries;Andean Countries', 'Hungary;Hungary',
 'Republic of Equatorial Guinea;Republic of Equatorial Guinea',
 "People's Democratic Republic of Algeria;People's Democratic Republic of
 Algeria",
 'Barbados;Barbados', 'Malaysia;Malaysia',
 'State of Eritrea;State of Eritrea', 'Mercosur;Mercosur',
 'Slovak Republic;Slovak Republic',
 'Republica Bolivariana de Venezuela;Republica Bolivariana de Venezuela',
 'Islamic Republic of Iran;Islamic Republic of Iran',
 'Republic of Lithuania;Republic of Lithuania',
 'St. Kitts and Nevis;St. Kitts and Nevis',
 'Republic of Korea;Republic of Korea',
 'Republic of Slovenia;Republic of Slovenia',
 'Republic of Estonia;Republic of Estonia',
 'Red Sea and Gulf of Aden;Red Sea and Gulf of Aden',
 'Aral Sea;Aral Sea', 'Republic of Cyprus;Republic of Cyprus',
 'Socialist Federal Republic of Yugoslavia;Socialist Federal Republic of
 Yugoslavia',
 'Portuguese Republic;Portuguese Republic',
 'Sultanate of Oman;Sultanate of Oman',
 'Hellenic Republic;Hellenic Republic',
 'Kingdom of Spain;Kingdom of Spain', 'Ireland;Ireland',
 'Republic of Singapore;Republic of Singapore',
 'State of Israel;State of Israel',
 'Republic of Finland;Republic of Finland',
 'Republic of Iceland;Republic of Iceland',
 'New Zealand;New Zealand', 'Taiwan; China;Taiwan; China',
 'EU Accession Countries;EU Accession Countries',
 'Sint Maarten;Sint Maarten', 'Japan;Japan',
 'Italian Republic;Italian Republic',
 'Kingdom of Norway;Kingdom of Norway',
 'Republic of Malta;Republic of Malta',
 'Kingdom of Denmark;Kingdom of Denmark',
 'Republic of Austria;Republic of Austria',
 'Commonwealth of Australia;Commonwealth of Australia',

```
'Kingdom of Belgium;Kingdom of Belgium',
'Kingdom of the Netherlands;Kingdom of the Netherlands',
'Grand Duchy of Luxembourg;Grand Duchy of Luxembourg',
'French Republic;French Republic'], dtype=object)
```

```
[38]: df_projects_data.count()
```

```
[38]: id                18248
      regionname        18248
      countryname       18248
      prodline          18248
      lendinginstr      18002
      lendinginstrtype  18002
      envassesmentcategorycode 12437
      supplementprojectflg 18195
      productlinetype   18248
      projectstatusdisplay 18244
      status            18244
      project_name      18248
      boardapprovaldate 16744
      board_approval_month 16744
      closingdate       14899
      lendprojectcost   18123
      ibrdcommamt       18248
      idacommamt        18248
      totalamt          18248
      grantamt          18248
      borrower          12329
      impagency          12151
      url               18248
      projectdoc        0
      majorsector_percent 0
      sector1           18248
      sector2           9527
      sector3           6487
      sector4           4376
      sector5           2713
      sector            17610
      mjsector1         0
      mjsector2         0
      mjsector3         0
      mjsector4         0
      mjsector5         0
      mjsector          17610
      theme1            18248
      theme2            9853
      theme3            7484
```

```

theme4          5234
theme5          2928
theme           0
goal           12133
financier       7060
mjtheme1name    0
mjtheme2name    0
mjtheme3name    0
mjtheme4name    0
mjtheme5name    0
location        4326
GeoLocID        4326
GeoLocName      4325
Latitude        4326
Longitude       4326
Country         4203
Unnamed: 56     0
dtype: int64

```

```
[39]: df_projects_data.drop(['Unnamed: 56'],axis=1,inplace=True)
```

```
[40]: df_projects_data.head()
```

```
[40]:
```

	id	regionname	countryname \
0	P162228	Other	World;World
1	P163962	Africa	Democratic Republic of the Congo;Democratic Re...
2	P167672	South Asia	People's Republic of Bangladesh;People's Repub...
3	P158768	South Asia	Islamic Republic of Afghanistan;Islamic Repu...
4	P161364	Africa	Federal Republic of Nigeria;Federal Republic o...

	prodline	lendinginstr	lendinginstrtype \
0	RE	Investment Project Financing	IN
1	PE	Investment Project Financing	IN
2	PE	Investment Project Financing	IN
3	PE	Investment Project Financing	IN
4	PE	Investment Project Financing	IN

	envassesmentcategorycode	supplementprojectflg	productlinetype \
0	C	N	L
1	B	N	L
2	NaN	Y	L
3	A	N	L
4	B	N	L

	projectstatusdisplay	...	mjtheme2name	mjtheme3name	mjtheme4name \
0	Active	...	NaN	NaN	NaN
1	Active	...	NaN	NaN	NaN

2	Active	...	NaN	NaN	NaN
3	Active	...	NaN	NaN	NaN
4	Active	...	NaN	NaN	NaN

	mjtheme5name	location \
0	NaN	NaN
1	NaN	NaN
2	NaN	NaN
3	NaN	NaN
4	NaN	0002327546!\$!Ogun State!\$!7!\$!3.58333!\$!NG;000...

	GeoLocID \
0	NaN
1	NaN
2	NaN
3	NaN
4	0002327546;0002328925;0002565340;0002565343;00...

	GeoLocName	Latitude \
0	NaN	NaN
1	NaN	NaN
2	NaN	NaN
3	NaN	NaN
4	Ogun State;Niger State;Abia State;Edo;Kebbi St...	7;10;5.41667;6.5;11.5;8

	Longitude	Country
0	NaN	NaN
1	NaN	NaN
2	NaN	NaN
3	NaN	NaN
4	3.58333;6;7.5;6;4;10.5	NG;NG;NG;NG;NG;NG

[5 rows x 56 columns]

Currently, the projects data and the indicators data have different values for country names. My task in this notebook is to clean both data sets so that they have consistent country names. This will allow you to join the two data sets together. Cleaning data, unfortunately, can be tedious and take a lot of your time as a data scientist.

Why might you want to join these data sets together? What if, for example, you wanted to run linear regression to try to predict project costs based on indicator data? Or you might want to analyze the types of projects that get approved versus the indicator data. For example, do countries with low rates of rural electrification have more rural themed projects?

```
[41]: df_population_data.drop(['Unnamed: 62'], axis=1, inplace=True)
```

```
[42]: df_population_data
```

[42]:	Country Name	Country Code	Indicator Name	Indicator Code	1960	\
0	Aruba	ABW	Population, total	SP.POP.TOTL	54211.0	
1	Afghanistan	AFG	Population, total	SP.POP.TOTL	8996351.0	
2	Angola	AGO	Population, total	SP.POP.TOTL	5643182.0	
3	Albania	ALB	Population, total	SP.POP.TOTL	1608800.0	
4	Andorra	AND	Population, total	SP.POP.TOTL	13411.0	
..	
259	Kosovo	XXK	Population, total	SP.POP.TOTL	947000.0	
260	Yemen, Rep.	YEM	Population, total	SP.POP.TOTL	5172135.0	
261	South Africa	ZAF	Population, total	SP.POP.TOTL	17456855.0	
262	Zambia	ZMB	Population, total	SP.POP.TOTL	3044846.0	
263	Zimbabwe	ZWE	Population, total	SP.POP.TOTL	3747369.0	
	1961	1962	1963	1964	1965	...
0	55438.0	56225.0	56695.0	57032.0	57360.0	...
1	9166764.0	9345868.0	9533954.0	9731361.0	9938414.0	...
2	5753024.0	5866061.0	5980417.0	6093321.0	6203299.0	...
3	1659800.0	1711319.0	1762621.0	1814135.0	1864791.0	...
4	14375.0	15370.0	16412.0	17469.0	18549.0	...
..
259	966000.0	994000.0	1022000.0	1050000.0	1078000.0	...
260	5260501.0	5351799.0	5446063.0	5543339.0	5643643.0	...
261	17920673.0	18401608.0	18899275.0	19412975.0	19942303.0	...
262	3140264.0	3240587.0	3345145.0	3452942.0	3563407.0	...
263	3870756.0	3999419.0	4132756.0	4269863.0	4410212.0	...
	2008	2009	2010	2011	2012	2013
0	101353.0	101453.0	101669.0	102053.0	102577.0	103187.0
1	27294031.0	28004331.0	28803167.0	29708599.0	30696958.0	31731688.0
2	21759420.0	22549547.0	23369131.0	24218565.0	25096150.0	25998340.0
3	2947314.0	2927519.0	2913021.0	2905195.0	2900401.0	2895092.0
4	83861.0	84462.0	84449.0	83751.0	82431.0	80788.0
..
259	1747383.0	1761474.0	1775680.0	1791000.0	1805200.0	1824100.0
260	22356391.0	22974929.0	23606779.0	24252206.0	24909969.0	25576322.0
261	50412129.0	50970818.0	51584663.0	52263516.0	52998213.0	53767396.0
262	13082517.0	13456417.0	13850033.0	14264756.0	14699937.0	15153210.0
263	13558469.0	13810599.0	14086317.0	14386649.0	14710826.0	15054506.0
	2014	2015	2016	2017		
0	103795.0	104341.0	104822.0	105264.0		
1	32758020.0	33736494.0	34656032.0	35530081.0		
2	26920466.0	27859305.0	28813463.0	29784193.0		
3	2889104.0	2880703.0	2876101.0	2873457.0		
4	79223.0	78014.0	77281.0	76965.0		
..		
259	1821800.0	1801800.0	1816200.0	1830700.0		

260	26246327.0	26916207.0	27584213.0	28250420.0
261	54539571.0	55291225.0	56015473.0	56717156.0
262	15620974.0	16100587.0	16591390.0	17094130.0
263	15411675.0	15777451.0	16150362.0	16529904.0

[264 rows x 62 columns]

[43]: df_projects_data

```
[43]:
```

	id	regionname \
0	P162228	Other
1	P163962	Africa
2	P167672	South Asia
3	P158768	South Asia
4	P161364	Africa
...
18243	P006578	Latin America and Caribbean
18244	P037451	Europe and Central Asia
18245	P037362	Europe and Central Asia
18246	P037452	Europe and Central Asia
18247	P037383	Europe and Central Asia

	countryname	prodline \
0	World;World	RE
1	Democratic Republic of the Congo;Democratic Re...	PE
2	People's Republic of Bangladesh;People's Repub...	PE
3	Islamic Republic of Afghanistan;Islamic Repu...	PE
4	Federal Republic of Nigeria;Federal Republic o...	PE
...
18243	Republic of Chile;Republic of Chile	PE
18244	Grand Duchy of Luxembourg;Grand Duchy of Luxem...	PE
18245	Kingdom of Denmark;Kingdom of Denmark	PE
18246	Kingdom of the Netherlands;Kingdom of the Neth...	PE
18247	French Republic;French Republic	PE

	lendinginstr	lendinginstrtype	envassesmentcategorycode \
0	Investment Project Financing	IN	C
1	Investment Project Financing	IN	B
2	Investment Project Financing	IN	NaN
3	Investment Project Financing	IN	A
4	Investment Project Financing	IN	B
...
18243	Specific Investment Loan	IN	NaN
18244	Structural Adjustment Loan	AD	NaN
18245	Structural Adjustment Loan	AD	NaN
18246	Structural Adjustment Loan	AD	NaN
18247	Structural Adjustment Loan	AD	NaN

	supplementprojectflg	productlinetype	projectstatusdisplay	...	\
0	N	L	Active	...	
1	N	L	Active	...	
2	Y	L	Active	...	
3	N	L	Active	...	
4	N	L	Active	...	
...	
18243	N	L	Closed	...	
18244	N	L	Closed	...	
18245	N	L	Closed	...	
18246	N	L	Closed	...	
18247	N	L	Closed	...	

	mjtheme2name	mjtheme3name	mjtheme4name	mjtheme5name	\
0	NaN	NaN	NaN	NaN	
1	NaN	NaN	NaN	NaN	
2	NaN	NaN	NaN	NaN	
3	NaN	NaN	NaN	NaN	
4	NaN	NaN	NaN	NaN	
...	
18243	NaN	NaN	NaN	NaN	
18244	NaN	NaN	NaN	NaN	
18245	NaN	NaN	NaN	NaN	
18246	NaN	NaN	NaN	NaN	
18247	NaN	NaN	NaN	NaN	

	location	\
0	NaN	
1	NaN	
2	NaN	
3	NaN	
4	0002327546!\$!Ogun State!\$!7!\$!3.58333!\$!NG;000...	
...	...	
18243	NaN	
18244	NaN	
18245	NaN	
18246	NaN	
18247	NaN	

	GeoLocID	\
0	NaN	
1	NaN	
2	NaN	
3	NaN	
4	0002327546;0002328925;0002565340;0002565343;00...	
...	...	


```

18243      NaN
18244      NaN
18245      NaN
18246      NaN
18247      NaN

```

```

                                GeoLocName  \
0                                NaN
1                                NaN
2                                NaN
3                                NaN
4      Ogun State;Niger State;Abia State;Edo;Kebbi St...
...                                ...
18243      NaN
18244      NaN
18245      NaN
18246      NaN
18247      NaN

```

```

                                Latitude      Longitude      Country
0                                NaN              NaN              NaN
1                                NaN              NaN              NaN
2                                NaN              NaN              NaN
3                                NaN              NaN              NaN
4      7;10;5.41667;6.5;11.5;8  3.58333;6;7.5;6;4;10.5  NG;NG;NG;NG;NG;NG
...                                ...              ...              ...
18243      NaN              NaN              NaN
18244      NaN              NaN              NaN
18245      NaN              NaN              NaN
18246      NaN              NaN              NaN
18247      NaN              NaN              NaN

```

```
[18248 rows x 56 columns]
```

The next code cell outputs the unique country names and ISO abbreviations in the population indicator data set.

```
[44]: df_population_data[['Country Name', 'Country Code']].drop_duplicates()
```

```

[44]:   Country Name Country Code
0      Aruba      ABW
1  Afghanistan      AFG
2    Angola      AGO
3   Albania      ALB
4   Andorra      AND
..      ...      ...
259  Kosovo      XKX

```

260	Yemen, Rep.	YEM
261	South Africa	ZAF
262	Zambia	ZMB
263	Zimbabwe	ZWE

[264 rows x 2 columns]

```
[45]: df_projects_data['countryname'].unique()
```

```
[45]: array(['World;World',
'Democratic Republic of the Congo;Democratic Republic of the Congo',
'People's Republic of Bangladesh;People's Republic of Bangladesh',
'Islamic Republic of Afghanistan;Islamic Republic of Afghanistan',
'Federal Republic of Nigeria;Federal Republic of Nigeria',
'Republic of Tunisia;Republic of Tunisia',
'Lebanese Republic;Lebanese Republic',
'Democratic Socialist Republic of Sri Lan;Democratic Socialist Republic
of Sri Lan',
'Nepal;Nepal', 'Kyrgyz Republic;Kyrgyz Republic',
'Hashemite Kingdom of Jordan;Hashemite Kingdom of Jordan',
'Republic of the Union of Myanmar;Republic of the Union of Myanmar',
'Arab Republic of Egypt;Arab Republic of Egypt',
'United Republic of Tanzania;United Republic of Tanzania',
'Federal Democratic Republic of Ethiopia;Federal Democratic Republic of
Ethiopia',
'Burkina Faso;Burkina Faso',
'Republic of Uzbekistan;Republic of Uzbekistan', 'Romania;Romania',
'Republic of Ghana;Republic of Ghana',
'Republic of Ecuador;Republic of Ecuador',
'Socialist Republic of Vietnam;Socialist Republic of Vietnam',
'People's Republic of China;People's Republic of China',
'Republic of Senegal;Republic of Senegal', 'Grenada;Grenada',
'Co-operative Republic of Guyana;Co-operative Republic of Guyana',
'Central Africa;Central Africa',
'Republic of Indonesia;Republic of Indonesia',
'Republic of Kenya;Republic of Kenya',
'Kingdom of Cambodia;Kingdom of Cambodia',
'Republic of Angola;Republic of Angola',
'Republic of India;Republic of India', 'Africa;Africa',
'Republic of Zambia;Republic of Zambia',
'Republic of Panama;Republic of Panama',
'Kingdom of Tonga;Kingdom of Tonga',
'Islamic Republic of Pakistan;Islamic Republic of Pakistan',
'Republic of Niger;Republic of Niger',
'Republic of Uganda;Republic of Uganda',
'Republic of Madagascar;Republic of Madagascar',
'Plurinational State of Bolivia;Plurinational State of Bolivia',
```

'Kingdom of Morocco;Kingdom of Morocco',
 'Republic of Djibouti;Republic of Djibouti',
 'Somali Democratic Republic;Somali Democratic Republic',
 'Republic of Maldives;Republic of Maldives',
 'Central African Republic;Central African Republic',
 'Western Africa;Western Africa',
 'Republic of Cabo Verde;Republic of Cabo Verde',
 'Republic of Cote d'Ivoire;Republic of Cote d'Ivoire",
 'Montenegro;Montenegro', 'West Bank and Gaza;West Bank and Gaza',
 'Republic of Haiti;Republic of Haiti',
 'Republic of Guinea-Bissau;Republic of Guinea-Bissau',
 'Samoa;Samoa', 'Republic of Congo;Republic of Congo',
 'Federated States of Micronesia;Federated States of Micronesia',
 'Republic of the Marshall Islands;Republic of the Marshall Islands',
 'Republic of Rwanda;Republic of Rwanda',
 'Republic of Albania;Republic of Albania',
 'Republic of Burundi;Republic of Burundi',
 'Argentine Republic;Argentine Republic',
 'Pacific Islands;Pacific Islands',
 'Republic of Turkey;Republic of Turkey',
 'Democratic Republic of Sao Tome and Prin;Democratic Republic of Sao Tome
 and Prin',
 'Republic of The Gambia;Republic of The Gambia',
 "Lao People's Democratic Republic;Lao People's Democratic Republic",
 'Republic of Liberia;Republic of Liberia',
 'Republic of Benin;Republic of Benin',
 'Republic of Mozambique;Republic of Mozambique',
 'Kingdom of Bhutan;Kingdom of Bhutan',
 'Republic of Cameroon;Republic of Cameroon',
 'Republic of Chad;Republic of Chad',
 'Republic of Guinea;Republic of Guinea',
 'Republic of Yemen;Republic of Yemen',
 'Commonwealth of Dominica;Commonwealth of Dominica',
 'Republic of Palau;Republic of Palau',
 'Republic of Malawi;Republic of Malawi',
 'Republic of Serbia;Republic of Serbia',
 'Republic of Iraq;Republic of Iraq',
 'Republic of the Philippines;Republic of the Philippines',
 'Solomon Islands;Solomon Islands',
 'Republic of Fiji;Republic of Fiji',
 'United Mexican States;United Mexican States',
 'Republic of Colombia;Republic of Colombia',
 'Republic of Peru;Republic of Peru',
 'Republic of Mali;Republic of Mali',
 'Islamic Republic of Mauritania;Islamic Republic of Mauritania',
 'Republic of Nicaragua;Republic of Nicaragua',
 'Republic of Belarus;Republic of Belarus', 'Jamaica;Jamaica',

'Ukraine;Ukraine', 'Republic of Togo;Republic of Togo',
 'Republic of Guatemala;Republic of Guatemala',
 'Republic of Sierra Leone;Republic of Sierra Leone',
 'Republic of Moldova;Republic of Moldova',
 'Republic of Armenia;Republic of Armenia',
 'Republic of Costa Rica;Republic of Costa Rica',
 'Republic of Tajikistan;Republic of Tajikistan',
 'Latin America;Latin America',
 'Federative Republic of Brazil;Federative Republic of Brazil',
 'Bosnia and Herzegovina;Bosnia and Herzegovina',
 'Republic of Suriname;Republic of Suriname', 'Mongolia;Mongolia',
 'Oriental Republic of Uruguay;Oriental Republic of Uruguay',
 'Republic of Kiribati;Republic of Kiribati',
 'Kingdom of Lesotho;Kingdom of Lesotho', 'Tuvalu;Tuvalu',
 'Southern Africa;Southern Africa', 'Georgia;Georgia',
 'Gabonese Republic;Gabonese Republic',
 'Republic of Chile;Republic of Chile',
 'Republic of Kosovo;Republic of Kosovo',
 'Dominican Republic;Dominican Republic',
 'Organization of Eastern Caribbean States;Organization of Eastern
 Caribbean States',
 'Caribbean;Caribbean', 'Republic of Zimbabwe;Republic of Zimbabwe',
 'Republic of Mauritius;Republic of Mauritius',
 'The Independent State of Papua New Guine;The Independent State of Papua
 New Guine',
 'Republic of Vanuatu;Republic of Vanuatu',
 'Eastern Africa;Eastern Africa',
 'St. Vincent and the Grenadines;St. Vincent and the Grenadines',
 'Republic of Honduras;Republic of Honduras',
 'Republic of South Sudan;Republic of South Sudan',
 'Republic of Croatia;Republic of Croatia',
 'Democratic Republic of Timor-Leste;Democratic Republic of Timor-Leste',
 'Republic of South Africa;Republic of South Africa',
 'Republic of Botswana;Republic of Botswana',
 'Republic of Kazakhstan;Republic of Kazakhstan',
 'Republic of Azerbaijan;Republic of Azerbaijan',
 'Kingdom of Swaziland;Kingdom of Swaziland',
 'Union of the Comoros;Union of the Comoros',
 'Turkmenistan;Turkmenistan',
 'Europe and Central Asia;Europe and Central Asia',
 'South Asia;South Asia',
 'Macedonia; former Yugoslav Republic of;Macedonia; former Yugoslav
 Republic of',
 'St. Lucia;St. Lucia', 'Belize;Belize',
 'Republic of Namibia;Republic of Namibia',
 'Republic of the Sudan;Republic of the Sudan',
 'Republic of Paraguay;Republic of Paraguay',

'Western Balkans;Western Balkans',
 'East Asia and Pacific;East Asia and Pacific',
 'Republic of Bulgaria;Republic of Bulgaria',
 'Central Asia;Central Asia',
 'Republic of Seychelles;Republic of Seychelles',
 'Kingdom of Thailand;Kingdom of Thailand',
 'Republic of Poland;Republic of Poland',
 'Multi-Regional;Multi-Regional',
 'Republic of El Salvador;Republic of El Salvador',
 'Caucasus;Caucasus', 'Russian Federation;Russian Federation',
 'Middle East and North Africa;Middle East and North Africa',
 'Antigua and Barbuda;Antigua and Barbuda',
 'Central America;Central America',
 'Commonwealth of The Bahamas;Commonwealth of The Bahamas',
 'Republic of Trinidad and Tobago;Republic of Trinidad and Tobago',
 "Socialist People's Libyan Arab Jamahiriyy;Socialist People's Libyan Arab
 Jamahiriyy",
 'Czech Republic;Czech Republic',
 'Republic of Latvia;Republic of Latvia', 'Mekong;Mekong',
 'American Samoa;American Samoa',
 'Syrian Arab Republic;Syrian Arab Republic', 'Asia;Asia',
 'Andean Countries;Andean Countries', 'Hungary;Hungary',
 'Republic of Equatorial Guinea;Republic of Equatorial Guinea',
 "People's Democratic Republic of Algeria;People's Democratic Republic of
 Algeria",
 'Barbados;Barbados', 'Malaysia;Malaysia',
 'State of Eritrea;State of Eritrea', 'Mercosur;Mercosur',
 'Slovak Republic;Slovak Republic',
 'Republica Bolivariana de Venezuela;Republica Bolivariana de Venezuela',
 'Islamic Republic of Iran;Islamic Republic of Iran',
 'Republic of Lithuania;Republic of Lithuania',
 'St. Kitts and Nevis;St. Kitts and Nevis',
 'Republic of Korea;Republic of Korea',
 'Republic of Slovenia;Republic of Slovenia',
 'Republic of Estonia;Republic of Estonia',
 'Red Sea and Gulf of Aden;Red Sea and Gulf of Aden',
 'Aral Sea;Aral Sea', 'Republic of Cyprus;Republic of Cyprus',
 'Socialist Federal Republic of Yugoslavia;Socialist Federal Republic of
 Yugoslavia',
 'Portuguese Republic;Portuguese Republic',
 'Sultanate of Oman;Sultanate of Oman',
 'Hellenic Republic;Hellenic Republic',
 'Kingdom of Spain;Kingdom of Spain', 'Ireland;Ireland',
 'Republic of Singapore;Republic of Singapore',
 'State of Israel;State of Israel',
 'Republic of Finland;Republic of Finland',
 'Republic of Iceland;Republic of Iceland',

```
'New Zealand;New Zealand', 'Taiwan; China;Taiwan; China',
'EU Accession Countries;EU Accession Countries',
'Sint Maarten;Sint Maarten', 'Japan;Japan',
'Italian Republic;Italian Republic',
'Kingdom of Norway;Kingdom of Norway',
'Republic of Malta;Republic of Malta',
'Kingdom of Denmark;Kingdom of Denmark',
'Republic of Austria;Republic of Austria',
'Commonwealth of Australia;Commonwealth of Australia',
'Kingdom of Belgium;Kingdom of Belgium',
'Kingdom of the Netherlands;Kingdom of the Netherlands',
'Grand Duchy of Luxembourg;Grand Duchy of Luxembourg',
'French Republic;French Republic'], dtype=object)
```

```
[46]: df_projects_data['Official Country Name'] = df_projects_data['countryname'].str.
      ↪split(';').str.get(0)
df_projects_data['Official Country Name']
```

```
[46]: 0          World
      1  Democratic Republic of the Congo
      2  People's Republic of Bangladesh
      3  Islamic Republic of Afghanistan
      4  Federal Republic of Nigeria
      ...
     18243 Republic of Chile
     18244 Grand Duchy of Luxembourg
     18245 Kingdom of Denmark
     18246 Kingdom of the Netherlands
     18247 French Republic
      Name: Official Country Name, Length: 18248, dtype: object
```

```
[47]: pip install pycountry
```

```
Requirement already satisfied: pycountry in c:\users\hp\anaconda3\lib\site-
packages (24.6.1)
```

```
Note: you may need to restart the kernel to use updated packages.
```

```
[48]: from pycountry import countries
      countries.get(name='India')
      countries.lookup('Republic of India')
```

```
[48]: Country(alpha_2='IN', alpha_3='IND', flag=' ', name='India', numeric='356',
      official_name='Republic of India')
```

The goal is to add the ISO codes to the projects data set. To start, use the pycountry library to make a dictionary mapping the unique countries in ‘Official Country Name’ to the ISO code.

Iterate through the unique countries in df_projects. Create a dictionary mapping the ‘Country

Name' to the alpha_3 ISO abbreviations.

The dictionary should look like: {'Kingdom of Spain':'ESP'}

If a country name cannot be found in the pycountry library, add it to a list called country_not_found.

```
[49]: from collections import defaultdict
country_not_found = []
project_country_abbrev_dict = defaultdict(str)

for country in df_projects_data['Official Country Name'].drop_duplicates().
    sort_values():
    try:
        project_country_abbrev_dict[country] = countries.lookup(country).alpha_3
    except:
        print(country, ' not found')
        country_not_found.append(country)
```

```
Africa not found
Andean Countries not found
Aral Sea not found
Asia not found
Caribbean not found
Caucasus not found
Central Africa not found
Central America not found
Central Asia not found
Co-operative Republic of Guyana not found
Commonwealth of Australia not found
Democratic Republic of Sao Tome and Prin not found
Democratic Republic of the Congo not found
Democratic Socialist Republic of Sri Lan not found
EU Accession Countries not found
East Asia and Pacific not found
Eastern Africa not found
Europe and Central Asia not found
Islamic Republic of Afghanistan not found
Kingdom of Swaziland not found
Latin America not found
Macedonia not found
Mekong not found
Mercosur not found
Middle East and North Africa not found
Multi-Regional not found
Organization of Eastern Caribbean States not found
Oriental Republic of Uruguay not found
Pacific Islands not found
```

Red Sea and Gulf of Aden not found
 Republic of Congo not found
 Republic of Cote d'Ivoire not found
 Republic of Korea not found
 Republic of Kosovo not found
 Republic of Niger not found
 Republic of Rwanda not found
 Republic of Togo not found
 Republic of Turkey not found
 Republic of the Union of Myanmar not found
 Republica Bolivariana de Venezuela not found
 Sint Maarten not found
 Socialist Federal Republic of Yugoslavia not found
 Socialist People's Libyan Arab Jamahiriyy not found
 Socialist Republic of Vietnam not found
 Somali Democratic Republic not found
 South Asia not found
 Southern Africa not found
 St. Kitts and Nevis not found
 St. Lucia not found
 St. Vincent and the Grenadines not found
 State of Eritrea not found
 The Independent State of Papua New Guinea not found
 West Bank and Gaza not found
 Western Africa not found
 Western Balkans not found
 World not found

[]:

```

[50]: indicator_countries = df_population_data[['Country Name', 'Country Code']].
      ↪drop_duplicates().sort_values(by='Country Name')

for country in country_not_found:
    if country in indicator_countries['Country Name'].tolist():
        print(country)
  
```

South Asia
 St. Kitts and Nevis
 St. Lucia
 St. Vincent and the Grenadines
 West Bank and Gaza
 World

```

[51]: # now manually create a dictionary that map the country name and country code
      country_not_found_mapping = {'Co-operative Republic of Guyana': 'GUY',
      'Commonwealth of Australia': 'AUS',
  
```



```

'Democratic Republic of Sao Tome and Prin':'STP',
'Democratic Republic of the Congo':'COD',
'Democratic Socialist Republic of Sri Lan':'LKA',
'East Asia and Pacific':'EAS',
'Europe and Central Asia': 'ECS',
'Islamic Republic of Afghanistan':'AFG',
'Latin America':'LCN',
'Caribbean':'LCN',
'Macedonia':'MKD',
'Middle East and North Africa':'MEA',
'Oriental Republic of Uruguay':'URY',
'Republic of Congo':'COG',
'Republic of Cote d'Ivoire':'CIV',
'Republic of Korea':'KOR',
'Republic of Niger':'NER',
'Republic of Kosovo':'XKX','Republic of Rwanda':'RWA',
'Republic of The Gambia':'GMB',
'Republic of Togo':'TGO',
'Republic of the Union of Myanmar':'MMR',
'Republica Bolivariana de Venezuela':'VEN',
'Sint Maarten':'SXM',
'Socialist People's Libyan Arab Jamahiriya':'LBY',
'Socialist Republic of Vietnam':'VNM',
'Somali Democratic Republic':'SOM',
'South Asia':'SAS',
'St. Kitts and Nevis':'KNA',
'St. Lucia':'LCA',
'St. Vincent and the Grenadines':'VCT',
'State of Eritrea':'ERI',
'The Independent State of Papua New Guinea':'PNG',
'West Bank and Gaza':'PSE',
'World':'WLD'}

```

```
[52]: project_country_abbrev_dict.update(country_not_found_mapping)
```

```
[53]: project_country_abbrev_dict
```

```
[53]: defaultdict(str,
    {'American Samoa': 'ASM',
     'Antigua and Barbuda': 'ATG',
     'Arab Republic of Egypt': 'EGY',
     'Argentine Republic': 'ARG',
     'Barbados': 'BRB',
     'Belize': 'BLZ',
     'Bosnia and Herzegovina': 'BIH',
     'Burkina Faso': 'BFA',
     'Central African Republic': 'CAF',

```

'Commonwealth of Dominica': 'DMA',
 'Commonwealth of The Bahamas': 'BHS',
 'Czech Republic': 'CZE',
 'Democratic Republic of Timor-Leste': 'TLS',
 'Dominican Republic': 'DOM',
 'Federal Democratic Republic of Ethiopia': 'ETH',
 'Federal Republic of Nigeria': 'NGA',
 'Federated States of Micronesia': 'FSM',
 'Federative Republic of Brazil': 'BRA',
 'French Republic': 'FRA',
 'Gabonese Republic': 'GAB',
 'Georgia': 'GEO',
 'Grand Duchy of Luxembourg': 'LUX',
 'Grenada': 'GRD',
 'Hashemite Kingdom of Jordan': 'JOR',
 'Hellenic Republic': 'GRC',
 'Hungary': 'HUN',
 'Ireland': 'IRL',
 'Islamic Republic of Iran': 'IRN',
 'Islamic Republic of Mauritania': 'MRT',
 'Islamic Republic of Pakistan': 'PAK',
 'Italian Republic': 'ITA',
 'Jamaica': 'JAM',
 'Japan': 'JPN',
 'Kingdom of Belgium': 'BEL',
 'Kingdom of Bhutan': 'BTN',
 'Kingdom of Cambodia': 'KHM',
 'Kingdom of Denmark': 'DNK',
 'Kingdom of Lesotho': 'LSO',
 'Kingdom of Morocco': 'MAR',
 'Kingdom of Norway': 'NOR',
 'Kingdom of Spain': 'ESP',
 'Kingdom of Thailand': 'THA',
 'Kingdom of Tonga': 'TON',
 'Kingdom of the Netherlands': 'NLD',
 'Kyrgyz Republic': 'KGZ',
 'Lao People's Democratic Republic': 'LAO',
 'Lebanese Republic': 'LBN',
 'Malaysia': 'MYS',
 'Mongolia': 'MNG',
 'Montenegro': 'MNE',
 'Nepal': 'NPL',
 'New Zealand': 'NZL',
 'People's Democratic Republic of Algeria': 'DZA',
 'People's Republic of Bangladesh': 'BGD',
 'People's Republic of China': 'CHN',
 'Plurinational State of Bolivia': 'BOL',

'Portuguese Republic': 'PRT',
'Republic of Albania': 'ALB',
'Republic of Angola': 'AGO',
'Republic of Armenia': 'ARM',
'Republic of Austria': 'AUT',
'Republic of Azerbaijan': 'AZE',
'Republic of Belarus': 'BLR',
'Republic of Benin': 'BEN',
'Republic of Botswana': 'BWA',
'Republic of Bulgaria': 'BGR',
'Republic of Burundi': 'BDI',
'Republic of Cabo Verde': 'CPV',
'Republic of Cameroon': 'CMR',
'Republic of Chad': 'TCD',
'Republic of Chile': 'CHL',
'Republic of Colombia': 'COL',
'Republic of Costa Rica': 'CRI',
'Republic of Croatia': 'HRV',
'Republic of Cyprus': 'CYP',
'Republic of Djibouti': 'DJI',
'Republic of Ecuador': 'ECU',
'Republic of El Salvador': 'SLV',
'Republic of Equatorial Guinea': 'GNQ',
'Republic of Estonia': 'EST',
'Republic of Fiji': 'FJI',
'Republic of Finland': 'FIN',
'Republic of Ghana': 'GHA',
'Republic of Guatemala': 'GTM',
'Republic of Guinea': 'GIN',
'Republic of Guinea-Bissau': 'GNB',
'Republic of Haiti': 'HTI',
'Republic of Honduras': 'HND',
'Republic of Iceland': 'ISL',
'Republic of India': 'IND',
'Republic of Indonesia': 'IDN',
'Republic of Iraq': 'IRQ',
'Republic of Kazakhstan': 'KAZ',
'Republic of Kenya': 'KEN',
'Republic of Kiribati': 'KIR',
'Republic of Latvia': 'LVA',
'Republic of Liberia': 'LBR',
'Republic of Lithuania': 'LTU',
'Republic of Madagascar': 'MDG',
'Republic of Malawi': 'MWI',
'Republic of Maldives': 'MDV',
'Republic of Mali': 'MLI',
'Republic of Malta': 'MLT',

'Republic of Mauritius': 'MUS',
'Republic of Moldova': 'MDA',
'Republic of Mozambique': 'MOZ',
'Republic of Namibia': 'NAM',
'Republic of Nicaragua': 'NIC',
'Republic of Palau': 'PLW',
'Republic of Panama': 'PAN',
'Republic of Paraguay': 'PRY',
'Republic of Peru': 'PER',
'Republic of Poland': 'POL',
'Republic of Senegal': 'SEN',
'Republic of Serbia': 'SRB',
'Republic of Seychelles': 'SYC',
'Republic of Sierra Leone': 'SLE',
'Republic of Singapore': 'SGP',
'Republic of Slovenia': 'SVN',
'Republic of South Africa': 'ZAF',
'Republic of South Sudan': 'SSD',
'Republic of Suriname': 'SUR',
'Republic of Tajikistan': 'TJK',
'Republic of The Gambia': 'GMB',
'Republic of Trinidad and Tobago': 'TTO',
'Republic of Tunisia': 'TUN',
'Republic of Uganda': 'UGA',
'Republic of Uzbekistan': 'UZB',
'Republic of Vanuatu': 'VUT',
'Republic of Yemen': 'YEM',
'Republic of Zambia': 'ZMB',
'Republic of Zimbabwe': 'ZWE',
'Republic of the Marshall Islands': 'MHL',
'Republic of the Philippines': 'PHL',
'Republic of the Sudan': 'SDN',
'Romania': 'ROU',
'Russian Federation': 'RUS',
'Samoa': 'WSM',
'Slovak Republic': 'SVK',
'Solomon Islands': 'SLB',
'State of Israel': 'ISR',
'Sultanate of Oman': 'OMN',
'Syrian Arab Republic': 'SYR',
'Taiwan': 'TWN',
'Turkmenistan': 'TKM',
'Tuvalu': 'TUV',
'Ukraine': 'UKR',
'Union of the Comoros': 'COM',
'United Mexican States': 'MEX',
'United Republic of Tanzania': 'TZA',

```

'Co-operative Republic of Guyana': 'GUY',
'Commonwealth of Australia': 'AUS',
'Democratic Republic of Sao Tome and Prin': 'STP',
'Democratic Republic of the Congo': 'COD',
'Democratic Socialist Republic of Sri Lan': 'LKA',
'East Asia and Pacific': 'EAS',
'Europe and Central Asia': 'ECS',
'Islamic Republic of Afghanistan': 'AFG',
'Latin America': 'LCN',
'Caribbean': 'LCN',
'Macedonia': 'MKD',
'Middle East and North Africa': 'MEA',
'Oriental Republic of Uruguay': 'URY',
'Republic of Congo': 'COG',
'Republic of Cote d'Ivoire': 'CIV',
'Republic of Korea': 'KOR',
'Republic of Niger': 'NER',
'Republic of Kosovo': 'XKX',
'Republic of Rwanda': 'RWA',
'Republic of Togo': 'TGO',
'Republic of the Union of Myanmar': 'MMR',
'Republica Bolivariana de Venezuela': 'VEN',
'Sint Maarten': 'SXM',
'Socialist People's Libyan Arab Jamahiriyy': 'LBY',
'Socialist Republic of Vietnam': 'VNM',
'Somali Democratic Republic': 'SOM',
'South Asia': 'SAS',
'St. Kitts and Nevis': 'KNA',
'St. Lucia': 'LCA',
'St. Vincent and the Grenadines': 'VCT',
'State of Eritrea': 'ERI',
'The Independent State of Papua New Guine': 'PNG',
'West Bank and Gaza': 'PSE',
'World': 'WLD'})

```

```

[54]: df_projects_data['Country Code'] = df_projects_data['Official Country Name'].
      ↪ apply(lambda x: project_country_abbrev_dict[x])

```

```

[55]: df_projects_data['Country Code']

```

```

[55]: 0      WLD
      1      COD
      2      BGD
      3      AFG
      4      NGA
      ...
      18243  CHL

```

```

18244    LUX
18245    DNK
18246    NLD
18247    FRA
Name: Country Code, Length: 18248, dtype: object

```

```
[56]: df_projects_data
```

```

[56]:      id      regionname \
0    P162228      Other
1    P163962      Africa
2    P167672    South Asia
3    P158768    South Asia
4    P161364      Africa
...
18243 P006578 Latin America and Caribbean
18244 P037451      Europe and Central Asia
18245 P037362      Europe and Central Asia
18246 P037452      Europe and Central Asia
18247 P037383      Europe and Central Asia

      countryname prodline \
0      World;World      RE
1  Democratic Republic of the Congo;Democratic Re...      PE
2  People's Republic of Bangladesh;People's Repub...      PE
3  Islamic Republic of Afghanistan;Islamic Repu...      PE
4  Federal Republic of Nigeria;Federal Republic o...      PE
...
18243      Republic of Chile;Republic of Chile      PE
18244  Grand Duchy of Luxembourg;Grand Duchy of Luxem...      PE
18245      Kingdom of Denmark;Kingdom of Denmark      PE
18246  Kingdom of the Netherlands;Kingdom of the Neth...      PE
18247      French Republic;French Republic      PE

      lendinginstr lendinginstrtype envassesmentcategorycode \
0  Investment Project Financing      IN      C
1  Investment Project Financing      IN      B
2  Investment Project Financing      IN      NaN
3  Investment Project Financing      IN      A
4  Investment Project Financing      IN      B
...
18243      Specific Investment Loan      IN      NaN
18244      Structural Adjustment Loan      AD      NaN
18245      Structural Adjustment Loan      AD      NaN
18246      Structural Adjustment Loan      AD      NaN
18247      Structural Adjustment Loan      AD      NaN

```

	supplementprojectflg	productlinetype	projectstatusdisplay	...	\
0	N	L	Active	...	
1	N	L	Active	...	
2	Y	L	Active	...	
3	N	L	Active	...	
4	N	L	Active	...	
...	
18243	N	L	Closed	...	
18244	N	L	Closed	...	
18245	N	L	Closed	...	
18246	N	L	Closed	...	
18247	N	L	Closed	...	

	mjtheme4name	mjtheme5name	\
0	NaN	NaN	
1	NaN	NaN	
2	NaN	NaN	
3	NaN	NaN	
4	NaN	NaN	
...	
18243	NaN	NaN	
18244	NaN	NaN	
18245	NaN	NaN	
18246	NaN	NaN	
18247	NaN	NaN	

	location	\
0	NaN	
1	NaN	
2	NaN	
3	NaN	
4	0002327546!\$!Ogun State!\$!7!\$!3.58333!\$!NG;000...	
...	...	
18243	NaN	
18244	NaN	
18245	NaN	
18246	NaN	
18247	NaN	

	GeoLocID	\
0	NaN	
1	NaN	
2	NaN	
3	NaN	
4	0002327546;0002328925;0002565340;0002565343;00...	
...	...	
18243	NaN	

18244	NaN
18245	NaN
18246	NaN
18247	NaN

	GeoLocName \
0	NaN
1	NaN
2	NaN
3	NaN
4	Ogun State;Niger State;Abia State;Edo;Kebbi St...
...	...
18243	NaN
18244	NaN
18245	NaN
18246	NaN
18247	NaN

	Latitude	Longitude	Country \
0	NaN	NaN	NaN
1	NaN	NaN	NaN
2	NaN	NaN	NaN
3	NaN	NaN	NaN
4	7;10;5.41667;6.5;11.5;8	3.58333;6;7.5;6;4;10.5	NG;NG;NG;NG;NG;NG
...
18243	NaN	NaN	NaN
18244	NaN	NaN	NaN
18245	NaN	NaN	NaN
18246	NaN	NaN	NaN
18247	NaN	NaN	NaN

	Official Country Name	Country Code
0	World	WLD
1	Democratic Republic of the Congo	COD
2	People's Republic of Bangladesh	BGD
3	Islamic Republic of Afghanistan	AFG
4	Federal Republic of Nigeria	NGA
...
18243	Republic of Chile	CHL
18244	Grand Duchy of Luxembourg	LUX
18245	Kingdom of Denmark	DNK
18246	Kingdom of the Netherlands	NLD
18247	French Republic	FRA

[18248 rows x 58 columns]

```
[57]: df_population_data
```


[57]:	Country Name	Country Code	Indicator Name	Indicator Code	1960	\
0	Aruba	ABW	Population, total	SP.POP.TOTL	54211.0	
1	Afghanistan	AFG	Population, total	SP.POP.TOTL	8996351.0	
2	Angola	AGO	Population, total	SP.POP.TOTL	5643182.0	
3	Albania	ALB	Population, total	SP.POP.TOTL	1608800.0	
4	Andorra	AND	Population, total	SP.POP.TOTL	13411.0	
..	
259	Kosovo	XXK	Population, total	SP.POP.TOTL	947000.0	
260	Yemen, Rep.	YEM	Population, total	SP.POP.TOTL	5172135.0	
261	South Africa	ZAF	Population, total	SP.POP.TOTL	17456855.0	
262	Zambia	ZMB	Population, total	SP.POP.TOTL	3044846.0	
263	Zimbabwe	ZWE	Population, total	SP.POP.TOTL	3747369.0	
	1961	1962	1963	1964	1965	...
0	55438.0	56225.0	56695.0	57032.0	57360.0	...
1	9166764.0	9345868.0	9533954.0	9731361.0	9938414.0	...
2	5753024.0	5866061.0	5980417.0	6093321.0	6203299.0	...
3	1659800.0	1711319.0	1762621.0	1814135.0	1864791.0	...
4	14375.0	15370.0	16412.0	17469.0	18549.0	...
..
259	966000.0	994000.0	1022000.0	1050000.0	1078000.0	...
260	5260501.0	5351799.0	5446063.0	5543339.0	5643643.0	...
261	17920673.0	18401608.0	18899275.0	19412975.0	19942303.0	...
262	3140264.0	3240587.0	3345145.0	3452942.0	3563407.0	...
263	3870756.0	3999419.0	4132756.0	4269863.0	4410212.0	...
	2008	2009	2010	2011	2012	2013
0	101353.0	101453.0	101669.0	102053.0	102577.0	103187.0
1	27294031.0	28004331.0	28803167.0	29708599.0	30696958.0	31731688.0
2	21759420.0	22549547.0	23369131.0	24218565.0	25096150.0	25998340.0
3	2947314.0	2927519.0	2913021.0	2905195.0	2900401.0	2895092.0
4	83861.0	84462.0	84449.0	83751.0	82431.0	80788.0
..
259	1747383.0	1761474.0	1775680.0	1791000.0	1805200.0	1824100.0
260	22356391.0	22974929.0	23606779.0	24252206.0	24909969.0	25576322.0
261	50412129.0	50970818.0	51584663.0	52263516.0	52998213.0	53767396.0
262	13082517.0	13456417.0	13850033.0	14264756.0	14699937.0	15153210.0
263	13558469.0	13810599.0	14086317.0	14386649.0	14710826.0	15054506.0
	2014	2015	2016	2017		
0	103795.0	104341.0	104822.0	105264.0		
1	32758020.0	33736494.0	34656032.0	35530081.0		
2	26920466.0	27859305.0	28813463.0	29784193.0		
3	2889104.0	2880703.0	2876101.0	2873457.0		
4	79223.0	78014.0	77281.0	76965.0		
..		
259	1821800.0	1801800.0	1816200.0	1830700.0		

```

260  26246327.0  26916207.0  27584213.0  28250420.0
261  54539571.0  55291225.0  56015473.0  56717156.0
262  15620974.0  16100587.0  16591390.0  17094130.0
263  15411675.0  15777451.0  16150362.0  16529904.0

```

[264 rows x 62 columns]

```
[58]: df_population_data.dtypes
```

```

[58]: Country Name      object
      Country Code      object
      Indicator Name     object
      Indicator Code     object
      1960                float64
      ...
      2013                float64
      2014                float64
      2015                float64
      2016                float64
      2017                float64
      Length: 62, dtype: object

```

- 1 Calculate the population sum by year for Canada,
- 2 the United States, and Mexico.

```

[59]: keepcol = ['Country Name']
      for i in range(1960, 2018, 1):
          keepcol.append(str(i))

      df_nafta = df_population_data[(df_population_data['Country Name'] == 'Canada') |
      ↪ (df_population_data['Country Name'] == 'United States') |
      ↪ (df_population_data['Country Name'] == 'Mexico')].iloc[:,]

```

```
[60]: df_nafta
```

```

[60]:      Country Name Country Code      Indicator Name Indicator Code \
33      Canada      CAN  Population, total  SP.POP.TOTL
152     Mexico      MEX  Population, total  SP.POP.TOTL
249  United States      USA  Population, total  SP.POP.TOTL

      1960      1961      1962      1963      1964 \
33  17909009.0  18271000.0  18614000.0  18964000.0  19325000.0
152  38174112.0  39394126.0  40649588.0  41939880.0  43264272.0
249  180671000.0  183691000.0  186538000.0  189242000.0  191889000.0

```

	1965	...	2008	2009	2010	2011	\
33	19678000.0	...	33245773.0	33628571.0	34005274.0	34342780.0	
152	44623043.0	...	113661809.0	115505228.0	117318941.0	119090017.0	
249	194303000.0	...	304093966.0	306771529.0	309338421.0	311644280.0	

	2012	2013	2014	2015	2016	\
33	34750545.0	35152370.0	35535348.0	35832513.0	36264604.0	
152	120828307.0	122535969.0	124221600.0	125890949.0	127540423.0	
249	313993272.0	316234505.0	318622525.0	321039839.0	323405935.0	

	2017
33	36708083.0
152	129163276.0
249	325719178.0

[3 rows x 62 columns]

```
[61]: df_nafta.sum(axis=0)[keepcol]
```

```
[61]: Country Name      CanadaMexicoUnited States
1960                                236754121.0
1961                                241356126.0
1962                                245801588.0
1963                                250145880.0
1964                                254478272.0
1965                                258604043.0
1966                                262619038.0
1967                                266553812.0
1968                                270344019.0
1969                                274128481.0
1970                                278405861.0
1971                                283025259.0
1972                                287367782.0
1973                                291558995.0
1974                                295716280.0
1975                                300054399.0
1976                                304176763.0
1977                                308380884.0
1978                                312660488.0
1979                                317041689.0
1980                                321178871.0
1981                                325358195.0
1982                                329468533.0
1983                                333444548.0
1984                                337307605.0
1985                                341226707.0
1986                                345271125.0
```

1987	349342052.0
1988	353477919.0
1989	357895891.0
1990	362771874.0
1991	368224194.0
1992	373861907.0
1993	379352863.0
1994	384587053.0
1995	389677579.0
1996	394753352.0
1997	399925939.0
1998	404923356.0
1999	409839779.0
2000	414651784.0
2001	419117923.0
2002	423342801.0
2003	427424386.0
2004	431795881.0
2005	436300827.0
2006	441042795.0
2007	445955481.0
2008	451001548.0
2009	455905328.0
2010	460662636.0
2011	465077077.0
2012	469572124.0
2013	473922844.0
2014	478379473.0
2015	482763301.0
2016	487210962.0
2017	491590537.0

dtype: object

```
[62]: df_projects_data.dtypes
```

```
[62]: id                object
      regionname        object
      countryname       object
      prodline          object
      lendinginstr       object
      lendinginstrtype   object
      envassesmentcategorycode object
      supplementprojectflg object
      productlinetype    object
      projectstatusdisplay object
      status             object
      project_name       object
```

boardapprovaldate	object
board_approval_month	object
closingdate	object
lendprojectcost	object
ibrdcommamt	object
idacommamt	object
totalamt	object
grantamt	object
borrower	object
impagency	object
url	object
projectdoc	object
majorsector_percent	object
sector1	object
sector2	object
sector3	object
sector4	object
sector5	object
sector	object
mjsector1	object
mjsector2	object
mjsector3	object
mjsector4	object
mjsector5	object
mjsector	object
theme1	object
theme2	object
theme3	object
theme4	object
theme5	object
theme	object
goal	object
financier	object
mjtheme1name	object
mjtheme2name	object
mjtheme3name	object
mjtheme4name	object
mjtheme5name	object
location	object
GeoLocID	object
GeoLocName	object
Latitude	object
Longitude	object
Country	object
Official Country Name	object
Country Code	object
dtype: object	

```
[63]: df_projects_data[['totalamt', 'lendprojectcost']].head()
```

```
[63]:      totalamt  lendprojectcost
0           0           500,000
1  200,000,000  200,000,000
2   58,330,000   50,000,000
3   20,000,000   50,000,000
4  100,000,000  100,000,000
```

```
[64]: df_projects_data['totalamt'].sum()
```

```
[64]: '0200,000,00058,330,00020,000,000100,000,000500,000,000350,000,000225,000,000125,000,000329,900,000200,000,000400,000,0000150,000,0000389,000,0000530,000,000350,000,000202,000,000300,000,000500,000,000493,060,000175,000,0000230,000,000080,000,000400,000,000130,000,000030,000,000035,000,0000250,000,000200,000,000400,000,000110,000,000150,000,000074,000,000118,000,000465,000,000050,000,000090,000,000100,000,000130,000,00010,000,000460,600,000100,000,000700,000,00030,000,000280,000,00040,000,000300,000,000090,000,000150,000,000150,000,00043,000,000100,000,00015,000,00015,000,000012,000,000030,000,000100,000,000250,000,000200,000,000150,000,00025,000,000500,000,000122,100,00020,000,00007,390,000000050,000,00075,000,00060,000,00025,000,00015,000,00000300,000,00025,000,00011,000,00009,000,000130,000,000140,000,000100,000,000200,000,000070,000,000140,000,00020,000,000188,000,000200,000,000500,000,00014,200,00040,000,000150,000,000003,550,000600,000,000400,000,000150,000,0006,000,00012,000,000100,000,000300,000,00041,000,00040,000,00015,000,00075,000,0000220,000,000080,000,000360,000,000220,000,0000150,000,000120,000,00035,000,00011,000,000021,700,000130,000,00048,000,00060,000,00036,000,00041,000,00025,000,000180,000,000090,000,000100,000,000250,000,000100,000,00020,000,00015,000,00045,000,00050,000,0000500,000,00050,000,00025,000,00040,000,00091,540,00025,000,000030,000,000200,000,000050,000,00010,000,00055,000,000190,000,000000025,000,000200,000,0000015,000,00015,000,0000030,000,000200,000,00050,000,00015,000,000450,640,00055,000,000110,000,00050,000,000145,000,000110,000,00031,100,000160,000,00051,000,00050,000,000140,000,00040,000,00030,000,000050,000,00066,000,00050,000,000200,000,000200,000,000027,800,00025,000,00020,000,00080,000,000225,200,00050,000,00060,000,000250,000,00035,000,000210,000,000600,000,00048,000,00010,000,00014,000,000000375,000,00015,000,000060,000,00045,000,00025,000,000420,000,00000026,750,00010,000,000010,000,0000486,000,00015,000,0000000300,000,00000300,000,000210,000,000110,000,000500,000,00034,890,000200,000,0001,800,00015,000,000300,000,00056,000,0000140,000,00020,000,00050,000,000020,000,0000170,000,00000120,000,00000040,000,000200,000,000200,000,00051,900,00035,000,00026,000,00080,000,000200,000,000100,000,0002,800,00093,000,000425,000,000400,000,00025,000,000125,000,000300,000,000510,000,00080,000,000150,000,00015,000,00034,000,000300,000,000300,000,000245,000,000041,900,0000500,000,000300,000,00075,000,000250,000,000200,000,000170,000,00080,000,000080,000,00060,600,00045,000,0000170,000,00000147,700,000125,000,000120,000,0001,150,000,000100,000,0000318,000,000125,000,000130,000,000120,000,00042,000,00010,000,000040,000,000020,000,0005,000,0000031,000,00018,300,000122,380,0008,750,00045,000,00002,000,0000020,000,0000200,000,000118,610,000150,000,00028,000,000120,000,0000300,000,000400,000,0005,000,00046,000,000
```

0000050,000,00050,130,0000160,000,00000015,000,0005,000,000010,000,00060,000,000
16,000,0005,000,000150,000,00060,000,000207,600,000150,000,000150,000,0000155,00
0,0007,000,00010,000,000000114,000,000000200,000,000700,000,000600,000,00060,000
,0000150,000,00000200,000,000119,000,00060,000,0000400,000,000200,000,000020,000
,000100,000,00050,000,000160,000,000000000060,000,00082,500,00012,000,00015,700,0
0050,000,000055,000,000500,000,0000000300,000,000150,000,000070,000,00003,000,00
00060,000,00070,000,0000100,000,0000050,000,000025,000,00030,000,00020,000,00030
,000,00062,000,00050,000,000120,000,000144,900,000345,000,000200,000,00030,000,0
0060,000,00045,000,00056,000,000020,800,000065,000,0000153,000,0000040,000,00045
,700,00030,000,000200,000,00026,500,00012,000,00095,800,000150,000,000250,000,00
017,500,00060,000,00047,490,000050,000,00050,000,000150,000,000150,000,00036,000
,00048,400,000611,000,00040,000,000033,630,000350,000,00010,000,00010,000,000042
,000,00035,000,000137,000,000116,000,00027,000,00086,000,000100,000,00035,000,00
020,000,00018,000,00025,000,00020,000,0000500,000,000100,000,00020,300,00060,000
,00036,100,000127,700,00099,310,00025,200,00022,000,00020,000,00053,000,00023,00
0,00012,000,00006,200,000080,000,00080,000,000020,000,00070,000,00049,850,00010,
000,000150,000,000072,400,000120,000,00023,300,00059,000,0000100,000,000125,000,
00020,000,00038,590,0004,000,00015,000,00016,200,00050,000,000240,000,00025,000,
000118,000,00050,000,00039,200,000240,000,000100,000,00072,520,00029,000,00061,6
20,00010,700,000300,000,0008,300,00081,000,00095,000,00080,000,00017,000,000200,
000,00083,000,00015,270,00025,000,00036,000,000350,000,00045,000,00028,000,00015
5,000,0000097,000,0000100,000,0000026,300,0000600,000,00019,630,000150,000,00020
0,000,0004,000,000040,000,000236,200,00078,740,00075,000,00080,000,000145,000,00
090,000,0000018,000,000200,000,00040,000,00017,000,00050,000,000225,700,00070,00
0,000150,000,000108,100,00040,000,00073,300,00023,330,00050,000,00060,000,00022,
000,00013,330,0000370,700,000200,000,000025,000,0005,000,000035,200,000074,000,0
00300,000,00059,000,000103,000,00050,000,0000000000101,700,00040,000,00020,000,00
0150,000,00045,000,00060,000,0000100,000,000030,000,00055,000,000375,000,000116,
200,00018,000,00000026,000,000300,000,000150,000,00075,000,000356,700,00012,000,
00000120,000,000445,000,000150,000,0000120,000,0006,000,00050,000,000010,000,000
26,900,00075,000,000325,000,00050,000,0005,000,00010,000,00030,000,00074,000,000
0000200,000,00035,000,0005,000,000100,000,000120,000,000185,000,00013,400,000007
0,000,0000125,000,000200,000,00080,000,00065,000,00000075,000,00015,000,00029,00
0,00065,000,000200,000,00065,000,000450,000,0000130,000,00040,700,0000150,000,00
000600,000,000100,000,000175,000,00050,000,000100,000,000210,000,000301,600,0000
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,00014,900,00040,000,00018,100,000110,000,00060,000,000150,000,00040,000,00010,0
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000115,500,00011,000,0006,140,0007,650,000150,000,0000290,900,00030,000,000350,0
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00022,000,0005,800,00028,000,000500,000,0001,000,000,00013,800,00030,500,000210,
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000350,000,00050,000,00018,200,000160,000,00024,600,000500,000,0008,500,000205,0
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8,500,00064,500,000490,000,00026,000,000610,000,00045,800,00025,000,00075,000,00
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000140,000,00015,000,00060,000,00028,000,0006,500,00079,000,00015,000,00023,000,
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3      20000000
4      100000000
...
18243   13500000
18244   12000000
18245    40000000
18246   195000000
18247   250000000
Name: totalamt, Length: 18248, dtype: int64
```

float64 int64 bool datetime64 timedelta object

where timedelta is the difference between two datetimes and object is a string. As you've seen here, you sometimes need to convert data types from one type to another type. Pandas has a few different methods for converting between data types, and here are link to the documentation:

[astype](#) to [datetime](#) to [numeric](#) to [timedelta](#)

```
[67]: parsed_date = pd.to_datetime('January 1st, 2017')
      parsed_date
```

```
[67]: Timestamp('2017-01-01 00:00:00')
```

```
[68]: parsed_date.month
```

```
[68]: 1
```

```
[69]: parsed_date.year
```

```
[69]: 2017
```

```
[70]: parsed_date = pd.to_datetime('5/3/2017 5:30')
      parsed_date.month
```

```
[70]: 5
```

```
[71]: parsed_date = pd.to_datetime('3/5/2017 5:30', format='%d/%m/%Y %H:%M')
      parsed_date.month
```

```
[71]: 5
```

```
[72]: df_projects_data.head(15)[['boardapprovaldate', 'board_approval_month',
      ↪ 'closingdate']]
```

```
[72]:
```

	boardapprovaldate	board_approval_month	closingdate
0	2018-06-28T00:00:00Z	June	NaN
1	2018-06-28T00:00:00Z	June	2023-12-31T00:00:00Z
2	2018-06-28T00:00:00Z	June	NaN
3	2018-06-27T00:00:00Z	June	2023-06-28T00:00:00Z
4	2018-06-27T00:00:00Z	June	2023-05-31T00:00:00Z
5	2018-06-27T00:00:00Z	June	2019-12-31T00:00:00Z
6	2018-06-27T00:00:00Z	June	2023-10-31T00:00:00Z
7	2018-06-27T00:00:00Z	June	2023-12-31T00:00:00Z
8	2018-06-27T00:00:00Z	June	2022-12-31T00:00:00Z
9	2018-06-27T00:00:00Z	June	2023-12-31T00:00:00Z
10	2018-06-27T00:00:00Z	June	2023-12-31T00:00:00Z
11	2018-06-27T00:00:00Z	June	NaN
12	2018-06-27T00:00:00Z	June	NaN
13	2018-06-27T00:00:00Z	June	NaN
14	2018-06-27T00:00:00Z	June	NaN

```
[73]: df_projects_data['boardapprovaldate'] = pd.
      ↪to_datetime(df_projects_data['boardapprovaldate'])
      df_projects_data['closingdate'] = pd.
      ↪to_datetime(df_projects_data['closingdate'])
```

```
[74]: df_projects_data['closingdate']
```

```
[74]: 0          NaT
      1    2023-12-31 00:00:00+00:00
      2          NaT
      3    2023-06-28 00:00:00+00:00
      4    2023-05-31 00:00:00+00:00
      ...
    18243  1954-12-31 00:00:00+00:00
    18244  1949-03-31 00:00:00+00:00
    18245  1949-03-31 00:00:00+00:00
    18246  1948-06-30 00:00:00+00:00
    18247  1947-12-31 00:00:00+00:00
      Name: closingdate, Length: 18248, dtype: datetime64[ns, UTC]
```

```
[75]: df_projects_data['boardapprovaldate'].dt.second
```

```
[75]: 0          0.0
      1          0.0
      2          0.0
      3          0.0
      4          0.0
      ...
    18243    0.0
    18244    0.0
    18245    0.0
    18246    0.0
    18247    0.0
      Name: boardapprovaldate, Length: 18248, dtype: float64
```

```
[76]: df_projects_data['boardapprovaldate'].dt.month
```

```
[76]: 0          6.0
      1          6.0
      2          6.0
      3          6.0
      4          6.0
      ...
    18243    3.0
    18244    8.0
    18245    8.0
    18246    8.0
    18247    5.0
      Name: boardapprovaldate, Length: 18248, dtype: float64
```

```
[77]: df_projects_data['boardapprovaldate'].dt.weekday
```



```
[77]: 0      3.0
      1      3.0
      2      3.0
      3      2.0
      4      2.0
      ...
      18243    3.0
      18244    3.0
      18245    4.0
      18246    3.0
      18247    4.0
      Name: boardapprovaldate, Length: 18248, dtype: float64
```

Part 2 - Create new columns

Now that the boardapprovaldate and closingdates are in datetime formats, create a few new columns in the df_projects data frame:

approvalyear approvalday approvalweekday closingyear closingday closingweekday

```
[78]: df_projects_data['approvalyear'] = df_projects_data['boardapprovaldate'].dt.year
      df_projects_data['approvalday'] = df_projects_data['boardapprovaldate'].dt.day
      df_projects_data['approvalweekday'] = df_projects_data['boardapprovaldate'].dt.
      ↪weekday
      df_projects_data['closingyear'] = df_projects_data['closingdate'].dt.year
      df_projects_data['closingday'] = df_projects_data['closingdate'].dt.day
      df_projects_data['closingweekday'] = df_projects_data['closingdate'].dt.weekday
```

```
[79]: df_projects_data
```

```
[79]:
```

	id	regionname \	countryname	prodlane \
0	P162228	Other	World;World	RE
1	P163962	Africa	Democratic Republic of the Congo;Democratic Re...	PE
2	P167672	South Asia	People's Republic of Bangladesh;People's Repub...	PE
3	P158768	South Asia	Islamic Republic of Afghanistan;Islamic Repu...	PE
4	P161364	Africa		
...		
18243	P006578	Latin America and Caribbean		
18244	P037451	Europe and Central Asia		
18245	P037362	Europe and Central Asia		
18246	P037452	Europe and Central Asia		
18247	P037383	Europe and Central Asia		

4	Federal Republic of Nigeria;Federal Republic o...	PE
...
18243	Republic of Chile;Republic of Chile	PE
18244	Grand Duchy of Luxembourg;Grand Duchy of Luxem...	PE
18245	Kingdom of Denmark;Kingdom of Denmark	PE
18246	Kingdom of the Netherlands;Kingdom of the Neth...	PE
18247	French Republic;French Republic	PE

	lendinginstr	lendinginstrtype	envassesmentcategorycode	\
0	Investment Project Financing	IN	C	
1	Investment Project Financing	IN	B	
2	Investment Project Financing	IN	NaN	
3	Investment Project Financing	IN	A	
4	Investment Project Financing	IN	B	
...	
18243	Specific Investment Loan	IN	NaN	
18244	Structural Adjustment Loan	AD	NaN	
18245	Structural Adjustment Loan	AD	NaN	
18246	Structural Adjustment Loan	AD	NaN	
18247	Structural Adjustment Loan	AD	NaN	

	supplementprojectflg	productlinetype	projectstatusdisplay	...	\
0	N	L	Active	...	
1	N	L	Active	...	
2	Y	L	Active	...	
3	N	L	Active	...	
4	N	L	Active	...	
...	
18243	N	L	Closed	...	
18244	N	L	Closed	...	
18245	N	L	Closed	...	
18246	N	L	Closed	...	
18247	N	L	Closed	...	

	Longitude	Country	\
0	NaN	NaN	
1	NaN	NaN	
2	NaN	NaN	
3	NaN	NaN	
4	3.58333;6;7.5;6;4;10.5	NG;NG;NG;NG;NG;NG	
...	
18243	NaN	NaN	
18244	NaN	NaN	
18245	NaN	NaN	
18246	NaN	NaN	
18247	NaN	NaN	

	Official Country Name	Country Code	approvalyear	approvalday \
0	World	WLD	2018.0	28.0
1	Democratic Republic of the Congo	COD	2018.0	28.0
2	People's Republic of Bangladesh	BGD	2018.0	28.0
3	Islamic Republic of Afghanistan	AFG	2018.0	27.0
4	Federal Republic of Nigeria	NGA	2018.0	27.0
...
18243	Republic of Chile	CHL	1948.0	25.0
18244	Grand Duchy of Luxembourg	LUX	1947.0	28.0
18245	Kingdom of Denmark	DNK	1947.0	22.0
18246	Kingdom of the Netherlands	NLD	1947.0	7.0
18247	French Republic	FRA	1947.0	9.0

	approvalweekday	closingyear	closingday	closingweekday
0	3.0	NaN	NaN	NaN
1	3.0	2023.0	31.0	6.0
2	3.0	NaN	NaN	NaN
3	2.0	2023.0	28.0	2.0
4	2.0	2023.0	31.0	2.0
...
18243	3.0	1954.0	31.0	4.0
18244	3.0	1949.0	31.0	3.0
18245	4.0	1949.0	31.0	3.0
18246	3.0	1948.0	30.0	2.0
18247	4.0	1947.0	31.0	2.0

[18248 rows x 64 columns]

#The English alphabet has only 26 letters. #But other languages have many more characters including accents, #tildes and umlauts. As time went on, more encodings were invented to deal with languages other than English. #The utf-8 standard tries to provide a single encoding schema that can encompass all text.

#The problem is that it's difficult to know what encoding rules were used to make a file unless somebody tells you. #The most common encoding by far is utf-8. Pandas will assume that files are utf-8 when you read them in or write them out.

```
[80]: from encodings.aliases import aliases

alias_values = set(aliases.values())

for encoding in set(aliases.values()):
    df=pd.read_csv("D:\etl\mystery.csv",encoding="utf-16")
    print('successful', encoding)
```

```
successful cp863
successful iso2022_jp
successful cp862
```

successful zlib_codec
successful mbcs
successful shift_jis_2004
successful cp437
successful iso2022_jp_ext
successful iso2022_jp_3
successful iso8859_3
successful hex_codec
successful cp932
successful cp1257
successful iso8859_7
successful iso8859_13
successful utf_16_be
successful mac_iceland
successful bz2_codec
successful iso8859_4
successful iso8859_11
successful iso8859_2
successful cp949
successful cp852
successful iso8859_16
successful cp775
successful iso2022_jp_2004
successful uu_codec
successful iso8859_15
successful cp1258
successful utf_16
successful cp860
successful hz
successful ascii
successful utf_8
successful cp1252
successful shift_jisx0213
successful cp1253
successful mac_cyrillic
successful cp861
successful quopri_codec
successful iso2022_jp_2
successful cp866
successful iso2022_jp_1
successful cp864
successful cp869
successful cp1251
successful johab
successful cp865
successful cp1254
successful euc_kr
successful iso8859_14

successful euc_jp
successful gb18030
successful cp1256
successful ptcp154
successful cp857
successful iso8859_8
successful tis_620
successful iso8859_9
successful koi8_r
successful cp037
successful iso8859_5
successful cp950
successful latin_1
successful cp1125
successful big5hkscs
successful cp1255
successful utf_32_be
successful utf_32
successful iso2022_kr
successful cp1026
successful shift_jis
successful mac_greek
successful gbk
successful cp500
successful mac_roman
successful big5
successful cp855
successful cp1140
successful utf_16_le
successful cp273
successful base64_codec
successful gb2312
successful mac_latin2
successful cp850
successful utf_32_le
successful cp424
successful iso8859_6
successful rot_13
successful cp1250
successful euc_jis_2004
successful euc_jisx0213
successful utf_7
successful iso8859_10
successful mac_turkish
successful hp_roman8
successful kz1048
successful cp858

```
[81]: pip install chardet
```

Requirement already satisfied: chardet in c:\users\hp\anaconda3\lib\site-packages (4.0.0)

Note: you may need to restart the kernel to use updated packages.

```
[82]: import chardet

with open("D:\etl\mystery.csv", 'rb') as file:
    print(chardet.detect(file.read()))
```

```
{'encoding': 'UTF-16', 'confidence': 1.0, 'language': ''}
```

```
[83]: df_gdp_data= pd.read_csv('D:\etl\gdp_data.csv', skiprows=4)
```

```
[84]: df_gdp_data.drop('Unnamed: 62', axis=1, inplace=True)
```

```
[85]: df_gdp_data.isnull().sum()
```

```
[85]: Country Name      0
Country Code        0
Indicator Name      0
Indicator Code      0
1960                140
...
2013                16
2014                17
2015                18
2016                23
2017                30
Length: 62, dtype: int64
```

```
[86]: df_gdp_data
```

```
[86]:   Country Name Country Code Indicator Name Indicator Code \
0      Aruba      ABW GDP (current US$) NY.GDP.MKTP.CD
1  Afghanistan      AFG GDP (current US$) NY.GDP.MKTP.CD
2      Angola      AGO GDP (current US$) NY.GDP.MKTP.CD
3    Albania      ALB GDP (current US$) NY.GDP.MKTP.CD
4    Andorra      AND GDP (current US$) NY.GDP.MKTP.CD
..      ...      ...      ...      ...
259    Kosovo      XKX GDP (current US$) NY.GDP.MKTP.CD
260  Yemen, Rep.      YEM GDP (current US$) NY.GDP.MKTP.CD
261 South Africa      ZAF GDP (current US$) NY.GDP.MKTP.CD
262      Zambia      ZMB GDP (current US$) NY.GDP.MKTP.CD
263    Zimbabwe      ZWE GDP (current US$) NY.GDP.MKTP.CD
```

	1960	1961	1962	1963	1964 \
0	NaN	NaN	NaN	NaN	NaN
1	5.377778e+08	5.488889e+08	5.466667e+08	7.511112e+08	8.000000e+08
2	NaN	NaN	NaN	NaN	NaN
3	NaN	NaN	NaN	NaN	NaN
4	NaN	NaN	NaN	NaN	NaN
..
259	NaN	NaN	NaN	NaN	NaN
260	NaN	NaN	NaN	NaN	NaN
261	7.575248e+09	7.972841e+09	8.497830e+09	9.423212e+09	1.037379e+10
262	7.130000e+08	6.962857e+08	6.931429e+08	7.187143e+08	8.394286e+08
263	1.052990e+09	1.096647e+09	1.117602e+09	1.159512e+09	1.217138e+09

	1965	...	2008	2009	2010 \
0	NaN	...	2.791961e+09	2.498933e+09	2.467704e+09
1	1.006667e+09	...	1.019053e+10	1.248694e+10	1.593680e+10
2	NaN	...	8.417804e+10	7.549239e+10	8.252614e+10
3	NaN	...	1.288135e+10	1.204421e+10	1.192695e+10
4	NaN	...	4.007353e+09	3.660531e+09	3.355695e+09
..
259	NaN	...	5.687488e+09	5.653793e+09	5.829934e+09
260	NaN	...	2.691085e+10	2.513027e+10	3.090675e+10
261	1.133417e+10	...	2.871000e+11	2.972167e+11	3.752981e+11
262	1.082857e+09	...	1.791086e+10	1.532834e+10	2.026556e+10
263	1.311436e+09	...	4.415703e+09	8.621574e+09	1.014186e+10

	2011	2012	2013	2014	2015 \
0	2.584464e+09	NaN	NaN	NaN	NaN
1	1.793024e+10	2.053654e+10	2.026425e+10	2.061610e+10	1.921556e+10
2	1.041158e+11	1.139232e+11	1.249125e+11	1.267302e+11	1.026212e+11
3	1.289087e+10	1.231978e+10	1.277628e+10	1.322824e+10	1.138693e+10
4	3.442063e+09	3.164615e+09	3.281585e+09	3.350736e+09	2.811489e+09
..
259	6.686683e+09	6.500193e+09	7.073420e+09	7.386891e+09	6.439947e+09
260	3.272642e+10	3.540133e+10	4.041524e+10	4.322858e+10	3.460248e+10
261	4.168782e+11	3.963327e+11	3.668294e+11	3.509046e+11	3.177410e+11
262	2.346010e+10	2.550337e+10	2.804546e+10	2.715063e+10	2.115439e+10
263	1.209845e+10	1.424249e+10	1.545177e+10	1.589105e+10	1.630467e+10

	2016	2017
0	NaN	NaN
1	1.946902e+10	2.081530e+10
2	9.533720e+10	1.242094e+11
3	1.188368e+10	1.303935e+10
4	2.877312e+09	3.012914e+09
..
259	6.715487e+09	7.128691e+09

```

260  1.821333e+10      NaN
261  2.957627e+11  3.494193e+11
262  2.095475e+10  2.580867e+10
263  1.661996e+10  1.784582e+10

```

[264 rows x 62 columns]

```

[87]: import matplotlib.pyplot as plt

df_melt = pd.melt(df_gdp_data, id_vars=['Country Name', 'Country Code',
    ↳ 'Indicator Name', 'Indicator Code'], var_name='year', value_name='GDP')

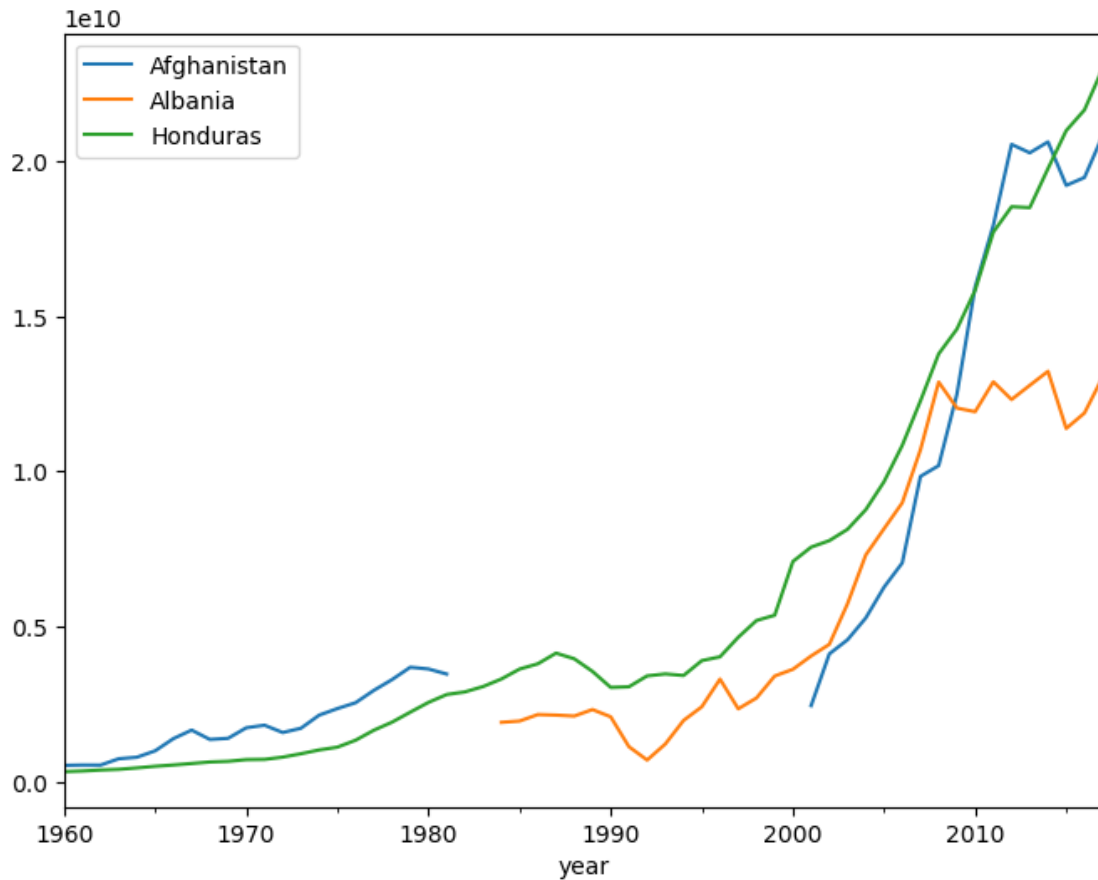
df_melt['year'] = pd.to_datetime(df_melt['year'])

def plot_results(column_name):
    fig, ax = plt.subplots(figsize=(8,6))

    df_melt[(df_melt['Country Name'] == 'Afghanistan') |
            (df_melt['Country Name'] == 'Albania') |
            (df_melt['Country Name'] == 'Honduras')].groupby('Country Name').
    ↳ plot('year', column_name, legend=True, ax=ax)
    ax.legend(labels=['Afghanistan', 'Albania', 'Honduras'])

plot_results('GDP')

```

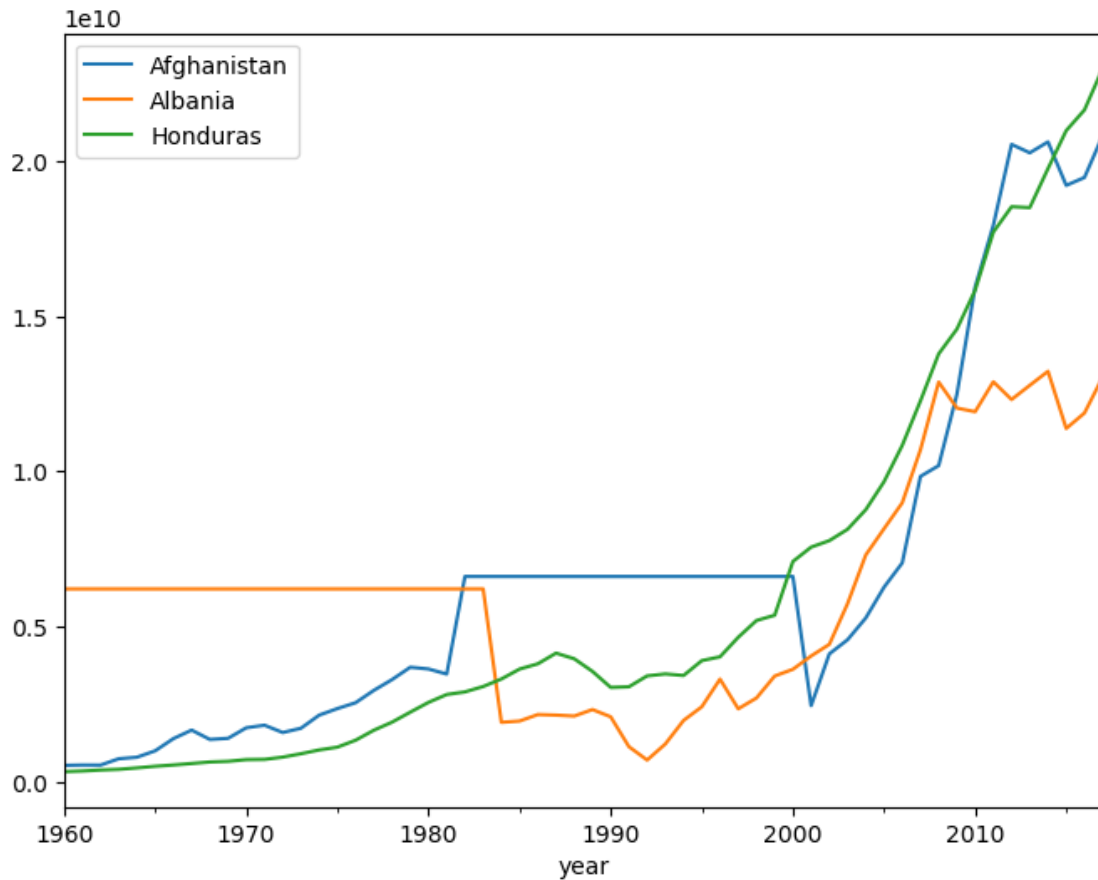
Afghanistan and Albania are missing data, which show up as gaps in the results.

Exercise - Part 1

Your first task is to calculate mean GDP for each country and fill in missing values with the country mean. This is a bit tricky to do in pandas

```
[88]: df_melt['GDP_filled'] = df_melt.groupby('Country Name')['GDP'].transform(lambda x: x.fillna(x.mean()))
```

```
[89]: plot_results('GDP_filled')
```



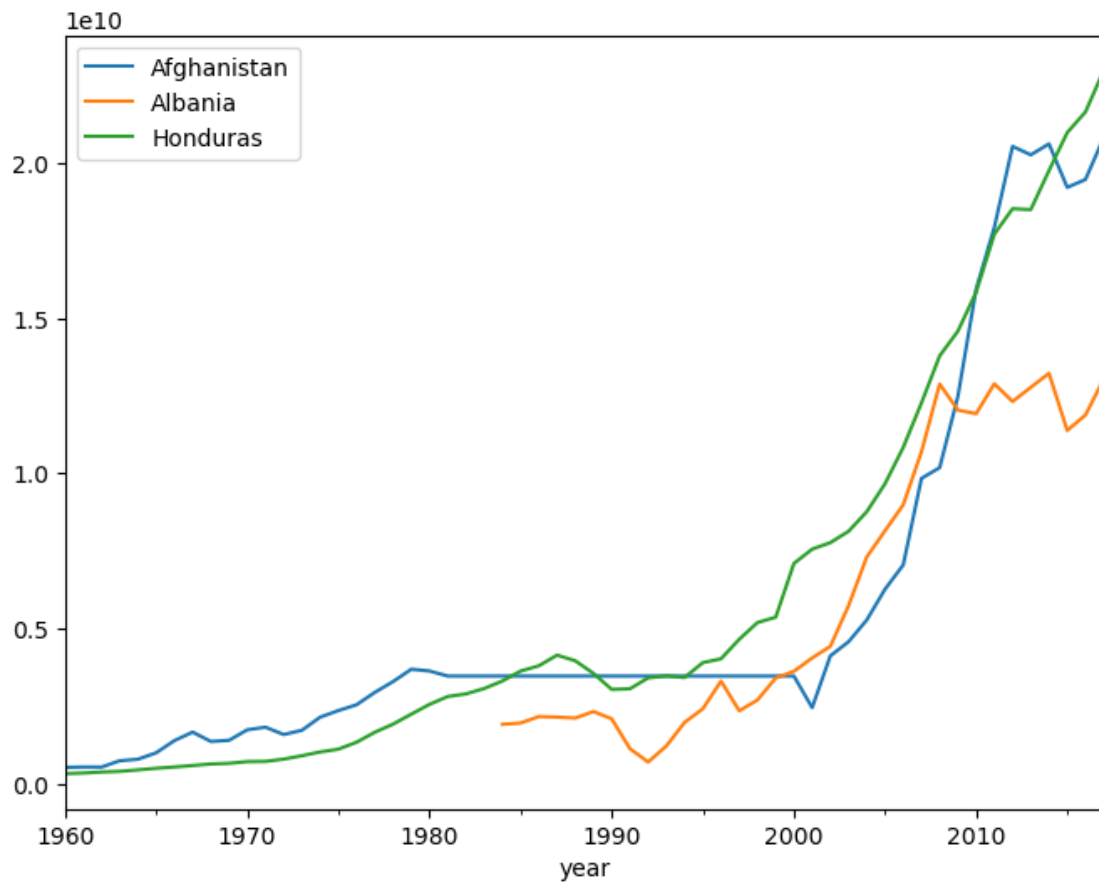
This is somewhat of an improvement. At least there is no missing data; however, because GDP tends to increase over time, the mean GDP is probably not the best way to fill in missing values for this particular case. Next, try using forward fill to deal with any missing values.

Exercise Part -2 The pandas fillna method has a forward fill option. For example, if you wanted to use forward fill on the GDP dataset, you could execute `df_melt[GDP].fillna(method='ffill')`. However, there are two issues with that code.

You want to first make sure the data is sorted by year. You need to group the data by country name so that the forward fill stays within each country.

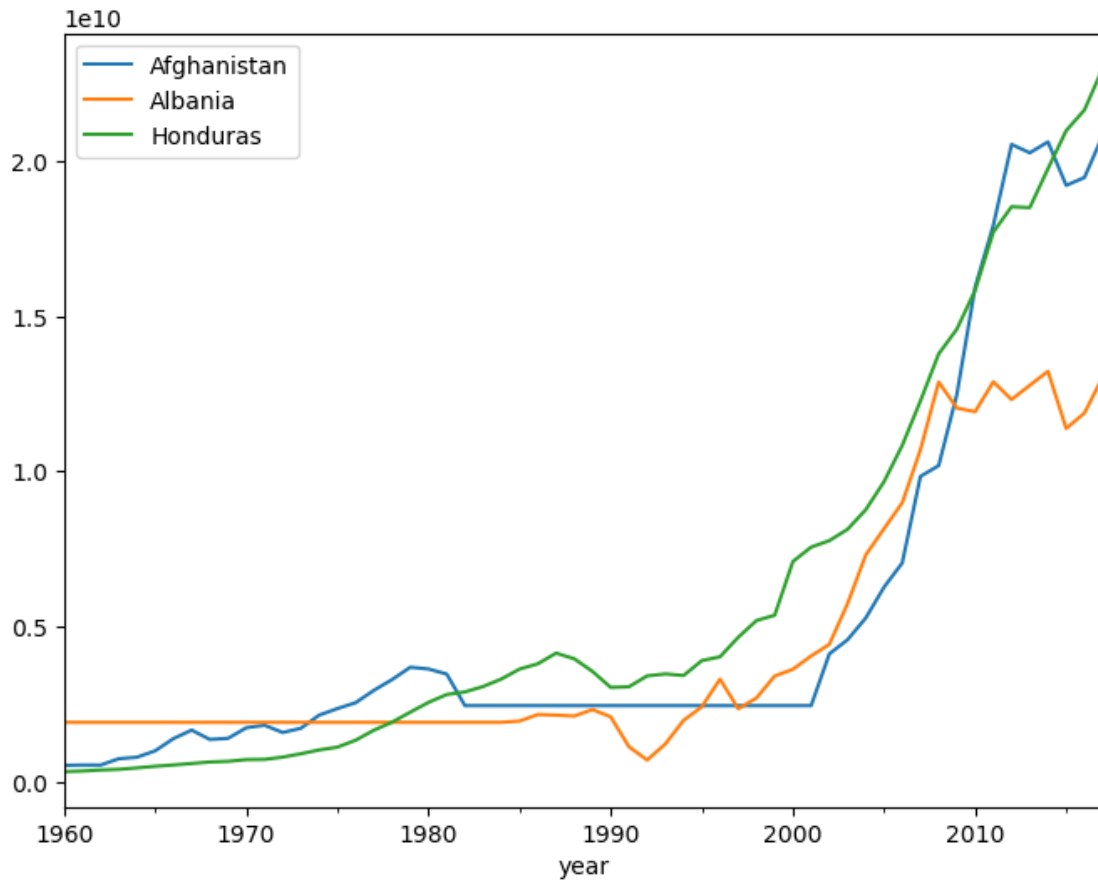
```
[90]: df_melt['GDP_ffill'] = df_melt.sort_values('year').groupby('Country_
↳ Name')['GDP'].fillna(method='ffill')
```

```
[91]: plot_results('GDP_ffill')
```



```
[92]: df_melt['GDP_bfill'] = df_melt.sort_values('year').groupby('Country_
↳Name')['GDP'].fillna(method='bfill')
```

```
[93]: plot_results('GDP_bfill')
```



```
[94]: df_melt['GDP_ff_bf'] = df_melt.sort_values('year').groupby('Country_
↳ Name')['GDP'].fillna(method='ffill').fillna(method='bfill')
```

```
df_melt
```

```
[94]:
```

	Country Name	Country Code	Indicator Name	Indicator Code	\
0	Aruba	ABW	GDP (current US\$)	NY.GDP.MKTP.CD	
1	Afghanistan	AFG	GDP (current US\$)	NY.GDP.MKTP.CD	
2	Angola	AGO	GDP (current US\$)	NY.GDP.MKTP.CD	
3	Albania	ALB	GDP (current US\$)	NY.GDP.MKTP.CD	
4	Andorra	AND	GDP (current US\$)	NY.GDP.MKTP.CD	
...	
15307	Kosovo	XKX	GDP (current US\$)	NY.GDP.MKTP.CD	
15308	Yemen, Rep.	YEM	GDP (current US\$)	NY.GDP.MKTP.CD	
15309	South Africa	ZAF	GDP (current US\$)	NY.GDP.MKTP.CD	
15310	Zambia	ZMB	GDP (current US\$)	NY.GDP.MKTP.CD	
15311	Zimbabwe	ZWE	GDP (current US\$)	NY.GDP.MKTP.CD	

	year	GDP	GDP_filled	GDP_ffill	GDP_bfill	\
0	1960-01-01	NaN	2.036355e+09	NaN	1.330168e+09	
1	1960-01-01	5.377778e+08	5.377778e+08	5.377778e+08	5.377778e+08	
2	1960-01-01	NaN	3.847557e+10	NaN	5.934074e+09	
3	1960-01-01	NaN	6.220172e+09	NaN	1.924242e+09	
4	1960-01-01	NaN	1.501056e+09	NaN	7.861921e+07	
...	
15307	2017-01-01	7.128691e+09	7.128691e+09	7.128691e+09	7.128691e+09	
15308	2017-01-01	NaN	1.701070e+10	1.821333e+10	NaN	
15309	2017-01-01	3.494193e+11	3.494193e+11	3.494193e+11	3.494193e+11	
15310	2017-01-01	2.580867e+10	2.580867e+10	2.580867e+10	2.580867e+10	
15311	2017-01-01	1.784582e+10	1.784582e+10	1.784582e+10	1.784582e+10	

	GDP_ff_bf
0	1.916242e+09
1	5.377778e+08
2	1.857319e+10
3	1.857319e+10
4	1.857319e+10
...	...
15307	7.128691e+09
15308	1.821333e+10
15309	3.494193e+11
15310	2.580867e+10
15311	1.784582e+10

[15312 rows x 10 columns]

Duplicate Data

A data set might have duplicate data: in other words, the same record is represented multiple times. Sometimes, it's easy to find and eliminate duplicate data like when two records are exactly the same duplicate data is hard to spot.

From the World Bank GDP data, count the number of countries that have had a project totalamt greater than 1 billion dollars (1,000,000,000). To get the count, you'll have to remove duplicate data rows.

```
[95]: df_projects_data['totalamt'] = df_projects_data['totalamt'].astype(str).str.\
      ↪replace(',', '')

df_projects_data['totalamt'] = pd.to_numeric(df_projects_data['totalamt'],\
      ↪errors='coerce')

df_projects_data['countryname'] = df_projects_data['countryname'].str.split(';'\
      ↪', expand=True)[0]
```

```
df_projects_data['boardapprovaldate'] = pd.
↳to_datetime(df_projects_data['boardapprovaldate'])
```

```
[100]: df_projects_data[df_projects_data['totalamt'] > 1000000000]['countryname'].
↳nunique()
```

```
[100]: 17
```

```
[101]: df_projects_data['totalamt']
```

```
[101]: 0          0
1      200000000
2      58330000
3      20000000
4      100000000
...
18243   13500000
18244   12000000
18245   40000000
18246   195000000
18247   250000000
Name: totalamt, Length: 18248, dtype: int64
```

Dummy Variables In this exercise, I'll create dummy variables from the projects data set. The idea is to transform categorical data like this:

Project ID Project Category 0 Energy 1 Transportation 2 Health 3 Employment

The reasoning behind these transformations is that machine learning algorithms read in numbers not text. Text needs to be converted into numbers. You could assign a number to each category like 1, 2, 3, and 4. But a categorical variable has no inherent order, so you want to reflect this in your features.

Pandas makes it very easy to create dummy variables with the `get_dummies` method. In this exercise, you'll create dummy variables from the World Bank projects data; however, there's a caveat. The World Bank data is not particularly clean, so you'll need to explore and wrangle the data first.

```
[102]: sector = df_projects_data.copy()
sector = sector[['project_name', 'lendinginstr', 'sector1', 'sector2', '
↳sector3', 'sector4', 'sector5', 'sector',
        'mjsector1', 'mjsector2', 'mjsector3', 'mjsector4', 'mjsector5',
        'mjsector', 'theme1', 'theme2', 'theme3', 'theme4', 'theme5', 'theme
↳',
        'goal', 'financier', 'mjtheme1name', 'mjtheme2name', 'mjtheme3name',
        'mjtheme4name', 'mjtheme5name']]
```

```
[103]: sector
```

```

[103]:
0      Creating a Trade in Value-Added Database for ...
1      Productive Inclusion Project
2      Additional Financing for Health Sector Support...
3      Public-Private Partnerships and Public Investm...
4      Nigeria For Women Project
...
18243      Power and Irrigation Project
18244      Steel Mill and Railway Project
18245      Post War Reconstruction Project
18246      Post-war Reconstruction Project
18247      Reconstruction Project

      lendinginstr
0      Investment Project Financing
1      Investment Project Financing
2      Investment Project Financing
3      Investment Project Financing
4      Investment Project Financing
...
18243      Specific Investment Loan
18244      Structural Adjustment Loan
18245      Structural Adjustment Loan
18246      Structural Adjustment Loan
18247      Structural Adjustment Loan

      sector1 \
0      Investment Project Financing
1      Investment Project Financing
2      Investment Project Financing
3      Investment Project Financing
4      Investment Project Financing
...
18243      Specific Investment Loan
18244      Structural Adjustment Loan
18245      Structural Adjustment Loan
18246      Structural Adjustment Loan
18247      Structural Adjustment Loan

      sector2 \
0      NaN
1      NaN
2      NaN
3      NaN
4      Other Industry; Trade and Services
...
18243      NaN
18244      NaN
18245      NaN
18246      NaN
18247      NaN

      sector3 \
0      NaN
1      NaN
2      NaN
3      NaN
4      Other Agriculture; Fishing and Forestry
...
18243      NaN

```

18244	NaN
18245	NaN
18246	NaN
18247	NaN

	sector4	sector5	\
0	NaN	NaN	
1	NaN	NaN	
2	NaN	NaN	
3	NaN	NaN	
4	Other Public Administration!\$!10!\$!BZ	NaN	
...	
18243	NaN	NaN	
18244	NaN	NaN	
18245	NaN	NaN	
18246	NaN	NaN	
18247	NaN	NaN	

	sector	mjsector1	mjsector2	\
0	NaN	NaN	NaN	
1	NaN	NaN	NaN	
2	NaN	NaN	NaN	
3	NaN	NaN	NaN	
4	Social Protection;Social Protection;Other Indu...	NaN	NaN	
...	
18243	(Historic)Hydro;(Historic)Hydro	NaN	NaN	
18244	(Historic)Economic management;(Historic)Econom...	NaN	NaN	
18245	(Historic)Economic management;(Historic)Econom...	NaN	NaN	
18246	(Historic)Economic management;(Historic)Econom...	NaN	NaN	
18247	(Historic)Economic management;(Historic)Econom...	NaN	NaN	

	...	theme4	theme5	theme	goal	financier	mjtheme1name	mjtheme2name	\
0	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
1	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
2	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
3	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
4	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
...	
18243	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
18244	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
18245	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
18246	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
18247	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	

	mjtheme3name	mjtheme4name	mjtheme5name
0	NaN	NaN	NaN
1	NaN	NaN	NaN

2	NaN	NaN	NaN
3	NaN	NaN	NaN
4	NaN	NaN	NaN
...
18243	NaN	NaN	NaN
18244	NaN	NaN	NaN
18245	NaN	NaN	NaN
18246	NaN	NaN	NaN
18247	NaN	NaN	NaN

[18248 rows x 27 columns]

```
[104]: 100 * sector.isnull().sum() / sector.shape[0]
```

```
[104]: project_name      0.000000
lendinginstr    1.348093
sector1         0.000000
sector2        47.791539
sector3        64.450899
sector4        76.019290
sector5        85.132617
sector          3.496274
mjsector1      100.000000
mjsector2      100.000000
mjsector3      100.000000
mjsector4      100.000000
mjsector5      100.000000
mjsector        3.496274
theme1          0.000000
theme2         46.005042
theme3         58.987286
theme4         71.317405
theme5         83.954406
theme          100.000000
goal           33.510522
financier       61.310829
mjtheme1name    100.000000
mjtheme2name    100.000000
mjtheme3name    100.000000
mjtheme4name    100.000000
mjtheme5name    100.000000
dtype: float64
```

```
[105]: uniquesectors1 = sector['sector1'].sort_values().unique()
uniquesectors1
```

```
[105]: array(['!$!0', '(Historic)Agency reform!$!50!$!AG',
          '(Historic)Agricultural credit!$!100!$!AC', ...,
          'Workforce Development and Vocational Education!$!96!$!EW',
          'Workforce Development and Vocational Education!$!98!$!EW',
          'Workforce Development and Vocational Education!$!99!$!EW'],
         dtype=object)
```

```
[106]: print('Number of unique values in sector1:', len(uniquesectors1))
```

Number of unique values in sector1: 3060

```
[107]: import numpy as np

sector['sector1'] = sector['sector1'].replace('!$!0', np.nan)

sector['sector1'] = sector['sector1'].replace('!'+, '', regex=True)

sector['sector1'] = sector['sector1'].replace('^(\(Historic\))', '', regex=True)

print('Number of unique sectors after cleaning:', len(list(sector['sector1'].
    ↪unique()))))
print('Percentage of null values after cleaning:', 100 * sector['sector1'].
    ↪isnull().sum() / sector['sector1'].shape[0])
```

Number of unique sectors after cleaning: 156

Percentage of null values after cleaning: 3.4962735642262164

```
[108]: sector['sector1'].unique()
```

```
[108]: array([nan, 'Social Protection', 'Urban Transport',
          'Other Public Administration',
          'Workforce Development and Vocational Education',
          'Energy Transmission and Distribution', 'Renewable Energy Solar',
          'Other Industry; Trade and Services', 'Health', 'Water Supply',
          'Primary Education',
          'Other Water Supply; Sanitation and Waste Management',
          'Public Administration - Energy and Extractives',
          'Central Government (Central Agencies)', 'ICT Services',
          'Rural and Inter-Urban Roads', 'Public Administration - Education',
          'Sub-National Government', 'Other Education',
          'Other Transportation', 'Renewable Energy Hydro',
          'Public Administration - Agriculture; Fishing & Forestry',
          'Public Administration - Transportation', 'Oil and Gas',
          'Other Non-bank Financial Institutions', 'Ports/Waterways',
          'Public Administration - Financial Sector', 'Mining',
          'Public Administration - Social Protection',
```

'Agricultural Extension; Research; and Other Support Activities',
 'Tertiary Education', 'Secondary Education', 'Crops',
 'Housing Construction', 'Livestock',
 'Public Administration - Industry; Trade and Services',
 'Other Information and Communications Technologies',
 'Renewable Energy Biomass', 'Early Childhood Education',
 'Manufacturing', 'Public Administration - Health',
 'ICT Infrastructure', 'Other Agriculture; Fishing and Forestry',
 'Agricultural markets; commercialization and agri-business',
 'Renewable Energy Wind', 'Forestry', 'Fisheries',
 'Banking Institutions', 'Irrigation and Drainage', 'Trade',
 'Non-Renewable Energy Generation',
 'Adult; Basic and Continuing Education', 'Railways',
 'Other Energy and Extractives', 'Aviation', 'Tourism',
 'Waste Management',
 'Public Administration - Water; Sanitation and Waste Management',
 'Sanitation', 'Insurance and Pension',
 'Health Facilities and Construction', 'Capital Markets',
 'Renewable Energy Geothermal', 'Law and Justice',
 'Public Administration - Information and Communications Technologies',
 'Power', 'Roads and highways', 'Renewable energy',
 'Micro- and SME finance', 'Agro-industry', 'Media', 'Sewerage',
 'Distribution and transmission', 'Research',
 'Natural resources management', 'Other agriculture',
 'Macro/non-trade', 'Postal services', 'Other finance',
 'Other public sector management', 'Public financial management',
 'Energy efficiency in Heat and Power', 'Other environment',
 'Pollution control / waste management', 'Other social services',
 'Other industry', 'Housing construction', 'Vocational training',
 'Telecommunications', 'Petrochemicals and fertilizers',
 'Animal production', 'Economic management', 'Housing finance',
 'Thermal', 'Telecommunications and informatics',
 'Refining; storage and distribution', 'Financial adjustment',
 'General finance sector', 'Public sector management adjustment',
 'Other transportation', 'Urban water supply', 'Urban management',
 'Industrial adjustment', 'Agricultural credit',
 'Agriculture adjustment', 'Industrial restructuring',
 'Business environment',
 'Compulsory pension and unemployment insurance',
 'Transportation adjustment', 'Highways',
 'Mining and other extractive', 'Oil and gas adjustment',
 'Small scale enterprise', 'Education adjustment',
 'Electric power and other energy adjustment', 'Urban housing',
 'Financial sector development', 'Trade policy reform',
 'Oil and gas exploration and development', 'Non-sector specific',
 'Other education', 'Urban development adjustment',
 'Other power and energy conversion', 'Targeted health',

```

'Public enterprise reform', 'Hydro',
'Fertilizer and other chemicals', 'Agro-industry and marketing',
'Perennial crops', 'Flood protection', 'Urban transport',
'Rural roads', 'Other population; health and nutrition',
'Institutional Development', 'Agricultural extension',
'Basic health', 'Annual crops',
'Other water supply and sanitation', 'Other urban development',
'Urban environment', 'Pre-investment / portfolio development',
'Oil and gas transportation', 'Rural water supply and sanitation',
'Water supply and sanitation adjustment', 'Other fuels',
'Environmental institutions', 'Other social protection',
'Civil service reform', 'Privatization',
'Pensions and social insurance', 'Social protection adjustment',
'Agency reform', 'Environment adjustment',
'Population; health and nutrition adjustment', 'Decentralization',
'HIV/AIDS'], dtype=object)

```

```

[109]: dummies = pd.DataFrame(pd.get_dummies(sector['sector1']))

df_projects_data['year'] = df_projects_data['boardapprovaldate'].dt.year
df = df_projects_data[['totalamt', 'year']]
df_final = pd.concat([df, dummies], axis=1)

df_final

```

```

[109]:
   totalamt  year  Adult; Basic and Continuing Education \
0          0  2018.0                                     0
1    200000000  2018.0                                     0
2     58330000  2018.0                                     0
3     20000000  2018.0                                     0
4    100000000  2018.0                                     0
...         ...   ...                                     ...
18243  13500000  1948.0                                     0
18244  12000000  1947.0                                     0
18245  40000000  1947.0                                     0
18246  19500000  1947.0                                     0
18247  25000000  1947.0                                     0

   Agency reform \
0                0
1                0
2                0
3                0
4                0
...         ...
18243            0
18244            0

```

18245	0
18246	0
18247	0

Agricultural Extension; Research; and Other Support Activities \	
0	0
1	0
2	0
3	0
4	0
...	...
18243	0
18244	0
18245	0
18246	0
18247	0

Agricultural credit	Agricultural extension \
0	0
1	0
2	0
3	0
4	0
...	...
18243	0
18244	0
18245	0
18246	0
18247	0

Agricultural markets; commercialization and agri-business \	
0	0
1	0
2	0
3	0
4	0
...	...
18243	0
18244	0
18245	0
18246	0
18247	0

Agriculture adjustment	Agro-industry	...	Urban environment \
0	0	0	0
1	0	0	0
2	0	0	0

3	0	0	...	0
4	0	0	...	0
...
18243	0	0	...	0
18244	0	0	...	0
18245	0	0	...	0
18246	0	0	...	0
18247	0	0	...	0

	Urban housing	Urban management	Urban transport	Urban water supply	\
0	0	0	0	0	
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
...	
18243	0	0	0	0	
18244	0	0	0	0	
18245	0	0	0	0	
18246	0	0	0	0	
18247	0	0	0	0	

	Vocational training	Waste Management	Water Supply	\
0	0	0	0	
1	0	0	0	
2	0	0	0	
3	0	0	0	
4	0	0	0	
...	
18243	0	0	0	
18244	0	0	0	
18245	0	0	0	
18246	0	0	0	
18247	0	0	0	

	Water supply and sanitation adjustment	\
0	0	
1	0	
2	0	
3	0	
4	0	
...	...	
18243	0	
18244	0	
18245	0	
18246	0	
18247	0	

	Workforce Development and Vocational Education
0	0
1	0
2	0
3	0
4	0
...	...
18243	0
18244	0
18245	0
18246	0
18247	0

[18248 rows x 157 columns]

[110]: dummies

	Adult; Basic and Continuing Education	Agency reform \
0	0	0
1	0	0
2	0	0
3	0	0
4	0	0
...
18243	0	0
18244	0	0
18245	0	0
18246	0	0
18247	0	0

	Agricultural Extension; Research; and Other Support Activities \
0	0
1	0
2	0
3	0
4	0
...	...
18243	0
18244	0
18245	0
18246	0
18247	0

	Agricultural credit	Agricultural extension \
0	0	0
1	0	0

2	0	0
3	0	0
4	0	0
...
18243	0	0
18244	0	0
18245	0	0
18246	0	0
18247	0	0

	Agricultural markets; commercialization and agri-business \
0	0
1	0
2	0
3	0
4	0
...	...
18243	0
18244	0
18245	0
18246	0
18247	0

	Agriculture adjustment	Agro-industry	Agro-industry and marketing \
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
...
18243	0	0	0
18244	0	0	0
18245	0	0	0
18246	0	0	0
18247	0	0	0

	Animal production	...	Urban environment	Urban housing \
0	0	...	0	0
1	0	...	0	0
2	0	...	0	0
3	0	...	0	0
4	0	...	0	0
...
18243	0	...	0	0
18244	0	...	0	0
18245	0	...	0	0
18246	0	...	0	0

18247	0	...	0	0
-------	---	-----	---	---

	Urban management	Urban transport	Urban water supply	\
0	0	0	0	
1	0	0	0	
2	0	0	0	
3	0	0	0	
4	0	0	0	
...	
18243	0	0	0	
18244	0	0	0	
18245	0	0	0	
18246	0	0	0	
18247	0	0	0	

	Vocational training	Waste Management	Water Supply	\
0	0	0	0	
1	0	0	0	
2	0	0	0	
3	0	0	0	
4	0	0	0	
...	
18243	0	0	0	
18244	0	0	0	
18245	0	0	0	
18246	0	0	0	
18247	0	0	0	

	Water supply and sanitation adjustment	\
0	0	
1	0	
2	0	
3	0	
4	0	
...	...	
18243	0	
18244	0	
18245	0	
18246	0	
18247	0	

	Workforce Development and Vocational Education
0	0
1	0
2	0
3	0
4	0

```
...
18243
18244
18245
18246
18247
```

```
[18248 rows x 155 columns]
```

```
[111]: gdp = pd.read_csv("D:\etl\gdp_data.csv", skiprows=4)
gdp.drop(['Unnamed: 62', 'Country Code', 'Indicator Name', 'Indicator Code'],
         inplace=True, axis=1)
population = pd.read_csv("D:\etl\population_data.csv", skiprows=4)
population.drop(['Unnamed: 62', 'Country Code', 'Indicator Name', 'Indicator_
               ↪Code'], inplace=True, axis=1)
```

```
[112]: gdp_melt = gdp.melt(id_vars=['Country Name'],
                           var_name='year',
                           value_name='gdp')

gdp_melt['gdp'] = gdp_melt.sort_values('year').groupby('Country Name')['gdp'].
               ↪fillna(method='ffill').fillna(method='bfill')

population_melt = population.melt(id_vars=['Country Name'],
                                  var_name='year',
                                  value_name='population')

population_melt['population'] = population_melt.sort_values('year').
               ↪groupby('Country Name')['population'].fillna(method='ffill').
               ↪fillna(method='bfill')

df_country = gdp_melt.merge(population_melt, on=('Country Name', 'year'))

df_2016 = df_country[df_country['year'] == '2016']
```

```
[113]: df_2016.head(10)
```

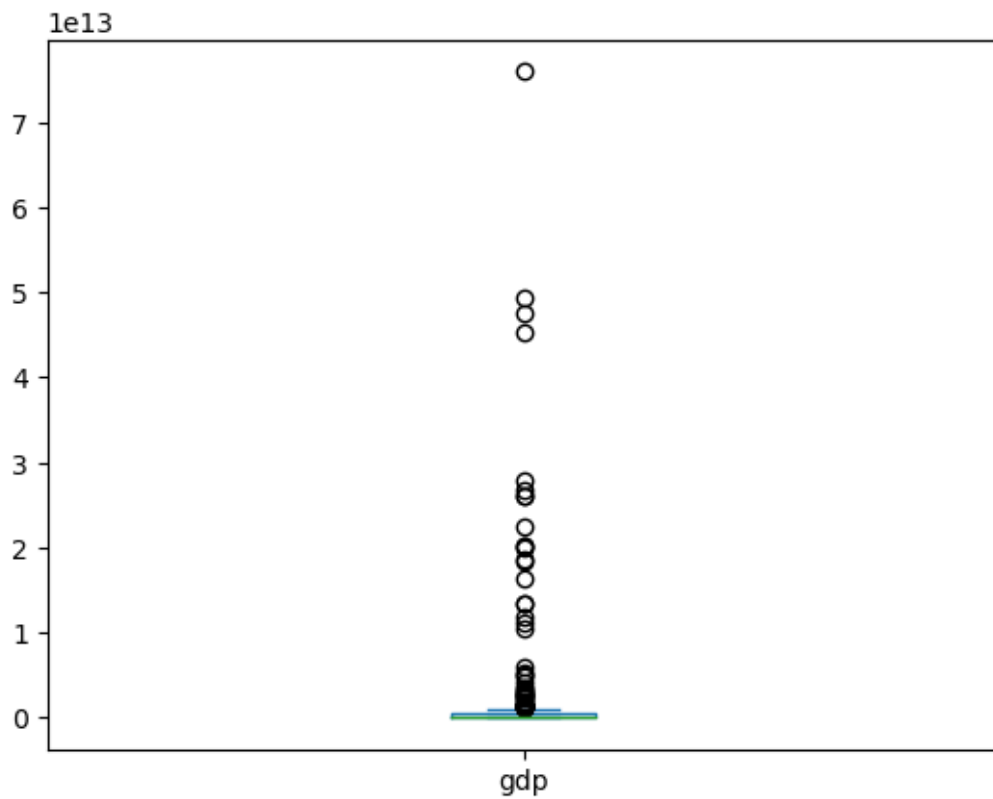
```
[113]:
```

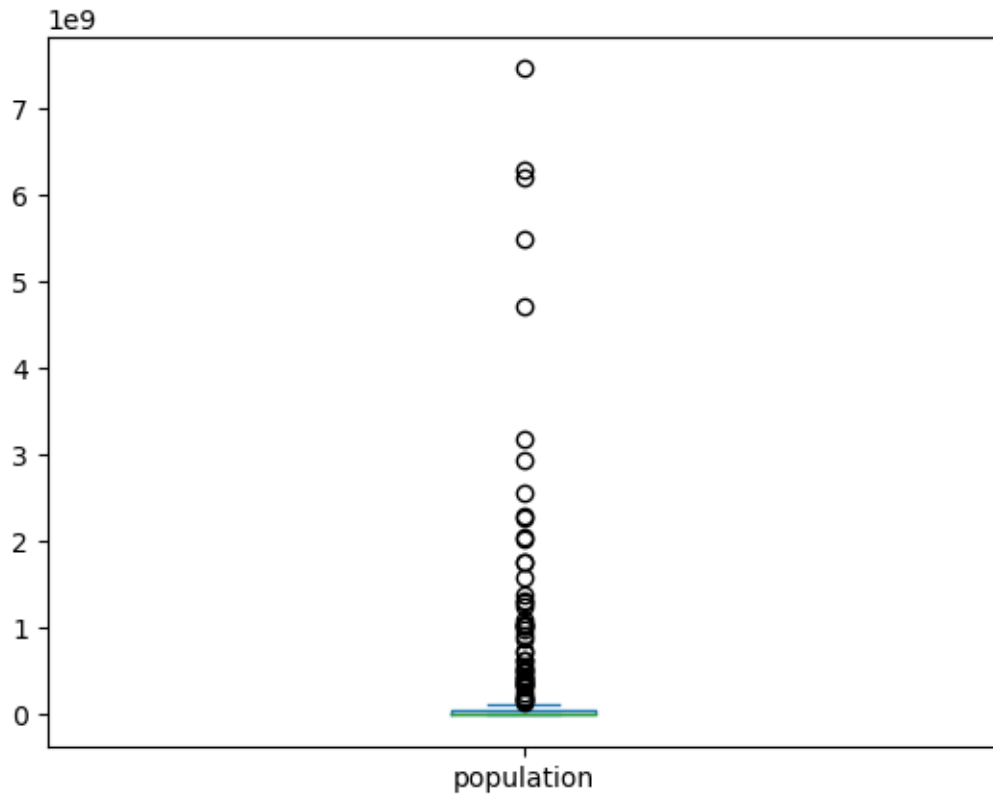
	Country Name	year	gdp	population
14784	Aruba	2016	2.584464e+09	104822.0
14785	Afghanistan	2016	1.946902e+10	34656032.0
14786	Angola	2016	9.533720e+10	28813463.0
14787	Albania	2016	1.188368e+10	2876101.0
14788	Andorra	2016	2.877312e+09	77281.0
14789	Arab World	2016	2.500164e+12	406452690.0

14790	United Arab Emirates	2016	3.570451e+11	9269612.0
14791	Argentina	2016	5.548609e+11	43847430.0
14792	Armenia	2016	1.054614e+10	2924816.0
14793	American Samoa	2016	6.580000e+08	55599.0

```
[114]: import matplotlib.pyplot as plt
```

```
df_2016.plot('population',kind='box')
df_2016.plot('gdp',kind='box')
plt.show()
```





```
[115]: population_2016=df_2016[['Country Name','population']]

Q1=population_2016['population'].quantile(0.25)

Q3=population_2016['population'].quantile(0.75)

IQR=Q3 - Q1

max_value = Q3 + 1.5 * IQR
min_value = Q1 - 1.5 * IQR

population_outliers = population_2016[(population_2016['population'] >
    ↪max_value) | (population_2016['population'] < min_value)]
population_outliers
```

```
[115]:
```

	Country Name	population
14789	Arab World	4.064527e+08
14802	Bangladesh	1.629516e+08

14811	Brazil	2.076529e+08
14822	China	1.378665e+09
14843	East Asia & Pacific (excluding high income)	2.053299e+09
14844	Early-demographic dividend	3.170658e+09
14845	East Asia & Pacific	2.298727e+09
14846	Europe & Central Asia (excluding high income)	4.132349e+08
14847	Europe & Central Asia	9.116863e+08
14850	Euro area	3.406174e+08
14855	European Union	5.112190e+08
14856	Fragile and conflict affected situations	4.995085e+08
14877	High income	1.242138e+09
14880	Heavily indebted poor countries (HIPC)	7.446030e+08
14884	IBRD only	4.699232e+09
14885	IDA & IBRD total	6.273585e+09
14886	IDA total	1.574353e+09
14887	IDA blend	5.211590e+08
14888	Indonesia	2.611155e+08
14889	IDA only	1.053194e+09
14891	India	1.324171e+09
14910	Latin America & Caribbean (excluding high income)	5.622548e+08
14916	Latin America & Caribbean	6.376639e+08
14917	Least developed countries: UN classification	9.793879e+08
14918	Low income	7.140223e+08
14921	Lower middle income	2.931076e+09
14922	Low & middle income	6.202020e+09
14924	Late-demographic dividend	2.264569e+09
14935	Middle East & North Africa	4.367380e+08
14938	Middle income	5.487997e+09
14943	Middle East & North Africa (excluding high inc...	3.737191e+08
14952	North America	3.597359e+08
14956	Nigeria	1.859896e+08
14963	OECD members	1.289987e+09
14966	Pakistan	1.932035e+08
14973	Pre-demographic dividend	8.792925e+08
14980	Post-demographic dividend	1.102779e+09
14984	Russian Federation	1.443424e+08
14986	South Asia	1.766394e+09
14997	Sub-Saharan Africa (excluding high income)	1.033118e+09
14999	Sub-Saharan Africa	1.033213e+09
15012	East Asia & Pacific (IDA & IBRD countries)	2.027896e+09
15013	Europe & Central Asia (IDA & IBRD countries)	4.553794e+08
15018	Latin America & the Caribbean (IDA & IBRD coun...	6.215349e+08
15020	Middle East & North Africa (IDA & IBRD countries)	3.691675e+08
15022	South Asia (IDA & IBRD)	1.766394e+09
15023	Sub-Saharan Africa (IDA & IBRD countries)	1.033213e+09
15031	Upper middle income	2.556922e+09
15033	United States	3.234059e+08

```

[116]: non_countries = ['World',
    'High income',
    'OECD members',
    'Post-demographic dividend',
    'IDA & IBRD total',
    'Low & middle income',
    'Middle income',
    'IBRD only',
    'East Asia & Pacific',
    'Europe & Central Asia',
    'North America',
    'Upper middle income',
    'Late-demographic dividend',
    'European Union',
    'East Asia & Pacific (excluding high income)',
    'East Asia & Pacific (IDA & IBRD countries)',
    'Euro area',
    'Early-demographic dividend',
    'Lower middle income',
    'Latin America & Caribbean',
    'Latin America & the Caribbean (IDA & IBRD countries)',
    'Latin America & Caribbean (excluding high income)',
    'Europe & Central Asia (IDA & IBRD countries)',
    'Middle East & North Africa',
    'Europe & Central Asia (excluding high income)',
    'South Asia (IDA & IBRD)',
    'South Asia',
    'Arab World',
    'IDA total',
    'Sub-Saharan Africa',
    'Sub-Saharan Africa (IDA & IBRD countries)',
    'Sub-Saharan Africa (excluding high income)',
    'Middle East & North Africa (excluding high income)',
    'Middle East & North Africa (IDA & IBRD countries)',
    'Central Europe and the Baltics',
    'Pre-demographic dividend',
    'IDA only',
    'Least developed countries: UN classification',
    'IDA blend',
    'Fragile and conflict affected situations',
    'Heavily indebted poor countries (HIPC)',
    'Low income',
    'Small states',
    'Other small states',
    'Caribbean small states',

```

```
'Pacific island small states']
```

```
df_2016 = df_2016[~df_2016['Country Name'].isin(non_countries)]
```

```
[117]: population_2016=df_2016[['Country Name','population']]
```

```
Q1=population_2016['population'].quantile(0.25)
```

```
Q3=population_2016['population'].quantile(0.75)
```

```
IQR=Q3 - Q1
```

```
max_value=Q3 + 1.5 * IQR
```

```
min_value=Q1 - 1.5 * IQR
```

```
population_outliers = population_2016[(population_2016['population'] >_  
↳max_value) | (population_2016['population'] < min_value)]  
population_outliers
```

```
[117]:
```

	Country Name	population
14802	Bangladesh	1.629516e+08
14811	Brazil	2.076529e+08
14822	China	1.378665e+09
14825	Congo, Dem. Rep.	7.873615e+07
14837	Germany	8.234867e+07
14849	Egypt, Arab Rep.	9.568868e+07
14854	Ethiopia	1.024032e+08
14859	France	6.685977e+07
14863	United Kingdom	6.559556e+07
14888	Indonesia	2.611155e+08
14891	India	1.324171e+09
14894	Iran, Islamic Rep.	8.027743e+07
14898	Italy	6.062750e+07
14901	Japan	1.269945e+08
14936	Mexico	1.275404e+08
14956	Nigeria	1.859896e+08
14966	Pakistan	1.932035e+08
14969	Philippines	1.033202e+08
14984	Russian Federation	1.443424e+08
15015	Thailand	6.886351e+07
15026	Turkey	7.951243e+07
15033	United States	3.234059e+08
15039	Vietnam	9.456907e+07
15045	South Africa	5.601547e+07

```
[118]: gdp_2016=df_2016[['Country Name','gdp']]

Q1=gdp_2016['gdp'].quantile(0.25)

Q3=gdp_2016['gdp'].quantile(0.75)

IQR=Q3 - Q1

max_value=Q3 + 1.5 * IQR
min_value=Q1 - 1.5 * IQR

gdp_outliers=gdp_2016[(gdp_2016['gdp'] > max_value) | (gdp_2016['gdp'] <
↪min_value)]
gdp_outliers
```

```
[118]:
```

	Country Name	gdp
14791	Argentina	5.548609e+11
14795	Australia	1.208039e+12
14799	Belgium	4.675455e+11
14811	Brazil	1.793989e+12
14817	Canada	1.535768e+12
14819	Switzerland	6.687453e+11
14822	China	1.119099e+13
14837	Germany	3.477796e+12
14852	Spain	1.237255e+12
14859	France	2.465134e+12
14863	United Kingdom	2.650850e+12
14888	Indonesia	9.322565e+11
14891	India	2.274230e+12
14894	Iran, Islamic Rep.	4.189767e+11
14898	Italy	1.859384e+12
14901	Japan	4.949273e+12
14908	Korea, Rep.	1.414804e+12
14936	Mexico	1.076912e+12
14958	Netherlands	7.772275e+11
14972	Poland	4.714003e+11
14984	Russian Federation	1.284728e+12
14987	Saudi Arabia	6.449355e+11
15005	Sweden	5.144600e+11
15026	Turkey	8.637216e+11
15033	United States	1.862448e+13
15036	Venezuela, RB	4.823593e+11

```
[119]: list(set(population_outliers['Country Name']).
↪intersection(gdp_outliers['Country Name']))
```



```
[119]: ['Iran, Islamic Rep.',  
        'Mexico',  
        'Brazil',  
        'India',  
        'United States',  
        'France',  
        'Italy',  
        'Germany',  
        'Russian Federation',  
        'Japan',  
        'United Kingdom',  
        'Turkey',  
        'Indonesia',  
        'China']
```

```
[120]: list(set(population_outliers['Country Name']) - set(gdp_outliers['Country_  
        ↪Name'])))
```

```
[120]: ['Ethiopia',  
        'Nigeria',  
        'Bangladesh',  
        'Vietnam',  
        'Egypt, Arab Rep.',  
        'Philippines',  
        'South Africa',  
        'Congo, Dem. Rep.',  
        'Thailand',  
        'Pakistan']
```

```
[121]: list(set(gdp_outliers['Country Name']) - set(population_outliers['Country_  
        ↪Name'])))
```

```
[121]: ['Canada',  
        'Australia',  
        'Saudi Arabia',  
        'Argentina',  
        'Korea, Rep.',  
        'Venezuela, RB',  
        'Poland',  
        'Belgium',  
        'Netherlands',  
        'Spain',  
        'Sweden',  
        'Switzerland']
```

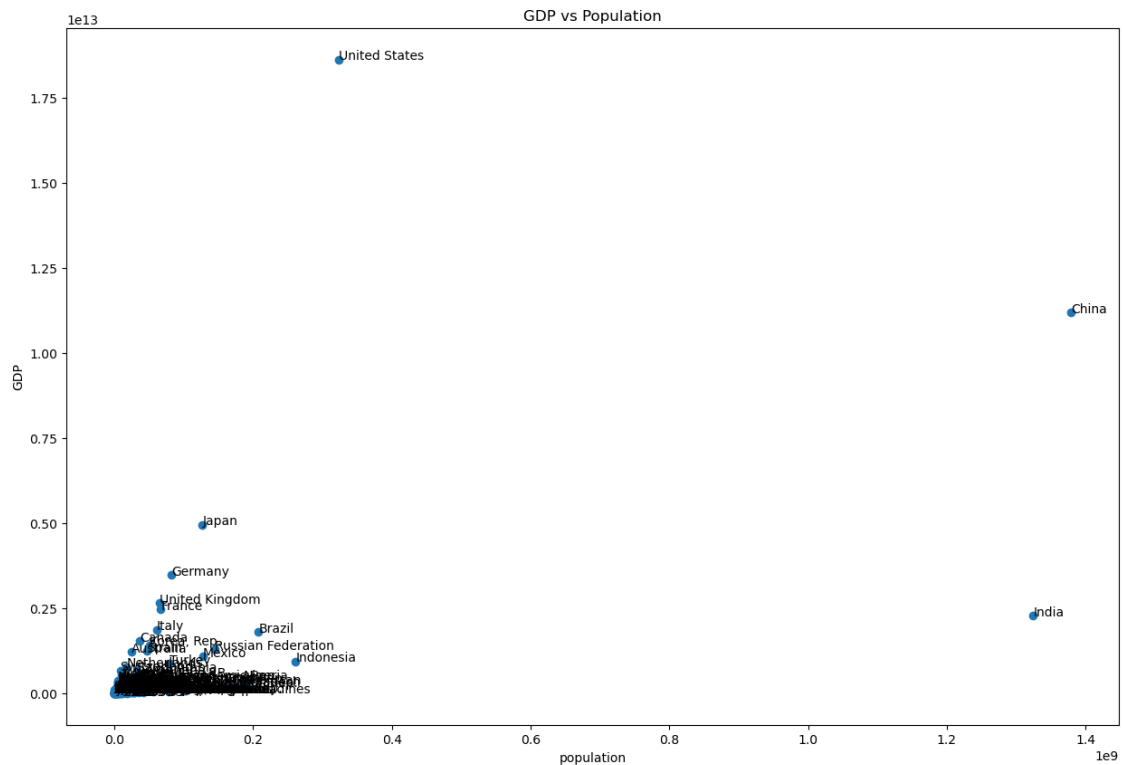
```
[122]: x = list(df_2016['population'])  
        y = list(df_2016['gdp'])
```

```

text = df_2016['Country Name']

fig, ax = plt.subplots(figsize=(15,10))
ax.scatter(x, y)
plt.title('GDP vs Population')
plt.xlabel('population')
plt.ylabel('GDP')
for i, txt in enumerate(text):
    ax.annotate(txt, (x[i],y[i]))

```



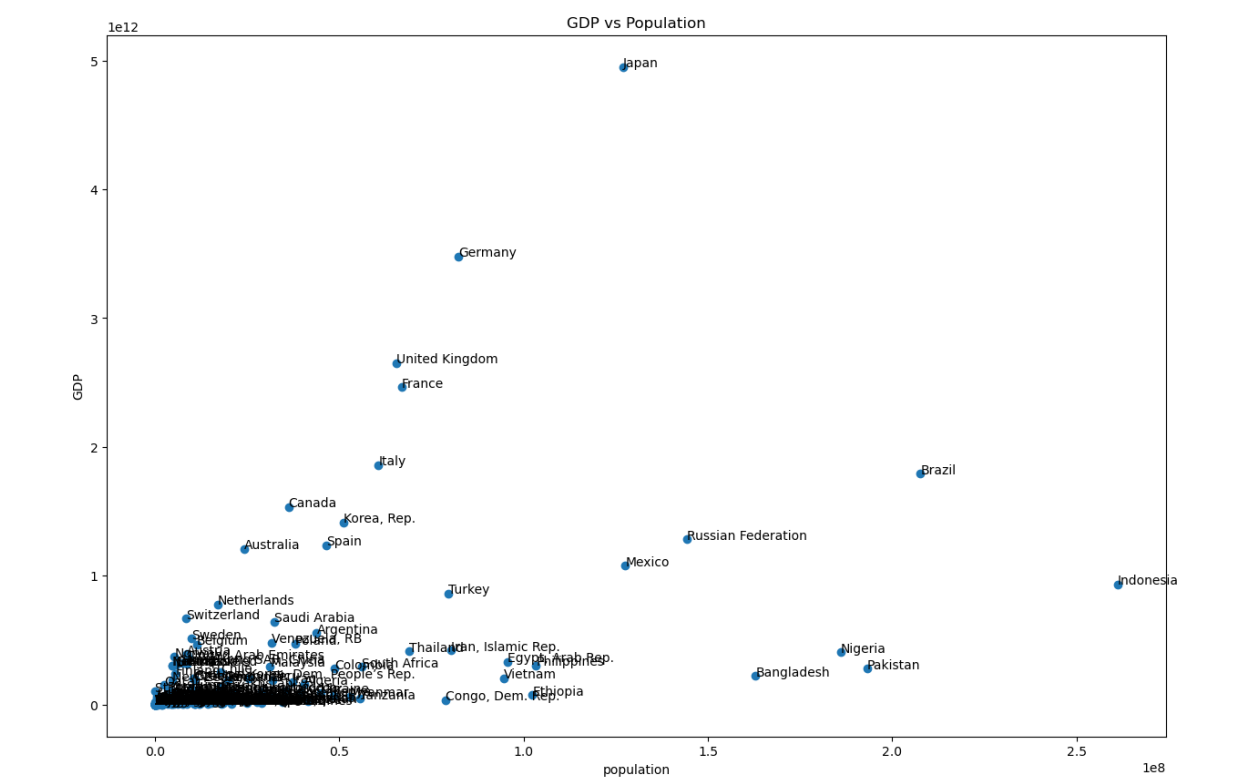
```

[123]: df_no_large = (df_2016['Country Name'] != 'United States') & (df_2016['Country_
↵Name'] != 'India') & (df_2016['Country Name'] != 'China')
x = list(df_2016[df_no_large]['population'])
y = list(df_2016[df_no_large]['gdp'])
text = df_2016[df_no_large]['Country Name']

fig, ax = plt.subplots(figsize=(15,10))
ax.scatter(x, y)
plt.title('GDP vs Population')
plt.xlabel('population')
plt.ylabel('GDP')
for i, txt in enumerate(text):

```

```
ax.annotate(txt, (x[i],y[i]))
```



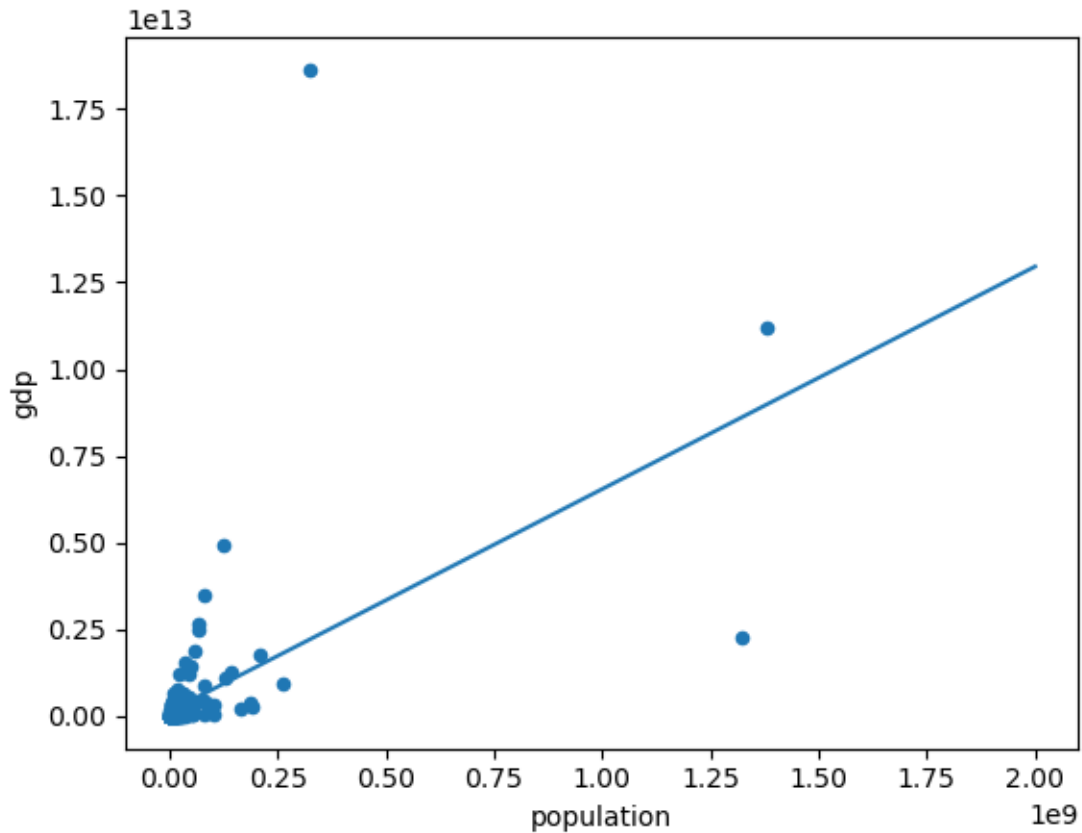
```
from sklearn.linear_model import LinearRegression

model = LinearRegression()
model.fit(df_2016['population'].values.reshape(-1, 1), df_2016['gdp'].values.
↪reshape(-1, 1))

inputs = np.linspace(1, 20000000000, num=50)
predictions = model.predict(inputs.reshape(-1,1))

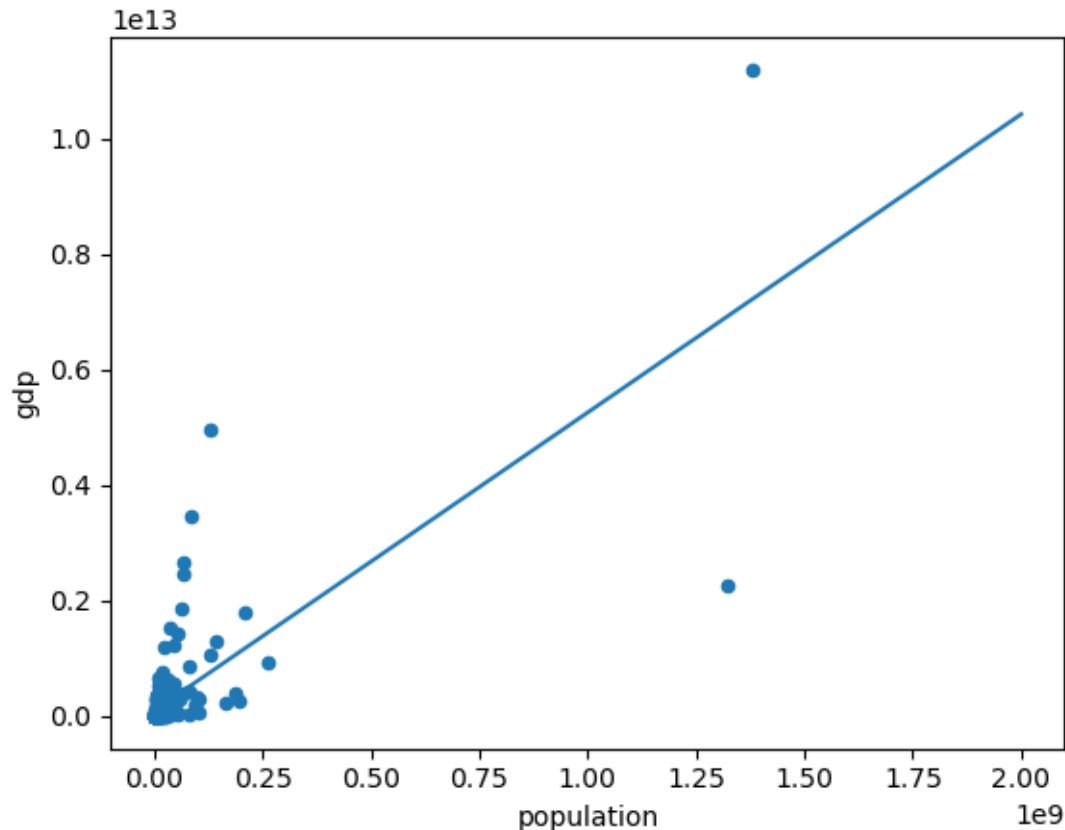
df_2016.plot('population', 'gdp', kind='scatter')
plt.plot(inputs, predictions)
```

```
[<matplotlib.lines.Line2D at 0x19b28b3f6d0>]
```



```
[125]: df_2016[df_2016['Country Name'] != 'United States'].plot('population', 'gdp',
    ↪kind='scatter')
    # plt.plot(inputs, predictions)
    model.fit(df_2016[df_2016['Country Name'] != 'United States']['population'].
    ↪values.reshape(-1, 1),
    df_2016[df_2016['Country Name'] != 'United States']['gdp'].values.
    ↪reshape(-1, 1))
    inputs = np.linspace(1, 20000000000, num=50)
    predictions = model.predict(inputs.reshape(-1,1))
    plt.plot(inputs, predictions)
```

```
[125]: [<matplotlib.lines.Line2D at 0x19b28de28d0>]
```



Notice that the code now outputs a GDP value of $5.26e+12$ when population equals $1e9$. In other words, removing the United States shifted the linear regression line down.

Data scientists sometimes have the task of creating an outlier removal model. In this exercise, you've used the Tukey rule. There are other one-dimensional models like eliminating data that is far from the mean. There are also more sophisticated models that take into account multi-dimensional data.

Eliminating Outliers

Eliminating outliers is a big topic. There are many different ways to eliminate outliers. A data engineer's job isn't necessarily to decide what counts as an outlier and what does not. A data scientist would determine that. The data engineer would code the algorithms that eliminate outliers from a data set based on any criteria that a data scientist has decided.

```
[126]: def tukey_rule(data_frame, column_name):
        data = data_frame[column_name]
        Q1 = data.quantile(0.25)
        Q3 = data.quantile(0.75)

        IQR = Q3 - Q1

        max_value = Q3 + 1.5 * IQR
```

```

min_value = Q1 - 1.5 * IQR

return data_frame[(data_frame[column_name] < max_value) &
↳ (data_frame[column_name] > min_value)]

```

```

[127]: df_outlier_removed = df_2016.copy()

for column in ['population', 'gdp']:
    df_outlier_removed = tukey_rule(df_outlier_removed, column)

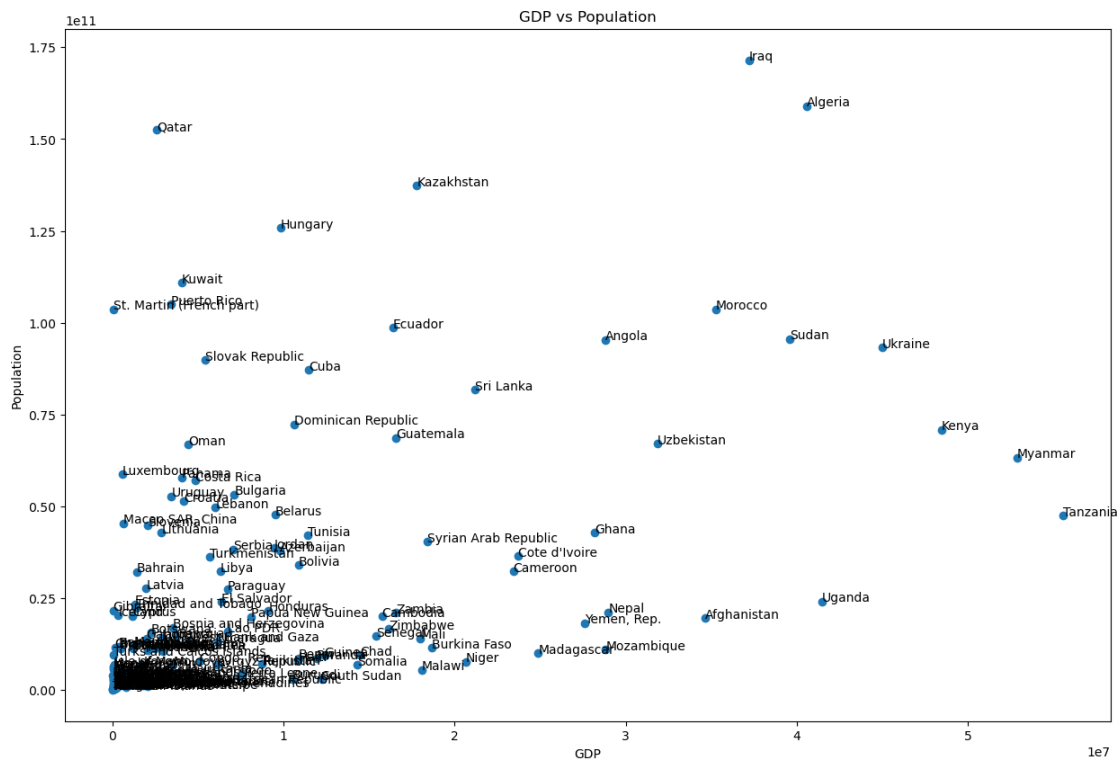
```

```

[128]: x = list(df_outlier_removed['population'])
y = list(df_outlier_removed['gdp'])
text = df_outlier_removed['Country Name']

fig, ax = plt.subplots(figsize=(15,10))
ax.scatter(x, y)
plt.title('GDP vs Population')
plt.xlabel('GDP')
plt.ylabel('Population')
for i, txt in enumerate(text):
    ax.annotate(txt, (x[i], y[i]))

```



```
[129]: def x_min_max(data):  
        minimum = min(data)  
        maximum = max(data)  
        return minimum, maximum  
  
x_min_max(df_2016['gdp'])
```

```
[129]: (36572611.8853148, 18624475000000.0)
```

```
[130]: def normalize(x, x_min, x_max):  
        # Complete this function  
        # The input is a single value  
        # The output is the normalized value  
        return (x - x_min) / (x_max - x_min)
```

```
[131]: class Normalizer():  
        def __init__(self, dataframe):  
            self.params = []  
  
            for column in dataframe.columns:  
                self.params.append(x_min_max(dataframe[column]))  
        def x_min_max(data):  
            minimum = min(data)  
            maximum = max(data)  
            return minimum, maximum  
  
        def normalize_data(self, x):  
            normalized = []  
            for i, value in enumerate(x):  
                x_max = self.params[i][1]  
                x_min = self.params[i][0]  
                normalized.append((x[i] - x_min) / (x_max - x_min))  
            return normalized
```

```
[132]: gdp_normalizer = Normalizer(df_2016[['gdp', 'population']])
```

```
[134]: gdp_normalizer.params
```

```
[134]: [(36572611.8853148, 18624475000000.0), (11097.0, 1378665000.0)]
```

```
[135]: gdp_normalizer.normalize_data([13424475000000.0, 13000000000])
```

```
[135]: [0.7207969507229194, 0.9429407193285986]
```

```
[136]: df_2016 = df_2016[~df_2016['Country Name'].isin(non_countries)]  
df_2016.reset_index(inplace=True, drop=True)
```

```
[137]: df_2016['gdppercapita'] = df_2016['gdp'] / df_2016['population']
```

```
[139]: df_2016
```

```
[139]:
```

	Country Name	year	gdp	population	gdppercapita
0	Aruba	2016	2.584464e+09	104822.0	24655.737223
1	Afghanistan	2016	1.946902e+10	34656032.0	561.778746
2	Angola	2016	9.533720e+10	28813463.0	3308.772828
3	Albania	2016	1.188368e+10	2876101.0	4131.872341
4	Andorra	2016	2.877312e+09	77281.0	37231.815671
..
213	Kosovo	2016	6.715487e+09	1816200.0	3697.548026
214	Yemen, Rep.	2016	1.821333e+10	27584213.0	660.280885
215	South Africa	2016	2.957627e+11	56015473.0	5280.017633
216	Zambia	2016	2.095475e+10	16591390.0	1262.989682
217	Zimbabwe	2016	1.661996e+10	16150362.0	1029.076649

```
[218 rows x 5 columns]
```

```
[188]: gdp = pd.read_csv("D:\etl\gdp_data.csv", skiprows=4)
gdp.drop(['Unnamed: 62', 'Indicator Name', 'Indicator Code'], inplace=True,
         axis=1)
population = pd.read_csv("D:\etl\population_data.csv", skiprows=4)
population.drop(['Unnamed: 62', 'Indicator Name', 'Indicator Code'],
               inplace=True, axis=1)

gdp_melt = gdp.melt(id_vars=['Country Name', 'Country Code'],
                   var_name='year',
                   value_name='gdp')

gdp_melt['gdp'] = gdp_melt.sort_values('year').groupby(['Country Name',
               'Country Code'])['gdp'].fillna(method='ffill').fillna(method='bfill')

population_melt = population.melt(id_vars=['Country Name', 'Country Code'],
                                var_name='year',
                                value_name='population')

population_melt['population'] = population_melt.sort_values('year').
    groupby('Country Name')['population'].fillna(method='ffill').
    fillna(method='bfill')

df_indicator = gdp_melt.merge(population_melt, on=('Country Name', 'Country
    Code', 'year'))
non_countries = ['World',
```


'High income',
'OECD members',
'Post-demographic dividend',
'IDA & IBRD total',
'Low & middle income',
'Middle income',
'IBRD only',
'East Asia & Pacific',
'Europe & Central Asia',
'North America',
'Upper middle income',
'Late-demographic dividend',
'European Union',
'East Asia & Pacific (excluding high income)',
'East Asia & Pacific (IDA & IBRD countries)',
'Euro area',
'Early-demographic dividend',
'Lower middle income',
'Latin America & Caribbean',
'Latin America & the Caribbean (IDA & IBRD countries)',
'Latin America & Caribbean (excluding high income)',
'Europe & Central Asia (IDA & IBRD countries)',
'Middle East & North Africa',
'Europe & Central Asia (excluding high income)',
'South Asia (IDA & IBRD)',
'South Asia',
'Arab World',
'IDA total',
'Sub-Saharan Africa',
'Sub-Saharan Africa (IDA & IBRD countries)',
'Sub-Saharan Africa (excluding high income)',
'Middle East & North Africa (excluding high income)',
'Middle East & North Africa (IDA & IBRD countries)',
'Central Europe and the Baltics',
'Pre-demographic dividend',
'IDA only',
'Least developed countries: UN classification',
'IDA blend',
'Fragile and conflict affected situations',
'Heavily indebted poor countries (HIPC)',
'Low income',
'Small states',
'Other small states',
'Not classified',
'Caribbean small states',
'Pacific island small states']

```

df_indicator = df_indicator[~df_indicator['Country Name'].isin(non_countries)]
df_indicator.reset_index(inplace=True, drop=True)

df_indicator.columns = ['countryname', 'countrycode', 'year', 'gdp',
↳ 'population']

df_indicator.head()

```

```

[188]:
countryname countrycode year gdp population
0 Aruba ABW 1960 1.916242e+09 54211.0
1 Afghanistan AFG 1960 5.377778e+08 8996351.0
2 Angola AGO 1960 1.857319e+10 5643182.0
3 Albania ALB 1960 1.857319e+10 1608800.0
4 Andorra AND 1960 1.857319e+10 13411.0

```

```

[189]: df_projects_data['countryname'] = df_projects_data['countryname'].str.split(';
↳ ').str.get(0)

from collections import defaultdict
country_not_found = []
project_country_abbrev_dict = defaultdict(str)

for country in df_projects_data['countryname'].drop_duplicates().sort_values():
    try:
        project_country_abbrev_dict[country] = countries.lookup(country).alpha_3
    except:
        country_not_found.append(country)

```

```

[190]: country_not_found_mapping = {'Co-operative Republic of Guyana': 'GUY',
    'Commonwealth of Australia': 'AUS',
    'Democratic Republic of Sao Tome and Prin': 'STP',
    'Democratic Republic of the Congo': 'COD',
    'Democratic Socialist Republic of Sri Lan': 'LKA',
    'East Asia and Pacific': 'EAS',
    'Europe and Central Asia': 'ECS',
    'Islamic Republic of Afghanistan': 'AFG',
    'Latin America': 'LCN',
    'Caribbean': 'LCN',
    'Macedonia': 'MKD',
    'Middle East and North Africa': 'MEA',
    'Oriental Republic of Uruguay': 'URY',
    'Republic of Congo': 'COG',
    'Republic of Cote d'Ivoire': 'CIV',
    'Republic of Korea': 'KOR',
    'Republic of Niger': 'NER',

```

```

'Republic of Kosovo':'XKX',
'Republic of Rwanda':'RWA',
'Republic of The Gambia':'GMB',
'Republic of Togo':'TGO',
'Republic of the Union of Myanmar':'MMR',
'Republica Bolivariana de Venezuela':'VEN',
'Sint Maarten':'SXM',
'Socialist People's Libyan Arab Jamahiriya':'LBY',
'Socialist Republic of Vietnam':'VNM',
'Somali Democratic Republic':'SOM',
'South Asia':'SAS',
'St. Kitts and Nevis':'KNA',
'St. Lucia':'LCA',
'St. Vincent and the Grenadines':'VCT',
'State of Eritrea':'ERI',
'The Independent State of Papua New Guinea':'PNG',
'West Bank and Gaza':'PSE',
'World':'WLD'}

```

```

df_projects_data.columns = df_projects_data.columns.str.lower()

df_projects_data['countrycode'] = df_projects_data['countryname'].apply(
    lambda x: project_country_abbrev_dict.get(x, 'Unknown')
)

df_projects_data['totalamt'] = pd.to_numeric(df_projects_data['totalamt'].
    ↪astype(str).str.replace(',', ''), errors='coerce')

df_projects_data = df_projects_data[['id', 'countryname', 'countrycode',
    ↪'totalamt', 'year']]

df_projects_data.head()

```

```

[190]:
      id      countryname countrycode  totalamt  year
0  P162228      World      Unknown         0  2018.0
1  P163962  Democratic Republic of the Congo      Unknown  200000000  2018.0
2  P167672  People's Republic of Bangladesh      BGD    58330000  2018.0
3  P158768  Islamic Republic of Afghanistan      Unknown  20000000  2018.0
4  P161364  Federal Republic of Nigeria      NGA   100000000  2018.0

```

```

[200]: df_merged = df_projects_data.merge(df_indicator, how='left', on=['countrycode',
    ↪'year'])

```

```
[201]: df_merged[(df_merged['year'] == '2017') & (df_merged['countryname_y'] ==  
↳ 'Jordan')]
```

```
[201]: Empty DataFrame  
Columns: [id, countryname_x, countrycode, totalamt, year, countryname_y, gdp,  
population]  
Index: []
```

```
[202]: df_merged.to_json('countrydata.json', orient='records')
```

```
[203]: df_merged.to_csv('countrydata.csv', index=False)
```

```
[204]: host = "localhost"  
user = "root"  
password = "Cybrom#1123"  
database = "worldbank"  
  
conn = pymysql.connect(host=host, user=user, password=password,  
↳ database=database)  
engine = create_engine(f"mysql+pymysql://{user}:{password}@{host}/{database}")  
  
df_merged.to_sql('merged', con=engine, if_exists='replace', index=False)  
  
query = 'SELECT * FROM merged WHERE year = "2017" AND countrycode = "BRA"  
result = pd.read_sql(query, con=engine)  
  
print(result.head())  
  
conn.close()
```

	id	countryname_x	countrycode	totalamt	year	\
0	P162033	Federative Republic of Brazil	BRA	125000000	2017.0	
1	P158000	Federative Republic of Brazil	BRA	0	2017.0	
2	P163868	Federative Republic of Brazil	BRA	250000000	2017.0	
3	P152285	Federative Republic of Brazil	BRA	0	2017.0	
4	P147158	Federative Republic of Brazil	BRA	50000000	2017.0	

	countryname_y	gdp	population
0	None	None	None
1	None	None	None
2	None	None	None
3	None	None	None
4	None	None	None

```
[206]: host = "localhost"
user = "root"
password = "Cybrom#1123"
database = "worldbank"

conn = pymysql.connect(host=host, user=user, password=password,
    ↪database=database)
engine = create_engine(f"mysql+pymysql://{user}:{password}@{host}/{database}")

df_indicator.to_sql('indicator', con=engine, if_exists='replace', index=False)
df_projects_data.to_sql('projects', con=engine, if_exists='replace',
    ↪index=False)

query = '''
SELECT *
FROM projects
LEFT JOIN indicator
ON projects.countrycode = indicator.countrycode
   AND projects.year = indicator.year
WHERE projects.year = "2017"
   AND projects.countrycode = "BRA"
'''
result = pd.read_sql(query, con=engine)

print(result.head())

conn.close()
```

	id	countryname	countrycode	totalamt	year	\
0	P162033	Federative Republic of Brazil	BRA	125000000	2017.0	
1	P158000	Federative Republic of Brazil	BRA	0	2017.0	
2	P163868	Federative Republic of Brazil	BRA	250000000	2017.0	
3	P152285	Federative Republic of Brazil	BRA	0	2017.0	
4	P147158	Federative Republic of Brazil	BRA	50000000	2017.0	

	countryname	countrycode	year	gdp	population
0	Brazil	BRA	2017	2.055506e+12	209288278.0
1	Brazil	BRA	2017	2.055506e+12	209288278.0
2	Brazil	BRA	2017	2.055506e+12	209288278.0
3	Brazil	BRA	2017	2.055506e+12	209288278.0
4	Brazil	BRA	2017	2.055506e+12	209288278.0

[]:

[]: