

# practical3

February 23, 2022

## 0.0.1 Exercise 1

Import modules, read the csv file and check its content.

```
[1]: import pandas as pd
import matplotlib.pyplot as plt

# read file into dataframe and print
df_countries = pd.read_csv("countries_top10.csv")
print(df_countries)
print()
```

|   | Country    | Population | Area     | GDP            |
|---|------------|------------|----------|----------------|
| 0 | Bangladesh | 160996000  | 147570   | 195100000000   |
| 1 | Brasil     | 207848000  | 8547404  | 1775000000000  |
| 2 | China      | 1379113000 | 9572419  | 10866000000000 |
| 3 | India      | 1311051000 | 3287263  | 2047000000000  |
| 4 | Indonesia  | 257564000  | 1912988  | 861900000000   |
| 5 | Mexico     | 127017000  | 1359162  | 1144000000000  |
| 6 | Nigeria    | 182202000  | 923768   | 481100000000   |
| 7 | Pakistan   | 188925000  | 796095   | 270000000000   |
| 8 | Russia     | 144097000  | 17075400 | 1326000000000  |
| 9 | USA        | 321419000  | 9809155  | 17947000000000 |

Calculate new columns and write into Excel file. Open the Excel file and have a look.

```
[2]: # calculate GDP per head and population per km^2
df_countries["GDP/head"] = df_countries["GDP"] / df_countries["Population"]
df_countries["Pop/km^2"] = df_countries["Population"] / df_countries["Area"]
print(df_countries)

# write into Excel file
df_countries.to_excel("countries_top10.xlsx")
```

|   | Country    | Population | Area   | GDP          | GDP/head    | Pop/km^2    |
|---|------------|------------|--------|--------------|-------------|-------------|
| 0 | Bangladesh | 160996000  | 147570 | 195100000000 | 1211.831350 | 1090.980552 |

|   |           |            |          |                |              |            |
|---|-----------|------------|----------|----------------|--------------|------------|
| 1 | Brasil    | 207848000  | 8547404  | 1775000000000  | 8539.894538  | 24.317091  |
| 2 | China     | 1379113000 | 9572419  | 10866000000000 | 7878.977285  | 144.071525 |
| 3 | India     | 1311051000 | 3287263  | 2047000000000  | 1561.342770  | 398.827535 |
| 4 | Indonesia | 257564000  | 1912988  | 861900000000   | 3346.352751  | 134.639632 |
| 5 | Mexico    | 127017000  | 1359162  | 1144000000000  | 9006.668399  | 93.452436  |
| 6 | Nigeria   | 182202000  | 923768   | 481100000000   | 2640.475955  | 197.237835 |
| 7 | Pakistan  | 188925000  | 796095   | 270000000000   | 1429.138547  | 237.314642 |
| 8 | Russia    | 144097000  | 17075400 | 1326000000000  | 9202.134673  | 8.438865   |
| 9 | USA       | 321419000  | 9809155  | 17947000000000 | 55836.773806 | 32.767247  |

Now the plot. "bo" is indicating blue circles.

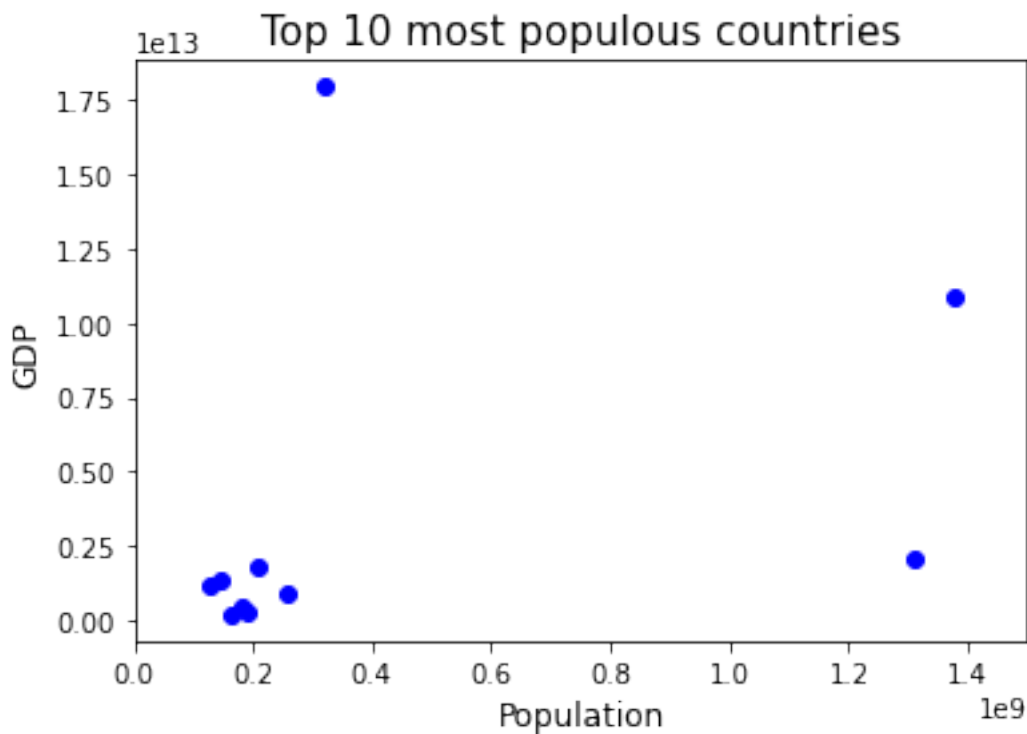
```
[3]: # scatter plot
plt.figure()

plt.plot(df_countries["Population"], df_countries["GDP"], "bo")

plt.xlabel("Population", fontsize=12)
plt.ylabel("GDP", fontsize=12)
plt.title("Top 10 most populous countries", size=15)

plt.xlim(0.0, 1.5e9)

plt.show()
```



## 0.0.2 Exercise 2

```
[4]: import pandas as pd
import matplotlib.pyplot as plt

# read file into dataframe and print
df_gdp = pd.read_excel("GDP_2015dollars.xls")
print(df_gdp)
print()

# line plots
plt.figure()

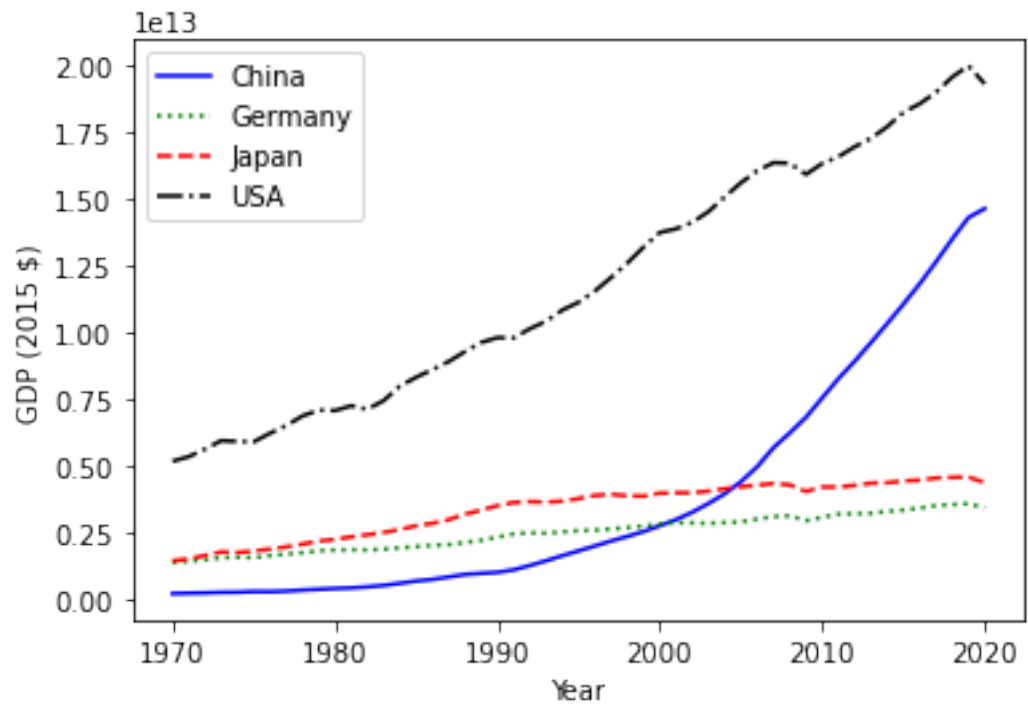
# plot the four countries with labels
plt.plot(df_gdp["Year"], df_gdp["China"], "b-", label="China")
plt.plot(df_gdp["Year"], df_gdp["Germany"], "g:", label="Germany")
plt.plot(df_gdp["Year"], df_gdp["Japan"], "r--", label="Japan")
plt.plot(df_gdp["Year"], df_gdp["United States"], "k-.", label="USA")

# set labels and show the legend
plt.xlabel("Year")
plt.ylabel("GDP (2015 $)")
plt.legend()

plt.show()
```

|    | Year | China        | Germany      | Japan        | United States |
|----|------|--------------|--------------|--------------|---------------|
| 0  | 1970 | 2.320617e+11 | 1.398222e+12 | 1.460289e+12 | 5.183548e+12  |
| 1  | 1971 | 2.484453e+11 | 1.442024e+12 | 1.528908e+12 | 5.354261e+12  |
| 2  | 1972 | 2.579111e+11 | 1.504036e+12 | 1.657543e+12 | 5.635836e+12  |
| 3  | 1973 | 2.779250e+11 | 1.575891e+12 | 1.790687e+12 | 5.954020e+12  |
| 4  | 1974 | 2.843450e+11 | 1.589918e+12 | 1.768747e+12 | 5.921835e+12  |
| 5  | 1975 | 3.091399e+11 | 1.576137e+12 | 1.823429e+12 | 5.909669e+12  |
| 6  | 1976 | 3.042864e+11 | 1.654144e+12 | 1.895910e+12 | 6.228090e+12  |
| 7  | 1977 | 3.273209e+11 | 1.709512e+12 | 1.979147e+12 | 6.516086e+12  |
| 8  | 1978 | 3.643932e+11 | 1.760943e+12 | 2.083486e+12 | 6.876771e+12  |
| 9  | 1979 | 3.920555e+11 | 1.834028e+12 | 2.197745e+12 | 7.094500e+12  |
| 10 | 1980 | 4.227697e+11 | 1.859867e+12 | 2.259669e+12 | 7.076285e+12  |
| 11 | 1981 | 4.443849e+11 | 1.869710e+12 | 2.354786e+12 | 7.255861e+12  |
| 12 | 1982 | 4.844556e+11 | 1.862327e+12 | 2.432787e+12 | 7.125046e+12  |
| 13 | 1983 | 5.366324e+11 | 1.891611e+12 | 2.518495e+12 | 7.451652e+12  |
| 14 | 1984 | 6.181551e+11 | 1.945010e+12 | 2.631878e+12 | 7.990901e+12  |
| 15 | 1985 | 7.011775e+11 | 1.990289e+12 | 2.769614e+12 | 8.324094e+12  |
| 16 | 1986 | 7.639327e+11 | 2.035813e+12 | 2.861746e+12 | 8.612328e+12  |
| 17 | 1987 | 8.529876e+11 | 2.064358e+12 | 2.997125e+12 | 8.910250e+12  |
| 18 | 1988 | 9.487149e+11 | 2.140889e+12 | 3.200481e+12 | 9.282437e+12  |

|    |      |              |              |              |              |
|----|------|--------------|--------------|--------------|--------------|
| 19 | 1989 | 9.886210e+11 | 2.224310e+12 | 3.355962e+12 | 9.623348e+12 |
| 20 | 1990 | 1.027377e+12 | 2.341198e+12 | 3.520159e+12 | 9.804841e+12 |
| 21 | 1991 | 1.122541e+12 | 2.460792e+12 | 3.640460e+12 | 9.794226e+12 |
| 22 | 1992 | 1.282217e+12 | 2.508115e+12 | 3.671334e+12 | 1.013922e+13 |
| 23 | 1993 | 1.460237e+12 | 2.483614e+12 | 3.652320e+12 | 1.041823e+13 |
| 24 | 1994 | 1.650605e+12 | 2.543020e+12 | 3.688589e+12 | 1.083796e+13 |
| 25 | 1995 | 1.831412e+12 | 2.582288e+12 | 3.785636e+12 | 1.112887e+13 |
| 26 | 1996 | 2.013135e+12 | 2.603096e+12 | 3.904273e+12 | 1.154872e+13 |
| 27 | 1997 | 2.199084e+12 | 2.649748e+12 | 3.942583e+12 | 1.205476e+13 |
| 28 | 1998 | 2.371623e+12 | 2.703112e+12 | 3.892499e+12 | 1.259498e+13 |
| 29 | 1999 | 2.553328e+12 | 2.754127e+12 | 3.879501e+12 | 1.319365e+13 |
| 30 | 2000 | 2.770108e+12 | 2.834341e+12 | 3.986756e+12 | 1.373821e+13 |
| 31 | 2001 | 3.001017e+12 | 2.882000e+12 | 4.002149e+12 | 1.387537e+13 |
| 32 | 2002 | 3.275119e+12 | 2.876294e+12 | 4.003828e+12 | 1.411704e+13 |
| 33 | 2003 | 3.603876e+12 | 2.856157e+12 | 4.065292e+12 | 1.452095e+13 |
| 34 | 2004 | 3.968358e+12 | 2.889719e+12 | 4.154164e+12 | 1.507259e+13 |
| 35 | 2005 | 4.420537e+12 | 2.910863e+12 | 4.229101e+12 | 1.560212e+13 |
| 36 | 2006 | 4.982871e+12 | 3.021955e+12 | 4.287139e+12 | 1.604756e+13 |
| 37 | 2007 | 5.691977e+12 | 3.111902e+12 | 4.350759e+12 | 1.634864e+13 |
| 38 | 2008 | 6.241291e+12 | 3.141772e+12 | 4.297493e+12 | 1.632631e+13 |
| 39 | 2009 | 6.827893e+12 | 2.962885e+12 | 4.052826e+12 | 1.591215e+13 |
| 40 | 2010 | 7.554099e+12 | 3.086730e+12 | 4.218908e+12 | 1.632010e+13 |
| 41 | 2011 | 8.275578e+12 | 3.207890e+12 | 4.219912e+12 | 1.657320e+13 |
| 42 | 2012 | 8.926348e+12 | 3.221315e+12 | 4.277926e+12 | 1.694602e+13 |
| 43 | 2013 | 9.619581e+12 | 3.235411e+12 | 4.363702e+12 | 1.725818e+13 |
| 44 | 2014 | 1.033391e+13 | 3.306899e+12 | 4.376628e+12 | 1.769412e+13 |
| 45 | 2015 | 1.106155e+13 | 3.356236e+12 | 4.444931e+12 | 1.823830e+13 |
| 46 | 2016 | 1.181913e+13 | 3.431080e+12 | 4.478438e+12 | 1.855044e+13 |
| 47 | 2017 | 1.264023e+13 | 3.523041e+12 | 4.553466e+12 | 1.898316e+13 |
| 48 | 2018 | 1.349342e+13 | 3.561302e+12 | 4.578914e+12 | 1.955198e+13 |
| 49 | 2019 | 1.429624e+13 | 3.598892e+12 | 4.591291e+12 | 1.997453e+13 |
| 50 | 2020 | 1.463184e+13 | 3.434436e+12 | 4.380757e+12 | 1.929448e+13 |



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