In [119]:
```
import pandas as pd
import numpy as np
import datetime as dt
import matplotlib.pyplot as plt
import seaborn as sns
import matplotlib.ticker as mtick
```

In [2]:
```
pd.set_option("display.max_columns",100)
```

In [3]:
```
df=pd.read_csv(r"C:\Users\berid\OneDrive\Desktop\mydata\Life Expectancy Data.csv")
```

In [4]:
```
df.columns=df.columns.str.title().str.replace(" ","")
```

In [5]:
```
df=df.sort_values(["Country","Year"],ascending=[True,True])
```

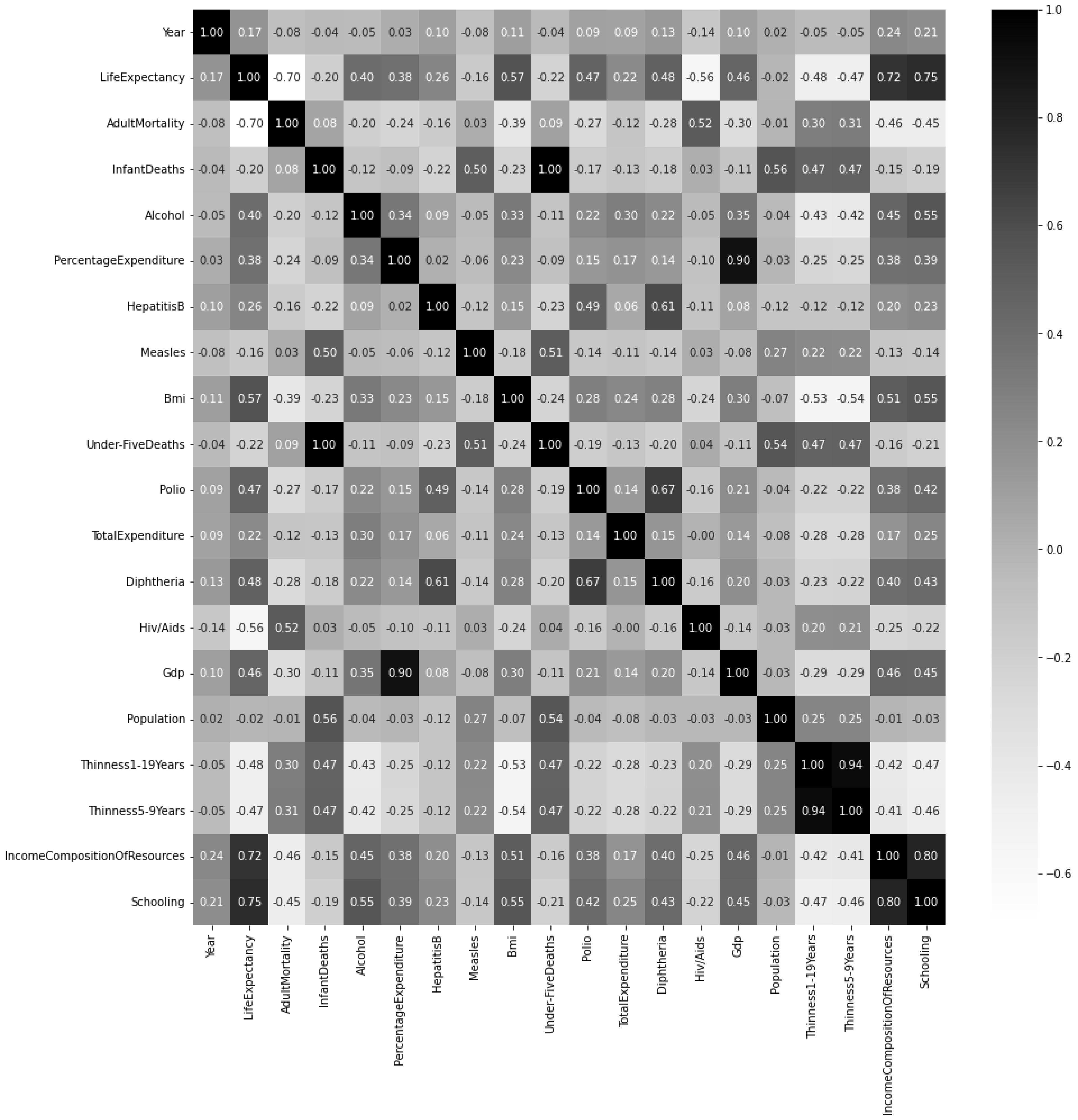
In [6]:
```
df
```

Out[6]:

	Country	Year	Status	LifeExpectancy	AdultMortality	InfantDeaths	Alcohol	PercentageExpenditure	HepatitisB	Measles	Bmi	Under-FiveDeaths	Polio	TotalExpenditure	Diphtheria	Hiv/Aids	Gdp	Population
15	Afghanistan	2000	Developing	54.8	321.0	88	0.01	10.424960	62.0	6532	12.2	122	24.0	8.20	24.0	0.1	114.560000	293756.0
14	Afghanistan	2001	Developing	55.3	316.0	88	0.01	10.574728	63.0	8762	12.6	122	35.0	7.80	33.0	0.1	117.496980	2966463.0
13	Afghanistan	2002	Developing	56.2	3.0	88	0.01	16.887351	64.0	2486	13.0	122	36.0	7.76	36.0	0.1	187.845950	21979923.0
12	Afghanistan	2003	Developing	56.7	295.0	87	0.01	11.089053	65.0	798	13.4	122	41.0	8.82	41.0	0.1	198.728544	2364851.0
11	Afghanistan	2004	Developing	57.0	293.0	87	0.02	15.296066	67.0	466	13.8	120	5.0	8.79	5.0	0.1	219.141353	24118979.0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2926	Zimbabwe	2011	Developing	54.9	464.0	28	6.00	63.750530	94.0	0	29.9	42	93.0	6.31	93.0	13.3	839.927936	14386649.0
2925	Zimbabwe	2012	Developing	56.6	429.0	26	6.09	92.602336	97.0	0	3.3	39	95.0	6.69	95.0	8.8	955.648466	1471826.0
2924	Zimbabwe	2013	Developing	58.0	399.0	25	6.39	10.666707	95.0	0	3.8	36	95.0	6.88	95.0	6.8	111.227396	155456.0
2923	Zimbabwe	2014	Developing	59.2	371.0	23	6.50	10.822595	91.0	0	31.3	34	92.0	6.44	91.0	6.3	127.474620	15411675.0
2922	Zimbabwe	2015	Developing	67.0	336.0	22	NaN	0.000000	87.0	0	31.8	32	88.0	NaN	87.0	6.2	118.693830	15777451.0

2938 rows × 22 columns

In [136]:
```
plt.figure(figsize=(15,15))
sns.heatmap(df.corr(),annot=True,cmap="Greys",fmt=".2f")
plt.show()
```



find columns with strong correlation between

In [10]:

```
col1s=[]
col2s=[]
correlations=[]
for col1 in df.columns:
    for col2 in df.columns:
        if col1!=col2 and col1 not in (["Country","Status"]) and col2 not in (["Country","Status"]):
            correlation=round(df[col1].corr(df[col2]),3)
            if correlation<-0.5 or correlation>0.6:
                col1s.append(col1)
                col2s.append(col2)
                correlations.append(correlation)
tuples=list(zip(col1s,col2s,correlations))
ndf=pd.DataFrame(tuples,columns=["col1","col2","correlation"])
ndf.drop_duplicates(subset="correlation",inplace=True)
ndf.sort_values(["col1","col2"])
```

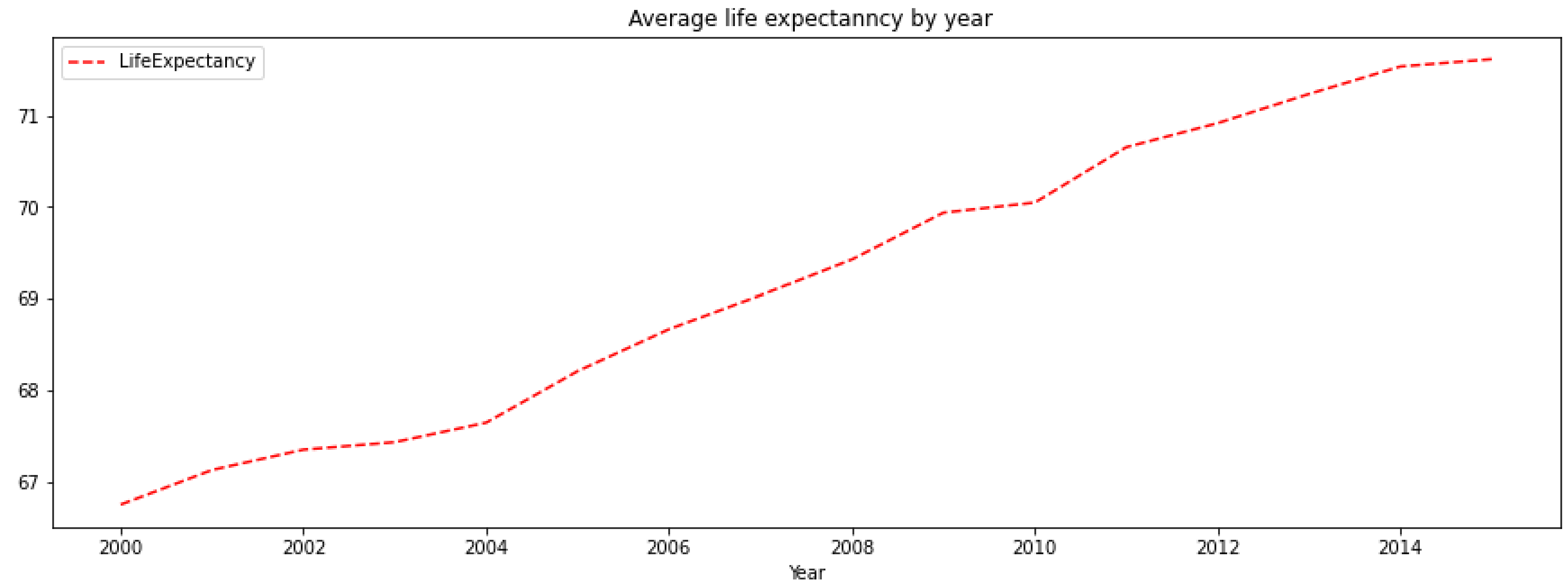
Out[10]:

	col1	col2	correlation
8	Bmi	Thinness1-19Years	-0.532
9	Bmi	Thinness5-9Years	-0.539
7	HepatitisB	Diphtheria	0.611
21	IncomeCompositionOfResources	Schooling	0.800
5	InfantDeaths	Under-FiveDeaths	0.997
0	LifeExpectancy	AdultMortality	-0.696
1	LifeExpectancy	Hiv/Aids	-0.557
2	LifeExpectancy	IncomeCompositionOfResources	0.725
3	LifeExpectancy	Schooling	0.752
6	PercentageExpenditure	Gdp	0.899
11	Polio	Diphtheria	0.674
17	Thinness1-19Years	Thinness5-9Years	0.939

how avg life expectancy has changed over time

In [166]:

```
grouped=df.groupby("Year")["LifeExpectancy"].mean().reset_index().sort_values("Year")
grouped.plot(kind="line",figsize=(15,5),xlabel=None,x="Year",y="LifeExpectancy",color="r",ls="--")
plt.title(" Average life expectanncy by year")
plt.show()
```



Find countries where life expectancy has decreased compared to the first year of survey. Plot life expectancy change graphs for these countries

In [12]:

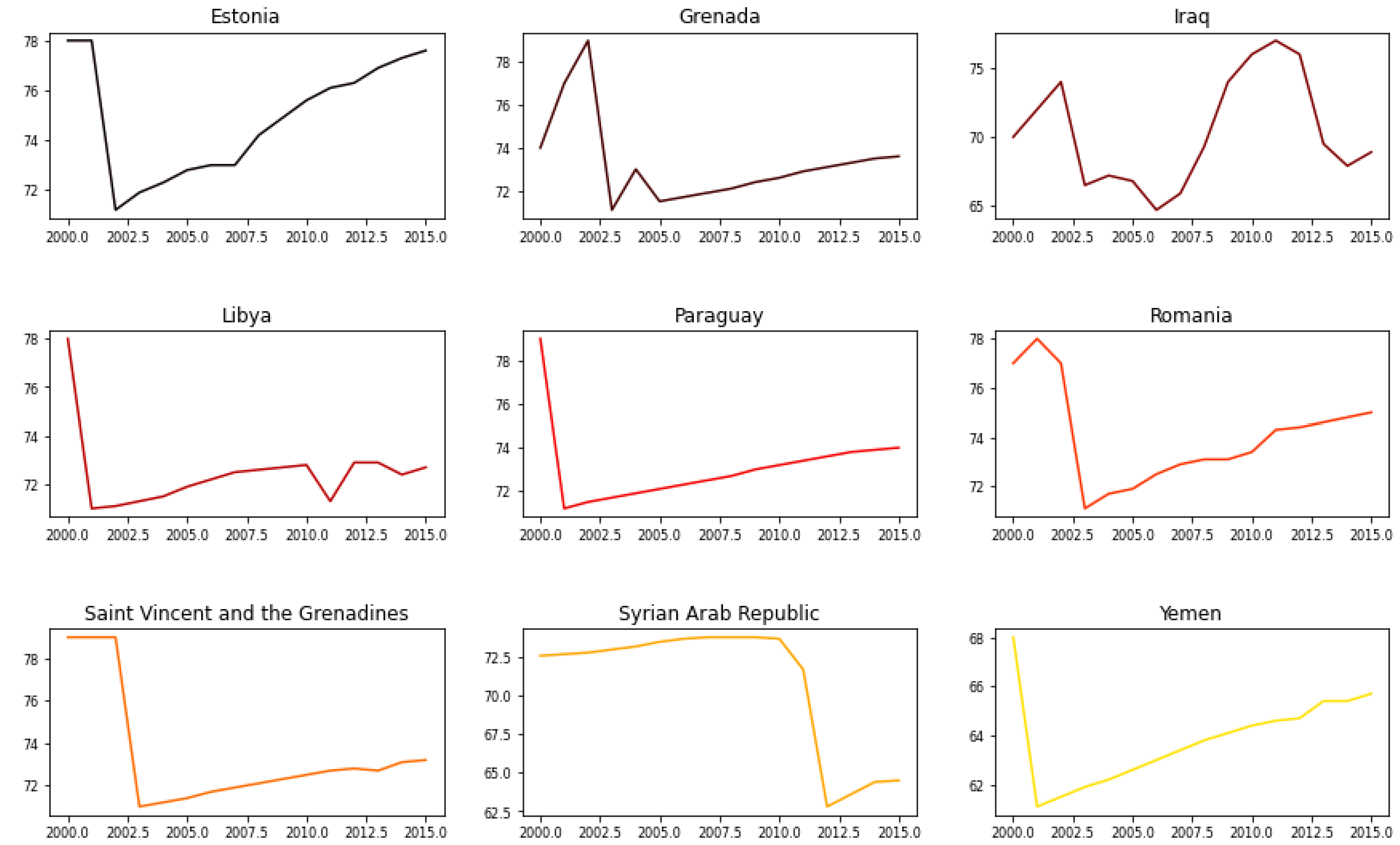
```
grouped=df[df.Year==2015].merge((df[df.Year==2000]),on="Country")[["Country","LifeExpectancy_x","LifeExpectancy_y"]]
grouped.rename(columns={"LifeExpectancy_x":"LE2015","LifeExpectancy_y":"LE2000"},inplace=True)
result=grouped[grouped.LE2015-grouped.LE2000<0]
result
```

Out[12]:

	Country	LE2015	LE2000
54	Estonia	77.6	78.0
65	Grenada	73.6	74.0
77	Iraq	68.9	70.0
94	Libya	72.7	78.0
124	Paraguay	74.0	79.0
132	Romania	75.0	77.0
136	Saint Vincent and the Grenadines	73.2	79.0
158	Syrian Arab Republic	64.5	72.6
180	Yemen	65.7	68.0

In [164]:

```
countries=[i for i in result["Country"]]
cmap=plt.get_cmap("hot")
colors=list(cmap(np.linspace(0,0.7,len(result.Country.unique()))))
fig,axes=plt.subplots(3,3,figsize=(15,9))
for ax,country,col in zip(axes.ravel(),countries,colors):
    df[df.Country==country].plot(kind="line",ax=ax,x="Year",y="LifeExpectancy",xlabel="",legend=False,fontsize=8,rot=0,color=col)
    ax.set_title(country)
    plt.subplots_adjust(hspace=0.6)
plt.show()
```



find countries where development status changed between 2000 and 2015

In [57]:

```
grouped=df.drop_duplicates(subset=["Country","Status"])[["Country","Status"]].\
groupby(["Country","Status"])["Country"].count().reset_index(name="Count")
grouped[grouped.Count!=1]
# there are no countries which development development status between these years
```

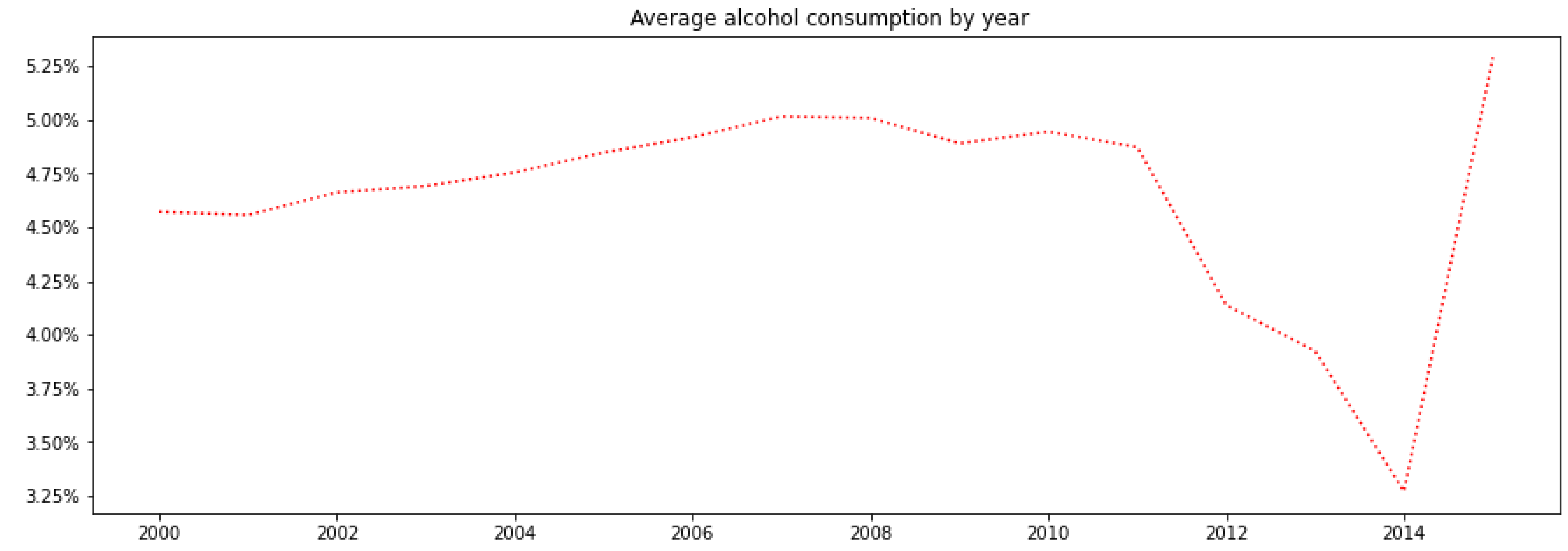
Out[57]:

Country	Status	Count

how was avg alcohol consumption changing between 2000 and 2015

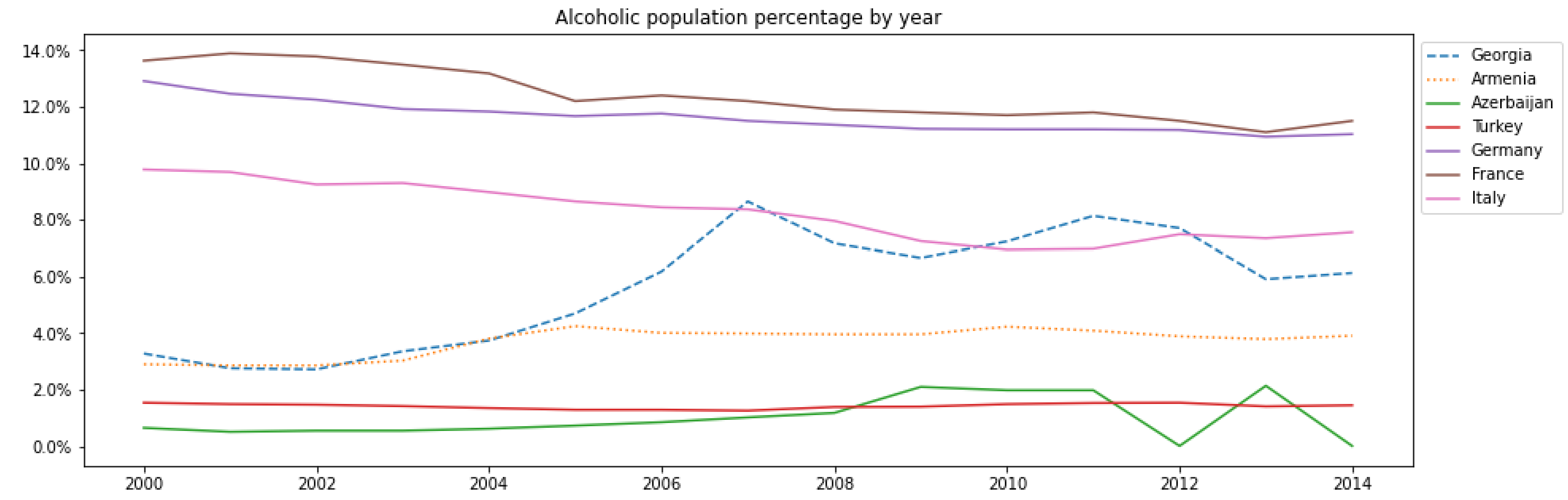
In [168]:

```
grouped=df.groupby("Year")["Alcohol"].mean().reset_index().sort_values("Year")
grouped.plot(kind="line",x="Year",y="Alcohol",figsize=(15,5),legend=False,xlabel="",color="r",ls=":")
plt.title(" Average alcohol consumption by year")
plt.gca().yaxis.set_major_formatter(mtick.PercentFormatter(100))
plt.show()
```

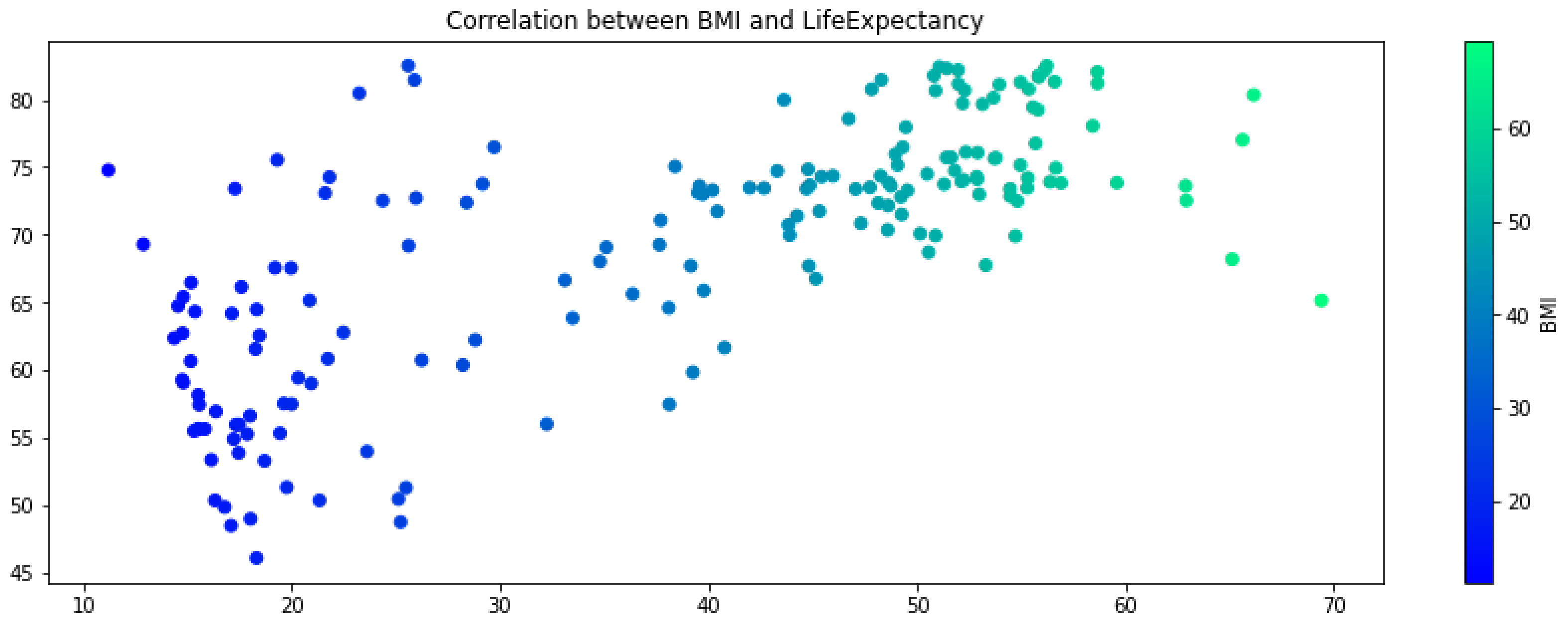


In [140]:

```
countries=["Georgia","Armenia","Azerbaijan","Turkey","Germany","France","Italy"]
plt.figure(figsize=(15,5))
for c in countries:
    plt.plot(df[df.Country==c]["Year"],df[df.Country==c]["Alcohol"],ls="--" if c=="Georgia" else ":" if c=="Armenia" else "-")
    plt.title("Alcoholic population percentage by year")
    plt.gca().yaxis.set_major_formatter(mtick.PercentFormatter(100))
    plt.legend(countries,bbox_to_anchor=(1,1))
plt.show()
```



```
In [159]: grouped=df.groupby("Country").agg({"Bmi":"mean","LifeExpectancy":"mean"}).reset_index()
          plt.figure(figsize=(15,5))
          plt.scatter(grouped.Bmi,grouped.LifeExpectancy,c=grouped.Bmi,cmap="winter")
          plt.colorbar().set_label("BMI")
          plt.title("Correlation between BMI and LifeExpectancy")
          plt.show()
```


Correlation between BMI and LifeExpectancy
BMI