Sample Midterm Exam Questions

For each question you are expected to write the Python code to attain the necessary graphs or results

```
# The necesary python packages have been imported
# for data structures and manipulation

import numpy as np # for mathematical caluclations
import pandas as pd
import datetime  # to access datetime

# for data visualization
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px # for interactive plotting
import plotly.graph_objects as go # for interactive plotting

# set the plot style in matplotlib to ggplot and the firgure size to
15x5## Augmented Dickey Fuller Test for Assessing Stationarity
plt.style.use('ggplot')
plt.rcParams["figure.figsize"] = (15,5)

# for ingnoring warnings
import warnings # to ignore warning
warnings.filterwarnings('ignore')

# The Netflix csv file is imported and shows the stock data for
Netflix where Open,High,Low, Close and Adj Close refers to
#Netflix stock price
Netflix=pd.read_csv('Netflix.csv',parse_dates=['Date'])
Netflix.head()

        Date      Open      High       Low     Close  Adj Close
Volume
0 2009-01-02  4.217143  4.357143  4.200000  4.267143   4.267143
6605200
1 2009-01-05  4.327143  4.562857  4.302857  4.562857   4.562857
13044500
2 2009-01-06  4.591429  4.750000  4.590000  4.705714   4.705714
12065900
3 2009-01-07  4.715714  4.734286  4.571429  4.672857   4.672857
10133900
4 2009-01-08  4.618571  4.797143  4.485714  4.735714   4.735714
8175300

#Extract the year, month and quarter information from the dataframe
and add them as new varriables to the Netflix dataframe
Netflix['Year']=Netflix['Date'].dt.year
```

```
Netflix['Month']=Netflix['Date'].dt.month
Netflix['quarter']=Netflix['Date'].dt.quarter
Netflix.head()

        Date      Open      High       Low     Close  Adj Close
Volume  \
0 2009-01-02  4.217143  4.357143  4.200000  4.267143   4.267143
6605200
1 2009-01-05  4.327143  4.562857  4.302857  4.562857   4.562857
13044500
2 2009-01-06  4.591429  4.750000  4.590000  4.705714   4.705714
12065900
3 2009-01-07  4.715714  4.734286  4.571429  4.672857   4.672857
10133900
4 2009-01-08  4.618571  4.797143  4.485714  4.735714   4.735714
8175300

   Year  Month  quarter
0  2009      1        1
1  2009      1        1
2  2009      1        1
3  2009      1        1
4  2009      1        1

#Create a new variable, Price Range which takes the difference between
the High and Low Price for the data and add it
#to the dataframe
Netflix['Price_Range']=Netflix['High']-Netflix['Low']
Netflix.head()

        Date      Open      High       Low     Close  Adj Close
Volume  \
0 2009-01-02  4.217143  4.357143  4.200000  4.267143   4.267143
6605200
1 2009-01-05  4.327143  4.562857  4.302857  4.562857   4.562857
13044500
2 2009-01-06  4.591429  4.750000  4.590000  4.705714   4.705714
12065900
3 2009-01-07  4.715714  4.734286  4.571429  4.672857   4.672857
10133900
4 2009-01-08  4.618571  4.797143  4.485714  4.735714   4.735714
8175300

   Year  Month  quarter  Price_Range
0  2009      1        1     0.157143
1  2009      1        1     0.260000
2  2009      1        1     0.160000
3  2009      1        1     0.162857
4  2009      1        1     0.311429
```

```
#Create a variable called PriceDiff which measures the difference
between the opening price and the closing price
#What is the proportion of days when Netflix stock closed for a loss
Netflix['PriceDiff']=Netflix['Open']-Netflix['Close']
Netflix['PriceLoss']=['Loss' if i <0 else 'Gain' for i in
Netflix['PriceDiff']]
Netflix['PriceLoss'].value_counts(normalize= True)
```

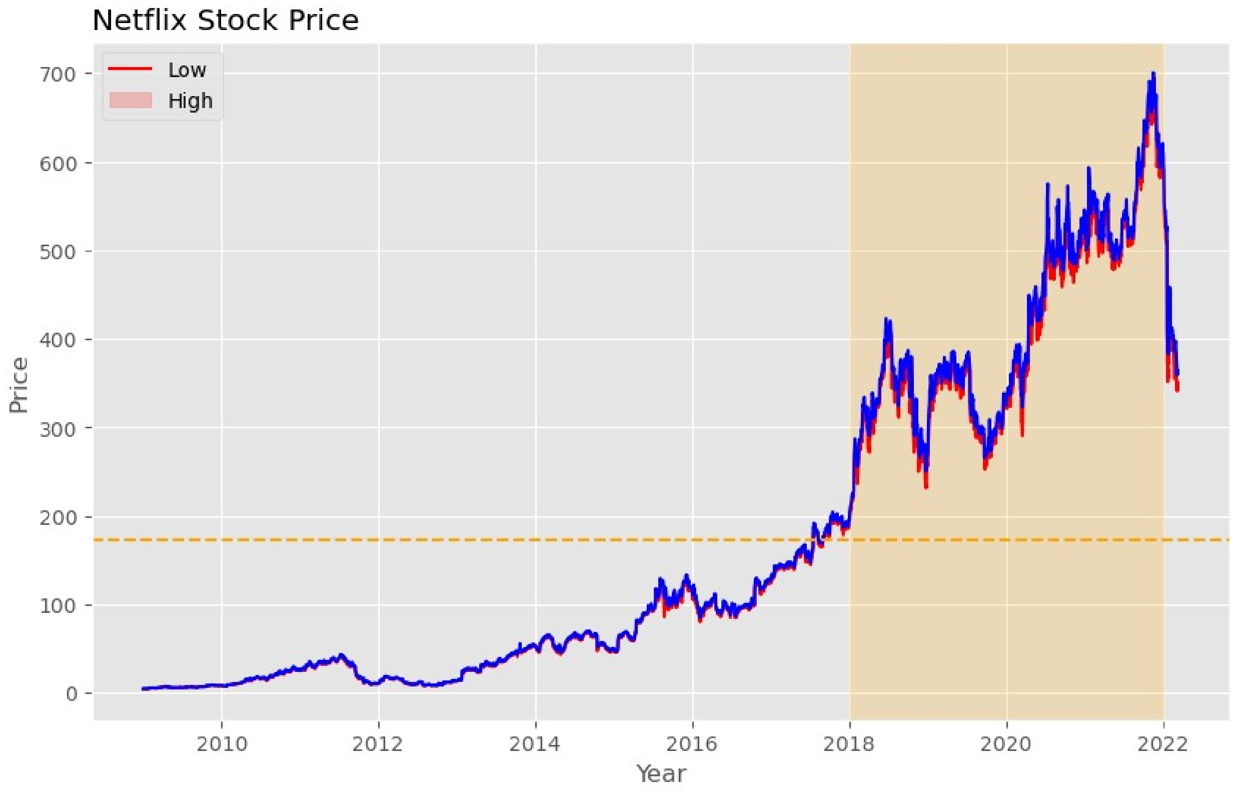
```
PriceLoss
Gain    0.504971
Loss    0.495029
Name: proportion, dtype: float64
```

```
Netflix['PriceLossA']=['Loss' if i <0 in Netflix['Open'] -
Netflix['Close'] else 'Gain' for i in Netflix['PriceDiff']]
Netflix['PriceLossA'].value_counts(normalize= True)
```

```
PriceLossA
Gain    0.504971
Loss    0.495029
Name: proportion, dtype: float64
```

```
#Create lineplots that show Netflix's High and Low prices for the day,
with linecolor red showing the low and blue the highs
#Include the x label (year) and y label (Price)
#Include the title Netflix Stock Price and locate to the left
#Include the legends "Low" and "High"
#Include a horizontal line that shows the average (High) price of
Netflix stock
#Include an orange vertical span that ranges from 2018 to 2022 with a
transparency of 0.2

plt.figure(figsize = (10, 6))
sns.lineplot(data=Netflix,x='Date',y='Low',color='red')
sns.lineplot(data=Netflix,x='Date',y='High',color='blue')
plt.ylabel('Price')
plt.xlabel('Year')
plt.title("Netflix Stock Price",loc='Left')
plt.legend(labels=['Low','High'])

avg_price=Netflix['High'].mean()

plt.axvspan("2018","2022",color='orange',alpha=0.2)

plt.axhline(y=avg_price,color='orange',linestyle='--')
```

```
<matplotlib.lines.Line2D at 0x14c58dd50>
```



```
#The dataset Health shows the Health Spending and Life Expectancy for
select countries over the years
health=pd.read_csv('healthexp.csv')
health.head()
```

```
   Year         Country  Spending_USD  Life_Expectancy
0  1970         Germany       252.311             70.6
1  1970          France       192.143             72.2
2  1970   Great Britain       123.993             71.9
3  1970           Japan       150.437             72.0
4  1970             USA       326.961             70.9
```

```
#Create a dataframe yearly-Health that shows the average annual health
spending for the countries over the years

health.groupby(['Country','Year']).Spending_USD.mean()
```

```
Country  Year
Canada   1971      313.391
         1976      543.337
         1979      692.269
         1980      791.812
         1981      898.807
                     ...
USA      2016     9717.649
         2017    10046.472
         2018    10451.386
         2019    10855.517
         2020    11859.179
Name: Spending_USD, Length: 274, dtype: float64
```

```
yearly_health=health.groupby(['Country','Year']).Spending_USD.mean().u
nstack()
yearly_health
```

```
Year                 1970     1971     1972     1973     1974     1975
1976  \
Country

Canada                NaN  313.391      NaN      NaN      NaN      NaN
543.337
France            192.143      NaN      NaN      NaN      NaN  363.610
NaN
Germany           252.311  298.251  337.364  384.541  452.744  532.481
591.098
Great Britain     123.993  134.172      NaN      NaN      NaN      NaN
NaN
Japan             150.437  163.854  185.390  205.778  242.018  284.269
303.725
USA               326.961  357.988  397.097  439.302  495.114  560.750
638.851

Year                 1977     1978     1979  ...      2011      2012
2013  \
Country                                    ...

Canada                NaN      NaN  692.269  ...  4228.962  4336.249
4428.753
France                NaN      NaN      NaN  ...  4161.698  4299.434
4544.964
Germany           647.352  729.457  800.703  ...  4566.678  4745.546
4951.677
Great Britain         NaN      NaN      NaN  ...  3495.652  3614.131
3667.636
Japan             340.628  392.577  452.931  ...  3740.756  3970.765
4308.252
USA               726.241  808.884  908.963  ...  8079.467  8346.064
8519.620

Year                  2014      2015      2016       2017       2018
2019  \
Country

Canada            4536.810  4635.285  5044.275   5150.470   5308.356
5189.721
France            4626.679  4667.156  4928.128   5005.756   5099.306
```

```
5167.839
Germany        5151.709  5295.975  5669.064   5970.163   6281.840
6407.928
Great Britain  3758.935  3805.820  3960.141   4059.125   4189.708
4385.463
Japan          4328.364  4515.556  4295.858   4412.852   4554.276
4610.794
USA            8925.879  9355.118  9717.649  10046.472  10451.386
10855.517

Year                2020
Country
Canada          5828.324
France          5468.418
Germany         6938.983
Great Britain   5018.700
Japan           4665.641
USA            11859.179

[6 rows x 51 columns]

#Extract the health spending, Life expectancy and year for the U.S.
health.loc[(health['Country']=='USA')].head()

    Year Country  Spending_USD  Life_Expectancy
4   1970     USA       326.961             70.9
9   1971     USA       357.988             71.2
12  1972     USA       397.097             71.2
15  1973     USA       439.302             71.4
18  1974     USA       495.114             72.0

#Show the average health spending for each country over the years.
yearly_health2=health.groupby(['Country'])['Spending_USD'].mean()
yearly_health2

Country
Canada           2685.778341
France           3045.145057
Germany          2667.280200
Great Britain    2034.192465
Japan            1860.257902
USA              4388.570529
Name: Spending_USD, dtype: float64

#Show the average life expectancy for each country over the years.
yearly_health3=health.groupby(['Country'])['Life_Expectancy'].mean()
yearly_health3

Country
Canada           78.706818
France           79.565714
```

```
Germany          76.726000
Great Britain    77.620930
Japan            79.554902
USA              75.843137
Name: Life_Expectancy, dtype: float64
```

```python
#List the Health spending for the countries for 2020 from highest to lowest
health.loc[health['Year']==2020,].sort_values(by='Spending_USD',ascending=False).reset_index()
```

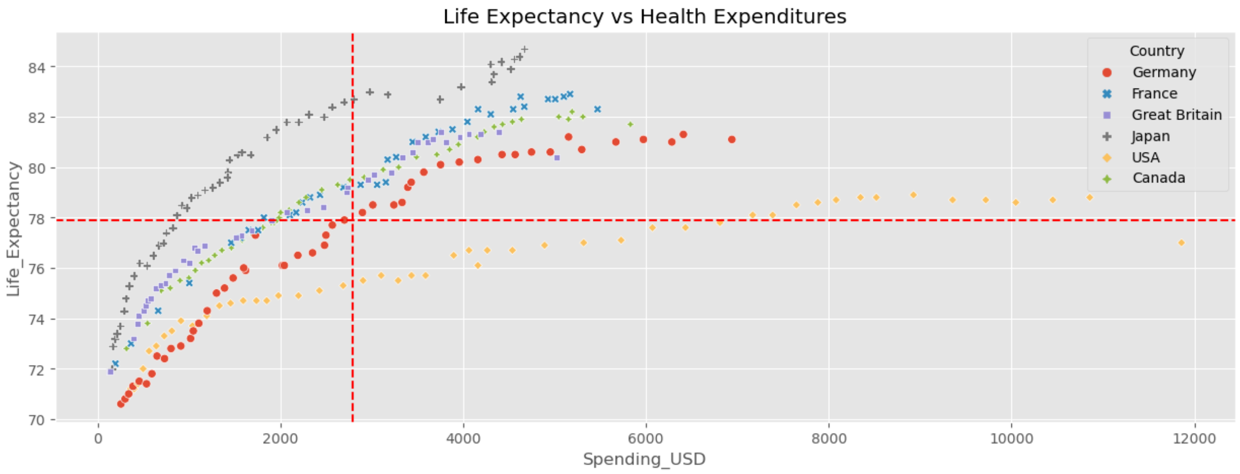
```
   index  Year        Country  Spending_USD  Life_Expectancy
0    273  2020            USA     11859.179             77.0
1    269  2020        Germany      6938.983             81.1
2    268  2020         Canada      5828.324             81.7
3    270  2020         France      5468.418             82.3
4    271  2020  Great Britain      5018.700             80.4
5    272  2020          Japan      4665.641             84.7
```

```python
#What is the total health spending for France in 2015?
health.loc[(health['Country']=='France') &
(health['Year']==2015),'Spending_USD'].sum()
```

```
4667.156
```

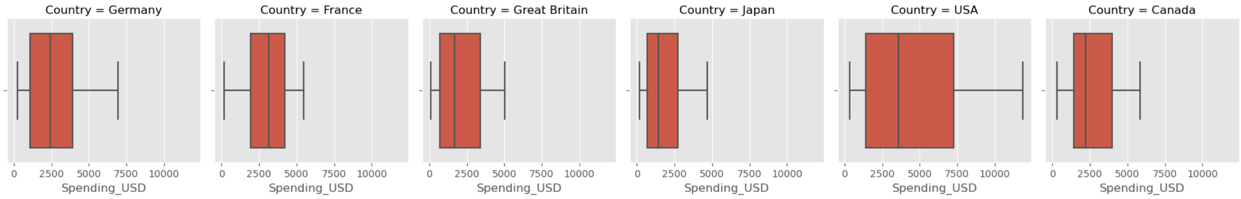
```python
#Create a scatterplot that shows Health Spending on the x-axis and life-expectancy on the y-axis for all countries
#Distinguish each country by a different color and marker
#add horizontal and vertical lines to your graph to correspond to the mean life expectancy(horizontal) and
#mean spending (vertical) selecting red as the line color and 'dashed' as the linesyle
#add the title "Life Expectancy ve Health Expenditures"

sns.scatterplot(health,x='Spending_USD',y='Life_Expectancy',style='Country',hue='Country')
plt.title("Life Expectancy vs Health Expenditures")
avg_exp=health['Spending_USD'].mean()
avg_lfexp=health['Life_Expectancy'].mean()
plt.axvline(x=avg_exp,color='red',linestyle='--')
plt.axhline(y=avg_lfexp,color='red',linestyle='--')
```

```
<matplotlib.lines.Line2D at 0x14c638450>
```



```
#Which country seems to have the largest health expenditure but
relatively low life-expctancies?
#Which country seeems to have the lowest health expenditures but
relatively higher life-expectancies?



#Create box-plots to compare the relative health expenditures of the 6
countries
g=sns.FacetGrid(health,col='Country')
g.map(sns.boxplot,'Spending_USD',order=['Canada','France','Germany','G
reat Britain','Japan','USA'])
```

```
<seaborn.axisgrid.FacetGrid at 0x14c72c950>
```



```
#Comment on the boxplots you created in terms of the summary measures


#It was been argued that health expenditures have increased
significantly in the last 20 years.
#Create 3 periods corresponding to the following:
#Period 1 from 1970 to before 1990
#Period 2 from 1970 to before 2010
#Period 3 from 2010 onwards
#Create box plots to correspond to these periods to compare the health
expenditures. Does the data support this argument?

def decade(year):
    if 1990 > year >=1970:
        return "Period1"
    elif 2010 > year >=1990:
        return "Period2"
    else:
        return "Period3"

def decade(year):
    if 1970 <= year <1990:
        return "Period1"
    elif 1990 <= year <2010:
        return "Period2"
    else:
        return "Period3"


health['Decade']=[decade(year) for year in health['Year']]
health.head(200)
```

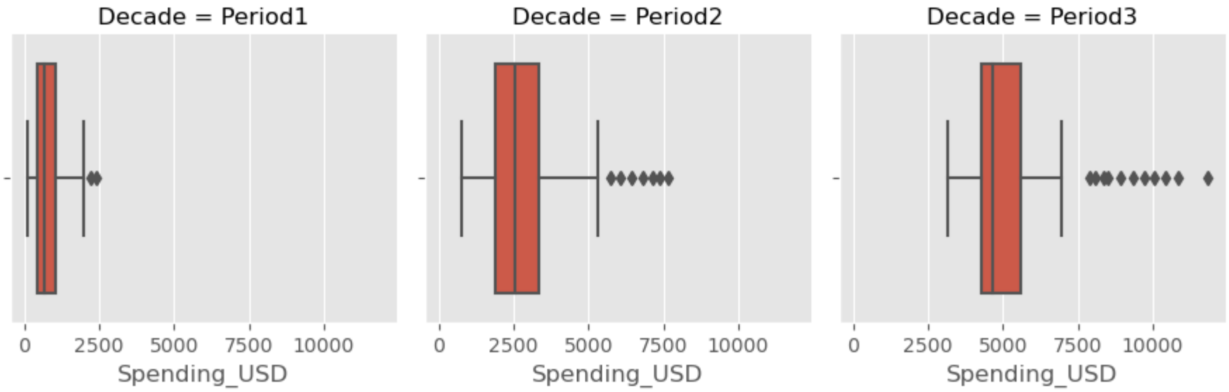
```
     Year        Country  Spending_USD  Life_Expectancy   Decade
0    1970        Germany       252.311             70.6  Period1
1    1970         France       192.143             72.2  Period1
2    1970  Great Britain       123.993             71.9  Period1
3    1970          Japan       150.437             72.0  Period1
4    1970            USA       326.961             70.9  Period1
..    ...            ...           ...              ...      ...
195  2007            USA      7166.513             78.1  Period2
196  2008         Canada      3849.544             80.7  Period2
197  2008        Germany      3955.136             80.2  Period2
198  2008         France      3729.353             81.4  Period2
199  2008  Great Britain      3207.853             79.8  Period2

[200 rows x 5 columns]
```

```
health["PeriodA"] = pd.Series(['Period1' if (1970 <= year < 1990) else
'Period2' if (1990 <= year < 2010) else 'Period3' for year in
health['Year']])
health.head()
```

```
   Year        Country  Spending_USD  Life_Expectancy   Decade
PeriodA
0  1970        Germany       252.311             70.6  Period1
Period1
1  1970         France       192.143             72.2  Period1
Period1
2  1970  Great Britain       123.993             71.9  Period1
Period1
3  1970          Japan       150.437             72.0  Period1
Period1
4  1970            USA       326.961             70.9  Period1
Period1
```

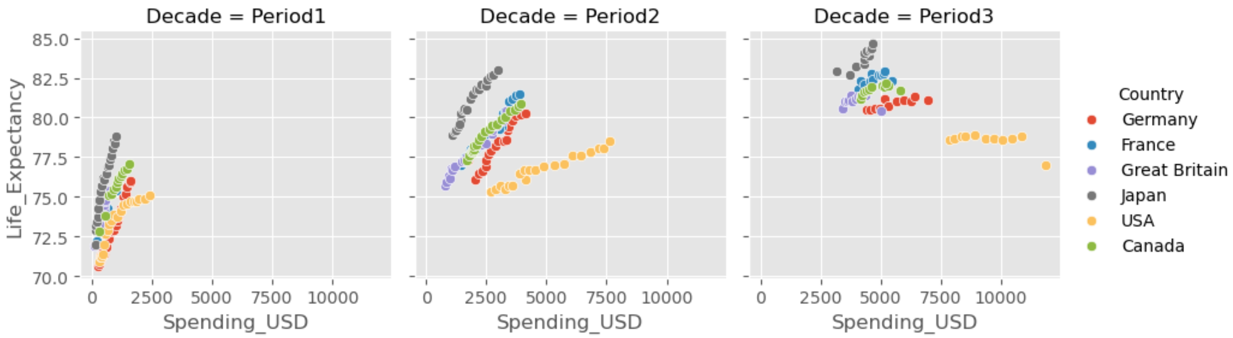
```
g=sns.FacetGrid(health,col='Decade')
g.map(sns.boxplot,'Spending_USD',order=['Period1','Period2','Period3']
)
```

```
<seaborn.axisgrid.FacetGrid at 0x14c548e90>
```



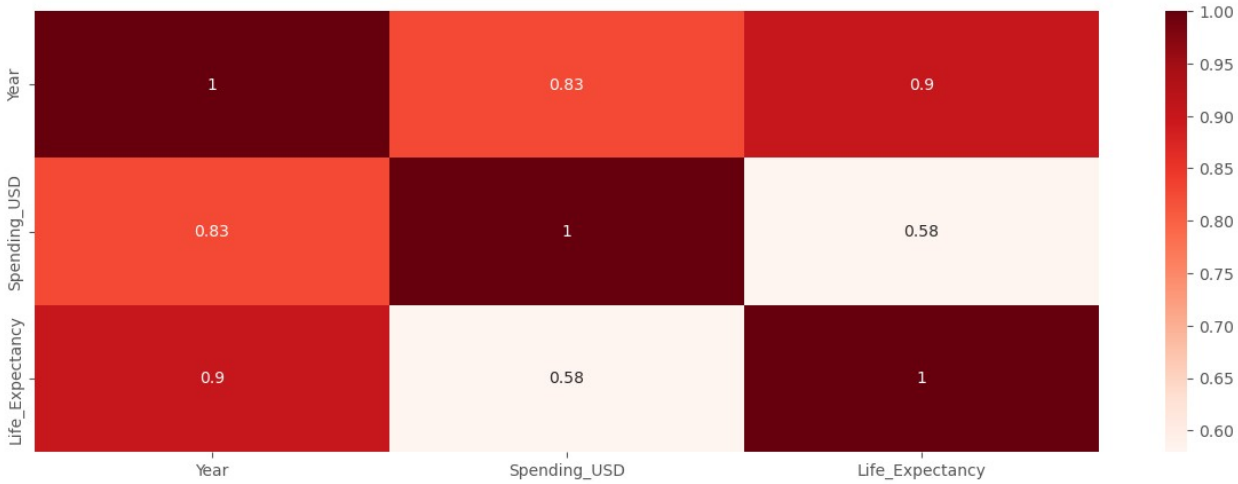
```
#Create 3 scatterplots to contrast the spending on heath care and Life
expectancy for the 6 countries foe the different periods.
#Add a legend to the plots
#Differentiate Country by Colors

g=sns.FacetGrid(health,col='Decade',hue='Country')
g.map(sns.scatterplot,'Spending_USD','Life_Expectancy')
g.add_legend()
```

```
<seaborn.axisgrid.FacetGrid at 0x14cb2c050>
```



```


#Create a heat-map to show the correlations between spending, life
expectancy and years
cor_heath=health.corr(numeric_only=True)
sns.heatmap(cor_heath,annot=True,cmap="Reds")
```

```
<Axes: >
```



Year
Spending_USD
Life_Expectancy
1
0.83
0.9
0.83
1
0.58
0.9
0.58
1
Year
Spending_USD
Life_Expectancy
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60