Assignment 2

May 6, 2020

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*You are currently looking at **version 1.2** of this notebook. To download notebooks and datafiles, as well as get help on Jupyter notebooks in the Coursera platform, visit the Jupyter Notebook FAQ course resource.*

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1 Assignment 2 - Pandas Introduction

All questions are weighted the same in this assignment. ## Part 1 The following code loads the olympics dataset (olympics.csv), which was derrived from the Wikipedia entry on All Time Olympic Games Medals, and does some basic data cleaning.

The columns are organized as # of Summer games, Summer medals, # of Winter games, Winter medals, total # number of games, total # of medals. Use this dataset to answer the questions below.

In [1]:
```
import pandas as pd

df = pd.read_csv('olympics.csv', index_col=0, skiprows=1)

for col in df.columns:
    if col[:2]=='01':
        df.rename(columns={col:'Gold'+col[4:]}, inplace=True)
    if col[:2]=='02':
        df.rename(columns={col:'Silver'+col[4:]}, inplace=True)
    if col[:2]=='03':
        df.rename(columns={col:'Bronze'+col[4:]}, inplace=True)
    if col[:1]=='':
        df.rename(columns={col:'#'+col[1:]}, inplace=True)

names_ids = df.index.str.split('\s\(') # split the index by '('

df.index = names_ids.str[0] # the [0] element is the country name (new index)
df['ID'] = names_ids.str[1].str[:3] # the [1] element is the abbreviation or ID (take fi

df = df.drop('Totals')
df.head()
```

Out[1]:

	# Summer	Gold	Silver	Bronze	Total	# Winter	Gold.1	\
Afghanistan	13	0	0	2	2	0	0	
Algeria	12	5	2	8	15	3	0	
Argentina	23	18	24	28	70	18	0	
Armenia	5	1	2	9	12	6	0	
Australasia	2	3	4	5	12	0	0	

	Silver.1	Bronze.1	Total.1	# Games	Gold.2	Silver.2	Bronze.2	\
Afghanistan	0	0	0	13	0	0	2	
Algeria	0	0	0	15	5	2	8	
Argentina	0	0	0	41	18	24	28	
Armenia	0	0	0	11	1	2	9	
Australasia	0	0	0	2	3	4	5	

	Combined total	ID
Afghanistan	2	AFG
Algeria	15	ALG
Argentina	70	ARG
Armenia	12	ARM
Australasia	12	ANZ

1.0.1 Question 0 (Example)

What is the first country in df?

This function should return a Series.

In [2]:
```
# You should write your whole answer within the function provided. The autograder will c
# this function and compare the return value against the correct solution value
def answer_zero():
    # This function returns the row for Afghanistan, which is a Series object. The assig
    # question description will tell you the general format the autograder is expecting
    return df.iloc[0]

# You can examine what your function returns by calling it in the cell. If you have ques
# about the assignment formats, check out the discussion forums for any FAQs
answer_zero()
```

Out[2]:

# Summer	13
Gold	0
Silver	0
Bronze	2
Total	2
# Winter	0
Gold.1	0
Silver.1	0
Bronze.1	0
Total.1	0
# Games	13

```
Gold.2              0
Silver.2            0
Bronze.2            2
Combined total      2
ID                AFG
Name: Afghanistan, dtype: object
```

1.0.2 Question 1

Which country has won the most gold medals in summer games?
This function should return a single string value.

```
In [3]: def answer_one():
            return df.loc[df["Gold"] == max(df["Gold"])].index.format()[0]

        answer_one()
```

```
Out[3]: 'United States'
```

1.0.3 Question 2

Which country had the biggest difference between their summer and winter gold medal counts?
This function should return a single string value.

```
In [4]: def answer_two():
            df["Gold.Diff"] = df["Gold"] - df["Gold.1"]
            return df[df["Gold.Diff"] == max(df["Gold.Diff"])].index.format()[0]

        answer_two()
```

```
Out[4]: 'United States'
```

1.0.4 Question 3

Which country has the biggest difference between their summer gold medal counts and winter gold medal counts relative to their total gold medal count?

$$\frac{\textit{Summer Gold} - \textit{Winter Gold}}{\textit{Total Gold}}$$

Only include countries that have won at least 1 gold in both summer and winter.
This function should return a single string value.

```
In [7]: def answer_three():
            countries = df.copy().loc[(df["Gold"]>0) & df["Gold.1"]>0,]
            countries["gold_diff"] = abs(countries["Gold"] - countries["Gold.1"])
            countries["rel_diff"] = countries["gold_diff"] / (countries["Gold"] + countries
        ["Gold.1"])
            return countries[countries["rel_diff"] == countries["rel_diff"].max()].index.
        format()[0]

        answer_three()
```

```
Out[7]: 'Bulgaria'
```

1.0.5 Question 4

Write a function that creates a Series called "Points" which is a weighted value where each gold medal (`Gold.2`) counts for 3 points, silver medals (`Silver.2`) for 2 points, and bronze medals (`Bronze.2`) for 1 point. The function should return only the column (a Series object) which you created, with the country names as indices.

This function should return a Series named `Points` of length 146

```
In [10]: def answer_four():
             df['Points'] = (df["Gold.2"]*3) + (df["Silver.2"]*2) + df["Bronze.2"]
             return df['Points']

         answer_four()
```

```
Out[10]: Afghanistan                    2
         Algeria                       27
         Argentina                    130
         Armenia                       16
         Australasia                   22
         Australia                    923
         Austria                      569
         Azerbaijan                    43
         Bahamas                       24
         Bahrain                        1
         Barbados                       1
         Belarus                      154
         Belgium                      276
         Bermuda                        1
         Bohemia                        5
         Botswana                       2
         Brazil                       184
         British West Indies            2
         Bulgaria                     411
         Burundi                        3
         Cameroon                      12
         Canada                       846
         Chile                         24
         China                       1120
         Colombia                      29
         Costa Rica                     7
         Ivory Coast                    2
         Croatia                       67
         Cuba                         420
         Cyprus                         2
                                      ...
         Spain                        268
```

```
Sri Lanka                          4
Sudan                              2
Suriname                           4
Sweden                          1217
Switzerland                      630
Syria                              6
Chinese Taipei                    32
Tajikistan                         4
Tanzania                           4
Thailand                          44
Togo                               1
Tonga                              2
Trinidad and Tobago               27
Tunisia                           19
Turkey                           191
Uganda                            14
Ukraine                          220
United Arab Emirates               3
United States                   5684
Uruguay                           16
Uzbekistan                        38
Venezuela                         18
Vietnam                            4
Virgin Islands                     2
Yugoslavia                       171
Independent Olympic Participants   4
Zambia                             3
Zimbabwe                          18
Mixed team                        38
Name: Points, dtype: int64
```

1.1 Part 2

For the next set of questions, we will be using census data from the United States Census Bureau. Counties are political and geographic subdivisions of states in the United States. This dataset contains population data for counties and states in the US from 2010 to 2015. See this document for a description of the variable names.

The census dataset (census.csv) should be loaded as census_df. Answer questions using this as appropriate.

1.1.1 Question 5

Which state has the most counties in it? (hint: consider the sumlevel key carefully! You'll need this for future questions too...)

This function should return a single string value.

```
In [11]: census_df = pd.read_csv('census.csv')
         census_df.head()
```

Out[11]:

	SUMLEV	REGION	DIVISION	STATE	COUNTY	STNAME	CTYNAME	\
0	40	3	6	1	0	Alabama	Alabama	
1	50	3	6	1	1	Alabama	Autauga County	
2	50	3	6	1	3	Alabama	Baldwin County	
3	50	3	6	1	5	Alabama	Barbour County	
4	50	3	6	1	7	Alabama	Bibb County	

	CENSUS2010POP	ESTIMATESBASE2010	POPESTIMATE2010	...	\
0	4779736	4780127	4785161	...	
1	54571	54571	54660	...	
2	182265	182265	183193	...	
3	27457	27457	27341	...	
4	22915	22919	22861	...	

	RDOMESTICMIG2011	RDOMESTICMIG2012	RDOMESTICMIG2013	RDOMESTICMIG2014	\
0	0.002295	-0.193196	0.381066	0.582002	
1	7.242091	-2.915927	-3.012349	2.265971	
2	14.832960	17.647293	21.845705	19.243287	
3	-4.728132	-2.500690	-7.056824	-3.904217	
4	-5.527043	-5.068871	-6.201001	-0.177537	

	RDOMESTICMIG2015	RNETMIG2011	RNETMIG2012	RNETMIG2013	RNETMIG2014	\
0	-0.467369	1.030015	0.826644	1.383282	1.724718	
1	-2.530799	7.606016	-2.626146	-2.722002	2.592270	
2	17.197872	15.844176	18.559627	22.727626	20.317142	
3	-10.543299	-4.874741	-2.758113	-7.167664	-3.978583	
4	0.177258	-5.088389	-4.363636	-5.403729	0.754533	

	RNETMIG2015
0	0.712594
1	-2.187333
2	18.293499
3	-10.543299
4	1.107861

[5 rows x 100 columns]

In [12]:
```
def answer_five():
    return census_df[census_df["SUMLEV"] == 50].groupby('STNAME')['CTYNAME']
.count().argmax()

answer_five()
```

Out[12]: 'Texas'

1.1.2 Question 6

Only looking at the three most populous counties for each state, what are the three most populous states (in order of highest population to lowest population)? Use `CENSUS2010POP`.

This function should return a list of string values.

```
In [16]: def answer_six():
             return census_df[census_df["SUMLEV"] == 50].groupby('STNAME')
         ['CENSUS2010POP'].apply(lambda x: x.nlargest(3).sum()).nlargest(3).
         index.format()

         answer_six()
```

```
Out[16]: ['California', 'Texas', 'Illinois']
```

1.1.3 Question 7

Which county has had the largest absolute change in population within the period 2010-2015? (Hint: population values are stored in columns POPESTIMATE2010 through POPESTIMATE2015, you need to consider all six columns.)

e.g. If County Population in the 5 year period is 100, 120, 80, 105, 100, 130, then its largest change in the period would be |130-80| = 50.

This function should return a single string value.

```
In [17]: def answer_seven():
             census_df["Min"] = census_df.loc[census_df["SUMLEV"] == 50,
         ["POPESTIMATE2010", "POPESTIMATE2011", "POPESTIMATE2012", "POPESTIMATE2013",
         "POPESTIMATE2014", "POPESTIMATE2015"]].min(axis=1)
             census_df["Max"] = census_df.loc[census_df["SUMLEV"] == 50,
         ["POPESTIMATE2010", "POPESTIMATE2011", "POPESTIMATE2012", "POPESTIMATE2013",
         "POPESTIMATE2014", "POPESTIMATE2015"]].max(axis=1)
             census_df["PopGrowth"] = census_df["Max"] - census_df["Min"]
             return census_df.loc[census_df["PopGrowth"] == census_df["PopGrowth"]
         .max(), "CTYNAME"].max()

         answer_seven()
```

```
Out[17]: 'Harris County'
```

1.1.4 Question 8

In this datafile, the United States is broken up into four regions using the "REGION" column.

Create a query that finds the counties that belong to regions 1 or 2, whose name starts with 'Washington', and whose POPESTIMATE2015 was greater than their POPESTIMATE 2014.

This function should return a 5x2 DataFrame with the columns = ['STNAME', 'CTYNAME'] and the same index ID as the census_df (sorted ascending by index).

```
In [18]: def answer_eight():
             return census_df.loc[((census_df["REGION"] == 1) |
         (census_df["REGION"] == 2)) & (census_df["CTYNAME"].str.startswith('Washington'))
         & (census_df["POPESTIMATE2015"] > census_df["POPESTIMATE2014"]),
         ['STNAME', 'CTYNAME']]

         answer_eight()
```

Out[18]:

	STNAME	CTYNAME
896	Iowa	Washington County
1419	Minnesota	Washington County
2345	Pennsylvania	Washington County
2355	Rhode Island	Washington County
3163	Wisconsin	Washington County

In [ ]: