Assignment 3 - Pandas Data Analysis Practice

This assignment is a part of the course ["Data Analysis with Python: Zero to Pandas"](#)

In this assignment, you'll get to practice some of the concepts and skills covered in this tutorial: https://jovian.ai/aakashns/python-pandas-data-analysis

As you go through this notebook, you will find a **???** in certain places. To complete this assignment, you must replace all the **???** with appropriate values, expressions or statements to ensure that the notebook runs properly end-to-end.

Some things to keep in mind:

- Make sure to run all the code cells, otherwise you may get errors like `NameError` for undefined variables.
- Do not change variable names, delete cells or disturb other existing code. It may cause problems during evaluation.
- In some cases, you may need to add some code cells or new statements before or after the line of code containing the **???**.
- Since you'll be using a temporary online service for code execution, save your work by running `jovian.commit` at regular intervals.
- Questions marked **(Optional)** will not be considered for evaluation, and can be skipped. They are for your learning.

You can make submissions on this page: https://jovian.ai/learn/data-analysis-with-python-zero-to-pandas/assignment/assignment-3-pandas-practice

If you are stuck, you can ask for help on the community forum: https://jovian.ai/forum/t/assignment-3-pandas-practice/11225/3. You can get help with errors or ask for hints, describe your approach in simple words, link to documentation, but **please don't ask for or share the full working answer code** on the forum.

How to run the code and save your work

The recommended way to run this notebook is to click the "Run" button at the top of this page, and select "Run on Binder". This will run the notebook on mybinder.org, a free online service for running Jupyter notebooks.

Before starting the assignment, let's save a snapshot of the assignment to your Jovian.ai profile, so that you can access it later, and continue your work.

```
import jovian
```

```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

```
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```

```
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```

```
# Run the next line to install Pandas
!pip install pandas --upgrade
```

Requirement already satisfied: pandas in /opt/conda/lib/python3.9/site-packages (1.4.3)
Requirement already satisfied: numpy>=1.18.5 in /opt/conda/lib/python3.9/site-packages
(from pandas) (1.20.3)
Requirement already satisfied: pytz>=2020.1 in /opt/conda/lib/python3.9/site-packages
(from pandas) (2021.1)
Requirement already satisfied: python-dateutil>=2.8.1 in /opt/conda/lib/python3.9/site-
packages (from pandas) (2.8.2)
Requirement already satisfied: six>=1.5 in /opt/conda/lib/python3.9/site-packages (from
python-dateutil>=2.8.1->pandas) (1.16.0)

```
import pandas as pd
```

In this assignment, we're going to analyze and operate on data from a CSV file. Let's begin by downloading the
CSV file.

```
from urllib.request import urlretrieve

urlretrieve('https://gist.githubusercontent.com/aakashns/28b2e504b3350afd9bdb157893f972
            'countries.csv')
```

('countries.csv', <http.client.HTTPMessage at 0x7f9a96a613d0>)

Let's load the data from the CSV file into a Pandas data frame.

```
countries_df = pd.read_csv('countries.csv')
```

```
countries_df
```

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita
0	Afghanistan	Asia	38928341.0	64.83	0.50	1803.987
1	Albania	Europe	2877800.0	78.57	2.89	11803.431
2	Algeria	Africa	43851043.0	76.88	1.90	13913.839
3	Andorra	Europe	77265.0	83.73	NaN	NaN
4	Angola	Africa	32866268.0	61.15	NaN	5819.495
...	...	...	...	...	...	...
205	Vietnam	Asia	97338583.0	75.40	2.60	6171.884
206	Western Sahara	Africa	597330.0	70.26	NaN	NaN
207	Yemen	Asia	29825968.0	66.12	0.70	1479.147
208	Zambia	Africa	18383956.0	63.89	2.00	3689.251
209	Zimbabwe	Africa	14862927.0	61.49	1.70	1899.775

210 rows × 6 columns

Q1: How many countries does the dataframe contain?

Hint: Use the `.shape` method.

```
num_countries = countries_df.shape[0]
```

```
print('There are {} countries in the dataset'.format(num_countries))
```

There are 210 countries in the dataset

```
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Q2: Retrieve a list of continents from the dataframe?

Hint: Use the `.unique` method of a series.

```
continents = list(countries_df['continent'].unique())
```

```
continents
```

['Asia', 'Europe', 'Africa', 'North America', 'South America', 'Oceania']

```
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Q3: What is the total population of all the countries listed in this dataset?

```
total_population = countries_df.population.sum()
```

```
print('The total population is {}.'.format(int(total_population)))
```

The total population is 7757980095.

```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

Q: (Optional) What is the overall life expectancy across in the world?

Hint: You'll need to take a weighted average of life expectancy using populations as weights.

```
overall_life_expectancy = countries_df.life_expectancy.sum() / countries_df.population.
```

```
print('The Overall Life Expectancy across the world is {}'.format(overall_life_expectan
```

The Overall Life Expectancy across the world is 1.961938521833756e-06

```
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```

Q4: Create a dataframe containing 10 countries with the highest population.

Hint: Chain the `sort_values` and `head` methods.

```
most_populous_df = countries_df.sort_values('population',ascending=False).head(10)
```

```
most_populous_df
```

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita
41	China	Asia	1.439324e+09	76.91	4.34	15308.712
90	India	Asia	1.380004e+09	69.66	0.53	6426.674
199	United States	North America	3.310026e+08	78.86	2.77	54225.446
91	Indonesia	Asia	2.735236e+08	71.72	1.04	11188.744
145	Pakistan	Asia	2.208923e+08	67.27	0.60	5034.708
27	Brazil	South America	2.125594e+08	75.88	2.20	14103.452
141	Nigeria	Africa	2.061396e+08	54.69	NaN	5338.454
15	Bangladesh	Asia	1.646894e+08	72.59	0.80	3523.984
157	Russia	Europe	1.459345e+08	72.58	8.05	24765.954
125	Mexico	North America	1.289328e+08	75.05	1.38	17336.469

```
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Q5: Add a new column in `countries_df` **to record the overall GDP per country (product of population & per capita GDP).**

```
countries_df['gdp'] = countries_df.population * countries_df.gdp_per_capita
```

```
countries_df
```

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita	gdp
0	Afghanistan	Asia	38928341.0	64.83	0.50	1803.987	7.022622e+10
1	Albania	Europe	2877800.0	78.57	2.89	11803.431	3.396791e+10
2	Algeria	Africa	43851043.0	76.88	1.90	13913.839	6.101364e+11
3	Andorra	Europe	77265.0	83.73	NaN	NaN	NaN
4	Angola	Africa	32866268.0	61.15	NaN	5819.495	1.912651e+11
...	...	...	...	...	...	...	...
205	Vietnam	Asia	97338583.0	75.40	2.60	6171.884	6.007624e+11
206	Western Sahara	Africa	597330.0	70.26	NaN	NaN	NaN
207	Yemen	Asia	29825968.0	66.12	0.70	1479.147	4.411699e+10
208	Zambia	Africa	18383956.0	63.89	2.00	3689.251	6.782303e+10
209	Zimbabwe	Africa	14862927.0	61.49	1.70	1899.775	2.823622e+10

210 rows × 7 columns

```
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Q: (Optional) Create a dataframe containing 10 countries with the lowest GDP per capita, among the counties with population greater than 100 million.

```
new_df = countries_df.sort_values('gdp_per_capita')
```

```
final_df = new_df[new_df.population > 1000000000]
final_df
```

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita	gdp
90	India	Asia	1.380004e+09	69.66	0.53	6426.674	8.868838e+12
41	China	Asia	1.439324e+09	76.91	4.34	15308.712	2.203419e+13

```
jovian.commit(project='pandas-practice-assignment', environment=None)
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Q6: Create a data frame that counts the number countries in each continent?

Hint: Use groupby , select the location column and aggregate using count .

```
country_counts_df = countries_df.groupby('continent')[['location']].count()
```

```
country_counts_df
```

	location
continent	
Africa	55
Asia	47
Europe	51
North America	36
Oceania	8
South America	13

```
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Q7: Create a data frame showing the total population of each continent.

Hint: Use groupby , select the population column and aggregate using sum .

```
continent_populations_df = countries_df.groupby('continent')[['population']].sum()
```

```
continent_populations_df
```

continent	population
Africa	1.339424e+09
Asia	4.607388e+09
Europe	7.485062e+08
North America	5.912425e+08
Oceania	4.095832e+07
South America	4.304611e+08

```
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Let's download another CSV file containing overall Covid-19 stats for various countires, and read the data into
another Pandas data frame.

```
urlretrieve('https://gist.githubusercontent.com/aakashns/b2a968a6cfd9fbbb0ff3d6bd0f2626
            'covid-countries-data.csv')
```

('covid-countries-data.csv', <http.client.HTTPMessage at 0x7f9a9520ed30>)

```
covid_data_df = pd.read_csv('covid-countries-data.csv')
```

```
covid_data_df
```

	location	total_cases	total_deaths	total_tests
0	Afghanistan	38243.0	1409.0	NaN
1	Albania	9728.0	296.0	NaN
2	Algeria	45158.0	1525.0	NaN
3	Andorra	1199.0	53.0	NaN
4	Angola	2729.0	109.0	NaN
...	...	...	...	...
207	Western Sahara	766.0	1.0	NaN
208	World	26059065.0	863535.0	NaN
209	Yemen	1976.0	571.0	NaN
210	Zambia	12415.0	292.0	NaN

	location	total_cases	total_deaths	total_tests
211	Zimbabwe	6638.0	206.0	97272.0

212 rows × 4 columns

Q8: Count the number of countries for which the `total_tests` data is missing.

Hint: Use the `.isna` method.

```
total_tests_missing = pd.isna(covid_data_df["total_tests"]) .sum()
```

```
print("The data for total tests is missing for {} countries.".format(int(total_tests_mi
```

```
The data for total tests is missing for 122 countries.
```

```
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```

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Let's merge the two data frames, and compute some more metrics.

Q9: Merge `countries_df` with `covid_data_df` on the `location` column.

Hint: Use the `.merge` method on `countries_df`.

```
combined_df = countries_df.merge(covid_data_df,on='location')
```

```
combined_df
```

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita	gdp
0	Afghanistan	Asia	38928341.0	64.83	0.50	1803.987	7.022622e+10
1	Albania	Europe	2877800.0	78.57	2.89	11803.431	3.396791e+10
2	Algeria	Africa	43851043.0	76.88	1.90	13913.839	6.101364e+11
3	Andorra	Europe	77265.0	83.73	NaN	NaN	NaN
4	Angola	Africa	32866268.0	61.15	NaN	5819.495	1.912651e+11
...	...	...	...	...	...	...	...
205	Vietnam	Asia	97338583.0	75.40	2.60	6171.884	6.007624e+11
206	Western Sahara	Africa	597330.0	70.26	NaN	NaN	NaN
207	Yemen	Asia	29825968.0	66.12	0.70	1479.147	4.411699e+10
208	Zambia	Africa	18383956.0	63.89	2.00	3689.251	6.782303e+10
209	Zimbabwe	Africa	14862927.0	61.49	1.70	1899.775	2.823622e+10

210 rows × 10 columns

```
jovian.commit(project='pandas-practice-assignment', environment=None)
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Q10: Add columns `tests_per_million`, `cases_per_million` and `deaths_per_million` into
`combined_df`.

```
combined_df['tests_per_million'] = combined_df['total_tests'] * 1e6 / combined_df['popu
```

```
combined_df['cases_per_million'] = combined_df['total_cases'] * 1e6 / combined_df['popu
```

```
combined_df['deaths_per_million'] = combined_df['total_deaths'] * 1e6 / combined_df['po
```

```
combined_df
```

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita	gdp
0	Afghanistan	Asia	38928341.0	64.83	0.50	1803.987	7.022622e+10
1	Albania	Europe	2877800.0	78.57	2.89	11803.431	3.396791e+10
2	Algeria	Africa	43851043.0	76.88	1.90	13913.839	6.101364e+11
3	Andorra	Europe	77265.0	83.73	NaN	NaN	NaN
4	Angola	Africa	32866268.0	61.15	NaN	5819.495	1.912651e+11
...	...	...	...	...	...	...	...
205	Vietnam	Asia	97338583.0	75.40	2.60	6171.884	6.007624e+11
206	Western Sahara	Africa	597330.0	70.26	NaN	NaN	NaN
207	Yemen	Asia	29825968.0	66.12	0.70	1479.147	4.411699e+10
208	Zambia	Africa	18383956.0	63.89	2.00	3689.251	6.782303e+10
209	Zimbabwe	Africa	14862927.0	61.49	1.70	1899.775	2.823622e+10

210 rows × 13 columns

```
jovian.commit(project='pandas-practice-assignment', environment=None)
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Q11: Create a dataframe with 10 countires that have highest number of tests per million people.

```
highest_tests_df = combined_df.sort_values('tests_per_million',ascending=False).head(10
```

```
highest_tests_df
```

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita	gdp
197	United Arab Emirates	Asia	9890400.0	77.97	1.200	67293.483	6.655595e+11
14	Bahrain	Asia	1701583.0	77.29	2.000	43290.705	7.366273e+10
115	Luxembourg	Europe	625976.0	82.25	4.510	94277.965	5.901574e+10
122	Malta	Europe	441539.0	82.53	4.485	36513.323	1.612206e+10
53	Denmark	Europe	5792203.0	80.90	2.500	46682.515	2.703946e+11
96	Israel	Asia	8655541.0	82.97	2.990	33132.320	2.867782e+11
89	Iceland	Europe	341250.0	82.99	2.910	46482.958	1.586231e+10
157	Russia	Europe	145934460.0	72.58	8.050	24765.954	3.614206e+12
199	United States	North America	331002647.0	78.86	2.770	54225.446	1.794877e+13
10	Australia	Oceania	25499881.0	83.44	3.840	44648.710	1.138537e+12

```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

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Q12: Create a dataframe with 10 countires that have highest number of positive cases per million people.

```
highest_cases_df = combined_df.sort_values('cases_per_million',ascending=False).head(10
```

```
highest_cases_df
```

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita	gdp	t
155	Qatar	Asia	2881060.0	80.23	1.20	116935.600	3.368985e+11	
14	Bahrain	Asia	1701583.0	77.29	2.00	43290.705	7.366273e+10	
147	Panama	North America	4314768.0	78.51	2.30	22267.037	9.607710e+10	
40	Chile	South America	19116209.0	80.18	2.11	22767.037	4.352194e+11	
162	San Marino	Europe	33938.0	84.97	3.80	56861.470	1.929765e+09	
9	Aruba	North America	106766.0	76.29	NaN	35973.781	3.840777e+09	

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita	gdp	t
105	Kuwait	Asia	4270563.0	75.49	2.00	65530.537	2.798523e+11	
150	Peru	South America	32971846.0	76.74	1.60	12236.706	4.034668e+11	
27	Brazil	South America	212559409.0	75.88	2.20	14103.452	2.997821e+12	3
199	United States	North America	331002647.0	78.86	2.77	54225.446	1.794877e+13	6

```
jovian.commit(project='pandas-practice-assignment', environment=None)
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Q13: Create a dataframe with 10 countires that have highest number of deaths cases per million people?

```
highest_deaths_df = combined_df.sort_values('deaths_per_million', ascending=False).head
```

```
highest_deaths_df
```

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita	gdp	t
162	San Marino	Europe	33938.0	84.97	3.80	56861.470	1.929765e+09	
150	Peru	South America	32971846.0	76.74	1.60	12236.706	4.034668e+11	
18	Belgium	Europe	11589616.0	81.63	5.64	42658.576	4.943965e+11	
3	Andorra	Europe	77265.0	83.73	NaN	NaN	NaN	
177	Spain	Europe	46754783.0	83.56	2.97	34272.360	1.602397e+12	
198	United Kingdom	Europe	67886004.0	81.32	2.54	39753.244	2.698689e+12	
40	Chile	South America	19116209.0	80.18	2.11	22767.037	4.352194e+11	
97	Italy	Europe	60461828.0	83.51	3.18	35220.084	2.129471e+12	
27	Brazil	South America	212559409.0	75.88	2.20	14103.452	2.997821e+12	
182	Sweden	Europe	10099270.0	82.80	2.22	46949.283	4.741535e+11	

```
jovian.commit(project='pandas-practice-assignment', environment=None)
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(Optional) Q: Count number of countries that feature in both the lists of "highest number of tests per million" and "highest number of cases per million".

```
countries_common_df = pd.merge(highest_tests_df, highest_cases_df, on="location")
```

```
count_countries_tests_cases = countries_common_df['location'].count()
```

```
print('Number of countries common in both the lists of "highest number of tests per mil
```

Number of countries common in both the lists of "highest number of tests per million" and "highest number of cases per million" is 2

```
jovian.commit(project='pandas-practice-assignment', environment=None)
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```
combined_df
```

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita	gdp
0	Afghanistan	Asia	38928341.0	64.83	0.50	1803.987	7.022622e+10
1	Albania	Europe	2877800.0	78.57	2.89	11803.431	3.396791e+10
2	Algeria	Africa	43851043.0	76.88	1.90	13913.839	6.101364e+11
3	Andorra	Europe	77265.0	83.73	NaN	NaN	NaN
4	Angola	Africa	32866268.0	61.15	NaN	5819.495	1.912651e+11
...	...	...	...	...	...	...	...
205	Vietnam	Asia	97338583.0	75.40	2.60	6171.884	6.007624e+11
206	Western Sahara	Africa	597330.0	70.26	NaN	NaN	NaN
207	Yemen	Asia	29825968.0	66.12	0.70	1479.147	4.411699e+10
208	Zambia	Africa	18383956.0	63.89	2.00	3689.251	6.782303e+10
209	Zimbabwe	Africa	14862927.0	61.49	1.70	1899.775	2.823622e+10

210 rows × 13 columns

(Optional) Q: Count number of countries that feature in both the lists "20 countries with lowest GDP per capita" and "20 countries with the lowest number of hospital beds per thousand population". Only consider countries with a population higher than 10 million while creating the list.

```python
gdp_df = combined_df.sort_values('gdp_per_capita').head(20)
gdp_df
```

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita	gd
38	Central African Republic	Africa	4829764.0	53.28	1.0	661.240	3.193633e+0
32	Burundi	Africa	11890781.0	61.58	0.8	702.225	8.350004e+0
111	Liberia	Africa	5057677.0	64.10	0.8	752.788	3.807359e+0
52	Democratic Republic of Congo	Africa	89561404.0	60.68	NaN	808.133	7.237753e+1
140	Niger	Africa	24206636.0	62.42	0.3	926.000	2.241534e+1
118	Malawi	Africa	19129955.0	64.26	1.3	1095.042	2.094810e+1
132	Mozambique	Africa	31255435.0	60.85	0.7	1136.103	3.550939e+1
168	Sierra Leone	Africa	7976985.0	54.70	NaN	1390.300	1.109040e+1
43	Comoros	Africa	869595.0	64.32	2.2	1413.890	1.229512e+0
117	Madagascar	Africa	27691019.0	67.04	0.2	1416.440	3.922267e+1
190	Togo	Africa	8278737.0	61.04	0.7	1429.813	1.183705e+1
207	Yemen	Asia	29825968.0	66.12	0.7	1479.147	4.411699e+1
61	Eritrea	Africa	3546427.0	66.32	0.7	1510.459	5.356733e+0
83	Guinea-Bissau	Africa	1967998.0	58.32	NaN	1548.675	3.047789e+0
71	Gambia	Africa	2416664.0	62.05	1.1	1561.767	3.774266e+0
176	South Sudan	Africa	11193729.0	57.85	NaN	1569.888	1.757290e+1
85	Haiti	North America	11402533.0	64.00	0.7	1653.173	1.885036e+1
195	Uganda	Africa	45741000.0	63.37	0.5	1697.707	7.765482e+1
31	Burkina Faso	Africa	20903278.0	61.58	0.4	1703.102	3.560041e+1
63	Ethiopia	Africa	114963583.0	66.60	0.3	1729.927	1.988786e+1

```python
beds_df = combined_df.sort_values('hospital_beds_per_thousand').head(20)
beds_df
```

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita	g
121	Mali	Africa	2.025083e+07	59.31	0.10	2014.306	4.079138e+1
117	Madagascar	Africa	2.769102e+07	67.04	0.20	1416.440	3.922267e+1
82	Guinea	Africa	1.313279e+07	61.60	0.30	1998.926	2.625148e+1
63	Ethiopia	Africa	1.149636e+08	66.60	0.30	1729.927	1.988786e+1
135	Nepal	Asia	2.913681e+07	70.78	0.30	2442.804	7.117551e+1
140	Niger	Africa	2.420664e+07	62.42	0.30	926.000	2.241534e+1
31	Burkina Faso	Africa	2.090328e+07	61.58	0.40	1703.102	3.560041e+1
0	Afghanistan	Asia	3.892834e+07	64.83	0.50	1803.987	7.022622e+1
195	Uganda	Africa	4.574100e+07	63.37	0.50	1697.707	7.765482e+1

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita	g
20	Benin	Africa	1.212320e+07	61.77	0.50	2064.236	2.502514e+
90	India	Asia	1.380004e+09	69.66	0.53	6426.674	8.868838e+
145	Pakistan	Asia	2.208923e+08	67.27	0.60	5034.708	1.112128e+
80	Guatemala	North America	1.791557e+07	74.30	0.60	7423.808	1.330017e+
190	Togo	Africa	8.278737e+06	61.04	0.70	1429.813	1.183705e+
207	Yemen	Asia	2.982597e+07	66.12	0.70	1479.147	4.411699e+
85	Haiti	North America	1.140253e+07	64.00	0.70	1653.173	1.885036e+
86	Honduras	North America	9.904608e+06	75.27	0.70	4541.795	4.498470e+
61	Eritrea	Africa	3.546427e+06	66.32	0.70	1510.459	5.356733e+(
187	Tanzania	Africa	5.973421e+07	65.46	0.70	2683.304	1.602851e+
132	Mozambique	Africa	3.125544e+07	60.85	0.70	1136.103	3.550939e+

```python
beds_gdp_df = pd.merge(gdp_df, beds_df, on = 'location')
final_df = beds_gdp_df[beds_gdp_df.population_x > 1e8]
common_count = final_df['location'].count()
common_count
```

1

```python
print('number of countries that feature in both the lists "20 countries with lowest GDP
```

number of countries that feature in both the lists "20 countries with lowest GDP per capita" and "20 countries with the lowest number of hospital beds per thousand population" with population greater than 10 million is 1

```python
import jovian
```

```python
jovian.commit(project='pandas-practice-assignment', environment=None)
```

[jovian] Updating notebook "ahmedatif655/pandas-practice-assignment" on https://jovian.ai

[jovian] Committed successfully! https://jovian.ai/ahmedatif655/pandas-practice-assignment

'https://jovian.ai/ahmedatif655/pandas-practice-assignment'

Submission

Congratulations on making it this far! You've reached the end of this assignment, and you just completed your first real-world data analysis problem. It's time to record one final version of your notebook for submission.

Make a submission here by filling the submission form: https://jovian.ai/learn/data-analysis-with-python-zero-to-pandas/assignment/assignment-3-pandas-practice

Also make sure to help others on the forum: https://jovian.ai/forum/t/assignment-3-pandas-practice/11225/2