In [13]:
```
import pandas as pd
import numpy as np
import datetime as dt
import matplotlib.pyplot as plt
import seaborn as sns
```

In [14]:
```
df=pd.read_csv(r"C:\Users\berid\OneDrive\Desktop\mydata\population_by_country_2020.csv")
```

In [15]:
```
df.columns=df.columns.str.strip()
```

In [16]:
```
df.columns=["country","population","yearly_change","net_change","density","area","migrants","fert_rate","med_age","urban_pop","world_share"]
```

In [5]:
```
df.isna().sum()
```

Out[5]:
```
country           0
population        0
yearly_change     0
net_change        0
density           0
area              0
migrants         34
fert_rate         0
med_age           0
urban_pop         0
world_share       0
dtype: int64
```

In [6]:
```
df
```

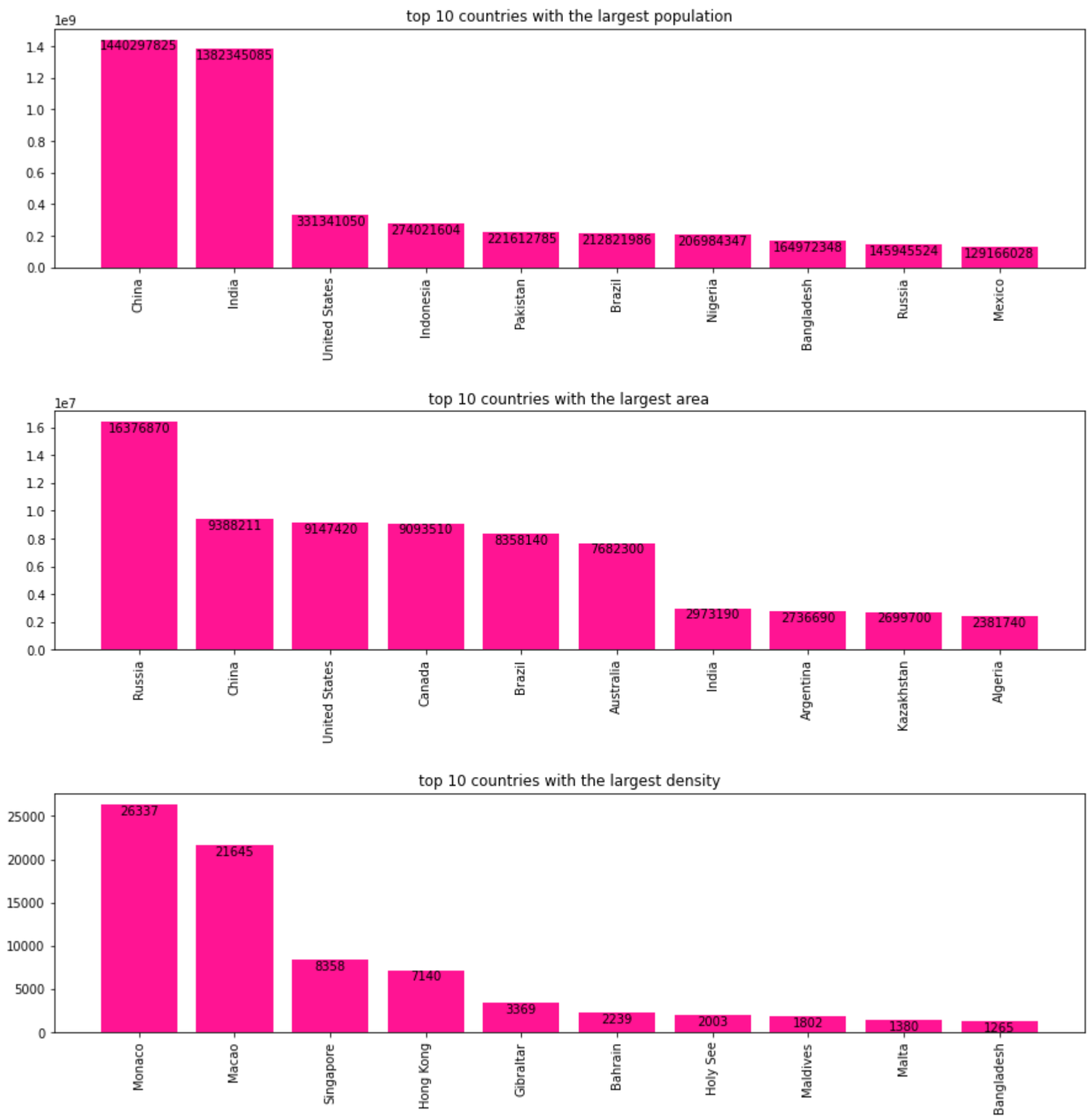
Out[6]:

	country	population	yearly_change	net_change	density	area	migrants	fert_rate	med_age	urban_pop	world_share
0	China	1440297825	0.39 %	5540090	153	9388211	-348399.0	1.7	38	61 %	18.47 %
1	India	1382345085	0.99 %	13586631	464	2973190	-532687.0	2.2	28	35 %	17.70 %
2	United States	331341050	0.59 %	1937734	36	9147420	954806.0	1.8	38	83 %	4.25 %
3	Indonesia	274021604	1.07 %	2898047	151	1811570	-98955.0	2.3	30	56 %	3.51 %
4	Pakistan	221612785	2.00 %	4327022	287	770880	-233379.0	3.6	23	35 %	2.83 %
...	...	...	...	...	...	...	...	...	...	...	...
230	Montserrat	4993	0.06 %	3	50	100	NaN	N.A.	N.A.	10 %	0.00 %
231	Falkland Islands	3497	3.05 %	103	0	12170	NaN	N.A.	N.A.	66 %	0.00 %
232	Niue	1628	0.68 %	11	6	260	NaN	N.A.	N.A.	46 %	0.00 %
233	Tokelau	1360	1.27 %	17	136	10	NaN	N.A.	N.A.	0 %	0.00 %
234	Holy See	801	0.25 %	2	2003	0	NaN	N.A.	N.A.	N.A.	0.00 %

235 rows × 11 columns

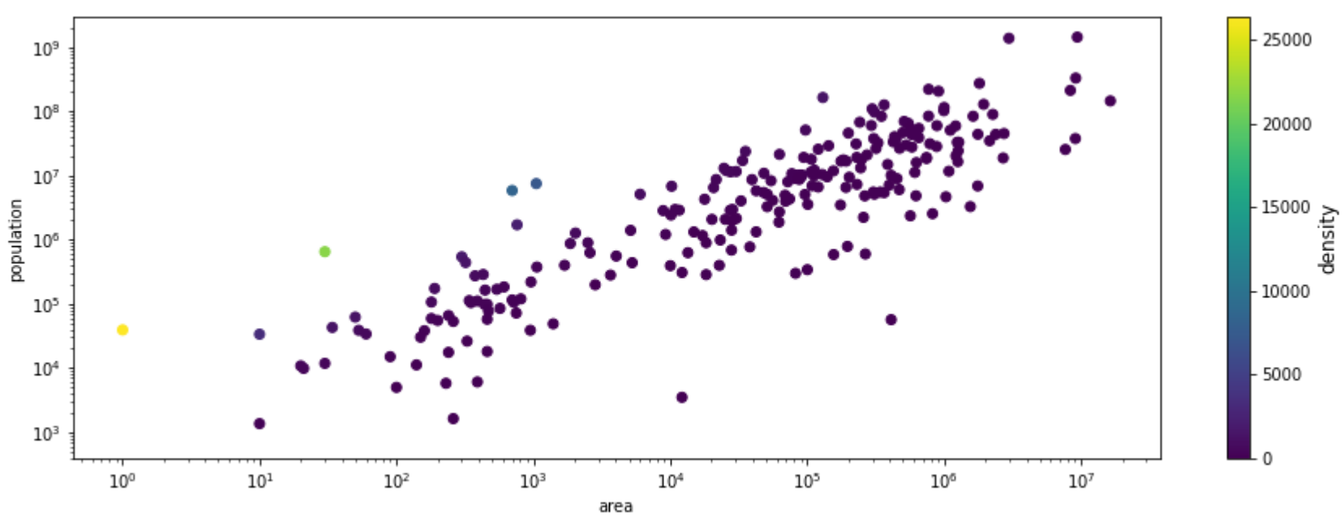
find 10 countries with the largest population, largest land area and largest density

In [11]:
```
fig,axes=plt.subplots(3,1,figsize=(15,15))
plt.subplot(3,1,1)
ordered=df.sort_values("population",ascending=False).head(10)
plt.bar(ordered.country,ordered.population,color="deeppink")
plt.xticks(rotation=90)
plt.title("top 10 countries with the largest population")
def value_labels(y):
    for i in range(len(y)):
        plt.text(i,y.iloc[i],y.iloc[i],size=10,ha="center",va="top",rotation=0)
value_labels(ordered["population"])


plt.subplot(3,1,2)
ordered=df.sort_values("area",ascending=False).head(10)
plt.bar(ordered.country,ordered.area,color="deeppink")
plt.xticks(rotation=90)
plt.title("top 10 countries with the largest area")
def value_labels(y):
    for i in range(len(y)):
        plt.text(i,y.iloc[i],y.iloc[i],size=10,ha="center",va="top",rotation=0)
value_labels(ordered["area"])

plt.subplot(3,1,3)
ordered=df.sort_values("density",ascending=False).head(10)
plt.bar(ordered.country,ordered.density,color="deeppink")
plt.xticks(rotation=90)
plt.title("top 10 countries with the largest density")
def value_labels(y):
    for i in range(len(y)):
        plt.text(i,y.iloc[i],y.iloc[i],size=10,ha="center",va="top",rotation=0)
value_labels(ordered["density"])

plt.subplots_adjust(hspace=0.6)

plt.show()
```

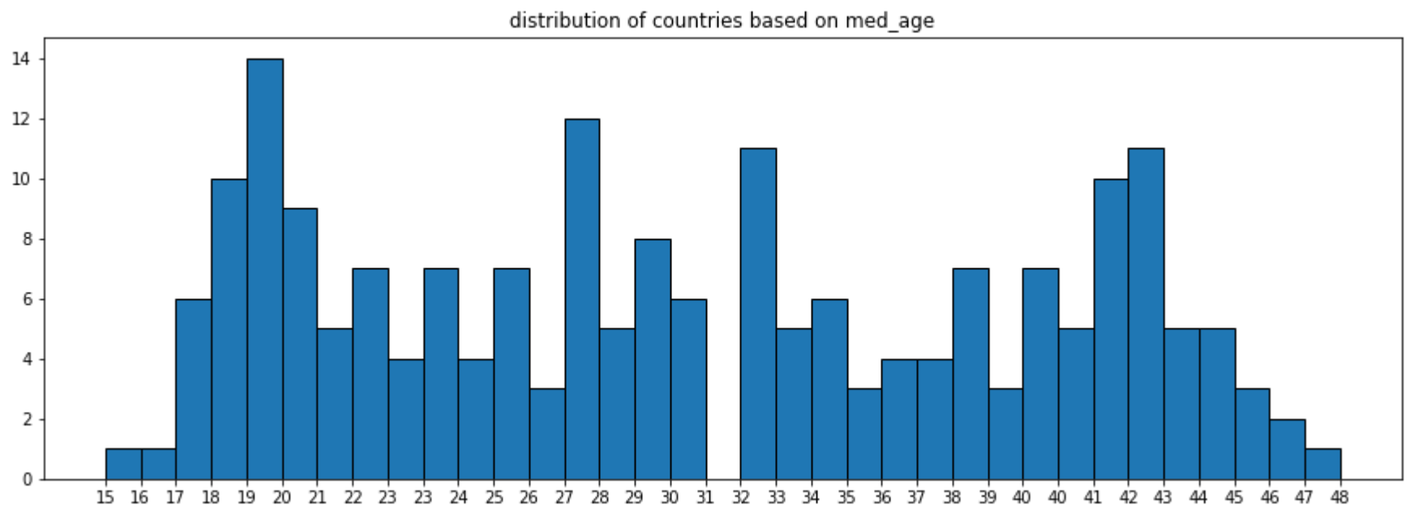


find correlation between country population and country land area

In [100]:
```
plt.figure(figsize=(15,5))
plt.scatter(df.area,df.population,c=df.density)
plt.colorbar().set_label("density",size=12)
plt.xlabel("area")
plt.ylabel("population")
plt.xscale("log")
plt.yscale("log")

plt.show()
```



In [9]:
```
plt.figure(figsize=(15,5))
n,bins,edges=plt.hist(df[df.med_age!="N.A."].sort_values("med_age")["med_age"],ec="k",density=False,bins=df.med_age.nunique())
plt.xticks(bins)
plt.title("distribution of countries based on med_age")

plt.show()
```



How many years from now will China and India population be equal if yearly change stays the same

In [80]:
```
import math
year=math.log(df[df.country=="India"]["population"][1]/df[df.country=="China"]["population"][0])/\
        math.log((1+float(df[df.country=="China"]["yearly_change"].str.replace("%","",regex=True))/100)/(1+float(df[df.country=="India"]["yearly_change"].str.replace("%","",regex=Tr
year
```

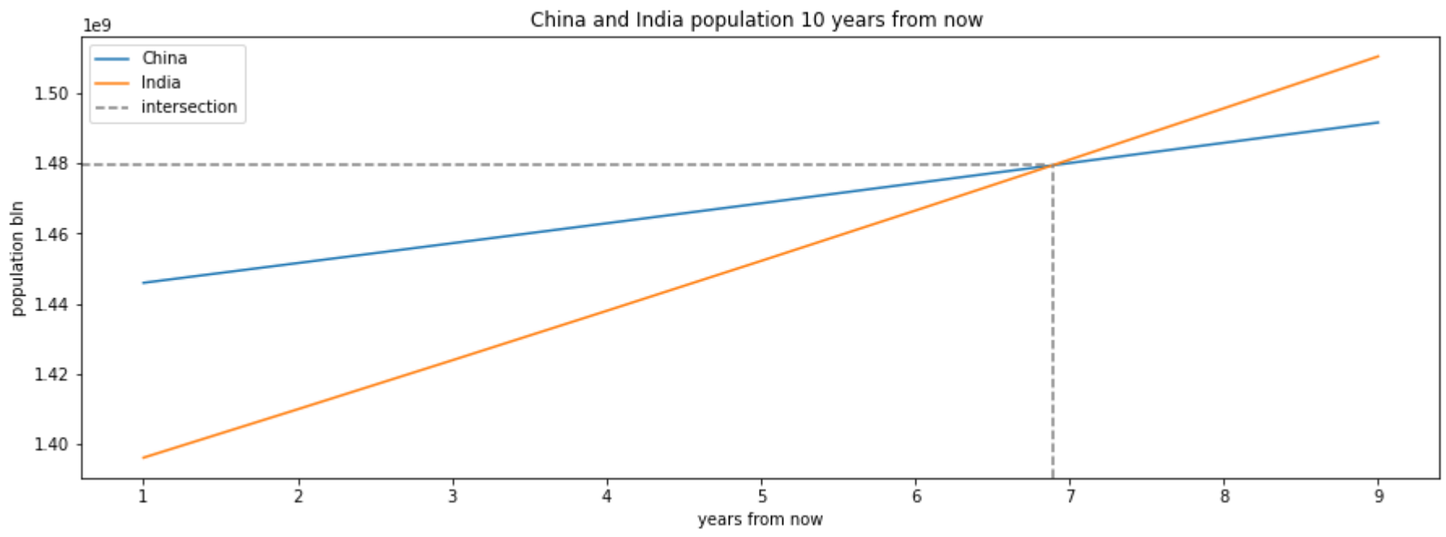
Out[80]: 6.891961944726117

In [81]:
```
equal_population=df[df.country=="China"]["population"][0]*(1+float(df[df.country=="China"]["yearly_change"].str.replace("%","",regex=True))/100)**year
round(equal_population)
```

Out[81]: 1479458717

In [97]:
```
years=[i for i in range(1,10,1)]
China_pop=[]
India_pop=[]
for i in range(1,10,1):
    x=(df[df.country=="China"]["population"]*((1+float(df[df.country=="China"]["yearly_change"].str.replace("%","",regex=True))/100))**i)[0]
    China_pop.append(x)
for i in range(1,10,1):
    y=(df[df.country=="India"]["population"]*((1+float(df[df.country=="India"]["yearly_change"].str.replace("%","",regex=True))/100))**i)[1]
    India_pop.append(y)
data_tuples=list(zip(years,China_pop,India_pop))
newdf=pd.DataFrame(data_tuples,columns=["Years","China_pop","India_pop"])
```

In [132]:
```
plt.figure(figsize=(15,5))
plt.plot(newdf.Years,newdf.China_pop,label="China")
plt.plot(newdf.Years,newdf.India_pop,label="India")
plt.title("China and India population 10 years from now ")
plt.xlabel("years from now")
plt.ylabel("population bln")
plt.axvline(year,color='grey',ls="--",label="intersection",ymax=0.71)
plt.axhline(equal_population,color='grey',ls="--",xmax=0.71)
plt.legend()
plt.show()
```



In [17]:
```
years=[i for i in range(1,10,1)]
ndf=pd.DataFrame()

for i in range(1,10,1):
    x=(df[df.country=="China"]["population"]*((1+float(df[df.country=="China"]["yearly_change"].str.replace("%","",regex=True))/100))**i)[0]
    ndf.append(x)
for i in range(1,10,1):
    y=(df[df.country=="India"]["population"]*((1+float(df[df.country=="India"]["yearly_change"].str.replace("%","",regex=True))/100))**i)[1]
    ndf.append(y)
ndf
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Input In [17], in <module>
      4 for i in range(1,10,1):
      5     x=(df[df.country=="China"]["population"]*((1+float(df[df.country=="China"]["yearly_change"].str.replace("%","",regex=True))/100))**i)[0]
----> 6     ndf.append(x)
      7 for i in range(1,10,1):
      8     y=(df[df.country=="India"]["population"]*((1+float(df[df.country=="India"]["yearly_change"].str.replace("%","",regex=True))/100))**i)[1]

File ~\AppData\Local\Programs\Python\Python39\lib\site-packages\pandas\core\frame.py:8965, in DataFrame.append(self, other, ignore_index, verify_integrity, sort)
   8962 else:
   8963     to_concat = [self, other]
   8964 return (
-> 8965     concat(
   8966         to_concat,
   8967         ignore_index=ignore_index,
   8968         verify_integrity=verify_integrity,
   8969         sort=sort,
   8970     )
   8971 ).__finalize__(self, method="append")

File ~\AppData\Local\Programs\Python\Python39\lib\site-packages\pandas\util\_decorators.py:311, in deprecate_nonkeyword_arguments.<locals>.decorate.<locals>.wrapper(*args, **kwargs)
    305 if len(args) > num_allow_args:
    306     warnings.warn(
    307         msg.format(arguments=arguments),
    308         FutureWarning,
    309         stacklevel=stacklevel,
    310     )
--> 311 return func(*args, **kwargs)

File ~\AppData\Local\Programs\Python\Python39\lib\site-packages\pandas\core\reshape\concat.py:294, in concat(objs, axis, join, ignore_index, keys, levels, names, verify_integrity, sort, copy)
     90 @deprecate_nonkeyword_arguments(version=None, allowed_args=["objs"])
     91 def concat(
     92     objs: Iterable[NDFrame] | Mapping[Hashable, NDFrame],
   (...)
    101     copy: bool = True,
    102 ) -> FrameOrSeriesUnion:
    103     """
    104     Concatenate pandas objects along a particular axis with optional set logic
    105     along the other axes.
   (...)
    292     ValueError: Indexes have overlapping values: ['a']
    293     """
--> 294     op = _Concatenator(
    295         objs,
    296         axis=axis,
    297         ignore_index=ignore_index,
    298         join=join,
    299         keys=keys,
    300         levels=levels,
    301         names=names,
    302         verify_integrity=verify_integrity,
    303         copy=copy,
    304         sort=sort,
    305     )
    307     return op.get_result()

File ~\AppData\Local\Programs\Python\Python39\lib\site-packages\pandas\core\reshape\concat.py:384, in _Concatenator.__init__(self, objs, axis, join, keys, levels, names, ignore_index, verify_integrity, copy, sort)
    379     if not isinstance(obj, (ABCSeries, ABCDataFrame)):
    380         msg = (
    381             f"cannot concatenate object of type '{type(obj)}'; "
    382             "only Series and DataFrame objs are valid"
    383         )
--> 384         raise TypeError(msg)
    386     ndims.add(obj.ndim)
    388 # get the sample
    389 # want the highest ndim that we have, and must be non-empty
    390 # unless all objs are empty

TypeError: cannot concatenate object of type '<class 'numpy.float64'>'; only Series and DataFrame objs are valid
```

In [7]:
```
newdf
```

Out[7]:

	Years	China_pop	India_pop
0	1	1.445915e+09	1.396030e+09
1	2	1.451554e+09	1.409851e+09
2	3	1.457215e+09	1.423809e+09
3	4	1.462898e+09	1.437904e+09
4	5	1.468604e+09	1.452139e+09
5	6	1.474331e+09	1.466516e+09
6	7	1.480081e+09	1.481034e+09
7	8	1.485853e+09	1.495696e+09
8	9	1.491648e+09	1.510504e+09

In [ ]: