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.

In [1]:
```
import jovian
```

In [2]:
```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

```
[jovian] Updating notebook "shahnawazmohammad446/pandas-practice-assignment" on http
s://jovian.ai
```

```
[jovian] Committed successfully! https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment
```

Out[2]:
```
'https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment'
```

In [3]:
```
# Run the next line to install Pandas
!pip install pandas --upgrade
```

```
Requirement already satisfied: pandas in /opt/conda/lib/python3.9/site-packages (1.3.3)
Collecting pandas
  Downloading pandas-1.4.3-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (11.7 MB)
     |████████████████████████████████| 11.7 MB 6.0 MB/s eta 0:00:01
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)
Installing collected packages: pandas
  Attempting uninstall: pandas
    Found existing installation: pandas 1.3.3
    Uninstalling pandas-1.3.3:
      Successfully uninstalled pandas-1.3.3
Successfully installed pandas-1.4.3
```

In [4]:
```
import pandas as pd
```

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

In [5]:
```
from urllib.request import urlretrieve

urlretrieve('https://gist.githubusercontent.com/aakashns/28b2e504b3350afd9bdb157893f
            'countries.csv')
```

Out[5]:
```
('countries.csv', <http.client.HTTPMessage at 0x7f6cf1cced60>)
```

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

In [6]:
```
countries_df = pd.read_csv('countries.csv')
```

In [7]:
```
countries_df
```

Out[7]:

	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
...	...	...	...	...	...	...

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita
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.

In [11]:
```
num_countries = countries_df["location"].shape
```

In [12]:
```
print('There are {} countries in the dataset'.format(num_countries))
```

```
There are (210,) countries in the dataset
```

In [13]:
```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

```
[jovian] Updating notebook "shahnawazmohammad446/pandas-practice-assignment" on https://jovian.ai
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```

Out[13]:
```
'https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment'
```

Q2: Retrieve a list of continents from the dataframe?

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

In [14]:
```
continents = countries_df["continent"].unique
```

In [15]:
```
continents
```

Out[15]:
```
<bound method Series.unique of 0        Asia
1      Europe
2      Africa
3      Europe
4      Africa
        ...
205      Asia
206    Africa
207      Asia
208    Africa
209    Africa
Name: continent, Length: 210, dtype: object>
```

In [16]:
```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

```
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```

Out[16]: 'https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment'

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

In [17]:
```
total_population = countries_df["population"].sum()
```

In [18]:
```
print('The total population is {}.'.format(int(total_population)))
```

```
The total population is 7757980095.
```

In [19]:
```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

```
[jovian] Updating notebook "shahnawazmohammad446/pandas-practice-assignment" on https://jovian.ai
[jovian] Committed successfully! https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment
```

Out[19]: 'https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment'

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.

In [ ]:
```
```

In [ ]:
```
```

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

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

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

In [20]:
```
most_populous_df = countries_df.sort_values("population", ascending=False).head(10)
```

In [21]:
```
most_populous_df
```

Out[21]:

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capi
41	China	Asia	1.439324e+09	76.91	4.34	15308.7
90	India	Asia	1.380004e+09	69.66	0.53	6426.6
199	United States	North America	3.310026e+08	78.86	2.77	54225.4
91	Indonesia	Asia	2.735236e+08	71.72	1.04	11188.7
145	Pakistan	Asia	2.208923e+08	67.27	0.60	5034.7

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capi
27	Brazil	South America	2.125594e+08	75.88	2.20	14103.4
141	Nigeria	Africa	2.061396e+08	54.69	NaN	5338.4
15	Bangladesh	Asia	1.646894e+08	72.59	0.80	3523.9
157	Russia	Europe	1.459345e+08	72.58	8.05	24765.9
125	Mexico	North America	1.289328e+08	75.05	1.38	17336.4

In [22]:
```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

Out[22]:
```
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'https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment'
```

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

In [23]:
```
countries_df['gdp'] = countries_df.population * countries_df.gdp_per_capita
```

In [24]:
```
countries_df
```

Out[24]:

	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 × 7 columns

In [25]:
```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

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s://jovian.ai
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ice-assignment
```

Out[25]: 'https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment'

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

In [ ]:

In [ ]:

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

Q6: Create a data frame that counts the number countries in each continent?

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

In [26]:
```
country_counts_df = countries_df.groupby("continent")["location"].count()
```

In [27]:
```
country_counts_df
```

Out[27]:
```
continent
Africa           55
Asia             47
Europe           51
North America    36
Oceania           8
South America    13
Name: location, dtype: int64
```

In [28]:
```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

```
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s://jovian.ai
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ice-assignment
```

Out[28]: 'https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment'

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

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

In [29]:
```
continent_populations_df = countries_df.groupby("continent")["population"].sum()
```

In [30]:
```
continent_populations_df
```

Out[30]:
```
continent
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
Name: population, dtype: float64
```

In [31]:
```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

```
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```

Out[31]:
```
'https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment'
```

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

In [32]:
```
urlretrieve('https://gist.githubusercontent.com/aakashns/b2a968a6cfd9fbbb0ff3d6bd0f2
            'covid-countries-data.csv')
```

Out[32]:
```
('covid-countries-data.csv', <http.client.HTTPMessage at 0x7f6cefcf0ee0>)
```

In [33]:
```
covid_data_df = pd.read_csv('covid-countries-data.csv')
```

In [34]:
```
covid_data_df
```

Out[34]:

	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
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.

In [35]:
```
total_tests_missing = covid_data_df.total_tests.isna().sum()
```

In [36]:
```
print("The data for total tests is missing for {} countries.".format(int(total_tests
```

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

In [37]:
```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

```
[jovian] Updating notebook "shahnawazmohammad446/pandas-practice-assignment" on http
s://jovian.ai
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ice-assignment
```
Out[37]:
```
'https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment'
```

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`.

In [38]:
```
combined_df = countries_df.merge(covid_data_df, on="location")
```

In [39]:
```
combined_df
```

Out[39]:

	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 × 10 columns

In [40]:
```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

```
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s://jovian.ai
[jovian] Committed successfully! https://jovian.ai/shahnawazmohammad446/pandas-pract
ice-assignment
```
Out[40]:
```
'https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment'
```

Q10: Add columns `tests_per_million`, `cases_per_million` and `deaths_per_million`

into `combined_df`.

In [41]:
```
combined_df['tests_per_million'] = combined_df['total_tests'] * 1e6 / combined_df['p
```

In [42]:
```
combined_df['cases_per_million'] = combined_df['total_cases'] * 1e6 / combined_df['p
```

In [43]:
```
combined_df['deaths_per_million'] = combined_df['total_deaths'] * 1e6 / combined_df[
```

In [44]:
```
combined_df
```

Out[44]:

	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 × 13 columns

In [45]:
```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

Out[45]:
```
[jovian] Updating notebook "shahnawazmohammad446/pandas-practice-assignment" on http
s://jovian.ai
[jovian] Committed successfully! https://jovian.ai/shahnawazmohammad446/pandas-pract
ice-assignment
'https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment'
```

Q11: Create a dataframe with 10 countires that have highest number of tests per million people.

In [48]:
```
highest_tests_df = combined_df.sort_values("tests_per_million", ascending=False).hea
```

In [49]:
```
highest_tests_df
```

Out[49]:

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capi

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capi
197	United Arab Emirates	Asia	9890400.0	77.97	1.200	67293.48
14	Bahrain	Asia	1701583.0	77.29	2.000	43290.70
115	Luxembourg	Europe	625976.0	82.25	4.510	94277.96
122	Malta	Europe	441539.0	82.53	4.485	36513.32
53	Denmark	Europe	5792203.0	80.90	2.500	46682.51
96	Israel	Asia	8655541.0	82.97	2.990	33132.32
89	Iceland	Europe	341250.0	82.99	2.910	46482.95
157	Russia	Europe	145934460.0	72.58	8.050	24765.95
199	United States	North America	331002647.0	78.86	2.770	54225.44
10	Australia	Oceania	25499881.0	83.44	3.840	44648.71

In [50]:
```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

```
[jovian] Updating notebook "shahnawazmohammad446/pandas-practice-assignment" on https://jovian.ai
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```

Out[50]: 'https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment'

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

In [51]:
```
highest_cases_df = combined_df.sort_values("cases_per_million", ascending=False).hea
```

In [52]:
```
highest_cases_df
```

Out[52]:

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita
155	Qatar	Asia	2881060.0	80.23	1.20	116935.600
14	Bahrain	Asia	1701583.0	77.29	2.00	43290.705
147	Panama	North America	4314768.0	78.51	2.30	22267.037
40	Chile	South America	19116209.0	80.18	2.11	22767.037
162	San Marino	Europe	33938.0	84.97	3.80	56861.470
9	Aruba	North America	106766.0	76.29	NaN	35973.781
105	Kuwait	Asia	4270563.0	75.49	2.00	65530.537
150	Peru	South America	32971846.0	76.74	1.60	12236.706

	location	continent	population	life_expectancy	hospital_beds_per_thousand	gdp_per_capita
27	Brazil	South America	212559409.0	75.88	2.20	14103.452
199	United States	North America	331002647.0	78.86	2.77	54225.446

In [53]:
```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

```
[jovian] Updating notebook "shahnawazmohammad446/pandas-practice-assignment" on http
s://jovian.ai
[jovian] Committed successfully! https://jovian.ai/shahnawazmohammad446/pandas-pract
ice-assignment
```

Out[53]: 'https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment'

Q13: Create a dataframe with 10 countires that have highest number of deaths cases per million people?

In [54]:
```
highest_deaths_df = combined_df.sort_values("deaths_per_million", ascending=False).h
```

In [55]:
```
highest_deaths_df
```

Out[55]:

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

In [56]:
```
jovian.commit(project='pandas-practice-assignment', environment=None)
```

```
[jovian] Updating notebook "shahnawazmohammad446/pandas-practice-assignment" on http
s://jovian.ai
[jovian] Committed successfully! https://jovian.ai/shahnawazmohammad446/pandas-pract
ice-assignment
```

Out[56]: 'https://jovian.ai/shahnawazmohammad446/pandas-practice-assignment'

(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".

In [ ]:

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

(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.

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```
import jovian
```

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

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

In [ ]: