PYTHON PROJECT

```
import pandas as pd
from io import StringIO

csv_data = """(id,Country (or dependency),Population 2025,Yearly Change,Net Change,Density (P/Km²),Land Area (Km
1,India,1463865525,0.89%,12929734,492,2973190,-495753,1.94,28.8,37.1%,17.78%
2,China,1416096094,-0.23%,-3225184,151,9388211,-268126,1.02,40.1,67.5%,17.20%
3,United States,347275807,0.54%,1849236,38,9147420,1230663,1.62,38.5,82.8%,4.22%
4,Indonesia,285721236,0.79%,2233305,158,1811570,-39509,2.1,30.4,59.6%,3.47%
5,Pakistan,255219554,1.57%,3950390,331,770880,-1235336,3.5,20.6,34.4%,3.10%
6,Nigeria,237527782,2.08%,4848304,261,910770,-15258,4.3,18.1,54.9%,2.89%
7,Brazil,212812405,0.38%,813832,25,8358140,-217283,1.6,34.8,91.4%,2.59%
8,Bangladesh,175686899,1.22%,2124535,1350,130170,-402100,2.11,26.0,42.6%,2.13%
9,Russia,143997393,-0.57%,-823030,9,16376870,-251822,1.47,40.3,75%,1.75%
10,Ethiopia,135472051,2.58%,3412284,135,1000000,24054,3.81,19.1,22.5%,1.65%
11,Mexico,131946900,0.83%,1085893,68,1943950,-108037,1.87,29.6,87.9%,1.60%
12,Japan,123103479,-0.52%,-649562,338,364555,140579,1.23,49.8,93.1%,1.50%
13,Egypt,118365995,1.57%,1827737,119,995450,-57305,2.71,24.5,40.9%,1.44%
14,Philippines,116786962,0.81%,943292,392,298170,-149315,1.88,26.1,49.3%,1.42%
15,DR Congo,112832473,3.25%,3556208,50,2267050,-27309,5.9,15.8,45%,1.37%
16,Vietnam,101598527,0.6%,610841,328,310070,-48171,1.88,33.4,41.4%,1.23%
17,Iran,92417681,0.93%,849943,57,1628550,116786,1.67,34.0,73.3%,1.12%
18,Turkey,87685426,0.24%,211621,114,769630,-258205,1.62,33.5,76.9%,1.07%
19,Germany,84075075,-0.56%,-477167,241,348560,-334072,1.46,45.5,76.5%,1.02%
20,Thailand,71619863,-0.07%,-48148,140,510890,27509,1.2,40.6,53.5%,0.87%)"""

df = pd.read_csv(StringIO(csv_data))
df
```

	(id	Country (or dependency)	Population 2025	Yearly Change	Net Change	Density (P/Km^2)	Land Area (Km^2)	Migrants (net)	Fert. Rate	Median Age	Urban Pop %	World Share
0	1	India	1463865525	0.89%	12929734	492	2973190	-495753	1.94	28.8	37.1%	17.78%
1	2	China	1416096094	-0.23%	-3225184	151	9388211	-268126	1.02	40.1	67.5%	17.20%
2	3	United States	347275807	0.54%	1849236	38	9147420	1230663	1.62	38.5	82.8%	4.22%
3	4	Indonesia	285721236	0.79%	2233305	158	1811570	-39509	2.10	30.4	59.6%	3.47%
4	5	Pakistan	255219554	1.57%	3950390	331	770880	-1235336	3.50	20.6	34.4%	3.10%
5	6	Nigeria	237527782	2.08%	4848304	261	910770	-15258	4.30	18.1	54.9%	2.89%
6	7	Brazil	212812405	0.38%	813832	25	8358140	-217283	1.60	34.8	91.4%	2.59%
7	8	Bangladesh	175686899	1.22%	2124535	1350	130170	-402100	2.11	26.0	42.6%	2.13%
8	9	Russia	143997393	-0.57%	-823030	9	16376870	-251822	1.47	40.3	75%	1.75%
9	10	Ethiopia	135472051	2.58%	3412284	135	1000000	24054	3.81	19.1	22.5%	1.65%
10	11	Mexico	131946900	0.83%	1085893	68	1943950	-108037	1.87	29.6	87.9%	1.60%
11	12	Japan	123103479	-0.52%	-649562	338	364555	140579	1.23	49.8	93.1%	1.50%
12	13	Egypt	118365995	1.57%	1827737	119	995450	-57305	2.71	24.5	40.9%	1.44%
13	14	Philippines	116786962	0.81%	943292	392	298170	-149315	1.88	26.1	49.3%	1.42%
14	15	DR Congo	112832473	3.25%	3556208	50	2267050	-27309	5.90	15.8	45%	1.37%
15	16	Vietnam	101598527	0.6%	610841	328	310070	-48171	1.88	33.4	41.4%	1.23%
16	17	Iran	92417681	0.93%	849943	57	1628550	116786	1.67	34.0	73.3%	1.12%
17	18	Turkey	87685426	0.24%	211621	114	769630	-258205	1.62	33.5	76.9%	1.07%
18	19	Germany	84075075	-0.56%	-477167	241	348560	-334072	1.46	45.5	76.5%	1.02%
19	20	Thailand	71619863	-0.07%	-48148	140	510890	27509	1.20	40.6	53.5%	0.87%)

Next steps: Generate code with df New interactive sheet

```
import matplotlib.pyplot as plt

# Set up matplotlib style
plt.style.use('seaborn-v0_8-darkgrid')
plt.rcParams['figure.figsize'] = (10, 6)
```

```
# Clean column names (remove special characters)
df.columns = df.columns.str.strip()
```

```
df.head()
```

	(id	Country (or dependency)	Population 2025	Yearly Change	Net Change	Density (P/Km²)	Land Area (Km²)	Migrants (net)	Fert. Rate	Median Age	Urban Pop %	World Share
0	1	India	1463865525	0.89	12929734	492	2973190	-495753	1.94	28.8	37.1	17.78%
1	2	China	1416096094	-0.23	-3225184	151	9388211	-268126	1.02	40.1	67.5	17.20%
2	3	United States	347275807	0.54	1849236	38	9147420	1230663	1.62	38.5	82.8	4.22%
3	4	Indonesia	285721236	0.79	2233305	158	1811570	-39509	2.10	30.4	59.6	3.47%
4	5	Pakistan	255219554	1.57	3950390	331	770880	-1235336	3.50	20.6	34.4	3.10%

Next steps: Generate code with df New interactive sheet

```
df.head(7)
```

	(id	Country (or dependency)	Population 2025	Yearly Change	Net Change	Density (P/Km²)	Land Area (Km²)	Migrants (net)	Fert. Rate	Median Age	Urban Pop %	World Share
0	1	India	1463865525	0.89	12929734	492	2973190	-495753	1.94	28.8	37.1	17.78%
1	2	China	1416096094	-0.23	-3225184	151	9388211	-268126	1.02	40.1	67.5	17.20%
2	3	United States	347275807	0.54	1849236	38	9147420	1230663	1.62	38.5	82.8	4.22%
3	4	Indonesia	285721236	0.79	2233305	158	1811570	-39509	2.10	30.4	59.6	3.47%
4	5	Pakistan	255219554	1.57	3950390	331	770880	-1235336	3.50	20.6	34.4	3.10%
5	6	Nigeria	237527782	2.08	4848304	261	910770	-15258	4.30	18.1	54.9	2.89%
6	7	Brazil	212812405	0.38	813832	25	8358140	-217283	1.60	34.8	91.4	2.59%

Next steps: Generate code with df New interactive sheet

```
df.tail(7)
```

	(id	Country (or dependency)	Population 2025	Yearly Change	Net Change	Density (P/Km²)	Land Area (Km²)	Migrants (net)	Fert. Rate	Median Age	Urban Pop %	World Share
13	14	Philippines	116786962	0.81	943292	392	298170	-149315	1.88	26.1	49.3	1.42%
14	15	DR Congo	112832473	3.25	3556208	50	2267050	-27309	5.90	15.8	45.0	1.37%
15	16	Vietnam	101598527	0.60	610841	328	310070	-48171	1.88	33.4	41.4	1.23%
16	17	Iran	92417681	0.93	849943	57	1628550	116786	1.67	34.0	73.3	1.12%
17	18	Turkey	87685426	0.24	211621	114	769630	-258205	1.62	33.5	76.9	1.07%
18	19	Germany	84075075	-0.56	-477167	241	348560	-334072	1.46	45.5	76.5	1.02%
19	20	Thailand	71619863	-0.07	-48148	140	510890	27509	1.20	40.6	53.5	0.87%)

```
df.dtypes
```

	0
(id	int64
Country (or dependency)	object
Population 2025	int64
Yearly Change	float64
Net Change	int64
Density (P/Km²)	int64
Land Area (Km²)	int64
Migrants (net)	int64
Fert. Rate	float64
Median Age	float64
Urban Pop %	float64
World Share	object

dtype: object

```
df.shape
```

```
(20, 12)
```

```
df.values
```

```
array([[1, 'India', 1463865525, 0.89, 12929734, 492, 2973190, -495753,
        1.94, 28.8, 37.1, '17.78%'],
       [2, 'China', 1416096094, -0.23, -3225184, 151, 9388211, -268126,
        1.02, 40.1, 67.5, '17.20%'],
       [3, 'United States', 347275807, 0.54, 1849236, 38, 9147420,
        1230663, 1.62, 38.5, 82.8, '4.22%'],
       [4, 'Indonesia', 285721236, 0.79, 2233305, 158, 1811570, -39509,
        2.1, 30.4, 59.6, '3.47%'],
       [5, 'Pakistan', 255219554, 1.57, 3950390, 331, 770880, -1235336,
        3.5, 20.6, 34.4, '3.10%'],
       [6, 'Nigeria', 237527782, 2.08, 4848304, 261, 910770, -15258, 4.3,
        18.1, 54.9, '2.89%'],
       [7, 'Brazil', 212812405, 0.38, 813832, 25, 8358140, -217283, 1.6,
        34.8, 91.4, '2.59%'],
       [8, 'Bangladesh', 175686899, 1.22, 2124535, 1350, 130170, -402100,
        2.11, 26.0, 42.6, '2.13%'],
       [9, 'Russia', 143997393, -0.57, -823030, 9, 16376870, -251822,
        1.47, 40.3, 75.0, '1.75%'],
       [10, 'Ethiopia', 135472051, 2.58, 3412284, 135, 1000000, 24054,
        3.81, 19.1, 22.5, '1.65%'],
       [11, 'Mexico', 131946900, 0.83, 1085893, 68, 1943950, -108037,
        1.87, 29.6, 87.9, '1.60%'],
       [12, 'Japan', 123103479, -0.52, -649562, 338, 364555, 140579,
        1.23, 49.8, 93.1, '1.50%'],
       [13, 'Egypt', 118365995, 1.57, 1827737, 119, 995450, -57305, 2.71,
        24.5, 40.9, '1.44%'],
       [14, 'Philippines', 116786962, 0.81, 943292, 392, 298170, -149315,
        1.88, 26.1, 49.3, '1.42%'],
       [15, 'DR Congo', 112832473, 3.25, 3556208, 50, 2267050, -27309,
        5.9, 15.8, 45.0, '1.37%'],
       [16, 'Vietnam', 101598527, 0.6, 610841, 328, 310070, -48171, 1.88,
        33.4, 41.4, '1.23%'],
       [17, 'Iran', 92417681, 0.93, 849943, 57, 1628550, 116786, 1.67,
        34.0, 73.3, '1.12%'],
       [18, 'Turkey', 87685426, 0.24, 211621, 114, 769630, -258205, 1.62,
        33.5, 76.9, '1.07%'],
       [19, 'Germany', 84075075, -0.56, -477167, 241, 348560, -334072,
        1.46, 45.5, 76.5, '1.02%'],
       [20, 'Thailand', 71619863, -0.07, -48148, 140, 510890, 27509, 1.2,
        40.6, 53.5, '0.87%)']], dtype=object)
```

```
df["Population 2025"].mean()
```

```
np.float64(285705356.35)
```

```
df["Population 2025"].median()
```

```
133709475.5
```

==

QUESTION 1: Top 10 Most Populous Countries

==

```
top_10 = df.nlargest(10, 'Population 2025')[['Country (or dependency)', 'Population 2025', 'World Share']]
print(top_10.to_string(index=False))
```

```
Country (or dependency)  Population 2025 World Share
                  India       1463865525      17.78%
                  China       1416096094      17.20%
          United States        347275807       4.22%
              Indonesia        285721236       3.47%
               Pakistan        255219554       3.10%
                Nigeria        237527782       2.89%
                 Brazil        212812405       2.59%
             Bangladesh        175686899       2.13%
                 Russia        143997393       1.75%
               Ethiopia        135472051       1.65%
```

==

QUESTION 2: Highest and Lowest Population Growth Rates

==

```
print("\n🔺 TOP 10 FASTEST GROWING COUNTRIES:")
fastest_growth = df.nlargest(10, 'Yearly Change')[['Country (or dependency)', 'Yearly Change', 'Net Change']]
print(fastest_growth.to_string(index=False))

print("\n🔻 TOP 10 DECLINING POPULATIONS:")
declining = df.nsmallest(10, 'Yearly Change')[['Country (or dependency)', 'Yearly Change', 'Net Change']]
print(declining.to_string(index=False))
```

```
🔺 TOP 10 FASTEST GROWING COUNTRIES:
Country (or dependency)  Yearly Change  Net Change
               DR Congo           3.25     3556208
               Ethiopia           2.58     3412284
                Nigeria           2.08     4848304
               Pakistan           1.57     3950390
                  Egypt           1.57     1827737
             Bangladesh           1.22     2124535
                   Iran           0.93      849943
                  India           0.89    12929734
                 Mexico           0.83     1085893
            Philippines           0.81      943292

🔻 TOP 10 DECLINING POPULATIONS:
Country (or dependency)  Yearly Change  Net Change
                 Russia          -0.57     -823030
                Germany          -0.56     -477167
                  Japan          -0.52     -649562
                  China          -0.23    -3225184
               Thailand          -0.07      -48148
                 Turkey           0.24      211621
                 Brazil           0.38      813832
          United States           0.54     1849236
                Vietnam           0.60      610841
              Indonesia           0.79     2233305
```

==

QUESTION 3: Population Density Analysis

==

```
print("\n🏙 TOP 10 MOST DENSELY POPULATED:")
densest = df.nlargest(10, 'Density (P/Km²)')[['Country (or dependency)', 'Density (P/Km²)', 'Land Area (Km²)']]
print(densest.to_string(index=False))

print("\n🌾 TOP 10 LEAST DENSELY POPULATED:")
```

```
least_dense = df.nsmallest(10, 'Density (P/Km²)')[['Country (or dependency)', 'Density (P/Km²)', 'Land Area (Km²
print(least_dense.to_string(index=False))

avg_density = df['Density (P/Km²)'].mean()
print(f"\n📊 Average global density: {avg_density:.2f} people/km²")
```

```
🏙 TOP 10 MOST DENSELY POPULATED:
Country (or dependency)  Density (P/Km²)  Land Area (Km²)
             Bangladesh             1350           130170
                  India              492          2973190
            Philippines              392           298170
                  Japan              338           364555
               Pakistan              331           770880
                Vietnam              328           310070
                Nigeria              261           910770
                Germany              241           348560
              Indonesia              158          1811570
                  China              151          9388211

🌾 TOP 10 LEAST DENSELY POPULATED:
Country (or dependency)  Density (P/Km²)  Land Area (Km²)
                 Russia                9         16376870
                 Brazil               25          8358140
          United States               38          9147420
               DR Congo               50          2267050
                   Iran               57          1628550
                 Mexico               68          1943950
                 Turkey              114           769630
                  Egypt              119           995450
               Ethiopia              135          1000000
               Thailand              140           510890

📊 Average global density: 239.85 people/km²
```

===

QUESTION 4: Youngest vs Oldest Populations

===

```
print("\n👶 TOP 10 YOUNGEST POPULATIONS:")
youngest = df.nsmallest(10, 'Median Age')[['Country (or dependency)', 'Median Age', 'Fert. Rate']]
print(youngest.to_string(index=False))

print("\n👴 TOP 10 OLDEST POPULATIONS:")
oldest = df.nlargest(10, 'Median Age')[['Country (or dependency)', 'Median Age', 'Fert. Rate']]
print(oldest.to_string(index=False))

avg_age = df['Median Age'].mean()
print(f"\n📊 Average global median age: {avg_age:.2f} years")
```

```
👶 TOP 10 YOUNGEST POPULATIONS:
Country (or dependency)  Median Age  Fert. Rate
               DR Congo        15.8        5.90
                Nigeria        18.1        4.30
               Ethiopia        19.1        3.81
               Pakistan        20.6        3.50
                  Egypt        24.5        2.71
             Bangladesh        26.0        2.11
            Philippines        26.1        1.88
                  India        28.8        1.94
                 Mexico        29.6        1.87
              Indonesia        30.4        2.10

👴 TOP 10 OLDEST POPULATIONS:
Country (or dependency)  Median Age  Fert. Rate
                  Japan        49.8        1.23
                Germany        45.5        1.46
               Thailand        40.6        1.20
                 Russia        40.3        1.47
                  China        40.1        1.02
          United States        38.5        1.62
                 Brazil        34.8        1.60
                   Iran        34.0        1.67
                 Turkey        33.5        1.62
                Vietnam        33.4        1.88

📊 Average global median age: 31.48 years
```

==

QUESTION 5: Urbanization vs Population Density

==

```
print("\n🏙️ TOP 10 MOST URBANIZED COUNTRIES:")
most_urban = df.nlargest(10, 'Urban Pop %')[['Country (or dependency)', 'Urban Pop %', 'Density (P/Km²)']]
print(most_urban.to_string(index=False))

print("\n🌳 TOP 10 LEAST URBANIZED COUNTRIES:")
least_urban = df.nsmallest(10, 'Urban Pop %')[['Country (or dependency)', 'Urban Pop %', 'Density (P/Km²)']]
print(least_urban.to_string(index=False))
```

```
🏙️ TOP 10 MOST URBANIZED COUNTRIES:
Country (or dependency)  Urban Pop %  Density (P/Km²)
                  Japan         93.1              338
                 Brazil         91.4               25
                 Mexico         87.9               68
          United States         82.8               38
                 Turkey         76.9              114
                Germany         76.5              241
                 Russia         75.0                9
                   Iran         73.3               57
                  China         67.5              151
              Indonesia         59.6              158

🌳 TOP 10 LEAST URBANIZED COUNTRIES:
Country (or dependency)  Urban Pop %  Density (P/Km²)
               Ethiopia         22.5              135
               Pakistan         34.4              331
                  India         37.1              492
                  Egypt         40.9              119
                Vietnam         41.4              328
             Bangladesh         42.6             1350
               DR Congo         45.0               50
            Philippines         49.3              392
               Thailand         53.5              140
                Nigeria         54.9              261
```

==

QUESTION 6: Net Migration Analysis

==

```
print("\n✈️ TOP 10 IMMIGRATION DESTINATIONS (Positive Net Migration):")
top_immigration = df.nlargest(10, 'Migrants (net)')[['Country (or dependency)', 'Migrants (net)', 'Population 20
print(top_immigration.to_string(index=False))

print("\n🚪 TOP 10 EMIGRATION SOURCES (Negative Net Migration):")
top_emigration = df.nsmallest(10, 'Migrants (net)')[['Country (or dependency)', 'Migrants (net)', 'Population 20
print(top_emigration.to_string(index=False))
```

```
✈️ TOP 10 IMMIGRATION DESTINATIONS (Positive Net Migration):
Country (or dependency)  Migrants (net)  Population 2025
          United States         1230663        347275807
                  Japan          140579        123103479
                   Iran          116786         92417681
               Thailand           27509         71619863
               Ethiopia           24054        135472051
                Nigeria          -15258        237527782
               DR Congo          -27309        112832473
              Indonesia          -39509        285721236
                Vietnam          -48171        101598527
                  Egypt          -57305        118365995

🚪 TOP 10 EMIGRATION SOURCES (Negative Net Migration):
Country (or dependency)  Migrants (net)  Population 2025
               Pakistan        -1235336        255219554
                  India         -495753       1463865525
             Bangladesh         -402100        175686899
                Germany         -334072         84075075
```

```
             China        -268126       1416096094
            Turkey        -258205         87685426
            Russia        -251822        143997393
            Brazil        -217283        212812405
       Philippines        -149315        116786962
            Mexico        -108037        131946900
```

==

QUESTION 7: Fertility Rate vs Median Age Correlation

==

```
print("\n👶 TOP 10 HIGHEST FERTILITY RATES:")
highest_fert = df.nlargest(10, 'Fert. Rate')[['Country (or dependency)', 'Fert. Rate', 'Median Age']]


print("\n📉 TOP 10 LOWEST FERTILITY RATES:")
lowest_fert = df.nsmallest(10, 'Fert. Rate')[['Country (or dependency)', 'Fert. Rate', 'Median Age']]
```

```
👶 TOP 10 HIGHEST FERTILITY RATES:
Country (or dependency)  Fert. Rate  Median Age
               DR Congo        5.90        15.8
                Nigeria        4.30        18.1
               Ethiopia        3.81        19.1
               Pakistan        3.50        20.6
                  Egypt        2.71        24.5
             Bangladesh        2.11        26.0
              Indonesia        2.10        30.4
                  India        1.94        28.8
            Philippines        1.88        26.1
                Vietnam        1.88        33.4

📉 TOP 10 LOWEST FERTILITY RATES:
Country (or dependency)  Fert. Rate  Median Age
                  China        1.02        40.1
               Thailand        1.20        40.6
                  Japan        1.23        49.8
                Germany        1.46        45.5
                 Russia        1.47        40.3
                 Brazil        1.60        34.8
          United States        1.62        38.5
                 Turkey        1.62        33.5
                   Iran        1.67        34.0
                 Mexico        1.87        29.6
```

==

QUESTION 8: Countries with Highest and Lowest Fertility Rates

==

```
print("\n👶 TOP 5 HIGHEST FERTILITY RATES:")
highest_fertility = df.nlargest(5, 'Fert. Rate')[['Country (or dependency)', 'Fert. Rate', 'Population 2025']]
print(highest_fertility.to_string(index=False))

print("\n📉 TOP 5 LOWEST FERTILITY RATES:")
lowest_fertility = df.nsmallest(5, 'Fert. Rate')[['Country (or dependency)', 'Fert. Rate', 'Population 2025']]
print(lowest_fertility.to_string(index=False))

avg_fertility = df['Fert. Rate'].mean()
print(f"\n📊 Average fertility rate: {avg_fertility:.2f}")
```

```
👶 TOP 5 HIGHEST FERTILITY RATES:
Country (or dependency)  Fert. Rate  Population 2025
               DR Congo        5.90        112832473
                Nigeria        4.30        237527782
               Ethiopia        3.81        135472051
               Pakistan        3.50        255219554
```

```
              Egypt        2.71        118365995

📉 TOP 5 LOWEST FERTILITY RATES:
Country (or dependency)  Fert. Rate  Population 2025
                  China        1.02       1416096094
               Thailand        1.20         71619863
                  Japan        1.23        123103479
                Germany        1.46         84075075
                 Russia        1.47        143997393

📊 Average fertility rate: 2.24
```

==

QUESTION 9: Countries with Declining Populations

==

```
declining_countries = df[df['Yearly Change'] < 0].sort_values('Yearly Change')
print("\n📉 Total countries with declining population: {len(declining_countries)}")
print("\nALL DECLINING POPULATIONS:")
print(declining_countries[['Country (or dependency)', 'Yearly Change', 'Net Change', 'Median Age']].to_string(in
```

```
📉 Total countries with declining population: {len(declining_countries)}

ALL DECLINING POPULATIONS:
Country (or dependency)  Yearly Change  Net Change  Median Age
                 Russia          -0.57     -823030        40.3
                Germany          -0.56     -477167        45.5
                  Japan          -0.52     -649562        49.8
                  China          -0.23    -3225184        40.1
               Thailand          -0.07      -48148        40.6
```

==

QUESTION 10: Land Area vs Population Density

==

```
print("\n🗺 TOP 10 LARGEST COUNTRIES BY LAND AREA:")
largest_land = df.nlargest(10, 'Land Area (Km²)')[['Country (or dependency)', 'Land Area (Km²)', 'Density (P/Km²)
print(largest_land.to_string(index=False))

# Calculate density efficiency (population per land area)
df['Pop_per_Million_km2'] = df['Population 2025'] / (df['Land Area (Km²)'] / 1000000)

print("\n📊 DENSITY INSIGHTS:")
print(f"   Largest country: Russia ({df.loc[df['Land Area (Km²)'].idxmax(), 'Land Area (Km²)']:,.0f} km²)")
print(f"   Smallest country: {df.loc[df['Land Area (Km²)'].idxmin(), 'Country (or dependency)']}")
print(f"   Most efficient use of land: {df.loc[df['Density (P/Km²)'].idxmax(), 'Country (or dependency)']} ({df['
```

```
🗺 TOP 10 LARGEST COUNTRIES BY LAND AREA:
Country (or dependency)  Land Area (Km²)  Density (P/Km²)  Population 2025
                 Russia         16376870                9        143997393
                  China          9388211              151       1416096094
          United States          9147420               38        347275807
                 Brazil          8358140               25        212812405
                  India          2973190              492       1463865525
               DR Congo          2267050               50        112832473
                 Mexico          1943950               68        131946900
              Indonesia          1811570              158        285721236
                   Iran          1628550               57         92417681
               Ethiopia          1000000              135        135472051

📊 DENSITY INSIGHTS:
   Largest country: Russia (16,376,870 km²)
   Smallest country: Bangladesh
   Most efficient use of land: Bangladesh (1350 p/km²)
```

```
print("\n" + "="*80)
print("ANALYSIS COMPLETE!")
print("="*80)
```

```
================================================================================
ANALYSIS COMPLETE!
================================================================================
```

==

VISUALIZATION SECTION

==

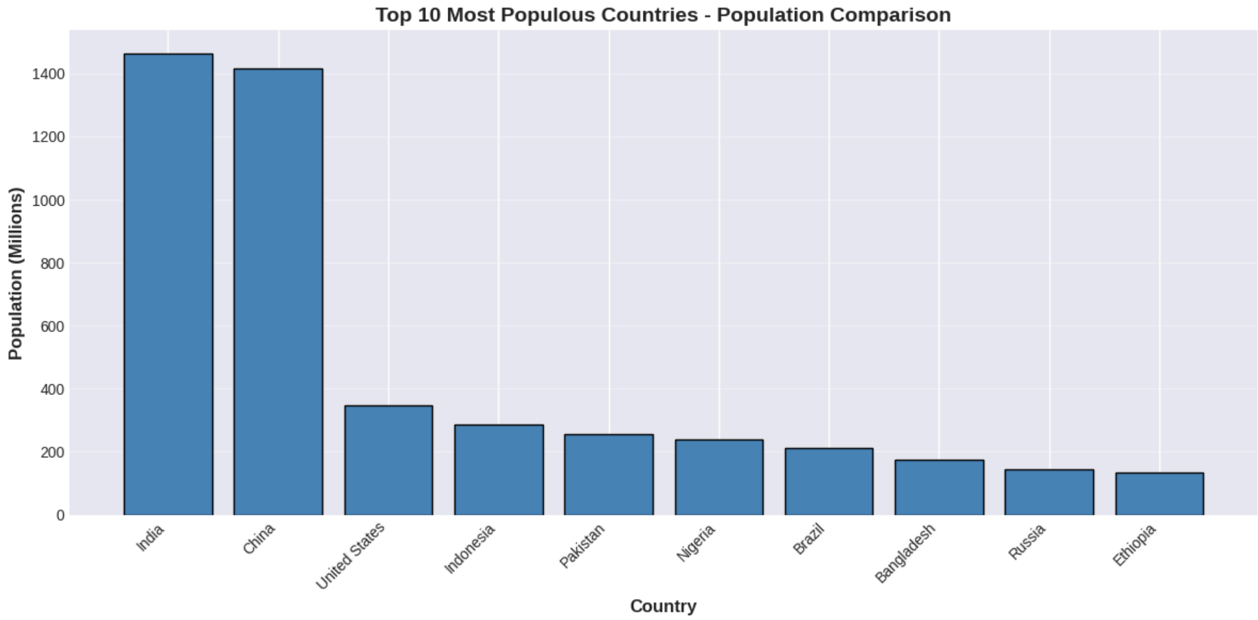
==

CHART 1: BAR GRAPH - How does population compare across top 10 countries?

==

```
print("\n📊 Chart 1: Creating Bar Graph - Population Comparison...")

plt.figure(figsize=(12, 6))
top_10_pop = df.nlargest(10, 'Population 2025')
plt.bar(top_10_pop['Country (or dependency)'],
        top_10_pop['Population 2025'] / 1e6,
        color='steelblue', edgecolor='black')
plt.xlabel('Country', fontsize=12, fontweight='bold')
plt.ylabel('Population (Millions)', fontsize=12, fontweight='bold')
plt.title('Top 10 Most Populous Countries - Population Comparison',
          fontsize=14, fontweight='bold')
plt.xticks(rotation=45, ha='right')
plt.grid(axis='y', alpha=0.3)
plt.tight_layout()
plt.savefig('bar_graph_population.png', dpi=300, bbox_inches='tight')
print("✅ Bar graph saved as 'bar_graph_population.png'")
plt.show()
```

```
📊 Chart 1: Creating Bar Graph - Population Comparison...
✅ Bar graph saved as 'bar_graph_population.png'
```



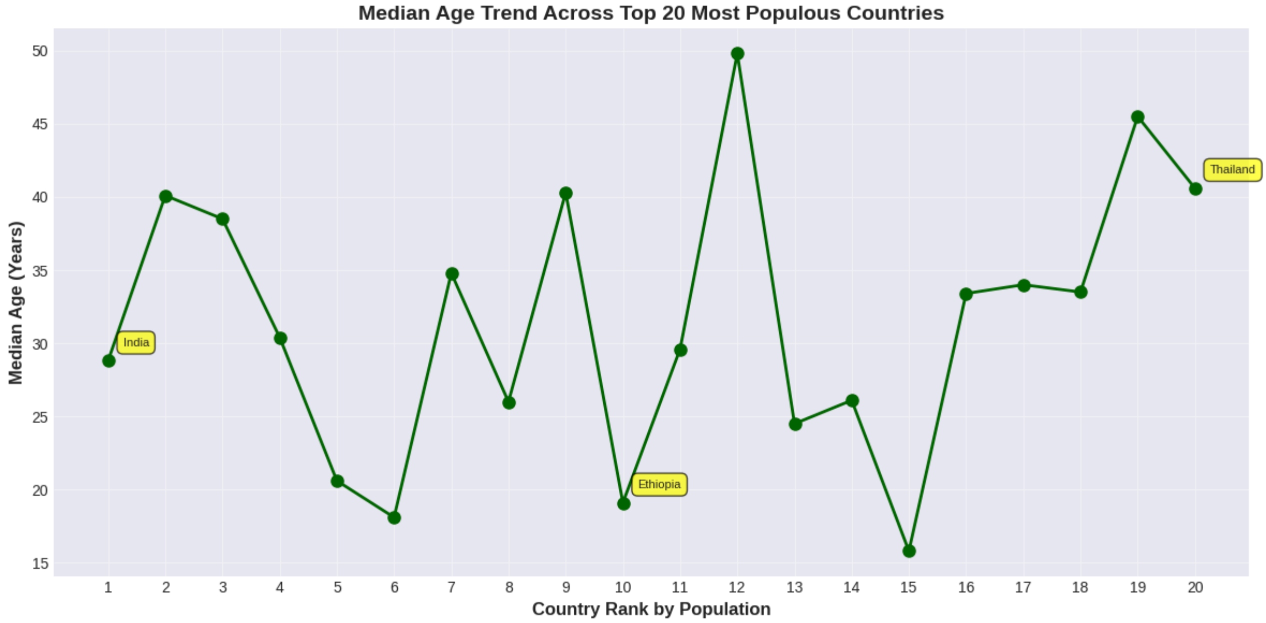
==

CHART 2: LINE CHART - How has the median age trend across countries ranked by population?

==

```
print("\n📈 Chart 2: Creating Line Chart - Median Age Trend...")

plt.figure(figsize=(12, 6))
top_20_sorted = df.nlargest(20, 'Population 2025').reset_index(drop=True)
plt.plot(range(1, 21), top_20_sorted['Median Age'],
         marker='o', linewidth=2, markersize=8, color='darkgreen')
plt.xlabel('Country Rank by Population', fontsize=12, fontweight='bold')
plt.ylabel('Median Age (Years)', fontsize=12, fontweight='bold')
plt.title('Median Age Trend Across Top 20 Most Populous Countries',
          fontsize=14, fontweight='bold')
plt.grid(True, alpha=0.3)
plt.xticks(range(1, 21))
# Add country names on hover-like annotation for key points
for i in [0, 9, 19]:  # First, 10th, and 20th country
    plt.annotate(top_20_sorted.loc[i, 'Country (or dependency)'],
                xy=(i+1, top_20_sorted.loc[i, 'Median Age']),
                xytext=(10, 10), textcoords='offset points',
                bbox=dict(boxstyle='round,pad=0.5', fc='yellow', alpha=0.7),
                fontsize=8)
plt.tight_layout()
plt.savefig('line_chart_median_age.png', dpi=300, bbox_inches='tight')
print("✅ Line chart saved as 'line_chart_median_age.png'")
plt.show()
```

```
📈 Chart 2: Creating Line Chart - Median Age Trend...
✅ Line chart saved as 'line_chart_median_age.png'
```



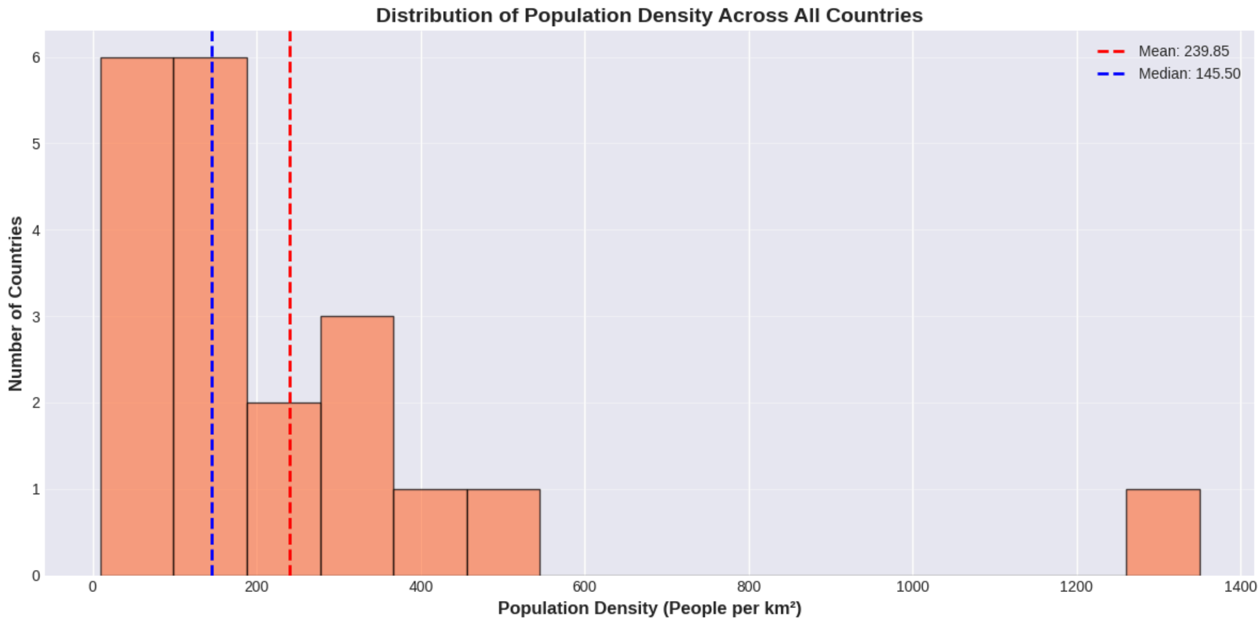
==

CHART 3: HISTOGRAM - What is the distribution of population density across countries?

==

```
print("\n📊 Chart 3: Creating Histogram - Population Density Distribution...")

plt.figure(figsize=(12, 6))
plt.hist(df['Density (P/Km²)'], bins=15, color='coral', edgecolor='black', alpha=0.7)
plt.xlabel('Population Density (People per km²)', fontsize=12, fontweight='bold')
plt.ylabel('Number of Countries', fontsize=12, fontweight='bold')
plt.title('Distribution of Population Density Across All Countries',
          fontsize=14, fontweight='bold')
plt.axvline(df['Density (P/Km²)'].mean(), color='red', linestyle='--',
            linewidth=2, label=f'Mean: {df["Density (P/Km²)"].mean():.2f}')
plt.axvline(df['Density (P/Km²)'].median(), color='blue', linestyle='--',
            linewidth=2, label=f'Median: {df["Density (P/Km²)"].median():.2f}')
plt.legend()
plt.grid(axis='y', alpha=0.3)
plt.tight_layout()
plt.savefig('histogram_density.png', dpi=300, bbox_inches='tight')
print("✅ Histogram saved as 'histogram_density.png'")
plt.show()
```

```
📊 Chart 3: Creating Histogram - Population Density Distribution...
✅ Histogram saved as 'histogram_density.png'
```



===

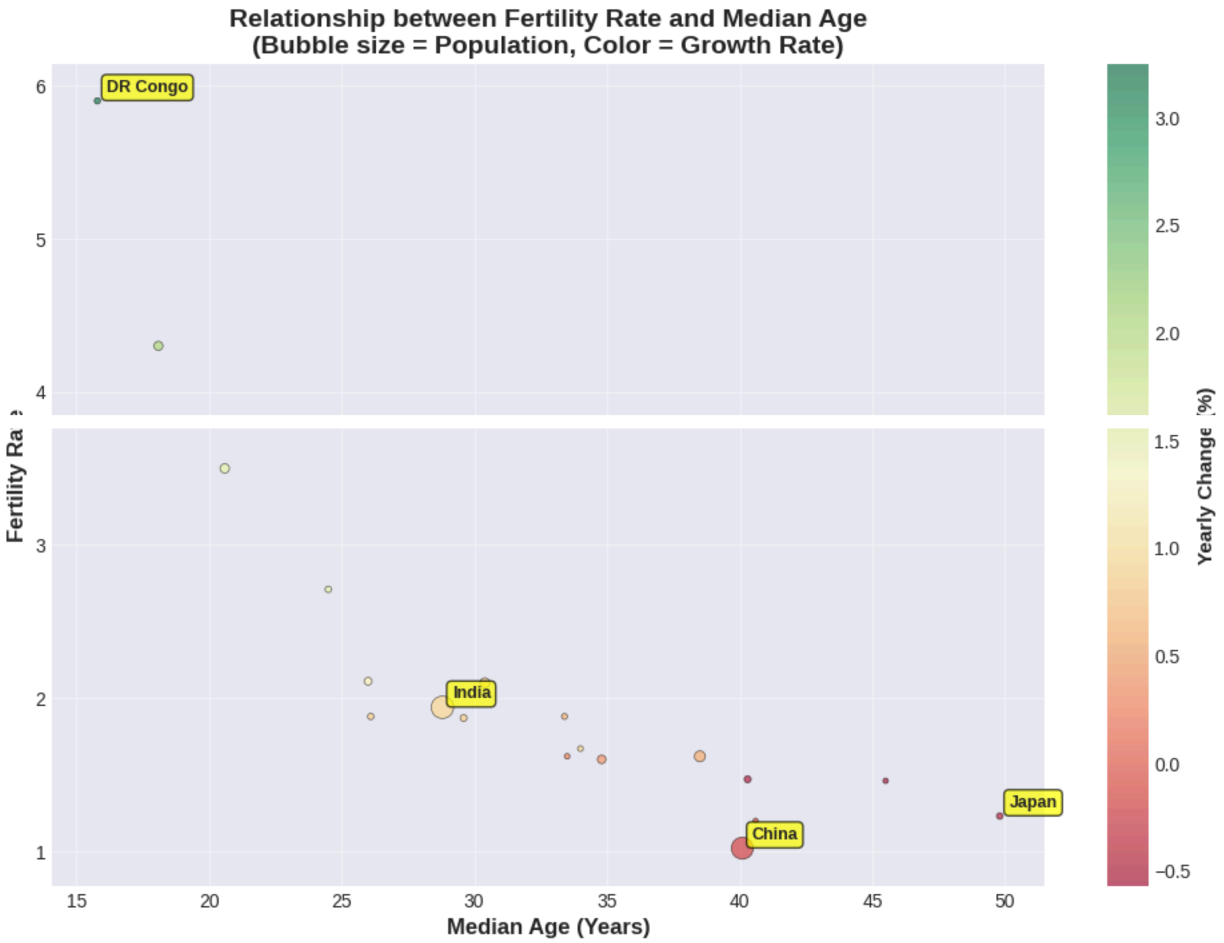
CHART 4: SCATTER PLOT - How are fertility rate and median age related?

===

```
print("\n📉 Chart 5: Creating Scatter Plot - Fertility Rate vs Median Age...")

plt.figure(figsize=(12, 8))
plt.scatter(df['Median Age'], df['Fert. Rate'],
           s=df['Population 2025']/1e7,  # Size based on population
           alpha=0.6, c=df['Yearly Change'], cmap='RdYlGn',
           edgecolors='black', linewidth=0.5)

# Add colorbar
cbar = plt.colorbar()
cbar.set_label('Yearly Change (%)', fontsize=11, fontweight='bold')

plt.xlabel('Median Age (Years)', fontsize=12, fontweight='bold')
plt.ylabel('Fertility Rate', fontsize=12, fontweight='bold')
plt.title('Relationship between Fertility Rate and Median Age\n(Bubble size = Population, Color = Growth Rate)',
          fontsize=14, fontweight='bold')
plt.grid(True, alpha=0.3)

# Annotate some interesting points
```

```
for idx in [0, 1, 11, 14]:  # India, China, Japan, DR Congo
    row = df.iloc[idx]
    plt.annotate(row['Country (or dependency)'],
                 xy=(row['Median Age'], row['Fert. Rate']),
                 xytext=(5, 5), textcoords='offset points',
                 fontsize=9, fontweight='bold',
                 bbox=dict(boxstyle='round,pad=0.3', fc='yellow', alpha=0.7))
```

```
📉 Chart 5: Creating Scatter Plot - Fertility Rate vs Median Age...
```




```
print("\n" + "="*80)
print("ALL VISUALIZATIONS CREATED SUCCESSFULLY!")
print("="*80)
print("\n📁 Generated files:")
print("   1. bar_graph_population.png")
print("   2. line_chart_median_age.png")
print("   3. histogram_density.png")

print("   4. scatter_plot_fertility_age.png")

print("\n🎉 Complete analysis with visualizations finished!")
```

```
================================================================================
ALL VISUALIZATIONS CREATED SUCCESSFULLY!
================================================================================

📁 Generated files:
   1. bar_graph_population.png
```