Sample Midterm Exam Questions

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

In [1]:
```
# 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##
plt.style.use('ggplot')
plt.rcParams["figure.figsize"] = (15,5)

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

In [2]:
```
# The Netflix csv file is imported and shows the stock data for Netflix whe
#Netflix stock price
Netflix=pd.read_csv('Netflix.csv',parse_dates=['Date'])
Netflix.head()
```

Out[2]:

	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

In [3]:
```
#Extract the year, month and quarter information from the dataframe and add
Netflix['Year']=Netflix['Date'].dt.year
Netflix['Month']=Netflix['Date'].dt.month
Netflix['quarter']=Netflix['Date'].dt.quarter
Netflix.head()
```

Out[3]:

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

In [4]:
```
#Create a new variable, Price Range which takes the difference between the H
#to the dataframe
Netflix['Price_Range']=Netflix['High']-Netflix['Low']
Netflix.head()
```

Out[4]:

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

In [5]:
```
#Create a variable called PriceDiff which measures the difference between th
#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)
```

Out[5]:
```
PriceLoss
Gain    0.504971
Loss    0.495029
Name: proportion, dtype: float64
```

In [6]:
```
Netflix['PriceLossA']=['Loss' if i <0 in Netflix['Open'] - Netflix['Close']
Netflix['PriceLossA'].value_counts(normalize= True)
```

Out[6]:
```
PriceLossA
Gain    0.504971
Loss    0.495029
Name: proportion, dtype: float64
```

In [7]:
```
#Create lineplots that show Netflix's High and Low prices for the day, with
#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 st
#Include an orange vertical span that ranges from 2018 to 2022 with a transp
```

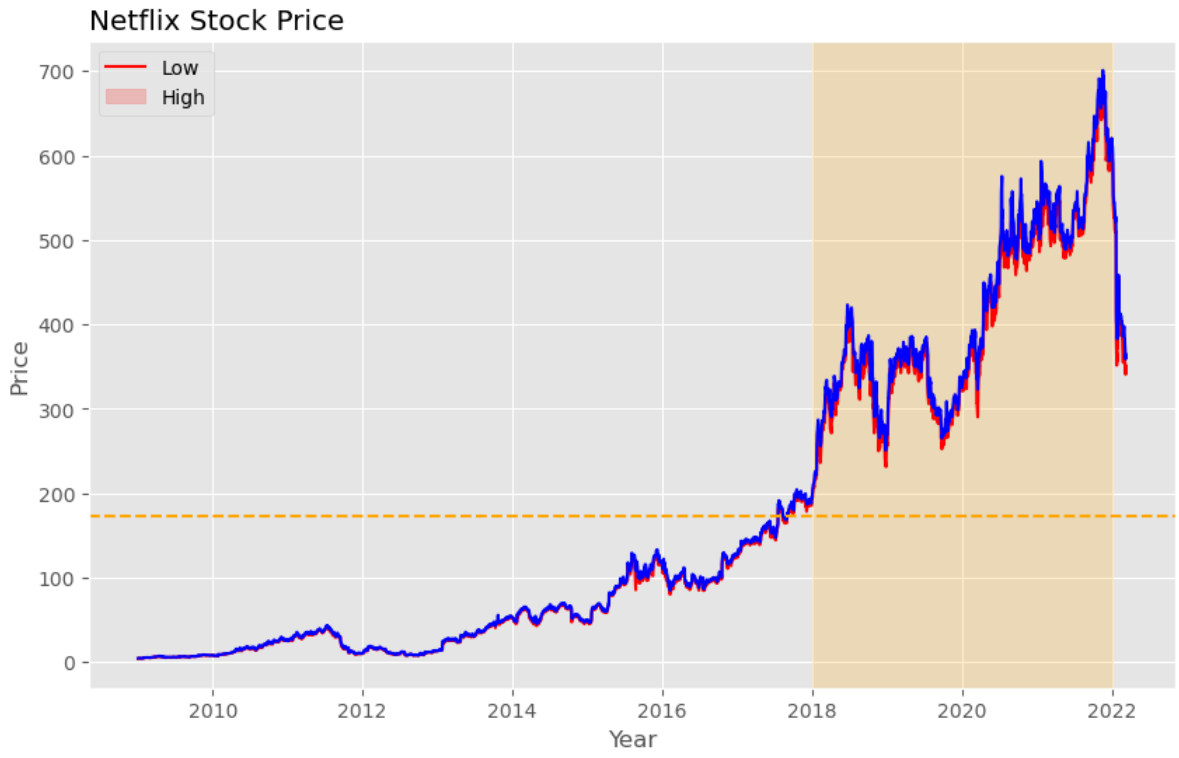
```
plt.figure(figsize = (10, 6))
sns.lineplot(data=Netflix,x='Date',y='Low',color='red')
sns.lineplot(data=Netflix,x='Date',y='High',color='blue')
plt.ylabel('Price')
plt.xlabel('Year')
plt.title("Netflix Stock Price",loc='Left')
plt.legend(labels=['Low','High'])

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

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

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

Out[7]:
```
<matplotlib.lines.Line2D at 0x11e9c9850>
```



In [8]:
```
#The dataset Health shows the Health Spending and Life Expenctancy for selec
health=pd.read_csv('healthexp.csv')
health.head()
```

Out[8]:

	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

In [9]:
```
#Create a dataframe yearly-Health that shows the average annual health spend
```

In [10]:
```
yearly_health=health.groupby(['Country','Year']).Spending_USD.mean().unstack
yearly_health
```

Out[10]:

Year	1970	1971	1972	1973	1974	1975	1976	1977	1978
Country									
Canada	NaN	313.391	NaN	NaN	NaN	NaN	543.337	NaN	NaN
France	192.143	NaN	NaN	NaN	NaN	363.610	NaN	NaN	NaN
Germany	252.311	298.251	337.364	384.541	452.744	532.481	591.098	647.352	729.457
Great Britain	123.993	134.172	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Japan	150.437	163.854	185.390	205.778	242.018	284.269	303.725	340.628	392.577
USA	326.961	357.988	397.097	439.302	495.114	560.750	638.851	726.241	808.884

6 rows × 51 columns

In [11]:
```
#Extract the health spending, Life expectancy and year for the U.S.
health.loc[(health['Country']=='USA')].head()
```

Out[11]:

	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

In [12]:
```
#Show the average health spending for each country over the years.
yearly_health2=health.groupby(['Country'])['Spending_USD'].mean()
yearly_health2
```

Out[12]:
```
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
```

In [13]:
```
#Show the average life expectancy for each country over the years.
yearly_health3=health.groupby(['Country'])['Life_Expectancy'].mean()
yearly_health3
```

Out[13]:
```
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
```

In [14]:
```
#List the Health spending for the countries for 2020 from highest to lowest
health.loc[health['Year']==2020,].sort_values(by='Spending_USD',ascending=Fa
```

Out[14]:

	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

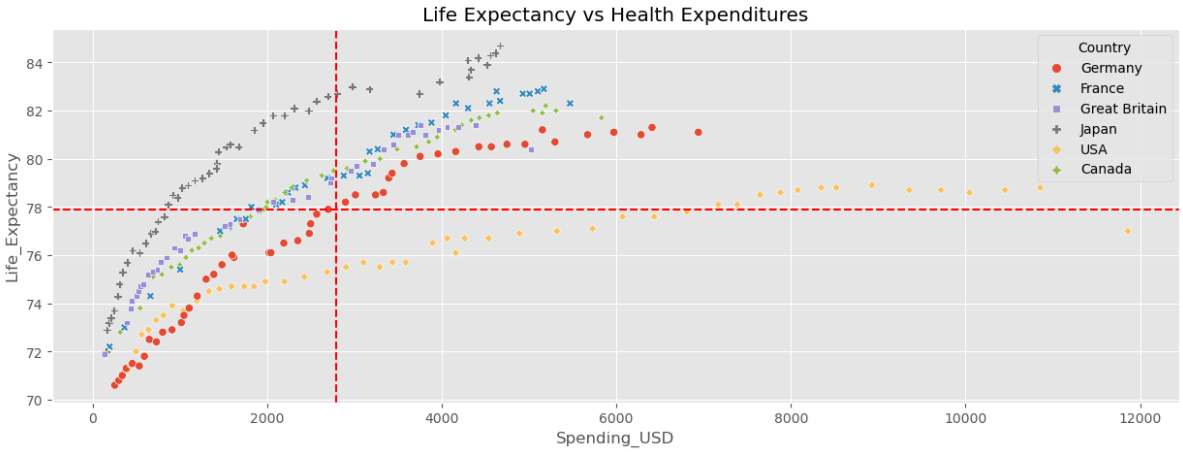
In [15]:
```
#What is the total health spending for France in 2015?
health.loc[(health['Country']=='France') & (health['Year']==2015),'Spending_
```

Out[15]:
```
4667.156
```

In [16]:
```
#Create a scatterplot that shows Health Spending on the x-axis and life-expe
#Distinguish each country by a different color and marker
#add horizontal and vertical lines to your graph to correspond to the mean l
#mean spending (vertical) selecting red as the line color and 'dashed' as th
#add the title "Life Expectancy ve Health Expenditures"

sns.scatterplot(health,x='Spending_USD',y='Life_Expectancy',style='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='--')
```

Out[16]:
```
<matplotlib.lines.Line2D at 0x11e5a1690>
```



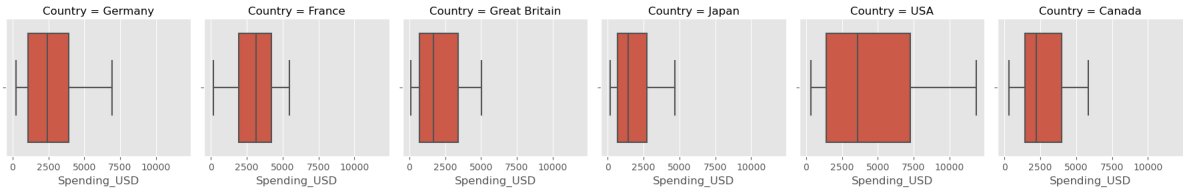
In [17]:
```
#Which country seems to have the largest health expenditure but relatively l
#Which country seeems to have the lowest health expenditures but relatively
```

In [ ]:
```

```

In [18]:
```
#Create box-plots to compare the relative health expenditures of the 6 count
g=sns.FacetGrid(health,col='Country')
g.map(sns.boxplot,'Spending_USD',order=['Canada','France','Germany','Great B
```

Out[18]:
```
<seaborn.axisgrid.FacetGrid at 0x11ead8750>
```



In [19]:
```
#Comment on the boxplots you created in terms of the summary measures
```

In [20]:
```
#It was been argued that health expenditures have increased significantly ir
#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 exper
```

In [21]:
```
def decade(year):
    if 1970 <= year <1990:
        return "Period1"
    elif 1990 <= year <2010:
        return "Period2"
    else:
        return "Period3"
```

In [22]:
```
health['Decade']=[decade(year) for year in health['Year']]
health.head(200)
```

Out[22]:

	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 × 5 columns

In [23]:
```
health["PeriodA"] = pd.Series(['Period1' if (1970 <= year < 1990) else 'Peri
health.head()
```

Out[23]:

	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

In [ ]:

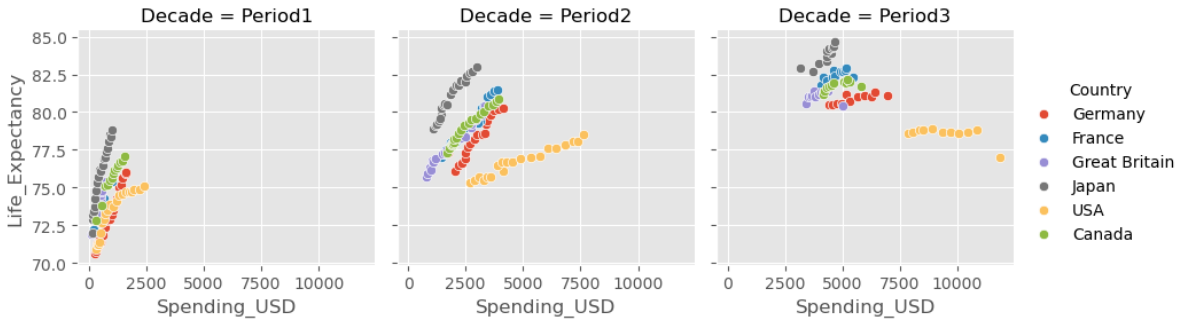
In [24]:
```
g=sns.FacetGrid(health,col='Decade')
g.map(sns.boxplot,'Spending_USD',order=['Period1','Period2','Period3'])
```

Out[24]:
```
<seaborn.axisgrid.FacetGrid at 0x11ed7bd50>
```

In [25]:
```
#Create 3 scatterplots to contrast the spending on heath care and Life expec
#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()
```

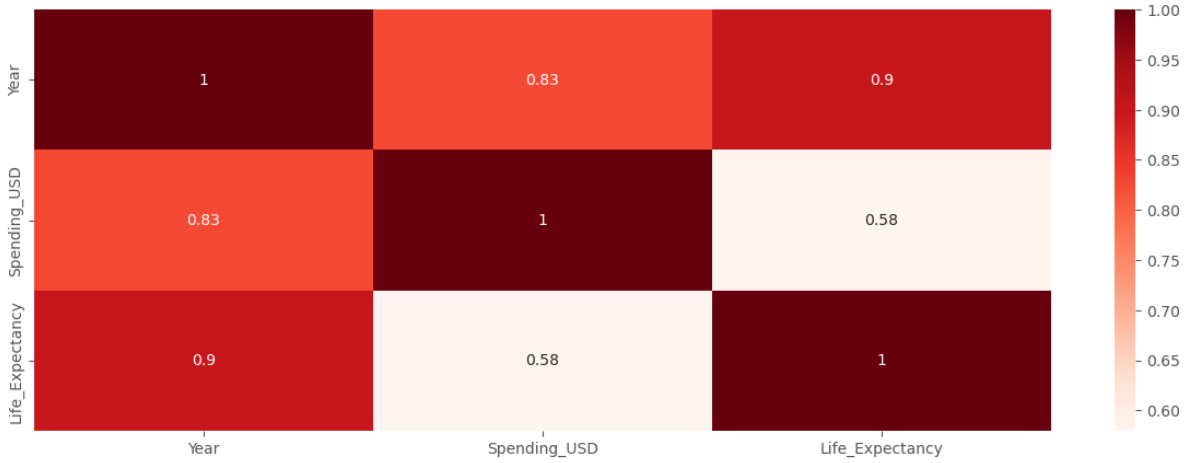
Out[25]:
```
<seaborn.axisgrid.FacetGrid at 0x103b23e50>
```



In [ ]:

In [26]:
```
#Create a heat-map to show the correlations between spending, life expectanc
cor_heath=health.corr(numeric_only=True)
sns.heatmap(cor_heath,annot=True,cmap="Reds")
```

Out[26]:
```
<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

In [ ]:

In [ ]: