Title: Problem for Covid - 19 Data Analysis Project using Python

1. Import the dataset using Pandas from above mentioned url.

In [113…

```
import pandas as pd
data=pd.read_csv("https://raw.githubusercontent.com/SR1608/Datasets/main/covid-data.csv",sep=",")
data.head()
```

Out[113]:

	iso_code	continent	location	date	total_cases	new_cases	new_cases_smoothed	total_deaths	new_deaths	new_deaths_smoothed	...	gdp_per_capita	extreme_pov
0	AFG	Asia	Afghanistan	31/12/19	NaN	0.0	NaN	NaN	0.0	NaN	...	1803.987	
1	AFG	Asia	Afghanistan	01/01/20	NaN	0.0	NaN	NaN	0.0	NaN	...	1803.987	
2	AFG	Asia	Afghanistan	02/01/20	NaN	0.0	NaN	NaN	0.0	NaN	...	1803.987	
3	AFG	Asia	Afghanistan	03/01/20	NaN	0.0	NaN	NaN	0.0	NaN	...	1803.987	
4	AFG	Asia	Afghanistan	04/01/20	NaN	0.0	NaN	NaN	0.0	NaN	...	1803.987	

5 rows × 49 columns

1. High Level Data Understanding:

In [114…

```
# a. Find no. of rows & columns in the dataset
data.shape
```

Out[114]:

```
(57394, 49)
```

In [115…

```
# b. Data types of columns.
data.dtypes
```

Out[115]:

```
iso_code                                object
continent                               object
location                                object
date                                    object
total_cases                            float64
new_cases                              float64
new_cases_smoothed                     float64
total_deaths                           float64
new_deaths                             float64
new_deaths_smoothed                    float64
total_cases_per_million                float64
new_cases_per_million                  float64
new_cases_smoothed_per_million         float64
total_deaths_per_million               float64
new_deaths_per_million                 float64
new_deaths_smoothed_per_million        float64
reproduction_rate                      float64
icu_patients                           float64
icu_patients_per_million               float64
hosp_patients                          float64
hosp_patients_per_million              float64
weekly_icu_admissions                  float64
weekly_icu_admissions_per_million      float64
weekly_hosp_admissions                 float64
weekly_hosp_admissions_per_million     float64
total_tests                            float64
new_tests                              float64
total_tests_per_thousand               float64
new_tests_per_thousand                 float64
new_tests_smoothed                     float64
new_tests_smoothed_per_thousand        float64
tests_per_case                         float64
positive_rate                          float64
stringency_index                       float64
population                             float64
population_density                     float64
median_age                             float64
aged_65_older                          float64
aged_70_older                          float64
gdp_per_capita                         float64
extreme_poverty                        float64
cardiovasc_death_rate                  float64
diabetes_prevalence                    float64
female_smokers                         float64
male_smokers                           float64
handwashing_facilities                 float64
hospital_beds_per_thousand             float64
life_expectancy                        float64
human_development_index                float64
dtype: object
```

In [116…

```
#  c. Info & describe of data in dataframe.
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 57394 entries, 0 to 57393
Data columns (total 49 columns):
 #   Column                              Non-Null Count  Dtype
---  ------                              --------------  -----
 0   iso_code                            57071 non-null  object
 1   continent                           56748 non-null  object
 2   location                            57394 non-null  object
 3   date                                57394 non-null  object
 4   total_cases                         53758 non-null  float64
 5   new_cases                           56465 non-null  float64
 6   new_cases_smoothed                  55652 non-null  float64
 7   total_deaths                        44368 non-null  float64
 8   new_deaths                          56465 non-null  float64
 9   new_deaths_smoothed                 55652 non-null  float64
 10  total_cases_per_million             53471 non-null  float64
 11  new_cases_per_million               56401 non-null  float64
 12  new_cases_smoothed_per_million      55587 non-null  float64
 13  total_deaths_per_million            44096 non-null  float64
 14  new_deaths_per_million              56401 non-null  float64
 15  new_deaths_smoothed_per_million     55587 non-null  float64
 16  reproduction_rate                   37696 non-null  float64
 17  icu_patients                        4490 non-null   float64
 18  icu_patients_per_million            4490 non-null   float64
 19  hosp_patients                       5005 non-null   float64
 20  hosp_patients_per_million           5005 non-null   float64
 21  weekly_icu_admissions               357 non-null    float64
 22  weekly_icu_admissions_per_million   357 non-null    float64
 23  weekly_hosp_admissions              645 non-null    float64
 24  weekly_hosp_admissions_per_million  645 non-null    float64
 25  total_tests                         22017 non-null  float64
 26  new_tests                           21787 non-null  float64
 27  total_tests_per_thousand            22017 non-null  float64
 28  new_tests_per_thousand              21787 non-null  float64
 29  new_tests_smoothed                  24612 non-null  float64
 30  new_tests_smoothed_per_thousand     24612 non-null  float64
 31  tests_per_case                      22802 non-null  float64
 32  positive_rate                       23211 non-null  float64
 33  stringency_index                    47847 non-null  float64
 34  population                          57071 non-null  float64
 35  population_density                  54371 non-null  float64
 36  median_age                          51034 non-null  float64
 37  aged_65_older                       50265 non-null  float64
 38  aged_70_older                       50768 non-null  float64
 39  gdp_per_capita                      50367 non-null  float64
 40  extreme_poverty                     33571 non-null  float64
 41  cardiovasc_death_rate               51013 non-null  float64
 42  diabetes_prevalence                 52881 non-null  float64
 43  female_smokers                      39669 non-null  float64
 44  male_smokers                        39156 non-null  float64
 45  handwashing_facilities              24176 non-null  float64
 46  hospital_beds_per_thousand          45936 non-null  float64
 47  life_expectancy                     56336 non-null  float64
 48  human_development_index             49247 non-null  float64
dtypes: float64(45), object(4)
memory usage: 21.5+ MB
```

1. Low Level Data Understanding :

In [117…

```
# a. Find count of unique values in location column.
data.location.unique()
```

Out[117]:

```
array(['Afghanistan', 'Albania', 'Algeria', 'Andorra', 'Angola',
       'Anguilla', 'Antigua and Barbuda', 'Argentina', 'Armenia', 'Aruba',
       'Australia', 'Austria', 'Azerbaijan', 'Bahamas', 'Bahrain',
       'Bangladesh', 'Barbados', 'Belarus', 'Belgium', 'Belize', 'Benin',
       'Bermuda', 'Bhutan', 'Bolivia', 'Bonaire Sint Eustatius and Saba',
       'Bosnia and Herzegovina', 'Botswana', 'Brazil',
       'British Virgin Islands', 'Brunei', 'Bulgaria', 'Burkina Faso',
       'Burundi', 'Cambodia', 'Cameroon', 'Canada', 'Cape Verde',
       'Cayman Islands', 'Central African Republic', 'Chad', 'Chile',
       'China', 'Colombia', 'Comoros', 'Congo', 'Costa Rica',
       "Cote d'Ivoire", 'Croatia', 'Cuba', 'Curacao', 'Cyprus',
       'Czech Republic', 'Democratic Republic of Congo', 'Denmark',
       'Djibouti', 'Dominica', 'Dominican Republic', 'Ecuador', 'Egypt',
       'El Salvador', 'Equatorial Guinea', 'Eritrea', 'Estonia',
       'Ethiopia', 'Faeroe Islands', 'Falkland Islands', 'Fiji',
       'Finland', 'France', 'French Polynesia', 'Gabon', 'Gambia',
       'Georgia', 'Germany', 'Ghana', 'Gibraltar', 'Greece', 'Greenland',
       'Grenada', 'Guam', 'Guatemala', 'Guernsey', 'Guinea',
       'Guinea-Bissau', 'Guyana', 'Haiti', 'Honduras', 'Hong Kong',
       'Hungary', 'Iceland', 'India', 'Indonesia', 'Iran', 'Iraq',
       'Ireland', 'Isle of Man', 'Israel', 'Italy', 'Jamaica', 'Japan',
       'Jersey', 'Jordan', 'Kazakhstan', 'Kenya', 'Kosovo', 'Kuwait',
       'Kyrgyzstan', 'Laos', 'Latvia', 'Lebanon', 'Lesotho', 'Liberia',
       'Libya', 'Liechtenstein', 'Lithuania', 'Luxembourg', 'Macedonia',
       'Madagascar', 'Malawi', 'Malaysia', 'Maldives', 'Mali', 'Malta',
       'Marshall Islands', 'Mauritania', 'Mauritius', 'Mexico', 'Moldova',
       'Monaco', 'Mongolia', 'Montenegro', 'Montserrat', 'Morocco',
       'Mozambique', 'Myanmar', 'Namibia', 'Nepal', 'Netherlands',
       'New Caledonia', 'New Zealand', 'Nicaragua', 'Niger', 'Nigeria',
       'Northern Mariana Islands', 'Norway', 'Oman', 'Pakistan',
       'Palestine', 'Panama', 'Papua New Guinea', 'Paraguay', 'Peru',
       'Philippines', 'Poland', 'Portugal', 'Puerto Rico', 'Qatar',
       'Romania', 'Russia', 'Rwanda', 'Saint Kitts and Nevis',
       'Saint Lucia', 'Saint Vincent and the Grenadines', 'San Marino',
       'Sao Tome and Principe', 'Saudi Arabia', 'Senegal', 'Serbia',
       'Seychelles', 'Sierra Leone', 'Singapore',
       'Sint Maarten (Dutch part)', 'Slovakia', 'Slovenia',
       'Solomon Islands', 'Somalia', 'South Africa', 'South Korea',
       'South Sudan', 'Spain', 'Sri Lanka', 'Sudan', 'Suriname',
       'Swaziland', 'Sweden', 'Switzerland', 'Syria', 'Taiwan',
       'Tajikistan', 'Tanzania', 'Thailand', 'Timor', 'Togo',
       'Trinidad and Tobago', 'Tunisia', 'Turkey',
       'Turks and Caicos Islands', 'Uganda', 'Ukraine',
       'United Arab Emirates', 'United Kingdom', 'United States',
       'United States Virgin Islands', 'Uruguay', 'Uzbekistan', 'Vanuatu',
       'Vatican', 'Venezuela', 'Vietnam', 'Wallis and Futuna',
       'Western Sahara', 'Yemen', 'Zambia', 'Zimbabwe', 'World',
       'International'], dtype=object)
```

In [118…

```
#  b. Find which continent has maximum frequency using values counts.

data.continent.value_counts().head(1)
```

Out[118]:

```
Europe    14828
Name: continent, dtype: int64
```

In [119…

```
#  c. Find maximum & mean value in 'total_cases'.
maximum=data["total_cases"].max()
print("maximum ",maximum)
m=data["total_cases"].mean()
print("mean ",m)
```

```
maximum  55154651.0
mean  167797.3688753302
```

In [120…

```
# d. Find 25%,50% & 75% quartile value in 'total_deaths'.
data["total_deaths"].head(100)
data["total_deaths"].describe()
```

Out[120]:

```
count    4.436800e+04
mean     6.858639e+03
std      5.578081e+04
min      1.000000e+00
25%      1.300000e+01
50%      8.400000e+01
75%      7.270000e+02
max      1.328537e+06
Name: total_deaths, dtype: float64
```

In [121…

```
# e. Find which continent has maximum 'human_development_index'.
data1=data.groupby(by="continent").mean()
data1.sort_values(by="human_development_index",ascending=False).head(1)
```

Out[121]:

	total_cases	new_cases	new_cases_smoothed	total_deaths	new_deaths	new_deaths_smoothed	total_cases_per_million	new_cases_per_million	new_cases_smoot
continent									
Europe	64943.089996	967.35581	926.678845	3771.910925	22.257118	21.717531	4884.905461	70.410528	

1 rows × 45 columns

In [122…

```
#  f. Find which continent has minimum 'gdp_per_capita'.
data1.sort_values(by="gdp_per_capita").head(1)
```

Out[122]:

	total_cases	new_cases	new_cases_smoothed	total_deaths	new_deaths	new_deaths_smoothed	total_cases_per_million	new_cases_per_million	new_cases_smoot
continent									
Africa	14121.679667	147.185847	147.204671	389.456834	3.529233	3.537624	825.859243	8.675412	

1 rows × 45 columns

1. Filter the dataframe with only this columns ['continent','location','date','total_cases','total_deaths','gdp_per_ca pita',' human_development_index'] and update the data frame.

In [123…

```
data=data[['continent','location','date','total_cases','total_deaths','gdp_per_capita','human_development_index']]
data
```

Out[123]:

	continent	location	date	total_cases	total_deaths	gdp_per_capita	human_development_index
0	Asia	Afghanistan	31/12/19	NaN	NaN	1803.987	0.498
1	Asia	Afghanistan	01/01/20	NaN	NaN	1803.987	0.498
2	Asia	Afghanistan	02/01/20	NaN	NaN	1803.987	0.498
3	Asia	Afghanistan	03/01/20	NaN	NaN	1803.987	0.498
4	Asia	Afghanistan	04/01/20	NaN	NaN	1803.987	0.498
...	...	...	...	...	...	...	...
57389	NaN	International	13/11/20	696.0	7.0	NaN	NaN
57390	NaN	International	14/11/20	696.0	7.0	NaN	NaN
57391	NaN	International	15/11/20	696.0	7.0	NaN	NaN
57392	NaN	International	16/11/20	696.0	7.0	NaN	NaN
57393	NaN	International	17/11/20	696.0	7.0	NaN	NaN

57394 rows × 7 columns

1. Data Cleaning

In [124…

```
# a. Remove all duplicates observations
data.loc[data.duplicated(), :]
data.drop_duplicates()
```

Out[124]:

	continent	location	date	total_cases	total_deaths	gdp_per_capita	human_development_index
0	Asia	Afghanistan	31/12/19	NaN	NaN	1803.987	0.498
1	Asia	Afghanistan	01/01/20	NaN	NaN	1803.987	0.498
2	Asia	Afghanistan	02/01/20	NaN	NaN	1803.987	0.498
3	Asia	Afghanistan	03/01/20	NaN	NaN	1803.987	0.498
4	Asia	Afghanistan	04/01/20	NaN	NaN	1803.987	0.498
...	...	...	...	...	...	...	...
57389	NaN	International	13/11/20	696.0	7.0	NaN	NaN
57390	NaN	International	14/11/20	696.0	7.0	NaN	NaN
57391	NaN	International	15/11/20	696.0	7.0	NaN	NaN
57392	NaN	International	16/11/20	696.0	7.0	NaN	NaN
57393	NaN	International	17/11/20	696.0	7.0	NaN	NaN

57394 rows × 7 columns

In [125…

```
#b. Find missing values in all columns
data.isnull().sum()
#data.shape
```

Out[125]:

```
continent                    646
location                       0
date                           0
total_cases                 3636
total_deaths               13026
gdp_per_capita              7027
human_development_index     8147
dtype: int64
```

In [103…

```
#c. Remove all observations where continent column value is missing
data.dropna()
data.dropna(subset=["continent"],inplace=True)
#Tip : using subset parameter in dropna
data.isnull().sum()
#data.shape
```

Out[103]:

```
continent                      0
location                       0
date                           0
total_cases                 3600
total_deaths               12964
gdp_per_capita              6704
human_development_index     7501
dtype: int64
```

In [104…

```
#d. Fill all missing values with 0
data.fillna(0,inplace=True)
data
data.isnull().sum()
```

Out[104]:

```
continent                  0
location                   0
date                       0
total_cases                0
total_deaths               0
gdp_per_capita             0
human_development_index    0
dtype: int64
```

1. Date time format :

In [105…

```
# a. Convert date column in datetime format using pandas.to_datetime
data
data["date"]= pd.to_datetime(data["date"])
data
```

Out[105]:

	continent	location	date	total_cases	total_deaths	gdp_per_capita	human_development_index
0	Asia	Afghanistan	2019-12-31	0.0	0.0	1803.987	0.498
1	Asia	Afghanistan	2020-01-01	0.0	0.0	1803.987	0.498
2	Asia	Afghanistan	2020-02-01	0.0	0.0	1803.987	0.498
3	Asia	Afghanistan	2020-03-01	0.0	0.0	1803.987	0.498
4	Asia	Afghanistan	2020-04-01	0.0	0.0	1803.987	0.498
...	...	...	...	...	...	...	...
56743	Africa	Zimbabwe	2020-11-13	8696.0	255.0	1899.775	0.535
56744	Africa	Zimbabwe	2020-11-14	8765.0	257.0	1899.775	0.535
56745	Africa	Zimbabwe	2020-11-15	8786.0	257.0	1899.775	0.535
56746	Africa	Zimbabwe	2020-11-16	8786.0	257.0	1899.775	0.535
56747	Africa	Zimbabwe	2020-11-17	8897.0	257.0	1899.775	0.535

56748 rows × 7 columns

In [106…

```
# b. Create new column month after extracting month data from date column.

data["month"]=pd.DatetimeIndex(data["date"]).month
data
```

Out[106]:

	continent	location	date	total_cases	total_deaths	gdp_per_capita	human_development_index	month
0	Asia	Afghanistan	2019-12-31	0.0	0.0	1803.987	0.498	12
1	Asia	Afghanistan	2020-01-01	0.0	0.0	1803.987	0.498	1
2	Asia	Afghanistan	2020-02-01	0.0	0.0	1803.987	0.498	2
3	Asia	Afghanistan	2020-03-01	0.0	0.0	1803.987	0.498	3
4	Asia	Afghanistan	2020-04-01	0.0	0.0	1803.987	0.498	4
...	...	...	...	...	...	...	...	...
56743	Africa	Zimbabwe	2020-11-13	8696.0	255.0	1899.775	0.535	11
56744	Africa	Zimbabwe	2020-11-14	8765.0	257.0	1899.775	0.535	11
56745	Africa	Zimbabwe	2020-11-15	8786.0	257.0	1899.775	0.535	11
56746	Africa	Zimbabwe	2020-11-16	8786.0	257.0	1899.775	0.535	11
56747	Africa	Zimbabwe	2020-11-17	8897.0	257.0	1899.775	0.535	11

56748 rows × 8 columns

1. Data Aggregation: a. Find max value in all columns using groupby function on 'continent' column b. Store the result in a new dataframe named 'df_groupby'. (Use df_groupby dataframe for all further analysis)

In [107…

```
df_groupby=data.groupby(by="continent").max()
df_groupby.reset_index(inplace = True)
df_groupby
```

Out[107]:

	continent	location	date	total_cases	total_deaths	gdp_per_capita	human_development_index	month
0	Africa	Zimbabwe	2020-12-11	752269.0	20314.0	26382.287	0.797	12
1	Asia	Yemen	2020-12-11	8874290.0	130519.0	116935.600	0.933	12
2	Europe	Vatican	2020-12-11	1991233.0	52147.0	94277.965	0.953	12
3	North America	United States Virgin Islands	2020-12-11	11205486.0	247220.0	54225.446	0.926	12
4	Oceania	Wallis and Futuna	2020-12-11	27750.0	907.0	44648.710	0.939	12
5	South America	Venezuela	2020-12-11	5876464.0	166014.0	22767.037	0.843	12

1. Feature Engineering : a. Create a new feature 'total_deaths_to_total_cases' by ratio of 'total_deaths' column to 'total_cases'

In [108…

```
df_groupby["total_deaths_to_total_cases"]=df_groupby['total_deaths']/df_groupby['total_cases']
df_groupby
```

Out[108]:

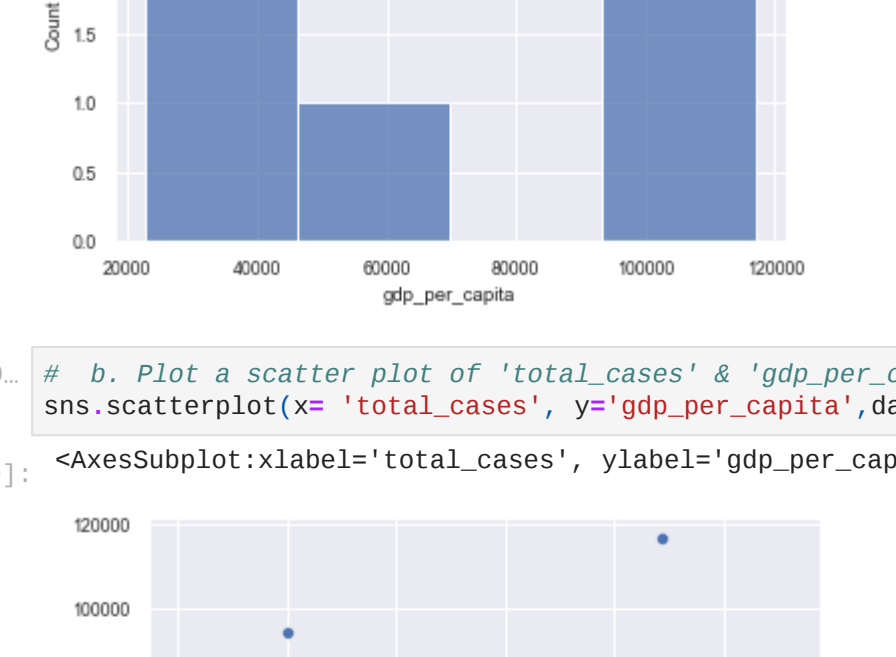
	continent	location	date	total_cases	total_deaths	gdp_per_capita	human_development_index	month	total_deaths_to_total_cases
0	Africa	Zimbabwe	2020-12-11	752269.0	20314.0	26382.287	0.797	12	0.027004
1	Asia	Yemen	2020-12-11	8874290.0	130519.0	116935.600	0.933	12	0.014708
2	Europe	Vatican	2020-12-11	1991233.0	52147.0	94277.965	0.953	12	0.026188
3	North America	United States Virgin Islands	2020-12-11	11205486.0	247220.0	54225.446	0.926	12	0.022062
4	Oceania	Wallis and Futuna	2020-12-11	27750.0	907.0	44648.710	0.939	12	0.032685
5	South America	Venezuela	2020-12-11	5876464.0	166014.0	22767.037	0.843	12	0.028251

1. Data Visualization :

In [109…

```
# a. Perform Univariate analysis on 'gdp_per_capita' column by plotting histogram using seaborn dist plot.

import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np
sns.set_style('darkgrid')
sns.set(font_scale=0.8)
sns.histplot(x='gdp_per_capita', data=df_groupby);
```

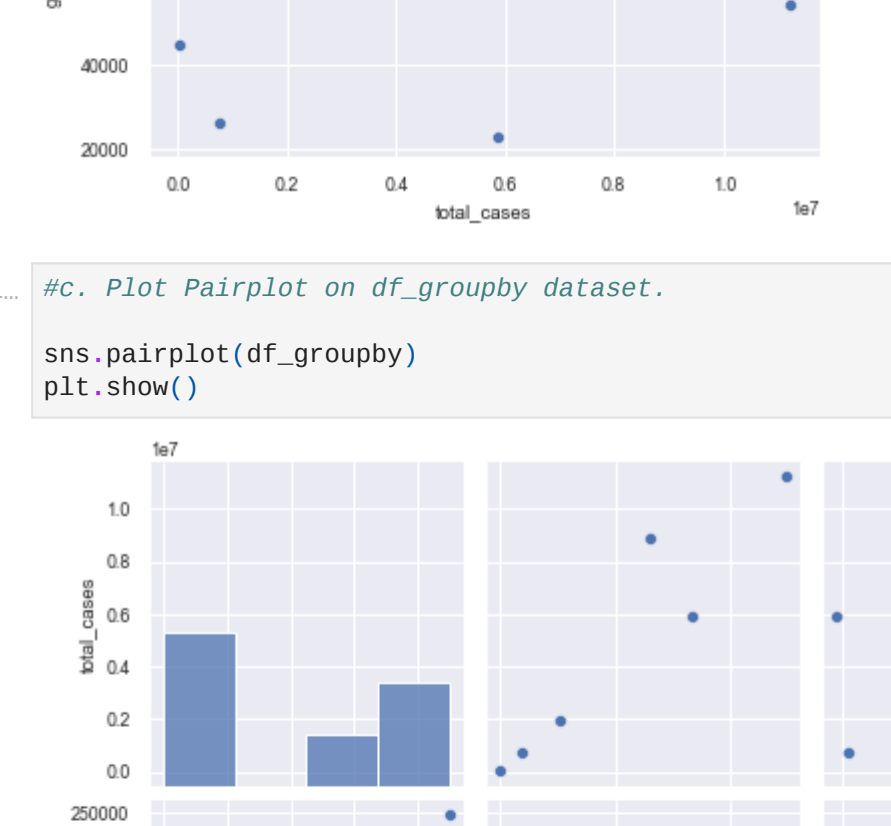


In [110…

```
#  b. Plot a scatter plot of 'total_cases' & 'gdp_per_capita'
sns.scatterplot(x= 'total_cases', y='gdp_per_capita',data=df_groupby)
```

Out[110]:

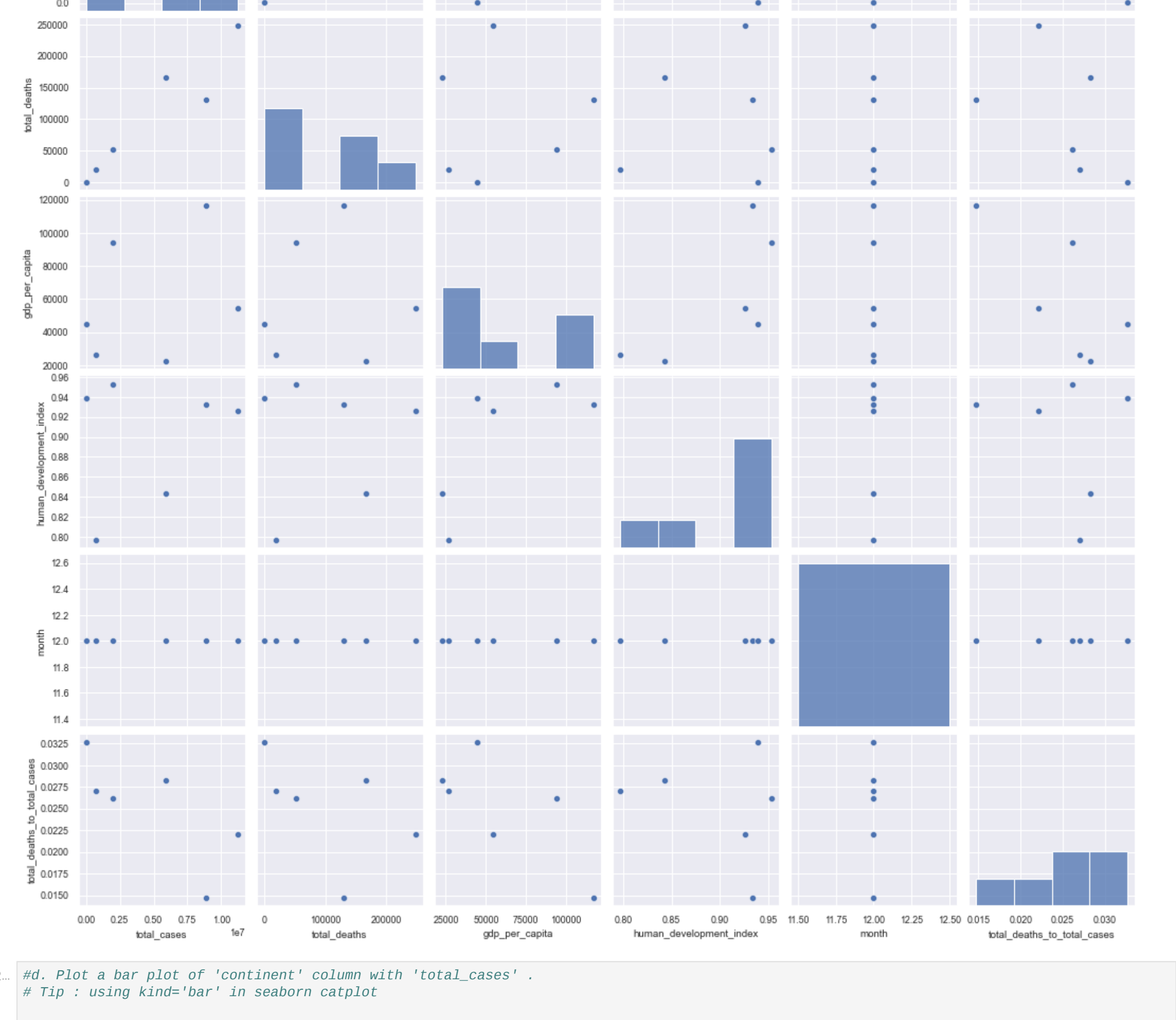
```
<AxesSubplot:xlabel='total_cases', ylabel='gdp_per_capita'>
```



In [111…

```
#c. Plot Pairplot on df_groupby dataset.

sns.pairplot(df_groupby)
plt.show()
```



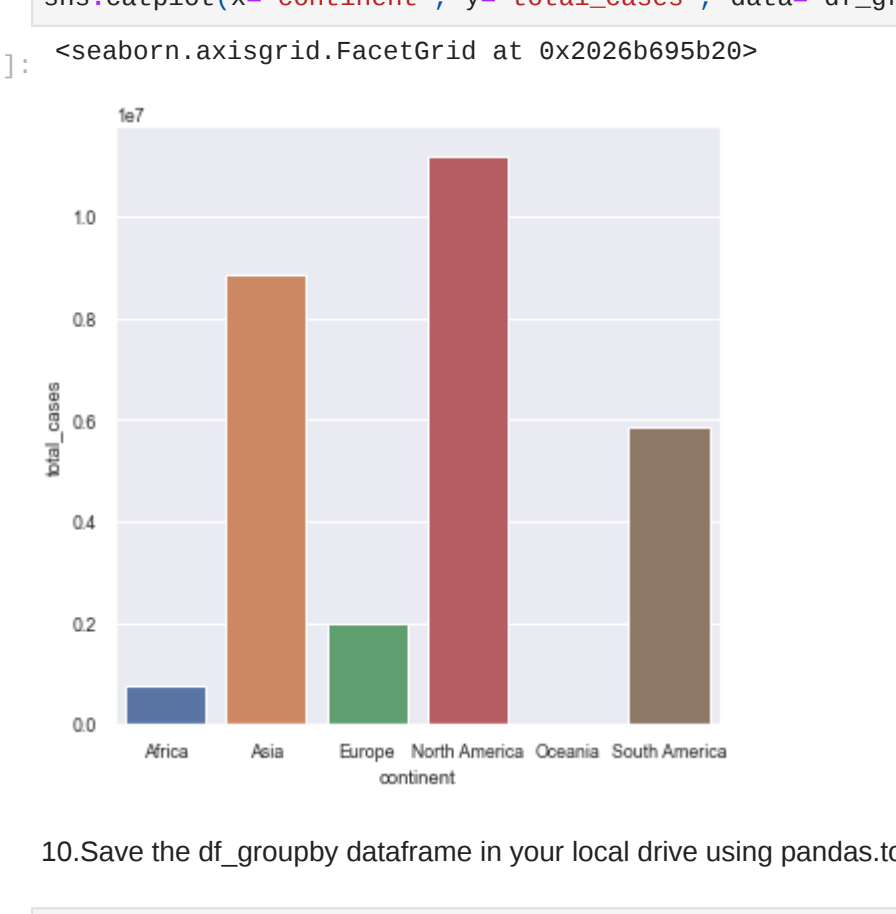
In [112…

```
#d. Plot a bar plot of 'continent' column with 'total_cases' .
# Tip : using kind='bar' in seaborn catplot

sns.catplot(x='continent', y='total_cases', data= df_groupby,kind='bar')
```

Out[112]:

```
<seaborn.axisgrid.FacetGrid at 0x2026b695b20>
```



10.Save the df_groupby dataframe in your local drive using pandas.to_csv function .

In [89]:

```
df= df_groupby.to_csv('data.csv', index = True)
```

In [ ]: