Main_ver2

April 20, 2022

[ ]:
```
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# Datasets are taken from Kaggle
```

1 Population dataset 1

First, let's take a look at a dataset from Kaggle which describes distribution of people by different age groups (0-19, 20-39, 40-59, and 60+) and sex (male, female) in different countries. The source is taken from: https://www.kaggle.com/alizahidraja/world-population-by-age-group-2020.

Initially, the dataset was imported and processed to convert the numbers into millions, i.e. 1000000 into 1 million:

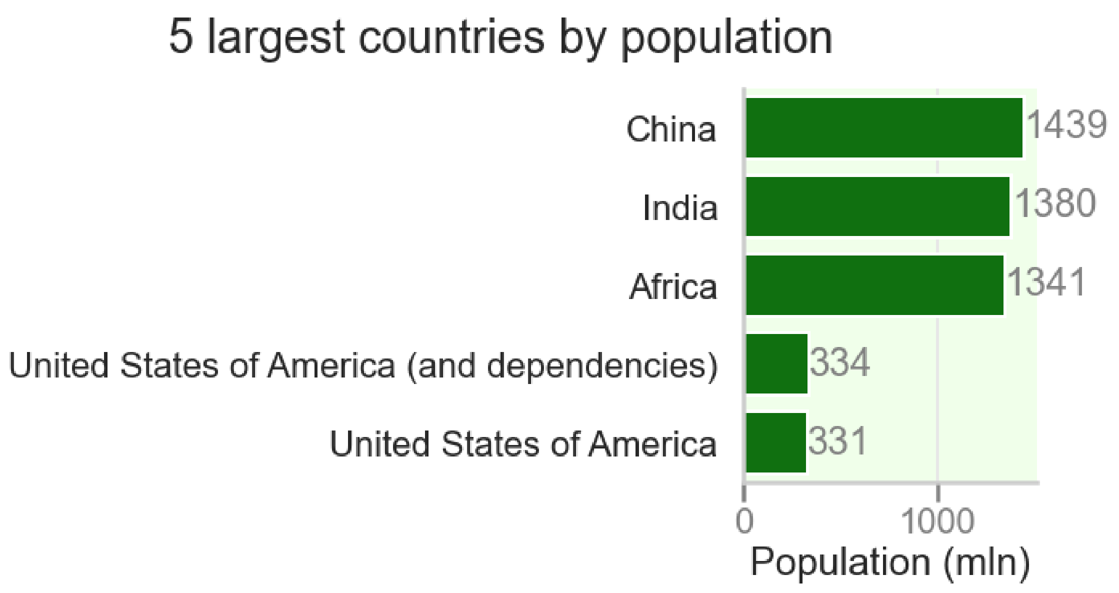
[ ]:
```
import pandas as pd, numpy as np, matplotlib.pyplot as plt, seaborn as sns

df = pd.read_csv('WorldPopulationByAge2020_proc.csv')
df['PopTotal'] = df['PopTotal'] * 1000
df['PopTotalMln'] = df['PopTotal'] / 1000000
df
```

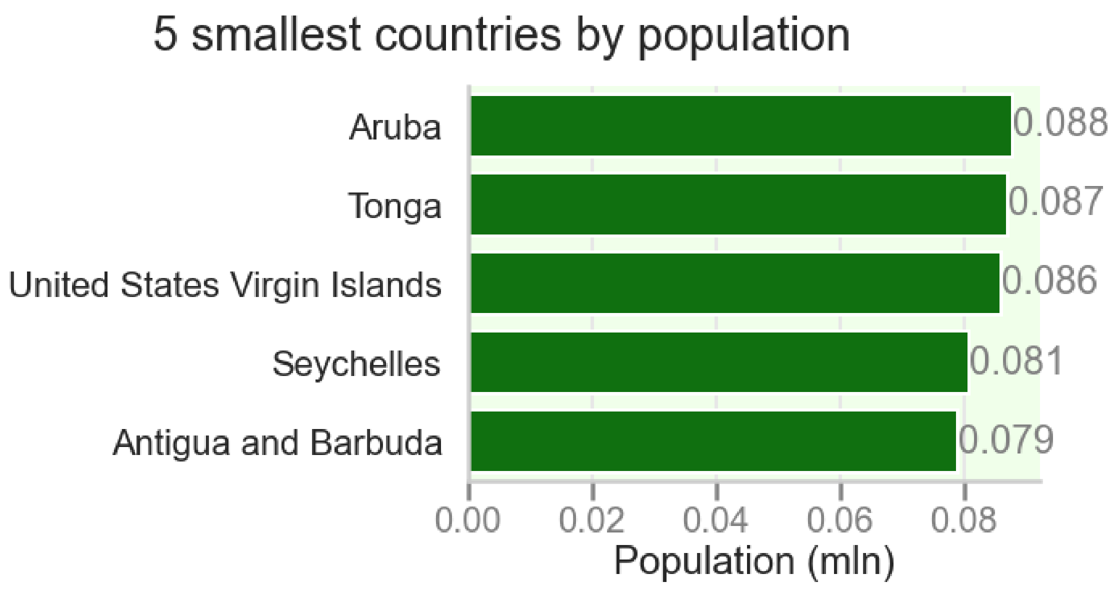
[ ]:
```
        Location AgeGrp   PopMale  PopFemale     PopTotal  PopTotalMln
0    Afghanistan   0-19   10709.0    10197.0   20906000.0       20.906
1    Afghanistan  20-39    5994.0     5574.0   11568000.0       11.568
2    Afghanistan  40-59    2485.0     2316.0    4801000.0        4.801
3    Afghanistan    60+     781.0      858.0    1639000.0        1.639
4         Africa   0-19  344109.0   334982.0  679091000.0      679.091
..           …      …        …          …            …            …
851       Zambia    60+     258.0      365.0     623000.0        0.623
852     Zimbabwe   0-19    3941.0     3923.0    7864000.0        7.864
853     Zimbabwe  20-39    1993.0     2354.0    4347000.0        4.347
854     Zimbabwe  40-59     892.0     1060.0    1952000.0        1.952
855     Zimbabwe    60+     257.0      424.0     681000.0        0.681

[856 rows x 6 columns]
```

Then, we can aim to answer different questions about the dataset.

1.1 Which 5 countries in this dataset have the largest and smallest population sizes?

```
[ ]: def N_countries(N: int, size: str):
         """
         Function that makes a bargraph of populations (in millions) of the N␣
     ↪largest/smallest countries in the dataset.

         Parameters:
         ---
                 N
                         integer, how many countries to consider
                 size = ``['largest', 'smallest']``
                         str, show largest or smallest countries?

         Example usage:
         ---
                 ``N_countries(5, 'largest')``
         """
         df3 = df.groupby('Location', as_index=False)['PopTotalMln'].sum()
         df3.sort_values(by='PopTotalMln', inplace=True, ascending=False)
         df3 = df3[df3['Location'] != 'World']
         if size == 'largest':
                 df3 = df3.head(N)
         elif size == 'smallest':
                 df3 = df3.tail(N)
         bargraph = sns.catplot(
                 x='PopTotalMln', y='Location',
                 data=df3,
                 kind='bar', color='green', orient='h', aspect=2
         )
         bargraph.set_axis_labels("Population (mln)", "")
         bargraph.fig.suptitle(f'{N} {size} countries by population', y=1.05)
         for iter, i in enumerate(df3['PopTotalMln']):
                 if size == 'largest':
                         plt.text(x=df3['PopTotalMln'].iloc[iter], y=iter,␣
     ↪s=round(df3['PopTotalMln'].iloc[iter]), ha='left', va='center', color='grey')
                 elif size == 'smallest':
                         plt.text(x=df3['PopTotalMln'].iloc[iter], y=iter,␣
     ↪s=round(df3['PopTotalMln'].iloc[iter], 3), ha='left', va='center',␣
     ↪color='grey')
         sns.set_context('poster')
         sns.set_style('whitegrid', {
                 'axes.facecolor': '#F0FFEA',
                 'grid.color': '#E7E7E7',
                 'xtick.color': 'grey',
                 'xtick.bottom': True,
        })

N_countries(5, 'largest')
N_countries(5, 'smallest')
```



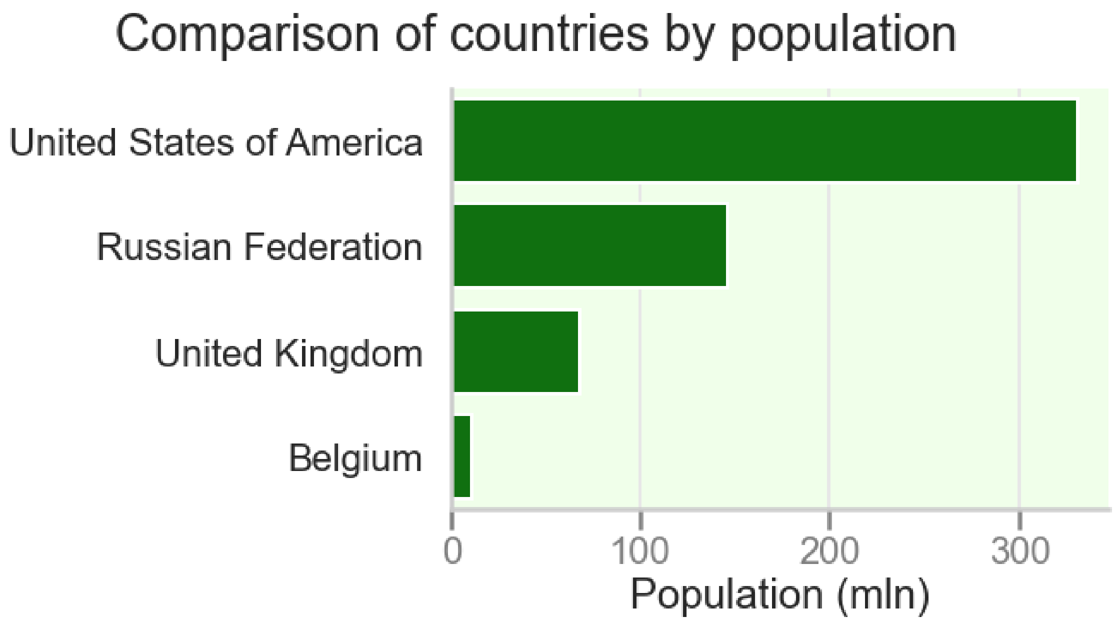


From the graphs above, we can see that the largest countries, such as China and India, have more than 1 billion people. Africa is not a country, but still gives an interesting estimation of the total amount of people on the continent.

1.2 Which of the countries - UK, USA, Belgium, or Russia - has the largest population?

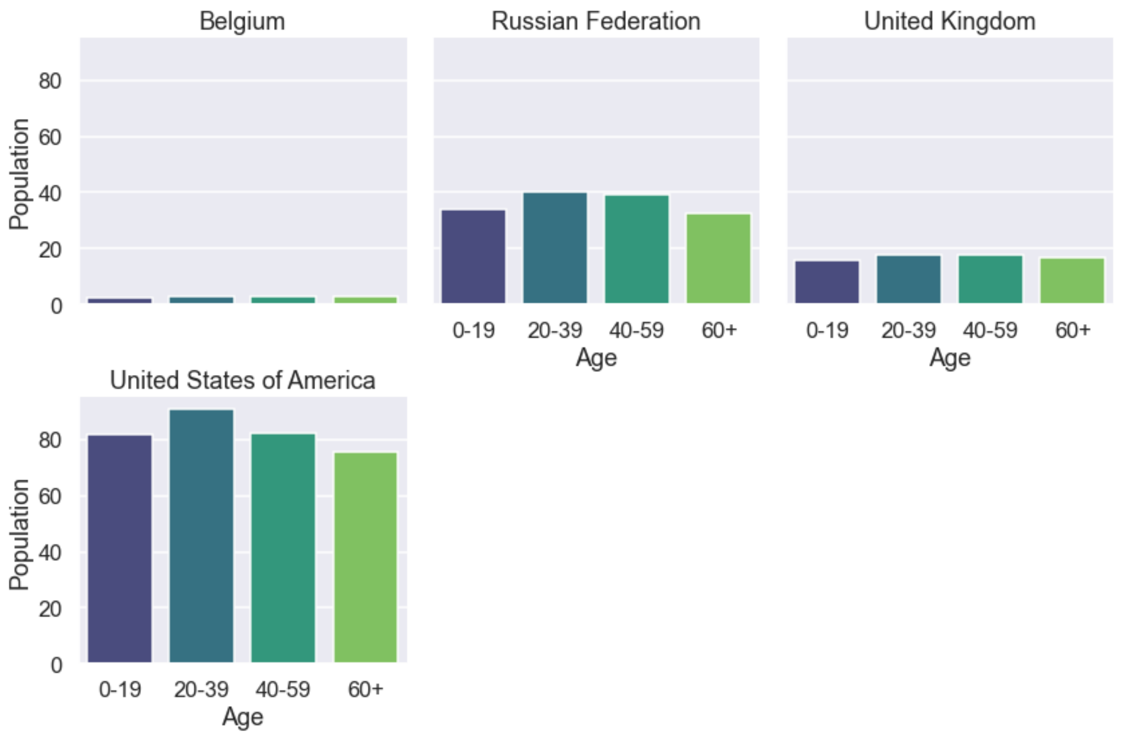
Below is the script for comparing populations of chosen countries:

```
[ ]: def bargraph_popByCountry2(countries:list):
         """
         Given a list of countries as an argument, graph the bar graph of the␣
     ↪ascending population size of those countries
         """
         df2 = df.groupby('Location', as_index=False)['PopTotalMln'].sum()
         df2.sort_values(by='PopTotalMln', inplace=True, ascending=False)
         bargraph = sns.catplot(
                 x='PopTotalMln', y='Location',
                 data=df2[df2['Location'].isin(countries)],
                 kind='bar', color='green', orient='h', aspect=2
         )
         sns.set_context('poster')
         bargraph.fig.suptitle(f'Comparison of countries by population', y=1.05)
         bargraph.set_axis_labels("Population (mln)", "")


     countryList = ['United Kingdom', 'United States of America', 'Belgium',␣
     ↪'Russian Federation']
     bargraph_popByCountry2(countryList)
```



1.3 In the four countries - UK, USA, Belgium, and Russia - what is the distribution of population by age groups?

```
[ ]: def bargraph_popByAge(countries:list):
            # plt.figure(figsize=(20, 10))
            bargraph = sns.catplot(
                    x='AgeGrp', y='PopTotalMln',
                    data=df[df['Location'].isin(countries)],
                    col='Location', col_wrap=3, kind='bar', height=4,␣
      ↪palette='viridis'
            )
            bargraph.set_titles("{col_name}")
            bargraph.set_axis_labels("Age", "Population")
            sns.set_style('darkgrid')
            sns.set_context('talk')

     bargraph_popByAge(countryList)
```



2 Population dataset 2

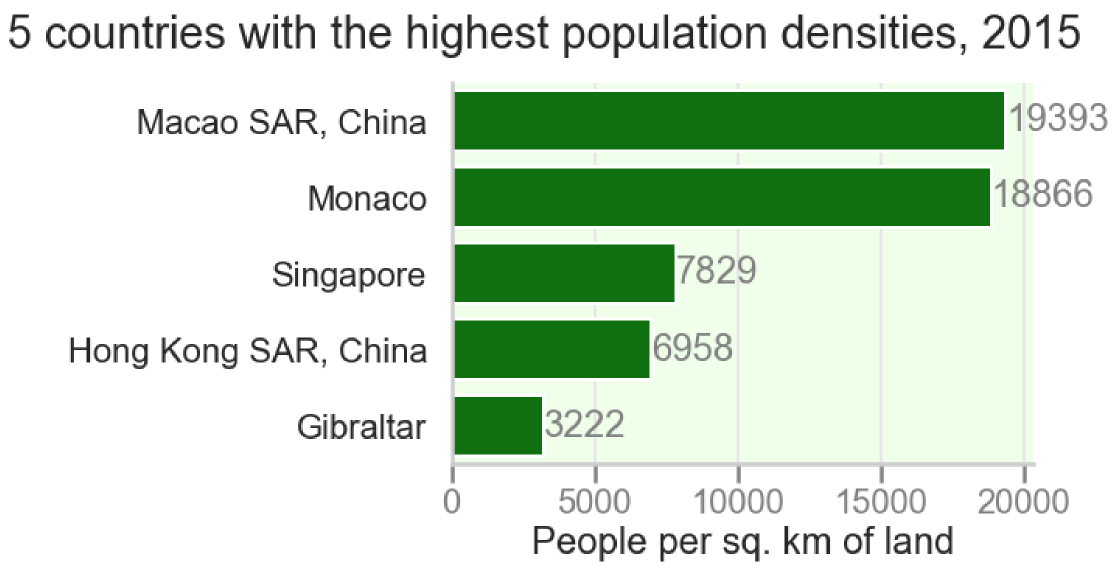
Now we can explore another dataset from Kaggle, this time with population density (in people per sq.km of land) over time (1961-2015) (https://www.kaggle.com/datasets/walla2ae/world-population?select=API_EN.POP.DNST_DS2_en_csv_v2.csv).

[ ]:
```
df = pd.read_csv('API_EN.POP.DNST_DS2_en_csv_v2.csv', skiprows=4)
df.head(3)
```

[ ]:
```
  Country Name Country Code  \
0        Aruba          ABW
1      Andorra          AND
2  Afghanistan          AFG

                                      Indicator Name Indicator Code  1960  \
0  Population density (people per sq. km of land …    EN.POP.DNST   NaN
1  Population density (people per sq. km of land …    EN.POP.DNST   NaN
2  Population density (people per sq. km of land …    EN.POP.DNST   NaN

         1961        1962        1963        1964        1965  …  \
0  307.972222  312.366667  314.983333  316.827778  318.666667  …
1   30.587234   32.714894   34.914894   37.170213   39.470213  …
2   14.038148   14.312061   14.599692   14.901579   15.218206  …

         2008        2009        2010        2011        2012        2013  \
0  563.011111  563.422222  564.427778  566.311111  568.850000  571.783333
1  182.161702  181.859574  179.614894  175.161702  168.757447  161.493617
2   40.634655   41.674005   42.830327   44.127634   45.533197   46.997059

         2014        2015  2016  Unnamed: 61
0  574.672222  577.161111   NaN          NaN
1  154.863830  149.942553   NaN          NaN
2   48.444546   49.821649   NaN          NaN

[3 rows x 62 columns]
```

2.1 Countries with the highest population density in 2015

[ ]:
```
def Nlargest(N):
        df.sort_values(by='2015', inplace=True, ascending=False)
        df3 = df.head(N)
        bargraph = sns.catplot(
                x='2015', y='Country Name',
                data=df3,
                kind='bar', color='green', orient='h', aspect=2
        )
        bargraph.fig.suptitle(f'{N} countries with the highest population␣
 ↪densities, 2015', y=1.05)
        bargraph.set_axis_labels("People per sq. km of land", "")
        sns.set_context('poster')
        # sns.set_context('poster')
        sns.set_style('whitegrid', {
                'axes.facecolor': '#F0FFEA',
                'grid.color': '#E7E7E7',
                'xtick.color': 'grey',
                'xtick.bottom': True,
        })
        for iter, i in enumerate(df3['2015']):
                plt.text(x=df3['2015'].iloc[iter], y=iter, s=round(df3['2015'].
↪iloc[iter]), ha='left', va='center', color='grey')

Nlargest(5)
```



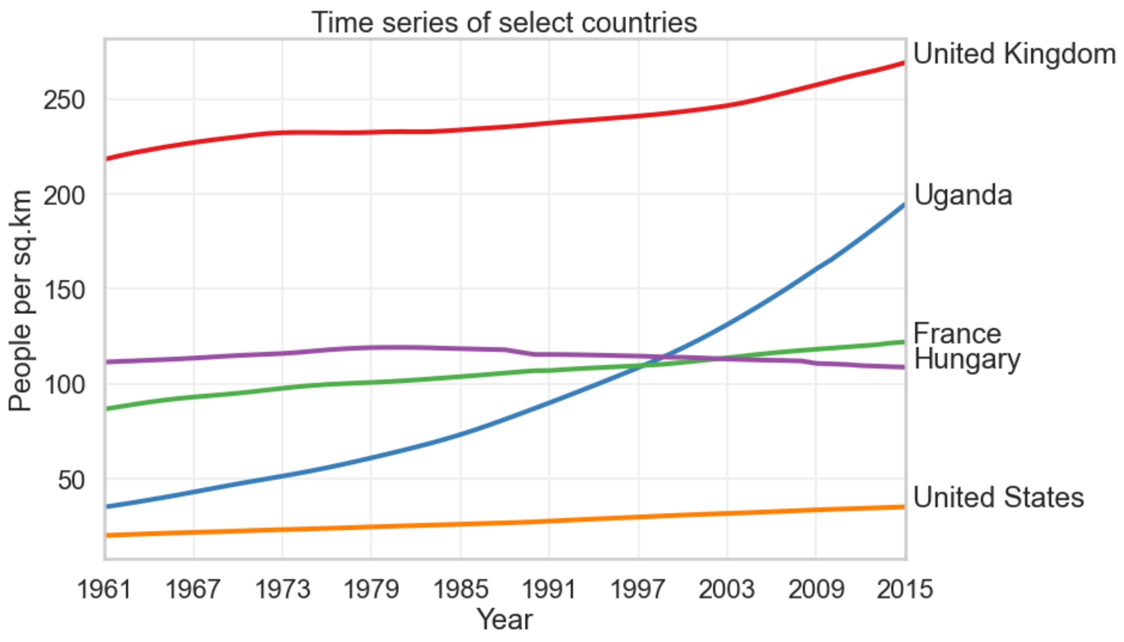
2.2 Time series for the selected countries

We can put the names of all available countries within a list. Then, perhaps we are unsure on how the United States of America is written in this dataset. To find this out, we can search the list of country names by their first letter:

[ ]:
```
def firstLetterName(a: str):
        allCountries = [i for i in df['Country Name']]; allCountries.sort()
        CountriesStartingWithLetter = [i for i in allCountries if i[0] == a.
↪upper()]
        return CountriesStartingWithLetter

firstLetterName('U')
```

[ ]:
```
['Uganda',
 'Ukraine',
 'United Arab Emirates',
 'United Kingdom',
 'United States',
 'Upper middle income',
 'Uruguay',
 'Uzbekistan']
```

```
[ ]: # Now let's graph a time series for the selected countries

df2 = pd.melt(df, id_vars=['Country Name'], value_vars=[str(i) for i in␣
 ↪range(1961, 2016)] )
df2.rename(columns={'variable': 'Year', 'value': 'People per sq.km'},␣
 ↪inplace=True)
df2['Year'] = df2['Year'].astype(int)

def lineplot(countries):
        plt.figure(figsize=(12,8))
        sns.lineplot(
                x='Year', y='People per sq.km', data=df2[df2['Country Name'].
 ↪isin(countries)], hue='Country Name', legend=False,
                palette='Set1', linewidth=4
        )
        plt.title('Time series of select countries')
        plt.xticks(ticks=[i for i in range(1961, 2016, 6)])
        sns.set_context('poster')
        sns.set_style('whitegrid', {'grid.color': '0.94'})
        plt.margins(x=0)
        for i in countries:
                df3 = df2[(df2['Country Name'] == i) & (df2['Year'] == 2015)]
                plt.text(x=2015+0.5, y=df3['People per sq.km'].iloc[0], s=i)

lineplot(['United Kingdom', 'United States', 'France', 'Hungary', 'Uganda'])
```


Time series of select countries
People per sq.km
Year
250
200
150
100
50
1961
1967
1973
1979
1985
1991
1997
2003
2009
2015
United Kingdom
Uganda
France
Hungary
United States