```
# This Python 3 environment comes with many helpful analytics
libraries installed
# It is defined by the kaggle/python Docker image:
https://github.com/kaggle/docker-python
# For example, here's several helpful packages to load

import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
from matplotlib import pyplot as plt

# Input data files are available in the read-only "../input/"
directory
# For example, running this (by clicking run or pressing Shift+Enter)
will list all files under the input directory

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

# You can write up to 20GB to the current directory (/kaggle/working/)
that gets preserved as output when you create a version using "Save &
Run All"
# You can also write temporary files to /kaggle/temp/, but they won't
be saved outside of the current session
```

```
/kaggle/input/covid-world-vaccination-progress/
country_vaccinations_by_manufacturer.csv
/kaggle/input/covid-world-vaccination-progress/country_vaccinations.cs
v
```

```
# Read data
df =
pd.read_csv("/kaggle/input/covid-world-vaccination-progress/country_va
ccinations.csv")

# Converted 'date' column to datetime to plot with matplotlib later
df['date'] = pd.to_datetime(df['date'])

# An overview of the data
df.head(n=3)
```

```
       country iso_code       date  total_vaccinations
people_vaccinated  \
0  Afghanistan      AFG 2021-02-22                 0.0
0.0
1  Afghanistan      AFG 2021-02-23                 NaN
NaN
2  Afghanistan      AFG 2021-02-24                 NaN
NaN
```

```
   people_fully_vaccinated  daily_vaccinations_raw  daily_vaccinations
\
0                      NaN                     NaN                 NaN

1                      NaN                     NaN              1367.0

2                      NaN                     NaN              1367.0


   total_vaccinations_per_hundred  people_vaccinated_per_hundred  \
0                             0.0                            0.0
1                             NaN                            NaN
2                             NaN                            NaN

   people_fully_vaccinated_per_hundred  daily_vaccinations_per_million
\
0                                  NaN                             NaN

1                                  NaN                            34.0

2                                  NaN                            34.0


                                          vaccines  \
0  Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi...
1  Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi...
2  Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi...

                 source_name  \
0  World Health Organization
1  World Health Organization
2  World Health Organization

                                       source_website
0  https://app.powerbi.com/view?r=eyJrIjoiYTkyM2V...
1  https://app.powerbi.com/view?r=eyJrIjoiYTkyM2V...
2  https://app.powerbi.com/view?r=eyJrIjoiYTkyM2V...
```

```python
def get_vaccines(cdf: pd.DataFrame):
    vaccines = cdf['vaccines'].unique()
    distinct_vaccines = []

    for vaccine in vaccines:
        for v in vaccine.split(','):
            v = v.strip()
            if v not in distinct_vaccines:
                distinct_vaccines.append(v)
    return distinct_vaccines
```

```
vaccines = get_vaccines(df)
print("Vaccines used:")
print(', '.join(vaccines))
```

```
Vaccines used:
Johnson&Johnson, Oxford/AstraZeneca, Pfizer/BioNTech,
Sinopharm/Beijing, Sinovac, Sputnik V, CanSino, Moderna, Covaxin,
Sinopharm/Wuhan, ZF2001, Abdala, Soberana02, COVIran Barekat, QazVac,
Sinopharm/HayatVax, EpiVacCorona, Medigen
```

```
vaccines_country = {}
people_vaccinated = {}
vaccinations_percentage = {}

countries = df['country'].unique()

for vaccine in vaccines:
    vaccines_country[vaccine] = []

for country in countries:
    country_df = df.loc[df['country'] == country]
    country_vaccinations = country_df['people_vaccinated'].sum()
    people_vaccinated[country] = country_vaccinations
    c_vaccines = country_df['vaccines'].unique()

    country_df =
country_df.dropna(subset=['people_vaccinated_per_hundred'])
    if not country_df.empty:
        vaccinations_percentage[country] =
list(country_df['people_vaccinated_per_hundred'])[-1]
    else:
        vaccinations_percentage[country] = 0

    for vaccine in c_vaccines:
        for v in vaccine.split(','):
            v = v.strip()
            vaccines_country[v].append(country)

for vaccine in vaccines_country:
    print(f"Vaccine: {vaccine}:")
    print(f"Number of countries using it:
{len(vaccines_country[vaccine])}")
    print(f"List of countries using it: \
n{vaccines_country[vaccine]}")
    print(f"-"*200, "\n")
```

```
Vaccine: Johnson&Johnson:
Number of countries using it: 51
List of countries using it:
['Afghanistan', 'Austria', 'Belgium', 'Bolivia', 'Brazil', 'British
Virgin Islands', 'Bulgaria', 'Cambodia', 'Colombia', 'Cyprus',
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'Czechia', 'Denmark', 'Djibouti', 'Egypt', 'Estonia', 'France',
'French Polynesia', 'Germany', 'Greece', 'Haiti', 'Honduras',
'Hungary', 'Iceland', 'Ireland', 'Italy', 'Jamaica', 'Laos', 'Latvia',
'Libya', 'Lithuania', 'Luxembourg', 'Malawi', 'Malta', 'Mexico',
'Moldova', 'Morocco', 'Netherlands', 'Philippines', 'Poland',
'Portugal', 'Romania', 'Somalia', 'South Africa', 'South Korea',
'Spain', 'Sudan', 'Syria', 'Tanzania', 'Tunisia', 'United States',
'Yemen']
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Vaccine: Oxford/AstraZeneca:
Number of countries using it: 182
List of countries using it:
['Afghanistan', 'Albania', 'Algeria', 'Andorra', 'Angola', 'Anguilla',
'Antigua and Barbuda', 'Argentina', 'Armenia', 'Australia', 'Austria',
'Azerbaijan', 'Bahamas', 'Bahrain', 'Bangladesh', 'Barbados',
'Belgium', 'Belize', 'Benin', 'Bermuda', 'Bhutan', 'Bolivia', 'Bosnia
and Herzegovina', 'Botswana', 'Brazil', 'British Virgin Islands',
'Brunei', 'Bulgaria', 'Burkina Faso', 'Cambodia', 'Cameroon',
'Canada', 'Cape Verde', 'Cayman Islands', 'Central African Republic',
'Chile', 'Colombia', 'Comoros', 'Congo', 'Costa Rica', "Cote
d'Ivoire", 'Croatia', 'Cyprus', 'Czechia', 'Democratic Republic of
Congo', 'Djibouti', 'Dominica', 'Dominican Republic', 'Ecuador',
'Egypt', 'El Salvador', 'England', 'Estonia', 'Eswatini', 'Ethiopia',
'Falkland Islands', 'Fiji', 'Finland', 'France', 'Gambia', 'Georgia',
'Germany', 'Ghana', 'Greece', 'Grenada', 'Guatemala', 'Guernsey',
'Guinea-Bissau', 'Guyana', 'Haiti', 'Honduras', 'Hungary', 'Iceland',
'India', 'Indonesia', 'Iran', 'Iraq', 'Ireland', 'Isle of Man',
'Italy', 'Jamaica', 'Japan', 'Jersey', 'Jordan', 'Kenya', 'Kiribati',
'Kosovo', 'Laos', 'Latvia', 'Lebanon', 'Lesotho', 'Liberia', 'Libya',
'Lithuania', 'Luxembourg', 'Madagascar', 'Malawi', 'Malaysia',
'Maldives', 'Mali', 'Malta', 'Mauritania', 'Mauritius', 'Mexico',
'Moldova', 'Mongolia', 'Montenegro', 'Montserrat', 'Morocco',
'Mozambique', 'Myanmar', 'Namibia', 'Nauru', 'Nepal', 'Netherlands',
'Nicaragua', 'Niger', 'Nigeria', 'Niue', 'North Macedonia', 'Northern
Cyprus', 'Northern Ireland', 'Oman', 'Pakistan', 'Palestine',
'Panama', 'Papua New Guinea', 'Paraguay', 'Peru', 'Philippines',
'Pitcairn', 'Poland', 'Portugal', 'Romania', 'Rwanda', 'Saint Helena',
'Saint Kitts and Nevis', 'Saint Lucia', 'Saint Vincent and the
Grenadines', 'Samoa', 'Sao Tome and Principe', 'Saudi Arabia',
'Scotland', 'Senegal', 'Serbia', 'Seychelles', 'Sierra Leone', 'Sint
Maarten (Dutch part)', 'Slovakia', 'Slovenia', 'Solomon Islands',
'Somalia', 'South Korea', 'South Sudan', 'Spain', 'Sri Lanka',
'Sudan', 'Suriname', 'Sweden', 'Syria', 'Taiwan', 'Tajikistan',
'Thailand', 'Timor', 'Togo', 'Tonga', 'Trinidad and Tobago',
'Tunisia', 'Turkmenistan', 'Tuvalu', 'Uganda', 'Ukraine', 'United Arab
Emirates', 'United Kingdom', 'Uruguay', 'Uzbekistan', 'Vanuatu',
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'Vietnam', 'Wales', 'Yemen', 'Zambia', 'Zimbabwe']
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Vaccine: Pfizer/BioNTech:
Number of countries using it: 129
List of countries using it:
['Afghanistan', 'Albania', 'Andorra', 'Argentina', 'Aruba',
'Australia', 'Austria', 'Bahrain', 'Bangladesh', 'Barbados',
'Belgium', 'Bermuda', 'Bhutan', 'Bolivia', 'Bonaire Sint Eustatius and
Saba', 'Bosnia and Herzegovina', 'Botswana', 'Brazil', 'Bulgaria',
'Canada', 'Cape Verde', 'Cayman Islands', 'Chile', 'Colombia', 'Cook
Islands', 'Costa Rica', 'Croatia', 'Curacao', 'Cyprus', 'Czechia',
'Denmark', 'Djibouti', 'Dominica', 'Dominican Republic', 'Ecuador',
'Egypt', 'El Salvador', 'England', 'Estonia', 'Faeroe Islands',
'Finland', 'France', 'French Polynesia', 'Georgia', 'Germany',
'Gibraltar', 'Greece', 'Grenada', 'Guernsey', 'Honduras', 'Hong Kong',
'Hungary', 'Iceland', 'Indonesia', 'Iraq', 'Ireland', 'Isle of Man',
'Israel', 'Italy', 'Jamaica', 'Japan', 'Jersey', 'Jordan', 'Kosovo',
'Kuwait', 'Laos', 'Latvia', 'Lebanon', 'Libya', 'Liechtenstein',
'Lithuania', 'Luxembourg', 'Macao', 'Malaysia', 'Maldives', 'Malta',
'Mexico', 'Moldova', 'Monaco', 'Mongolia', 'Montenegro', 'Morocco',
'Netherlands', 'New Caledonia', 'New Zealand', 'North Macedonia',
'Northern Cyprus', 'Northern Ireland', 'Norway', 'Oman', 'Pakistan',
'Palestine', 'Panama', 'Paraguay', 'Peru', 'Philippines', 'Poland',
'Portugal', 'Qatar', 'Romania', 'Rwanda', 'Saint Kitts and Nevis',
'San Marino', 'Saudi Arabia', 'Scotland', 'Serbia', 'Singapore', 'Sint
Maarten (Dutch part)', 'Slovakia', 'Slovenia', 'South Africa', 'South
Korea', 'Spain', 'Sri Lanka', 'Sudan', 'Sweden', 'Switzerland',
'Thailand', 'Tokelau', 'Tunisia', 'Turkey', 'Turks and Caicos
Islands', 'Ukraine', 'United Arab Emirates', 'United Kingdom', 'United
States', 'Uruguay', 'Vietnam', 'Wales']
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Vaccine: Sinopharm/Beijing:
Number of countries using it: 69
List of countries using it:
['Afghanistan', 'Algeria', 'Argentina', 'Bahrain', 'Bangladesh',
'Barbados', 'Belarus', 'Belize', 'Bhutan', 'Bolivia', 'Brunei',
'Cambodia', 'Cameroon', 'Chad', 'China', 'Comoros', 'Congo',
'Djibouti', 'Dominica', 'Dominican Republic', 'Egypt', 'Equatorial
Guinea', 'Gabon', 'Gambia', 'Georgia', 'Guinea-Bissau', 'Hungary',
'Indonesia', 'Iran', 'Iraq', 'Jordan', 'Kyrgyzstan', 'Laos',
'Lebanon', 'Libya', 'Macao', 'Maldives', 'Mauritania', 'Mauritius',
'Moldova', 'Mongolia', 'Montenegro', 'Morocco', 'Mozambique',
'Myanmar', 'Namibia', 'Nepal', 'Niger', 'North Macedonia', 'Pakistan',
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'Paraguay', 'Peru', 'Senegal', 'Serbia', 'Seychelles', 'Sierra Leone',
'Somalia', 'Sri Lanka', 'Sudan', 'Syria', 'Thailand', 'Trinidad and
Tobago', 'Tunisia', 'Turkmenistan', 'United Arab Emirates',
'Venezuela', 'Vietnam', 'Zambia', 'Zimbabwe']
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Vaccine: Sinovac:
Number of countries using it: 41
List of countries using it:
['Albania', 'Armenia', 'Azerbaijan', 'Benin', 'Bosnia and
Herzegovina', 'Botswana', 'Brazil', 'Cambodia', 'Chile', 'China',
'Colombia', 'Djibouti', 'Dominican Republic', 'Ecuador', 'Egypt', 'El
Salvador', 'Georgia', 'Hong Kong', 'Indonesia', 'Laos', 'Libya',
'Malaysia', 'Mexico', 'North Macedonia', 'Northern Cyprus', 'Oman',
'Pakistan', 'Paraguay', 'Philippines', 'Singapore', 'Somalia',
'Sudan', 'Syria', 'Tajikistan', 'Thailand', 'Timor', 'Tunisia',
'Turkey', 'Ukraine', 'Uruguay', 'Zimbabwe']
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Vaccine: Sputnik V:
Number of countries using it: 51
List of countries using it:
['Albania', 'Algeria', 'Argentina', 'Armenia', 'Azerbaijan',
'Bahrain', 'Belarus', 'Bolivia', 'Bosnia and Herzegovina', 'Congo',
'Djibouti', 'Egypt', 'Ghana', 'Guinea', 'Guyana', 'Honduras',
'Hungary', 'India', 'Iran', 'Iraq', 'Jordan', 'Kazakhstan', 'Kenya',
'Kyrgyzstan', 'Laos', 'Lebanon', 'Libya', 'Mexico', 'Moldova',
'Mongolia', 'Montenegro', 'Morocco', 'Nicaragua', 'North Macedonia',
'Oman', 'Pakistan', 'Palestine', 'Paraguay', 'Philippines', 'Russia',
'San Marino', 'Serbia', 'Sri Lanka', 'Syria', 'Tunisia',
'Turkmenistan', 'United Arab Emirates', 'Uzbekistan', 'Venezuela',
'Vietnam', 'Zimbabwe']
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Vaccine: CanSino:
Number of countries using it: 7
List of countries using it:
['Argentina', 'Chile', 'China', 'Ecuador', 'Malaysia', 'Mexico',
'Pakistan']
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Vaccine: Moderna:
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Number of countries using it: 73
List of countries using it:
['Argentina', 'Austria', 'Bangladesh', 'Belgium', 'Bhutan', 'Bonaire
Sint Eustatius and Saba', 'Botswana', 'Bulgaria', 'Canada',
'Colombia', 'Congo', 'Croatia', 'Curacao', 'Cyprus', 'Czechia',
'Denmark', 'England', 'Estonia', 'Faeroe Islands', 'Finland',
'France', 'Germany', 'Greece', 'Greenland', 'Guatemala', 'Guernsey',
'Honduras', 'Hungary', 'Iceland', 'Indonesia', 'Ireland', 'Israel',
'Italy', 'Jamaica', 'Japan', 'Jersey', 'Latvia', 'Libya',
'Liechtenstein', 'Lithuania', 'Luxembourg', 'Malta', 'Mexico',
'Netherlands', 'Northern Ireland', 'Norway', 'Pakistan', 'Palestine',
'Paraguay', 'Philippines', 'Poland', 'Portugal', 'Qatar', 'Romania',
'Rwanda', 'Scotland', 'Singapore', 'Sint Maarten (Dutch part)',
'Slovakia', 'South Korea', 'Spain', 'Sri Lanka', 'Sweden',
'Switzerland', 'Taiwan', 'Tajikistan', 'Tunisia', 'Ukraine', 'United
Kingdom', 'United States', 'Vietnam', 'Wales', 'Wallis and Futuna']
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Vaccine: Covaxin:
Number of countries using it: 7
List of countries using it:
['Central African Republic', 'Comoros', 'India', 'Iran', 'Mauritius',
'Pakistan', 'Paraguay']
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Vaccine: Sinopharm/Wuhan:
Number of countries using it: 3
List of countries using it:
['China', 'United Arab Emirates', 'Venezuela']
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Vaccine: ZF2001:
Number of countries using it: 2
List of countries using it:
['China', 'Uzbekistan']
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Vaccine: Abdala:
Number of countries using it: 1
List of countries using it:
['Cuba']
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Vaccine: Soberana02:
Number of countries using it: 1
List of countries using it:
['Cuba']
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Vaccine: COVIran Barekat:
Number of countries using it: 1
List of countries using it:
['Iran']
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Vaccine: QazVac:
Number of countries using it: 1
List of countries using it:
['Kazakhstan']
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Vaccine: Sinopharm/HayatVax:
Number of countries using it: 1
List of countries using it:
['Kazakhstan']
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Vaccine: EpiVacCorona:
Number of countries using it: 2
List of countries using it:
['Russia', 'Turkmenistan']
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Vaccine: Medigen:
Number of countries using it: 1
List of countries using it:
['Taiwan']
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vaccine_counts = {}
for v in vaccines_country:
    vaccine_counts[v] = len(vaccines_country[v])

plt.rcParams["figure.figsize"] = (20,7)
plt.bar(vaccine_counts.keys(), vaccine_counts.values())
plt.xticks(rotation=60)
plt.show()
```
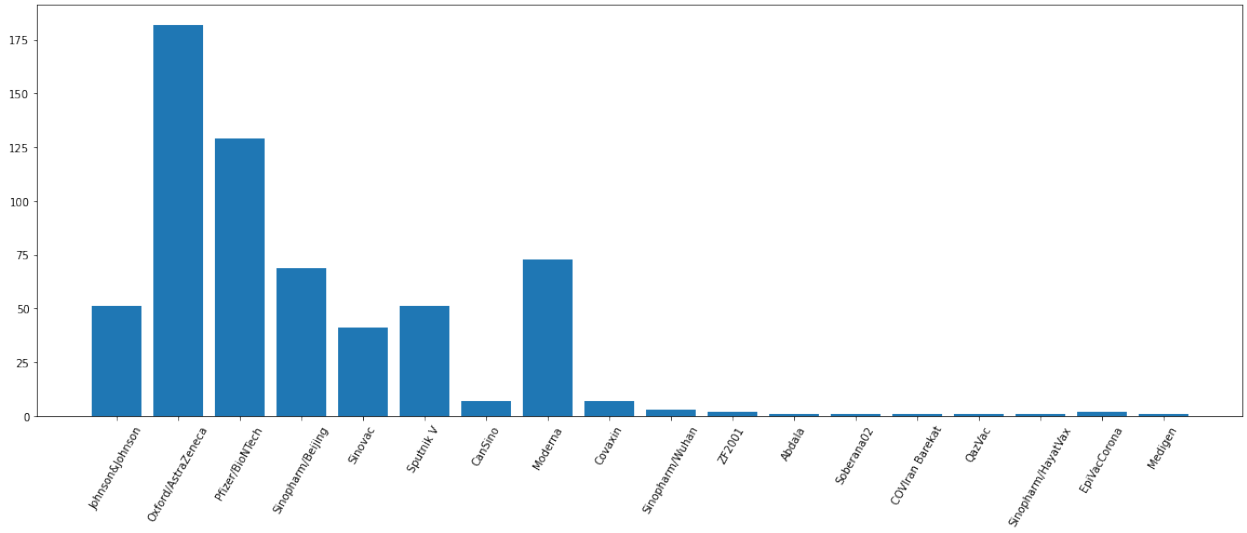
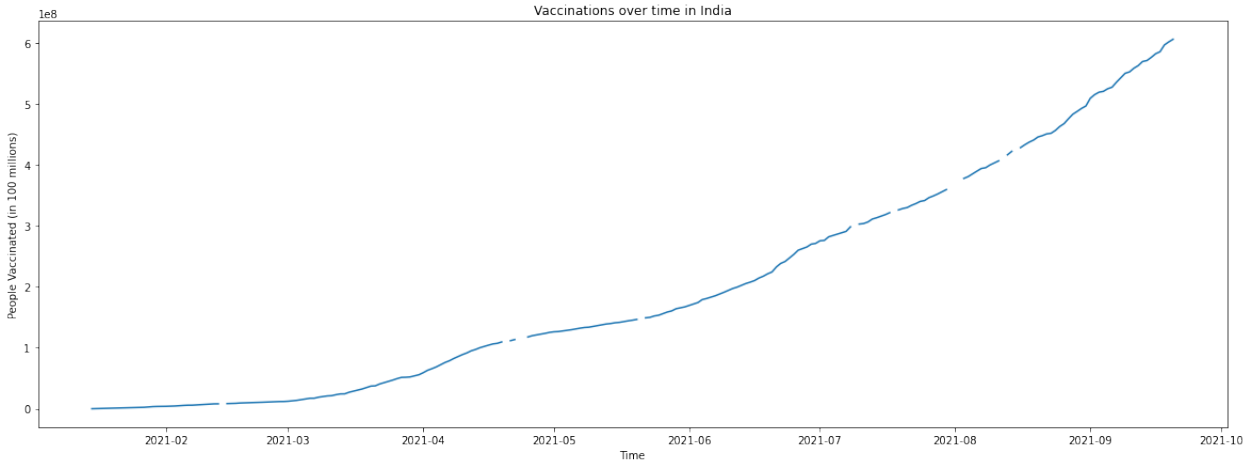




```
max_v_country = max(people_vaccinated, key=people_vaccinated.get)
print("Country with highest vaccinations: ",max_v_country)
```

```
Country with highest vaccinations:  India
```

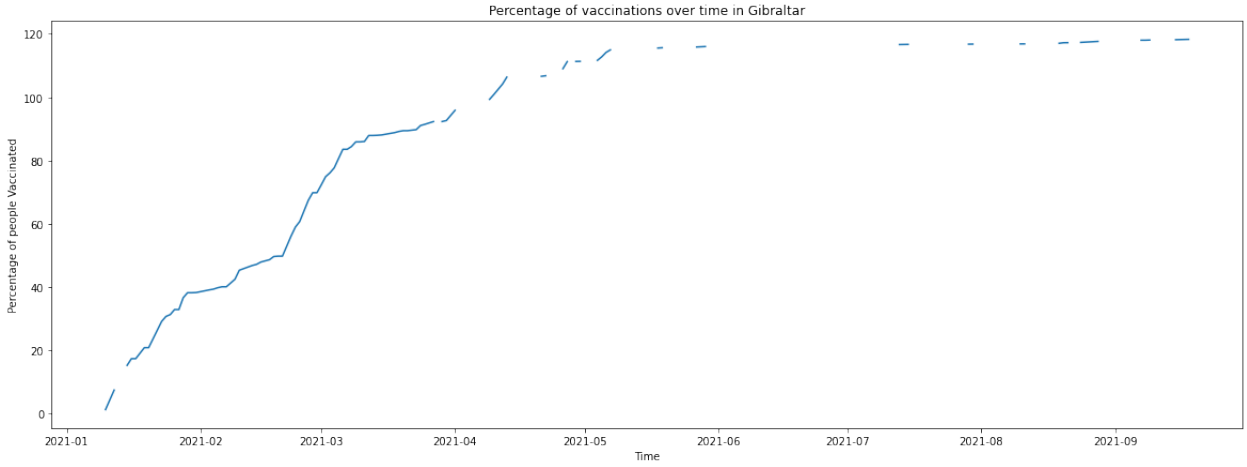
```
max_v_cntry_df = df.loc[df['country'] == max_v_country]
max_v_cntry_df = max_v_cntry_df.sort_values(by='date')

plt.plot(max_v_cntry_df['date'], max_v_cntry_df['people_vaccinated'])

plt.title(f"Vaccinations over time in {max_v_country}")
plt.xlabel("Time")
plt.ylabel("People Vaccinated (in 100 millions)")

plt.show()
```




```
max_per_country = max(vaccinations_percentage,
key=vaccinations_percentage.get)
print("Country which has vaccinated larger percent of population: ",
max_per_country)
print("Percent of population vaccinated: ",
vaccinations_percentage[max_per_country])
```

```
Country which has vaccinated larger percent of population:  Gibraltar
Percent of population vaccinated:  118.27
```

```
max_per_cntry_df = df.loc[df['country'] == max_per_country]
max_per_cntry_df = max_per_cntry_df.sort_values(by='date')

plt.plot(max_per_cntry_df['date'],
max_per_cntry_df['people_vaccinated_per_hundred'])

plt.title(f"Percentage of vaccinations over time in
{max_per_country}")
plt.xlabel("Time")
plt.ylabel("Percentage of people Vaccinated")

plt.show()
```


Percentage of vaccinations over time in Gibraltar
Percentage of people Vaccinated
120
100
80
60
40
20
0
2021-01
2021-02
2021-03
2021-04
2021-05
2021-06
2021-07
2021-08
2021-09
Time