Quest 5- Pandas 2

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0.1 Rishab Vaishya

0.2 Class - CSE 8392 Special Topics (Advanced Application Programming)

0.3 Quest 5 - Pandas 2

0.4 SMU ID – 47505527

# Part A. States and area codes
we read from the states.areacodes.csv and display the 1st 5 rows of the data

```
In [483]: import pandas as pd

          csvfile = open(r'D:\\Documents\Notes\CSE - 7345 - Advance Application Programming\As
          area_codes = pd.read_csv(csvfile)

          # head functios shows only the top 5 rows of the table
          area_codes.head()
```

```
Out[483]:    ï»¿Area code           State State code
          0            201      New Jersey         NJ
          1            202   Washington,DC         DC
          2            203     Connecticut         CT
          3            205         Alabama         AL
          4            206      Washington         WA
```

Now, make a list of all the non state present in the dataframe & remove it using 'isin' function & taking '~' negation of it

```
In [484]: non_US_state_codes = ['DC','AS','GU','MP','PR','VI']

          # removes all rows having state codes from the above list
          area_codes = area_codes[~area_codes['State code'].isin(non_US_state_codes)]

          # head functios shows only the top 5 rows of the table
          area_codes.head()
```

```
Out[484]:    ï»¿Area code         State State code
          0            201    New Jersey         NJ
          2            203   Connecticut         CT
```

```
3           205      Alabama         AL
4           206   Washington         WA
5           207        Maine         ME
```

here we do the following in sequence

1. sort the data in ascending order.
2. group by states
3. filter the group who has length == 1
4. display the group by their size.

```
In [485]: # 1. sort the data in ascending order.
          area_codes = area_codes.sort_values(['State'],ascending=True)

          # 2. group by states
          area_codes_grouped = area_codes.groupby(['State'])

          # 3. filter the group who has length == 1
          area_codes_filtered = area_codes_grouped.filter(lambda area_codes_groupby_state: len

          # 4. display the group by their size.
          area_codes_filtered.groupby('State').size()
```

```
Out[485]: State
          Alaska           1
          Delaware         1
          Hawaii           1
          Idaho            1
          Maine            1
          Montana          1
          New Hampshire    1
          New Mexico       1
          North Dakota     1
          Rhode Island     1
          South Dakota     1
          Vermont          1
          West Virginia    1
          Wyoming          1
          dtype: int64
```

1 Part B. Zipcodes and States

we read from the zipcodes.states.gps.csv and display the 1st 5 rows of the data

```
In [486]: csvfile = open(r'D:\\Documents\Notes\CSE - 7345 - Advance Application Programming\As
          zipcodes_state_gps = pd.read_csv(csvfile)

          # head functios shows only the top 5 rows of the table
          zipcodes_state_gps.head()
```

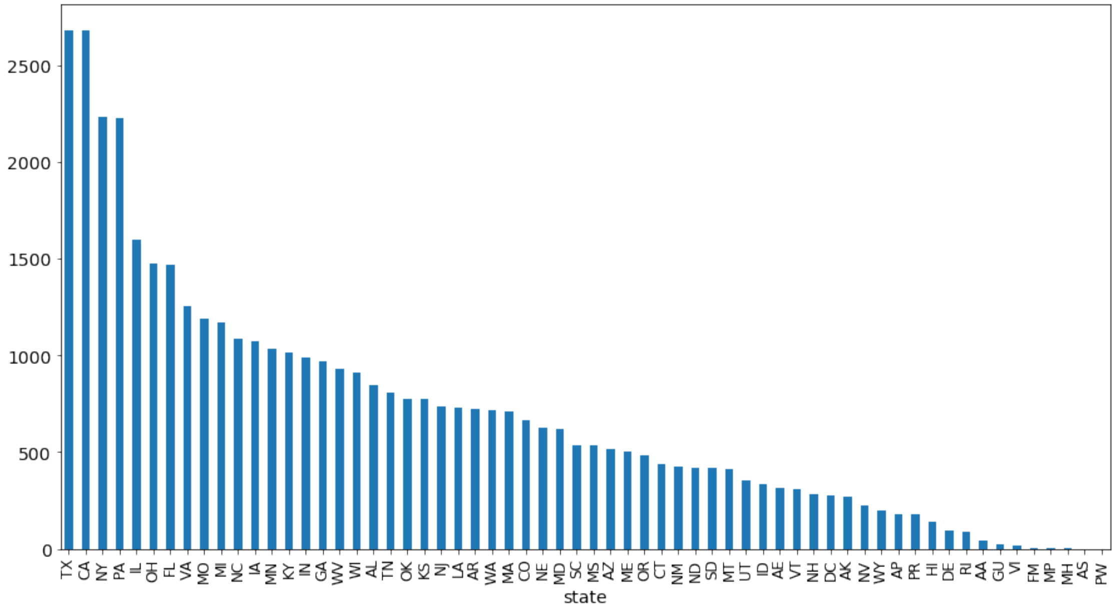
```
Out[486]:    zip_code   latitude  longitude        city state     county
          0       501  40.922326 -72.637078  Holtsville    NY    Suffolk
          1       544  40.922326 -72.637078  Holtsville    NY    Suffolk
          2       601  18.165273 -66.722583    Adjuntas    PR   Adjuntas
          3       602  18.393103 -67.180953      Aguada    PR     Aguada
          4       603  18.455913 -67.145780   Aguadilla    PR  Aguadilla
```

we import matplot lib then customize the graph, so that the bar chart is displayed properly

1. we first group the data by states & keep only the 'zip_code' column
2. sort values in decending
3. plot the bar graph

```
In [487]: import matplotlib.pyplot as plt
          %matplotlib inline

          # edit graph settings to view it nicely
          plt.rcParams['figure.figsize'] = (15,8)
          plt.xlabel('X label size', size = 14)
          plt.yticks(size = 14)
          plt.xticks(size = 12)

          # 1. we first group the data by states & keep only the 'zip_code' column
          # 2. sort values in decending
          # 3. plot the bar graph
          zipcodes_state_gps.groupby('state')['zip_code'].size().sort_values(ascending=False).
```

```
Out[487]: <matplotlib.axes._subplots.AxesSubplot at 0x2b792c66780>
```



2 Part C. Films

we read from the films2.csv and display the 1st 5 rows of the data

```
In [488]: csvfile = open(r'D:\\Documents\Notes\CSE - 7345 - Advance Application Programming\Ass
          films = pd.read_csv(csvfile)

          # head functios shows only the top 5 rows of the table
          films.head()
```

```
Out[488]:    ïż£Year  Length                    Title Subject                Actor  \
          0     1990   111.0  Tie Me Up! Tie Me Down!  Comedy    Banderas, Antonio
          1     1991   113.0               High Heels  Comedy        BosÃľ, Miguel
          2     1983   104.0           Dead Zone, The  Horror  Walken, Christopher
          3     1979   122.0                     Cuba  Action        Connery, Sean
          4     1978    94.0           Days of Heaven   Drama        Gere, Richard

                     Actress           Director  Popularity Awards        *Image,,,,,
          0  Abril, Victoria  AlmodÃşvar, Pedro        68.0     No  NicholasCage.png,,
          1  Abril, Victoria  AlmodÃşvar, Pedro        68.0     No  NicholasCage.png,,
          2     Adams, Brooke  Cronenberg, David        79.0     No   NicholasCage.png,
          3     Adams, Brooke    Lester, Richard         6.0     No   seanConnery.png,,
          4     Adams, Brooke   Malick, Terrence        14.0     No  NicholasCage.png,,
```

Here we are doing the following

1. we merge 'Westerns' into 'Western'
2. Add another column name 'nFilms' which holds the count the count of group subject & actor
3. get max value of 'nFilms' for each row using idmax() function
4. display the result

```
In [489]: # 1. replace westerns to western
          films = films.replace('Westerns', 'Western')

          # 2. group by 'Subject' & 'Actor'
          films = films.groupby(['Subject','Actor']).size().reset_index(name="nFilms")

          # remove all rows with nFilms == 1
          films = films[films.nFilms !=1]

          # get max value of 'nFilms' for each row using idmax() function
          films = films.loc[films.groupby(["Subject"], sort=False)["nFilms"].idxmax()][["Subje

          films
```

```
Out[489]:              Subject           Actor  nFilms
          15            Action   Connery, Sean      15
          321           Comedy  Sellers, Peter      22
          399            Drama  Brando, Marlon      17
```

```
739           Horror   Ford, Wallace       3
822          Mystery   Connery, Sean       3
915  Science Fiction    Hamill, Mark       3
956              War     Wayne, John      10
996          Western     Wayne, John      46
```

3 Part D. Stock Trading Algorithm with Moving Averages (MA)

we read from the SPY.histdata.csv and display the 1st 5 rows of the data after doing the following editions

1. sort the values in Date ascendng
2. add the moving verage column
3. drop rows with NaN values for 'MA100' columns

```
In [490]: csvfile = open(r'D:\\Documents\Notes\CSE - 7345 - Advance Application Programming\As
          SPY_hist_data = pd.read_csv(csvfile, parse_dates=['Date'])

          # sort the values in Date ascendng
          SPY_hist_data = SPY_hist_data.sort_values(by='Date', ascending=True)

          # add the moving verage column
          SPY_hist_data['MA100'] = SPY_hist_data['SPY'].rolling(100).mean()

          # drop rows with NaN values for 'MA100' columns
          SPY_hist_data = SPY_hist_data.dropna()

          # head functios shows only the top 5 rows of the table
          SPY_hist_data.head()
```

```
Out[490]:            Date       SPY       MA100
          4602 2000-05-24   99.5118  101.376287
          4601 2000-05-25   97.8044  101.325023
          4600 2000-05-26   97.9153  101.315119
          4599 2000-05-30  101.1082  101.335375
          4598 2000-05-31  101.3300  101.373773
```

```
In [491]: balance1 = 1000.0
          number_of_stocks = 0.0

          # saving values to plot graph later
          buy_array = []
          buy_date_array = []
          sell_array = []
          sell_date_array = []



          # iterating through each day from the SPY_hist_data
```

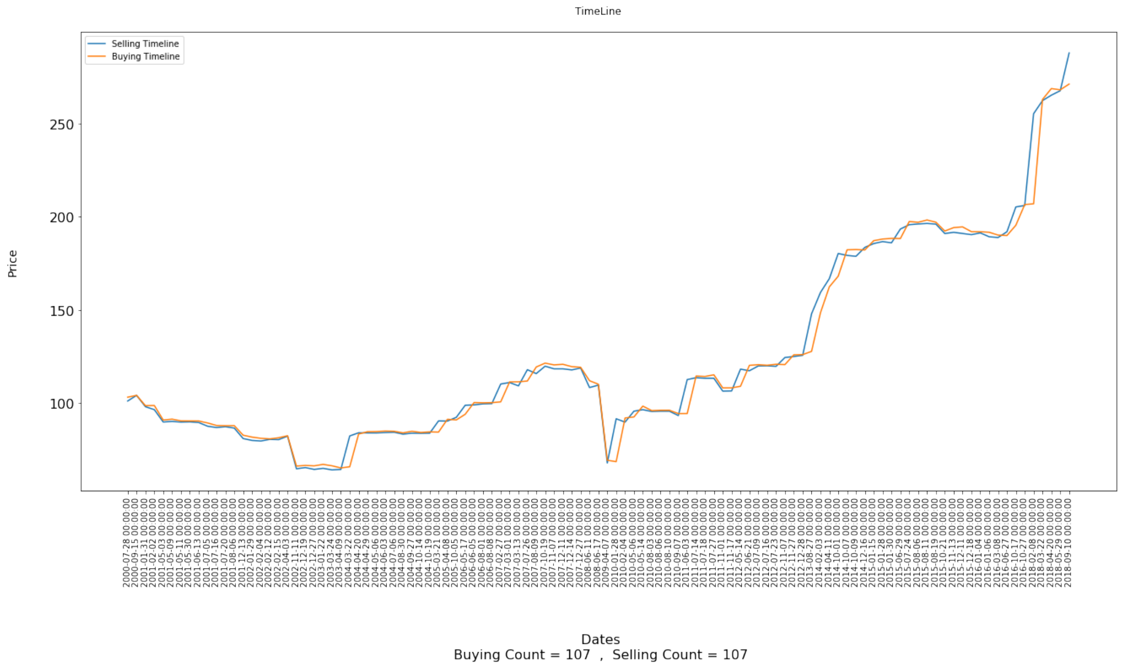
```python
for index, row in SPY_hist_data.iterrows() :

    # sell if we still have stocks in had on the last day
    if index == 0 :
        if number_of_stocks > 0 :
            balance1 = row['SPY'] * number_of_stocks
            number_of_stocks = 0

            # log transactions in an array
            sell_array.append(row['SPY'])
            sell_date_array.append(row['Date'])

    # for all indexes other than 0
    else :
        # buy if number of stocks ==0 & SPY crosses MA100
        if number_of_stocks == 0 and row['SPY'] > row['MA100'] :
            number_of_stocks += balance1 / row['SPY']
            balance1 = 0

            # log transactions in an array
            buy_array.append(row['SPY'])
            buy_date_array.append(row['Date'])

        # sell if number of stocks > 0 & SPY crosses MA100
        elif number_of_stocks > 0 and row['SPY'] < row['MA100'] :
            balance1 += row['SPY'] * number_of_stocks
            number_of_stocks = 0

            # log transactions in an array
            sell_array.append(row['SPY'])
            sell_date_array.append(row['Date'])

# print the details after the algorithm is complete
print('balance = ',balance1)
print ('percentage profit = ',(((balance1-1000))/1000)*100,'%')
print('number of stocks = ',number_of_stocks)
print('Buy count = ',len(buy_array))
print('Sell count = ',len(sell_array))
```

```
balance =  2169.0758636030896
percentage profit =  116.90758636030895 %
number of stocks =  0
Buy count =  107
Sell count =  107
```

3.1 plot timeline graph

this is showing the timeline of buying & selling transactions made in these 18 years

```
In [492]: plt.rcParams["figure.figsize"] = [22,10]

          plt.plot(range(len(sell_date_array)), sell_array)
          plt.plot(range(len(buy_date_array)), buy_array)

          plt.title("TimeLine\n")

          plt.xlabel("\n\n\n Dates\n Buying Count = %d  ,  Selling Count = %d" % (len(buy_arra
          plt.ylabel("Price\n\n", size = 14)

          plt.legend(['Selling Timeline','Buying Timeline' ], loc='upper left')
          plt.yticks(size = 16)
          plt.xticks(range(len(sell_date_array)), sell_date_array, size = 10,rotation='vertical

          plt.show()
```



3.2 Implementing buy & hold strategy

we fetch the 1st & last row from the dataframe & calculate the profit when implementing the buy & hold strategy

```
In [493]: first_SPY_value = SPY_hist_data.iloc[0,1]
          last_SPY_value = SPY_hist_data.iloc[-1,1]
          balance2 =1000
          number_of_stocks += balance2 / first_SPY_value
          balance2 = last_SPY_value * number_of_stocks
          number_of_stocks = 0

          print('balance = ',balance2)
          print ('percentage profit = ',(((balance2-1000))/1000)*100,'%')
          print('number of stocks = ',number_of_stocks)
```

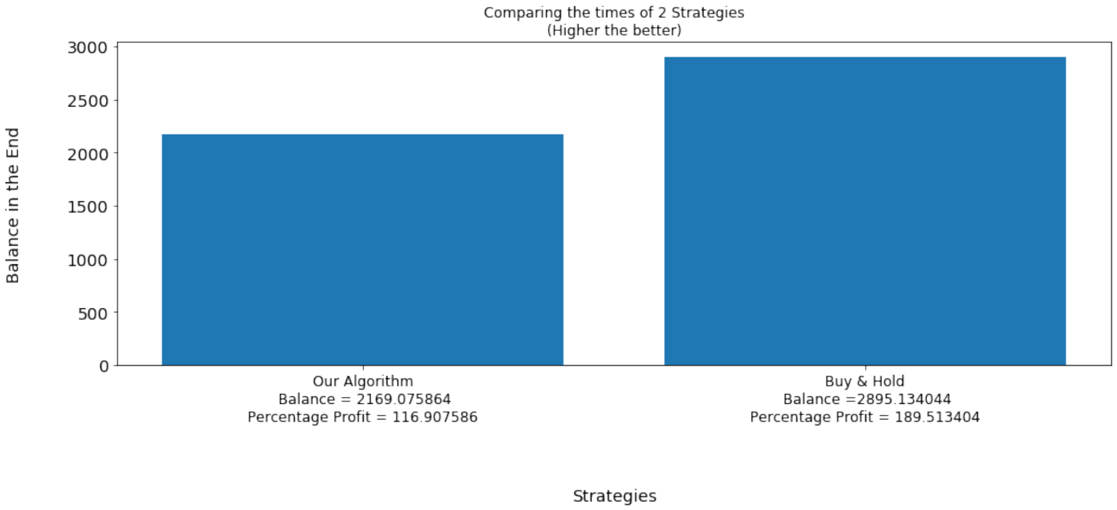
```
balance =  2895.1340444047846
percentage profit =  189.51340444047847 %
number of stocks =  0
```

as we can see that the 'Buy & Hold strategy' has more balance at the end of 18 years than the algorithm we implemented.

4 comparing the 2 Strategies

we now plot the balance found after 18 years using both the strategies

```
In [494]: plt.rcParams["figure.figsize"] = [15,5]

          startegyList = ['Our Algorithm\n Balance = %f\nPercentage Profit = %f' % (balance1,(
          balanceList = [balance1, balance2]

          bars = plt.bar(range(len(startegyList)), balanceList)
          plt.title("Comparing the times of 2 Strategies\n(Higher the better)")

          plt.xlabel("\n\n\nStrategies", size = 14)
          plt.ylabel("Balance in the End\n\n", size = 14)

          plt.yticks(size = 14)
          plt.xticks(range(len(startegyList)), startegyList, size = 12)

          plt.show()
```


Comparing the times of 2 Strategies
(Higher the better)
Balance in the End
3000
2500
2000
1500
1000
500
0
Our Algorithm
Balance = 2169.075864
Percentage Profit = 116.907586
Buy & Hold
Balance =2895.134044
Percentage Profit = 189.513404
Strategies