GDP Life, Life Expectancy, and Population for Western Countries Analysis

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import matplotlib.ticker as mticker
%matplotlib inline
%load_ext autotime
```

```
df = pd.read_csv('gdp.csv')
```

```
df.shape
```

```
(3000, 6)
```

```
df.tail(20)
```

	country	continent	year	lifeExp	pop	gdpPercap
2980	Afghanistan	Asia	1962	30.332	8658506	351.4
2981	Afghanistan	Asia	1967	32.779	9717314	294.4
2982	Afghanistan	Asia	1972	34.677	10967281	521.8
2983	Afghanistan	Asia	1977	38.418	12265921	779.4
2984	Afghanistan	Asia	1982	39.854	14381961	962.4
2985	Afghanistan	Asia	1987	40.822	16620541	853.1
2986	Afghanistan	Asia	1992	41.674	19067554	836
2987	Afghanistan	Asia	1997	41.763	21486954	974.5
2988	Afghanistan	Asia	2002	42.129	25268405	727.9
2989	Afghanistan	Asia	2007	43.828	31889923	974.6
2990	Albania	Europe	1952	55.23	1728137	1601.056
2991	Albania	Europe	1957	59.28	1884211	1942.284
2992	Albania	Europe	1962	64.82	1963011	2312.888
2993	Albania	Europe	1967	66.22	2259078	2760.197
2994	Albania	Europe	1972	67.690	2607930	3313.422
2995	Albania	Europe	1977	68.305	2671997	3533.004
2996	Albania	Europe	1982	70.420	2953997	3630.881
2997	Albania	Europe	1987	72.000	3076309	3738.932
2998	Albania	Europe	1992	71.581	3089027	2497.437
2999	Albania	Europe	1997	72.950	3085875	3193.054

```
df.dtypes
```

```
country     object
continent   object
year         int64
lifeExp     float64
pop          int64
gdpPercap   float64
dtype: object
```

```
df.describe()
```

	year	lifeExp	pop	gdpPercap
count	3000.000000	3000.000000	3000.000000	3000.000000
mean	1979.500000	67.037233	29796048.889667	7215.327081
std	17.320508	12.779762	106157897.138835	10732.986903
min	1952.000000	23.599000	60011.000000	277.551859
25%	1965.750000	57.160750	2793664.250000	1202.060309
50%	1979.500000	70.845500	7023596.000000	3531.847034
75%	1993.250000	76.413750	19585221.750000	9325.462346
max	2007.000000	82.603000	1318683096.000000	113523.132900

```
df.describe(include='object')
```

	country	continent
count	3000	3000
unique	100	5
top	Afghanistan	Asia
freq	30	1080

```
continent_counts = df['continent'].value_counts()
```

```
continent_counts.index.astype(str).tolist()
```

```
['Asia',
'Europe',
'Africa',
'Oceania',
'Americas']
```

```
continent_counts.values.tolist()
```

```
[1080, 1080, 660, 180, 1080]
```

```
df.isnull().sum()
```

```
country    0
continent  0
year       0
lifeExp    0
pop        0
gdpPercap  0
dtype: int64
```

```
df.isnull.sum(axis=1)
```

```
0       0
1       0
2       0
3       0
4       0
       ..
2995    0
2996    0
2997    0
2998    0
2999    0
Length: 3000, dtype: int64
```

```
df['country'].nunique()
```

```
100
```

```
df['continent'].nunique()
```

```
5
```

```
df['continent'].unique()
```

```
array['Asia', 'Europe', 'Africa', 'Oceania', 'Americas']
```

```
df['continent'].value_counts()
```

```
continent
Asia      1080
Europe    1080
Africa    660
Oceania   180
Americas  1080
Name: count, dtype: int64
```

```
df['country'].value_counts()
```

```
country
Afghanistan    30
Angola         30
Albania        30
Argentina      30
Australia      30
Austria        30
Bahrain        30
Bangladesh     30
Belgium        30
Bolivia        30
Brazil         30
Bulgaria       30
Cambodia       30
Canada         30
Chile          30
China          30
Colombia       30
Comoros        30
Congo, Dem. Rep.  30
Congo, Rep.    30
Costa Rica     30
Croatia        30
Cuba           30
Czech Republic 30
Denmark        30
Dominican Republic  30
Ecuador        30
Egypt          30
El Salvador    30
Equatorial Guinea  30
Eritrea        30
Ethiopia       30
Finland        30
France         30
Gabon          30
Gambia         30
Germany        30
Ghana          30
Greece         30
Guatemala      30
Guinea         30
Haiti          30
Honduras       30
Hong Kong, China  30
Hungary        30
Iceland        30
India          30
Indonesia      30
Iran           30
Iraq           30
Ireland        30
Israel         30
Italy          30
Jamaica        30
Japan          30
Jordan         30
Kenya          30
Korea, Dem. Rep.  30
Korea, Rep.    30
Kuwait         30
Lebanon        30
Lesotho        30
Liberia        30
Libya          30
Madagascar     30
Malawi         30
Malaysia       30
Mali           30
Mauritania     30
Mauritius      30
Mexico         30
Mongolia       30
Montenegro     30
Morocco        30
Mozambique     30
Myanmar        30
Nepal          30
Netherlands    30
New Zealand    30
Nicaragua      30
Niger          30
Nigeria        30
Norway         30
Oman           30
Pakistan       30
Panama         30
Paraguay       30
Peru           30
Philippines    30
Poland         30
Portugal       30
Puerto Rico    30
Reunion        30
Romania        30
Rwanda         30
Sao Tome and Principe  30
Saudi Arabia   30
Senegal        30
Serbia         30
Sierra Leone   30
Singapore      30
Slovak Republic  30
Slovenia       30
Somalia        30
South Africa   30
Sudan          30
Swaziland      30
Sweden         30
Switzerland    30
Syria          30
Taiwan         30
Tanzania       30
Thailand       30
Togo           30
Trinidad and Tobago  30
Tunisia        30
Turkey         30
Uganda         30
United Kingdom 30
United States  30
Uruguay        30
Venezuela      30
Vietnam        30
West Bank and Gaza  30
Yemen, Rep.    30
Zambia         30
Zimbabwe       30
Name: count, dtype: int64
```

```
df['country'].value_counts().index.tolist()
```

```
['Afghanistan',
'Angola',
'Albania',
'Argentina',
'Australia',
'Austria',
'Bahrain',
'Bangladesh',
'Belgium',
'Bolivia',
'Brazil',
'Bulgaria',
'Cambodia',
'Canada',
'Chile',
'China',
'Colombia',
'Comoros',
'Congo, Dem. Rep.',
'Congo, Rep.',
'Costa Rica',
'Croatia',
'Cuba',
'Czech Republic',
'Denmark',
'Dominican Republic',
'Ecuador',
'Egypt',
'El Salvador',
'Equatorial Guinea',
'Eritrea',
'Ethiopia',
'Finland',
'France',
'Gabon',
'Gambia',
'Germany',
'Ghana',
'Greece',
'Guatemala',
'Guinea',
'Haiti',
'Honduras',
'Hong Kong, China',
'Hungary',
'Iceland',
'India',
'Indonesia',
'Iran',
'Iraq',
'Ireland',
'Israel',
'Italy',
'Jamaica',
'Japan',
'Jordan',
'Kenya',
'Korea, Dem. Rep.',
'Korea, Rep.',
'Kuwait',
'Lebanon',
'Lesotho',
'Liberia',
'Libya',
'Madagascar',
'Malawi',
'Malaysia',
'Mali',
'Mauritania',
'Mauritius',
'Mexico',
'Mongolia',
'Montenegro',
'Morocco',
'Mozambique',
'Myanmar',
'Nepal',
'Netherlands',
'New Zealand',
'Nicaragua',
'Niger',
'Nigeria',
'Norway',
'Oman',
'Pakistan',
'Panama',
'Paraguay',
'Peru',
'Philippines',
'Poland',
'Portugal',
'Puerto Rico',
'Reunion',
'Romania',
'Rwanda',
'Sao Tome and Principe',
'Saudi Arabia',
'Senegal',
'Serbia',
'Sierra Leone',
'Singapore',
'Slovak Republic',
'Slovenia',
'Somalia',
'South Africa',
'Sudan',
'Swaziland',
'Sweden',
'Switzerland',
'Syria',
'Taiwan',
'Tanzania',
'Thailand',
'Togo',
'Trinidad and Tobago',
'Tunisia',
'Turkey',
'Uganda',
'United Kingdom',
'United States',
'Uruguay',
'Venezuela',
'Vietnam',
'West Bank and Gaza',
'Yemen, Rep.',
'Zambia',
'Zimbabwe']
```

```
df['continent'].value_counts().index.tolist()
```

```
['Asia', 'Europe', 'Africa', 'Oceania', 'Americas']
```

```
df['continent'].value_counts().index.tolist()[0]
```

```
'Asia'
```

```
df['continent'].value_counts().index.tolist()[1]
```

```
'Europe'
```

```
df['continent'].value_counts().index.tolist()[2]
```

```
'Africa'
```

```
df['continent'].value_counts().index.tolist()[3]
```

```
'Oceania'
```

```
df['continent'].value_counts().index.tolist()[4]
```

```
'Americas'
```

```
df['continent'].value_counts().tolist()[0]
```

```
1080
```

```
df['continent'].value_counts().tolist()[1]
```

```
1080
```

```
df['continent'].value_counts().tolist()[2]
```

```
660
```

```
df['continent'].value_counts().tolist()[3]
```

```
180
```

```
df['continent'].value_counts().tolist()[4]
```

```
1080
```

```
df['continent'].value_counts().tolist()[0]/df['continent'].value_counts().tolist()[1]
```

```
1.0
```

```
df['continent'].value_counts().tolist()[0]/df['continent'].value_counts().tolist()[2]
```

```
1.6666666666666667
```

```
df['continent'].value_counts().tolist()[0]/df['continent'].value_counts().tolist()[3]
```

```
6.0
```

```
df['continent'].value_counts().tolist()[0]/df['continent'].value_counts().tolist()[4]
```

```
1.0
```

```
df['continent'].value_counts(normalize=True)
```

```
continent
Asia      0.360
Europe    0.360
Africa    0.220
Oceania   0.060
Americas  0.360
Name: proportion, dtype: float64
```

```
df['continent'].value_counts(normalize=True).tolist()[0]
```

```
0.36
```

```
df['continent'].value_counts(normalize=True).tolist()[1]
```

```
0.36
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```
df['continent'].value_counts(normalize=True).tolist()[2]
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```
0.22
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```
df['continent'].value_counts(normalize=True).tolist()[3]
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0.06
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```
df['continent'].value_counts(normalize=True).tolist()[4]
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0.36
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df['country'].value_counts(normalize=True).tolist()[0]
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0.01
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df['country'].value_counts(normalize=True).tolist()[1]
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0.01
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df['country'].value_counts(normalize=True).tolist()[2]
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df['country'].value_counts(normalize=True).tolist()[3]
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df['country'].value_counts(normalize=True).tolist()[4]
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df['country'].value_counts(normalize=True).tolist()[5]
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df['country'].value_counts(normalize=True).tolist()[6]
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df['country'].value_counts(normalize=True).tolist()[7]
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df['country'].value_counts(normalize=True).tolist()[8]
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df['country'].value_counts(normalize=True).tolist()[9]
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df['country'].value_counts(normalize=True).tolist()[10]
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df['country'].value_counts(normalize=True).tolist()[11]
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df['country'].value_counts(normalize=True).tolist()[12]
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df['country'].value_counts(normalize=True).tolist()[13]
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df['country'].value_counts(normalize=True).tolist()[14]
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df['country'].value_counts(normalize=True).tolist()[17]
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df['country'].value_counts(normalize=True).tolist()[19]
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df['country'].value_counts(normalize=True).tolist()[20]
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df['country'].value_counts(normalize=True).tolist()[21]
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df['country'].value_counts(normalize=True).tolist()[23]
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df['country'].value_counts(normalize=True).tolist()[24]
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df['country'].value_counts(normalize=True).tolist()[25]
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df['country'].value_counts(normalize=True).tolist()[26]
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df['country'].value_counts(normalize=True).tolist()[27]
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df['country'].value_counts(normalize=True).tolist()[39]
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df['country'].value_counts(normalize=True).tolist()[67]
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df['country'].value_counts(normalize=True).tolist()[68]
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df['country'].value_counts(normalize=True).tolist()[69]
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df['country'].value_counts(normalize=True).tolist()[70]
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df['country'].value_counts(normalize=True).tolist()[71]
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df['country'].value_counts(normalize=True).tolist()[72]
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df['country'].value_counts(normalize=True).tolist()[73]
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df['country'].value_counts(normalize=True).tolist()[74]
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df['country'].value_counts(normalize=True).tolist()[76]
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df['country'].value_counts(normalize=True).tolist()[77]
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df['country'].value_counts(normalize=True).tolist()[78]
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df['country'].value_counts(normalize=True).tolist()[79]
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df['country'].value_counts(normalize=True).tolist()[80]
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df['country'].value_counts(normalize=True).tolist()[81]
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df['country'].value_counts(normalize=True).tolist()[82]
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df['country'].value_counts(normalize=True).tolist()[83]
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df['country'].value_counts(normalize=True).tolist()[84]
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df['country'].value_counts(normalize=True).tolist()[85]
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df['country'].value_counts(normalize=True).tolist()[86]
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df['country'].value_counts(normalize=True).tolist()[87]
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df['country'].value_counts(normalize=True).tolist()[88]
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df['country'].value_counts(normalize=True).tolist()[89]
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df['country'].value_counts(normalize=True).tolist()[90]
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df['country'].value_counts(normalize=True).tolist()[91]
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df['country'].value_counts(normalize=True).tolist()[92]
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df['country'].value_counts(normalize=True).tolist()[93]
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df['country'].value_counts(normalize=True).tolist()[94]
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df['country'].value_counts(normalize=True).tolist()[95]
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df['country'].value_counts(normalize=True).tolist()[96]
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```
df['country'].value_counts(normalize=True).tolist()[97]
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0.01
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```
df['country'].value_counts(normalize=True).tolist()[98]
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```
0.01
```

```
df['country'].value_counts(normalize=True).tolist()[99]
```

```
0.01
```

```
df['continent'].value_counts(normalize=True).tolist()
```

```
[0.36, 0.36, 0.22, 0.06, 0.36]
```

```
df['continent'].value_counts(normalize=True).tolist()[0]+df['continent'].value_counts(normalize=True).tolist()[1]+df['continent'].value_counts(normalize=True).tolist()[2]+df['continent'].value_counts(normalize=True).tolist()[3]+df['continent'].value_counts(normalize=True).tolist()[4]
```

```
1.0
```

```
df['continent'].value_counts(normalize=True).tolist()[0]+df['continent'].value_counts(normalize=True).tolist()[1]+df['continent'].value_counts(normalize=True).tolist()[2]+df['continent'].value_counts(normalize=True).tolist()[3]
```

```
0.94
```

```
df['continent'].value_counts(normalize=True).tolist()[0]+df['continent'].value_counts(normalize=True).tolist()[1]+df['continent'].value_counts(normalize=True).tolist()[2]
```

```
0.94
```

```
df['continent'].value_counts(normalize=True).tolist()[0]+df['continent'].value_counts(normalize=True).tolist()[1]
```

```
0.72
```

```
df['continent'].value_counts(normalize=True).tolist()[0]
```

```
0.36
```

```
df['continent'].value_counts(normalize=True).tolist()[1]
```

```
0.36
```

```
df['continent'].value_counts(normalize=True).tolist()[2]
```

```
0.22
```

```
df['continent'].value_counts(normalize=True).tolist()[3]
```

```
0.06
```

```
df['continent'].value_counts(normalize=True).tolist()[4]
```

```
0.36
```

```
df['country'].value_counts(normalize=True).tolist()[0]+df['country'].value_counts(normalize=True).tolist()[1]+df['country'].value_counts(normalize=True).tolist()[2]+df['country'].value_counts(normalize=True).tolist()[3]+df['country'].value_counts(normalize=True).tolist()[4]+df['country'].value_counts(normalize=True).tolist()[5]+df['country'].value_counts(normalize=True).tolist()[6]+df['country'].value_counts(normalize=True).tolist()[7]+df['country'].value_counts(normalize=True).tolist()[8]+df['country'].value_counts(normalize=True).tolist()[9]+df['country'].value_counts(normalize=True).tolist()[10]+df['country'].value_counts(normalize=True).tolist()[11]+df['country'].value_counts(normalize=True).tolist()[12]+df['country'].value_counts(normalize=True).tolist()[13]+df['country'].value_counts(normalize=True).tolist()[14]+df['country'].value_counts(normalize=True).tolist()[15]+df['country'].value_counts(normalize=True).tolist()[16]+df['country'].value_counts(normalize=True).tolist()[17]+df['country'].value_counts(normalize=True).tolist()[18]+df['country'].value_counts(normalize=True).tolist()[19]+df['country'].value_counts(normalize=True).tolist()[20]+df['country'].value_counts(normalize=True).tolist()[21]+df['country'].value_counts(normalize=True).tolist()[22]+df['country'].value_counts(normalize=True).tolist()[23]+df['country'].value_counts(normalize=True).tolist()[24]+df['country'].value_counts(normalize=True).tolist()[25]+df['country'].value_counts(normalize=True).tolist()[26]+df['country'].value_counts(normalize=True).tolist()[27]+df['country'].value_counts(normalize=True).tolist()[28]+df['country'].value_counts(normalize=True).tolist()[29]+df['country'].value_counts(normalize=True).tolist()[30]+df['country'].value_counts(normalize=True).tolist()[31]+df['country'].value_counts(normalize=True).tolist()[32]+df['country'].value_counts(normalize=True).tolist()[33]+df['country'].value_counts(normalize=True).tolist()[34]+df['country'].value_counts(normalize=True).tolist()[35]+df['country'].value_counts(normalize=True).tolist()[36]+df['country'].value_counts(normalize=True).tolist()[37]+df['country'].value_counts(normalize=True).tolist()[38]+df['country'].value_counts(normalize=True).tolist()[39]+df['country'].value_counts(normalize=True).tolist()[40]+df['country'].value_counts(normalize=True).tolist()[41]+df['country'].value_counts(normalize=True).tolist()[42]+df['country'].value_counts(normalize=True).tolist()[43]+df['country'].value_counts(normalize=True).tolist()[44]+df['country'].value_counts(normalize=True).tolist()[45]+df['country'].value_counts(normalize=True).tolist()[46]+df['country'].value_counts(normalize=True).tolist()[47]+df['country'].value_counts(normalize=True).tolist()[48]+df['country'].value_counts(normalize=True).tolist()[49]+df['country'].value_counts(normalize=True).tolist()[50]+df['country'].value_counts(normalize=True).tolist()[51]+df['country'].value_counts(normalize=True).tolist()[52]+df['country'].value_counts(normalize=True).tolist()[53]+df['country'].value_counts(normalize=True).tolist()[54]+df['country'].value_counts(normalize=True).tolist()[55]+df['country'].value_counts(normalize=True).tolist()[56]+df['country'].value_counts(normalize=True).tolist()[57]+df['country'].value_counts(normalize=True).tolist()[58]+df['country'].value_counts(normalize=True).tolist()[59]+df['country'].value_counts(normalize=True).tolist()[60]+df['country'].value_counts(normalize=True).tolist()[61]+df['country'].value_counts(normalize=True).tolist()[62]+df['country'].value_counts(normalize=True).tolist()[63]+df['country'].value_counts(normalize=True).tolist()[64]+df['country'].value_counts(normalize=True).tolist()[65]+df['country'].value_counts(normalize=True).tolist()[66]+df['country'].value_counts(normalize=True).tolist()[67]+df['country'].value_counts(normalize=True).tolist()[68]+df['country'].value_counts(normalize=True).tolist()[69]+df['country'].value_counts(normalize=True).tolist()[70]+df['country'].value_counts(normalize=True).tolist()[71]+df['country'].value_counts(normalize=True).tolist()[72]+df['country'].value_counts(normalize=True).tolist()[73]+df['country'].value_counts(normalize=True).tolist()[74]+df['country'].value_counts(normalize=True).tolist()[75]+df['country'].value_counts(normalize=True).tolist()[76]+df['country'].value_counts(normalize=True).tolist()[77]+df['country'].value_counts(normalize=True).tolist()[78]+df['country'].value_counts(normalize=True).tolist()[79]+df['country'].value_counts(normalize=True).tolist()[80]+df['country'].value_counts(normalize=True).tolist()[81]+df['country'].value_counts(normalize=True).tolist()[82]+df['country'].value_counts(normalize=True).tolist()[83]+df['country'].value_counts(normalize=True).tolist()[84]+df['country'].value_counts(normalize=True).tolist()[85]+df['country'].value_counts(normalize=True).tolist()[86]+df['country'].value_counts(normalize=True).tolist()[87]+df['country'].value_counts(normalize=True).tolist()[88]+df['country'].value_counts(normalize=True).tolist()[89]+df['country'].value_counts(normalize=True).tolist()[90]+df['country'].value_counts(normalize=True).tolist()[91]+df['country'].value_counts(normalize=True).tolist()[92]+df['country'].value_counts(normalize=True).tolist()[93]+df['country'].value_counts(normalize=True).tolist()[94]+df['country'].value_counts(normalize=True).tolist()[95]+df['country'].value_counts(normalize=True).tolist()[96]+df['country'].value_counts(normalize=True).tolist()[97]+df['country'].value_counts(normalize=True).tolist()[98]+df['country'].value_counts(normalize=True).tolist()[99]
```

```
1.0
```

```
df.shape
```

```
(3000, 6)
```

```
df.shape[0]
```

```
3000
```

```
df.shape[1]
```

```
6
```

```
df.dtypes
```

```
country     object
continent   object
year         int64
lifeExp     float64
pop          int64
gdpPercap   float64
dtype: object
```

```
df.dtypes.value_counts
```

```
<bmethod_DataFrame.value_counts>
```

```
df.dtypes.value_counts()
```

```
object    2
int64     3
float64   1
Name: count, dtype: int64
```

```
df.dtypes.value_counts().index.tolist()
```

```
[dtype('object'), dtype('int64'), dtype('float64')]
```

```
df.dtypes.value_counts().tolist()
```

```
[2, 3, 1]
```

```
df.dtypes.value_counts().tolist()[0]
```

```
2
```

```
df.dtypes.value_counts().tolist()[1]
```

```
3
```

```
df.dtypes.value_counts().tolist()[2]
```

```
1
```

```
df.dtypes.value_counts().tolist()[0]+df.dtypes.value_counts().tolist()[1]+df.dtypes.value_counts().tolist()[2]
```

```
6
```

```
df.dtypes.value_counts().tolist()[0]+df.dtypes.value_counts().tolist()[1]
```

```
5
```

```
df.dtypes.value_counts().tolist()[0]+df.dtypes.value_counts().tolist()[2]
```

```
3
```

```
df.dtypes.value_counts().tolist()[1]+df.dtypes.value_counts().tolist()[2]
```

```
4
```

```
df.dtypes.value_counts().tolist()[0]/df.dtypes.value_counts().tolist()[1]
```

```
0.4
```

```
df.dtypes.value_counts().tolist()[0]/df.dtypes.value_counts().tolist()[2]
```

```
2.0
```

```
df.dtypes.value_counts().tolist()[1]/df.dtypes.value_counts().tolist()[2]
```

```
3.0
```

```
df.dtypes.value_counts(normalize=True)
```

```
object    0.333333
int64     0.500000
float64   0.166667
Name: proportion, dtype: float64
```

```
df.dtypes.value_counts(normalize=True).tolist()
```

```
[0.3333333333333333, 0.5, 0.1666666666666667]
```

```
df.dtypes.value_counts(normalize=True).tolist()[0]
```

```
0.3333333333333333
```

```
df.dtypes.value_counts(normalize=True).tolist()[1]
```

```
0.5
```

```
df.dtypes.value_counts(normalize=True).tolist()[2]
```

```
0.1666666666666667
```

```
df.dtypes.value_counts(normalize=True).tolist()[0]+df.dtypes.value_counts(normalize=True).tolist()[1]+df.dtypes.value_counts(normalize=True).tolist()[2]
```

```
1.0
```

```
df.dtypes.value_counts(normalize=True).tolist()[0]+df.dtypes.value_counts(normalize=True).tolist()[1]
```

```
0.8333333333333333
```

```
df.dtypes.value_counts(normalize=True).tolist()[0]+df.dtypes.value_counts(normalize=True).tolist()[2]
```

```
0.5000000000000000
```

```
df.dtypes.value_counts(normalize=True).tolist()[1]+df.dtypes.value_counts(normalize=True).tolist()[2]
```

```
0.6666666666666667
```

```
df.dtypes.value_counts(normalize=True).tolist()[0]/df.dtypes.value_counts(normalize=True).tolist()[1]
```

```
0.6666666666666667
```

```
df.dtypes.value_counts(normalize=True).tolist()[0]/df.dtypes.value_counts(normalize=True).tolist()[2]
```

```
2.000000000000000
```

```
df.dtypes.value_counts(normalize=True).tolist()[1]/df.dtypes.value_counts(normalize=True).tolist()[2]
```

```
3.000000000000000
```

Box Plots

```
sns.boxplot(data=df, x='Population', y='Continent', color='Yellowgreen', orient='h', linewidth=2.5, fliersize=5, linecolor='Black', fliercolor='Red', dashed=True, dodge=True, saturation=0.75, gap=0.1, whiskerprop={'linewidth': 2.5, 'linestyle': '-.', 'color': 'Black'})
plt.title('Population - United States - Only', fontsize=18, fontweight='bold', pad=20)
plt.xticks(rotation=0, fontsize=12, fontweight='bold')
plt.yticks(rotation=0, fontsize=12, fontweight='bold')
plt.xlabel('Continent', fontsize=14, fontweight='bold', labelpad=10)
plt.ylabel('Population', fontsize=14, fontweight='bold', labelpad=10)
plt.show()
```

Population - United States - Only
Continent
Population
Continent
Population
Continent
Population

```
gapminder_continent_pop <- gapminder %>%
  group_by(continent, year) %>%
  summarise(continent_population = sum(pop))
```

```
`summarise()` has grouped output by 'continent'. You can override using the `.groups` argument.
```

```
gapminder_continent_pop
```

```
# A tibble: 60 × 3
# Groups:   continent [5]
   continent year continent_population
   <fct>     <int>                <dbl>
 1 Africa     1952            237500117
 2 Africa     1957            267083246
 3 Africa     1962            296516865
 4 Africa     1967            328960674
 5 Africa     1972            368090240
 6 Africa     1977            409467709
 7 Africa     1982            456235465
 8 Africa     1987            517834392
 9 Africa     1992            581801067
10 Africa     1997            638023220
11 Africa     2002            701854016
12 Africa     2007            766735460
13 Americas   1952            345152446
14 Americas   1957            364004989
15 Americas   1962            383083671
16 Americas   1967            402213449
17 Americas   1972            423086517
18 Americas   1977            443828656
19 Americas   1982            467164889
20 Americas   1987            490351937
21 Americas   1992            514731449
22 Americas   1997            537426000
23 Americas   2002            561359166
24 Americas   2007            586098529
25 Asia       1952            395683039
26 Asia       1957            459274056
27 Asia       1962            521268960
28 Asia       1967            581848275
29 Asia       1972            645064999
30 Asia       1977            708033956
31 Asia       1982            773779193
32 Asia       1987            835957000
33 Asia       1992            898871184
34 Asia       1997            962429000
35 Asia       2002            1019314113
36 Asia       2007            1080146000
37 Europe     1952            418235751
38 Europe     1957            437890351
39 Europe     1962            457234368
40 Europe     1967            467251446
41 Europe     1972            476929906
42 Europe     1977            486772509
43 Europe     1982            497544643
44 Europe     1987            507833000
45 Europe     1992            517810000
46 Europe     1997            526848000
47 Europe     2002            535746000
48 Europe     2007            545237000
49 Oceania    1952             10686006
50 Oceania    1957             11731765
51 Oceania    1962             12796395
52 Oceania    1967             13845689
53 Oceania    1972             14873428
54 Oceania    1977             15838688
55 Oceania    1982             16821058
56 Oceania    1987             17827000
57 Oceania    1992             18811000
58 Oceania    1997             19732000
59 Oceania    2002             20686000
60 Oceania    2007             21389000
```

```
ggplot(data = gapminder_continent_pop, aes(x = year, y = continent_population, color = continent))
  + geom_line()
```

```
ggsave("gapminder_continent_pop.pdf")
```

```
Saving 7.29 x 4.51 in image
```

```
ggsave("gapminder_continent_pop.jpeg")
```

```
Saving 7.29 x 4.51 in image
```

```
ggsave("gapminder_continent_pop.tiff")
```

```
Saving 7.29 x 4.51 in image
```

```
ls -lh gapminder_continent_pop.*
```

```
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop.jpeg
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop.pdf
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop.tiff
```

Trendline

```
ggplot(data = gapminder_continent_pop, aes(x = year, y = continent_population, color = continent))
  + geom_line()
  + geom_smooth(method=lm)
```

```
`geom_smooth()` using formula = 'y ~ x'
```

```
ggsave("gapminder_continent_pop_trendline.pdf")
```

```
Saving 7.29 x 4.51 in image
```

```
ggsave("gapminder_continent_pop_trendline.jpeg")
```

```
Saving 7.29 x 4.51 in image
```

```
ggsave("gapminder_continent_pop_trendline.tiff")
```

```
Saving 7.29 x 4.51 in image
```

```
ls -lh gapminder_continent_pop_trendline.*
```

```
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop_trendline.jpeg
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop_trendline.pdf
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop_trendline.tiff
```

```
ls -lh *.pdf
```

```
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop.pdf
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop_trendline.pdf
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop_trend.pdf
```

```
ls -lh *.jpeg
```

```
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop.jpeg
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop_trendline.jpeg
```

```
ls -lh *.tiff
```

```
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop.tiff
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop_trendline.tiff
```

```
ls -lh *.*
```

```
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop.jpeg
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop.pdf
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop.tiff
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop_trendline.jpeg
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop_trendline.pdf
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop_trendline.tiff
```

```
gapminder_continent_pop
```

```
# A tibble: 60 × 3
# Groups:   continent [5]
   continent year continent_population
   <fct>     <int>                <dbl>
 1 Africa     1952            237500117
 2 Africa     1957            267083246
 3 Africa     1962            296516865
 4 Africa     1967            328960674
 5 Africa     1972            368090240
 6 Africa     1977            409467709
 7 Africa     1982            456235465
 8 Africa     1987            517834392
 9 Africa     1992            581801067
10 Africa     1997            638023220
11 Africa     2002            701854016
12 Africa     2007            766735460
13 Americas   1952            345152446
14 Americas   1957            364004989
15 Americas   1962            383083671
16 Americas   1967            402213449
17 Americas   1972            423086517
18 Americas   1977            443828656
19 Americas   1982            467164889
20 Americas   1987            490351937
21 Americas   1992            514731449
22 Americas   1997            537426000
23 Americas   2002            561359166
24 Americas   2007            586098529
25 Asia       1952            395683039
26 Asia       1957            459274056
27 Asia       1962            521268960
28 Asia       1967            581848275
29 Asia       1972            645064999
30 Asia       1977            708033956
31 Asia       1982            773779193
32 Asia       1987            835957000
33 Asia       1992            898871184
34 Asia       1997            962429000
35 Asia       2002            1019314113
36 Asia       2007            1080146000
37 Europe     1952            418235751
38 Europe     1957            437890351
39 Europe     1962            457234368
40 Europe     1967            467251446
41 Europe     1972            476929906
42 Europe     1977            486772509
43 Europe     1982            497544643
44 Europe     1987            507833000
45 Europe     1992            517810000
46 Europe     1997            526848000
47 Europe     2002            535746000
48 Europe     2007            545237000
49 Oceania    1952             10686006
50 Oceania    1957             11731765
51 Oceania    1962             12796395
52 Oceania    1967             13845689
53 Oceania    1972             14873428
54 Oceania    1977             15838688
55 Oceania    1982             16821058
56 Oceania    1987             17827000
57 Oceania    1992             18811000
58 Oceania    1997             19732000
59 Oceania    2002             20686000
60 Oceania    2007             21389000
```

```
ggplot(data = gapminder_continent_pop, aes(x = year, y = continent_population, color = continent))
  + geom_line()
  + geom_smooth(method=lm)
```

```
`geom_smooth()` using formula = 'y ~ x'
```

```
ggsave("gapminder_continent_pop_trend.pdf")
```

```
Saving 7.29 x 4.51 in image
```

```
ls -lh *.pdf
```

```
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop.pdf
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop_trendline.pdf
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 gapminder_continent_pop_trend.pdf
```

Must reload df2

```
df2 <- ls.str("df2")
```

```
df2 <- df2[c("country", "continent", "year", "lifeExp")]
```

```
df2 <- ls.str("df2")
```

```
fig.gm_lifeExp_europe <- ggplot(data = df2, aes(x = year, y = lifeExp, color = country))
  + geom_line(size=1)
  + scale_color_manual(values=c("#FF0000", "#00FF00", "#0000FF", "#000000", "#00FFFF", "#FF00FF", "#FFFF00", "#FF7F00", "#7F00FF", "#7F0000"))
  + ggtitle("Life Expectancy Over Time - Western Europe")
  + ylab("Life Expectancy")
  + xlab("Year")
  + theme_bw()
  + theme(axis.text.x = element_text(angle = 90, hjust = 1))
  + facet_wrap(~ continent)
```

```
fig.gm_lifeExp_europe
```

```
fig.gm_lifeExp_europe.pdf
```

```
Saving 7.29 x 4.51 in image
```

```
fig.gm_lifeExp_europe.jpeg
```

```
Saving 7.29 x 4.51 in image
```

```
fig.gm_lifeExp_europe.tiff
```

```
Saving 7.29 x 4.51 in image
```

```
ls -lh fig.gm_lifeExp_europe.*
```

```
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 fig.gm_lifeExp_europe.jpeg
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 fig.gm_lifeExp_europe.pdf
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 fig.gm_lifeExp_europe.tiff
```

```
fig.gm_lifeExp_europe
```

```
fig.gm_lifeExp_europe.pdf
```

```
Saving 7.29 x 4.51 in image
```

```
fig.gm_lifeExp_europe.jpeg
```

```
Saving 7.29 x 4.51 in image
```

```
fig.gm_lifeExp_europe.tiff
```

```
Saving 7.29 x 4.51 in image
```

```
ls -lh fig.gm_lifeExp_europe.*
```

```
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 fig.gm_lifeExp_europe.jpeg
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 fig.gm_lifeExp_europe.pdf
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 fig.gm_lifeExp_europe.tiff
```

```
fig.gm_gdpPerCap_europe <- ggplot(data = df2, aes(x = year, y = gdpPerCap, color = country))
  + geom_line(size=1)
  + scale_color_manual(values=c("#FF0000", "#00FF00", "#0000FF", "#000000", "#00FFFF", "#FF00FF", "#FFFF00", "#FF7F00", "#7F00FF", "#7F0000"))
  + ggtitle("GDP Per Capita - Western Europe")
  + ylab("GDP Per Capita")
  + xlab("Year")
  + theme_bw()
  + theme(axis.text.x = element_text(angle = 90, hjust = 1))
  + facet_wrap(~ continent)
```

```
fig.gm_gdpPerCap_europe
```

```
fig.gm_gdpPerCap_europe.pdf
```

```
Saving 7.29 x 4.51 in image
```

```
fig.gm_gdpPerCap_europe.jpeg
```

```
Saving 7.29 x 4.51 in image
```

```
fig.gm_gdpPerCap_europe.tiff
```

```
Saving 7.29 x 4.51 in image
```

```
ls -lh fig.gm_gdpPerCap_europe.*
```

```
-rw-r--r--  1 root  root  1.0M Jun 13 12:11 fig.gm_gdpPerCap_europe.jpeg
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-rw-r--r--  1 root  root  1.0M Jun 13 12:11 fig.gm_gdpPerCap_europe.tiff
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df2
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 4 Afghan… Asia      1967   34.0 11537…     836…
 5 Afghan… Asia      1972   36.0 13079…     739…
 6 Afghan… Asia      1977   38.4 14880…     786…
 7 Afghan… Asia      1982   39.8 12881…     978…
 8 Afghan… Asia      1987   40.8 13867…     852…
 9 Afghan… Asia      1992   41.7 16317…     649…
10 Afghan… Asia      1997   41.8 18686…     635…
11 Afghan… Asia      2002   42.1 19351…     726…
12 Afghan… Asia      2007   43.8 22227…     974…
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17 Albania Europe    1972   67.7 1885…     4090…
18 Albania Europe    1977   68.3 2061…     4481…
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24 Albania Europe    2007   76.4 2821…     5937…
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70 Australia Oceania 1997   78.8 18565…    26997…
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88 Bahrain Asia      1967   59.9 1736…     20771…
89 Bahrain Asia      1972   63.3 1929…     18269…
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91 Bahrain Asia      1982   67.9 2436…     18115…
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127 Bolivia Americas 1982   53.9 4570…     3082…
128 Bolivia Americas 1987   57.6 5000…     3100…
129 Bolivia Americas 1992   60.4 5401…     3064…
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273 Colombia Americas 1992  70.4 2269…     6678…
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275 Colombia Americas 2002  72.8 2619…     5755…
276 Colombia Americas 2007  72.9 2792…     7258…
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334 Croatia Europe   1997   73.3 4857…     6080…
335 Croatia Europe   2002   74.9 4824…     8448…
336 Croatia Europe   2007   75.7 4493…     14619…
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338 Cuba Americas    1957   59.7 6401…     6092…
339 Cuba Americas    1962   62.5 6737…     6431…
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364 Denmark Europe   1967   71.7 4772…     11733…
365 Denmark Europe   1972   72.4 4866…     13267…
366 Denmark Europe   1977   74.3 4930…     15305…
367 Denmark Europe   1982   74.6 5000…     16884…
368 Denmark Europe   1987   74.8 5088…     18333…
369 Denmark Europe   1992   75.2 5171…     18866…
370 Denmark Europe   1997   75.4 5252…     20422…
371 Denmark Europe   2002   76.5 5338…     23626…
372 Denmark Europe   2007   78.3 5427…     26406…
373 Djibou… Africa   1952   34.8 62…       2189…
374 Djibou… Africa   1957   37.3 71…       2381…
375 Djibou… Africa   1962   40.3 89…       2567…
376 Djibou… Africa   1967   43.3 116…      2745…
377 Djibou… Africa   1972   46.3 147…      2929…
378 Djibou… Africa   1977   49.3 192…      3269…
379 Djibou… Africa   1982   52.3 244…      3414…
380 Djibou… Africa   1987   55.3 311…      3380…
381 Djibou… Africa   1992   58.3 384…      3004…
382 Djibou… Africa   1997   53.4 461…      2082…
383 Djibou… Africa   2002   53.3 529…      2081…
384 Djibou… Africa   2007   54.5 516…      2379…
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386 Dominican Republic Americas 1957 50.9 2923…  1544…
387 Dominican Republic Americas 1962 53.5 3453…  1662…
388 Dominican Republic Americas 1967 55.8 4049…  1828…
389 Dominican Republic Americas 1972 58.4 4671…  2027…
390 Dominican Republic Americas 1977 61.0 5302…  2465…
391 Dominican Republic Americas 1982 63.1 5913…  2781…
392 Dominican Republic Americas 1987 65.8 6541…  3189…
393 
```

Life Expectancy range.

```
# Life Expectancy range.
# Life expectancy is a statistical measure of the average length of life that people can expect to live.
# There are many factors that can influence life expectancy, such as genetics, lifestyle, environment, and healthcare.
# Life expectancy varies from country to country and can be influenced by factors such as poverty, access to healthcare, and lifestyle choices.
```

```
df[['Country', 'LE']].sort_values('LE')
```

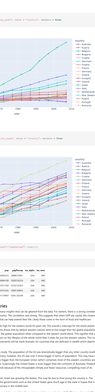
```
LE% Remain ...
```

	Country	Continent	year	Birthrate	Death rate	GDP/Capita	Life Exp	LE% Left	LE% Used	PE/Year
1	Angola	Africa	1960	50.00	25.000	2500.00000	32.978	67	33.00000000	0.0303030303
2	Angola	Africa	1961	50.000000	24.900000	2500.000000	33.000	67	33.000000000	0.0303030303
3	Canada	Canada	1960	19.00	7.000000	12117.00000	69.00	31	31.000000000	0.0323333333
4	Canada	Canada	1961	19.000000	7.000000	12117.000000	69.000	31	31.000000000	0.0323333333
5	Canada	Canada	1962	19.000000	7.000000	12117.000000	69.000000	31	31.000000000	0.0323333333

Base 100 Charts

GDP Base

```
# Base 100 charts
# Plot GDP/Capita, LE% Used, LE% Left, Death rate, Birthrate, PE/Year, Remaining
# Group by country
```



Population Base

```
# Population Base
# Plot GDP/Capita, LE% Used, LE% Left, Death rate, Birthrate, PE/Year, Remaining
# Group by country
```

Life Base

```
df[['Country', 'LE', 'Birth rate', 'Death rate', 'GDP/Capita']].sort_values('LE')
```

```
KeyVal_Series
```

```
df[['Country', 'LE', 'Birth rate', 'Death rate', 'GDP/Capita']].sort_values('LE')
```



```
df[['Country', 'LE', 'Birth rate', 'Death rate', 'GDP/Capita']].sort_values('LE')
```

```
KeyVal_Series
```

	Country	Continent	year	Birthrate	Death rate	GDP/Capita	Life Exp	LE% Left	LE% Used
1	Angola	Africa	1960	50.00	25.000	2500.00000	32.978	67	33.00000000
2	Angola	Africa	1961	50.000000	24.900000	2500.000000	33.000	67	33.000000000
3	Canada	Canada	1960	19.00	7.000000	12117.00000	69.00	31	31.000000000
4	Canada	Canada	1961	19.000000	7.000000	12117.000000	69.000	31	31.000000000
5	Canada	Canada	1962	19.000000	7.000000	12117.000000	69.000000	31	31.000000000

Analysis for Western Countries

Overall, life span is quite stunning. There are many insights that can be gleaned from this data. For starters, there is a strong correlation between GDP/Capita and life expectancy. Wealthier countries live longer. Life expectancy is also strongly correlated with birth rate. Countries with lower birth rates generally have longer life spans. Death rate is also a factor, but not as significant as birth rate.

The p-value(0.05) for the linear regression was quite high for the variable's birth rate. The p-value(0.05) for the GDP/Capita was quite low. The p-value(0.05) for death rate was quite low. The p-value for the linear regression was quite low. The p-value for the GDP/Capita was quite low. The p-value for the death rate was quite low. The p-value for the birth rate