# 2a-shark-tank

October 17, 2023

## 1 Shark Tank

*Shark Tank* is a reality TV show. Contestants present their idea for a company to a panel of investors (a.k.a. “sharks”), who then decide whether or not to invest in that company. The investors give a certain amount of money in exchange for a percentage stake in the company (“equity”). If you are not familiar with the show, you may want to watch part of an episode here to get a sense of how it works. You can also search for a clip on YouTube.

The data that you will examine in this lab contains data about all contestants from the first 6 seasons of the show, including: - the name and industry of the proposed company - whether or not it was funded (i.e., the “Deal” column) - which sharks chose to invest in the venture (N.B. There are 7 regular sharks, not including “Guest”. Each shark has a column in the data set, labeled by their last name.) - if funded, the amount of money the sharks put in and the percentage equity they got in return

To earn full credit on this lab, you should: - use built-in `pandas` methods (like `.sum()` and `.max()`) instead of writing a for loop over a `DataFrame` or `Series` - use the split-apply-combine pattern wherever possible

Of course, if you can’t think of a vectorized solution, a `for` loop is still better than no solution at all!

### 1.1 GROUP DETAILS

1. MEMBER-1: MANAN KUMAR (SID: 862393075)
2. MEMBER-2: NITYASH GAUTAM (SID: 862395403)

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

### 1.2 Question 0. Getting and Cleaning the Data

The data is stored in the CSV file `sharktank.csv`. Read in the data into a Pandas `DataFrame`.

[2]:
```
sharktank_df = pd.read_csv('sharktank.csv')

sharktank_df
```

[2]:
```
     Season  No. in series                       Company Deal  \
0       1.0            1.0              Ava the Elephant  Yes
1       1.0            1.0          Mr. Tod's Pie Factory  Yes
```

```
2       1.0            1.0                      Wispots   No
3       1.0            1.0  College Foxes Packing Boxes   No
4       1.0            1.0                    Ionic Ear   No
..      …            …                            …  …
490     6.0           28.0                 You Kick Ass  Yes
491     6.0           29.0                  Shark Wheel  Yes
492     6.0           29.0                    Gato Cafe   No
493     6.0           29.0             Sway Motorsports  Yes
494     6.0           29.0                    Spikeball  Yes

                 Industry Entrepreneur Gender    Amount Equity  Corcoran  \
0              Healthcare              Female   $50,000    55%       1.0
1       Food and Beverage                Male  $460,000    50%       1.0
2       Business Services                Male       NaN    NaN       NaN
3        Lifestyle / Home                Male       NaN    NaN       NaN
4       Uncertain / Other                Male       NaN    NaN       NaN
..                    …                  …       …    …         …
490  Children / Education              Female  $100,000    10%       NaN
491      Fitness / Sports                Male  $225,000     8%       NaN
492     Uncertain / Other              Female       NaN    NaN       NaN
493       Green/CleanTech                Male  $300,000    20%       NaN
494      Fitness / Sports                Male  $500,000    20%       NaN

     Cuban  Greiner  Herjavec  John  O'Leary  Harrington  Guest  \
0      NaN      NaN       NaN   NaN      NaN         NaN    NaN
1      NaN      NaN       NaN   1.0      NaN         NaN    NaN
2      NaN      NaN       NaN   NaN      NaN         NaN    NaN
3      NaN      NaN       NaN   NaN      NaN         NaN    NaN
4      NaN      NaN       NaN   NaN      NaN         NaN    NaN
..     …      …       …   …      …         …    …
490    1.0      NaN       NaN   NaN      NaN         NaN    NaN
491    1.0      NaN       1.0   NaN      NaN         NaN    1.0
492    NaN      NaN       NaN   NaN      NaN         NaN    NaN
493    1.0      NaN       NaN   NaN      NaN         NaN    NaN
494    NaN      NaN       NaN   1.0      NaN         NaN    NaN

                                       Details / Notes
0                                                  NaN
1                                                  NaN
2                                                  NaN
3                                                  NaN
4                                                  NaN
..                                                 …
490                                                NaN
491  10% royalty until $500K; then converts to 5% e…
492                                                NaN
493                                                NaN
```

```
494                                                NaN

[495 rows x 17 columns]
```

There is one column for each of the sharks. A 1 indicates that they chose to invest in that company, while a missing value indicates that they did not choose to invest in that company. Notice that these missing values show up as NaNs when we read in the data. Fill in these missing values with zeros. Other columns may also contain NaNs; be careful not to fill those columns with zeros, or you may end up with strange results down the line.

[3]:

```
# Replacing the Null Values with 0

shark_columns = ["Corcoran", "Cuban", "Greiner", "Herjavec", "John", "O'Leary",␣
 ↪"Harrington", "Guest"]

sharktank_df[shark_columns] = sharktank_df[shark_columns].fillna(0)

sharktank_df
```

[3]:

```
     Season  No. in series                      Company Deal  \
0        1.0            1.0             Ava the Elephant  Yes
1        1.0            1.0        Mr. Tod's Pie Factory  Yes
2        1.0            1.0                      Wispots   No
3        1.0            1.0  College Foxes Packing Boxes   No
4        1.0            1.0                    Ionic Ear   No
..      …            …                          …  …
490      6.0           28.0                 You Kick Ass  Yes
491      6.0           29.0                  Shark Wheel  Yes
492      6.0           29.0                    Gato Cafe   No
493      6.0           29.0             Sway Motorsports  Yes
494      6.0           29.0                    Spikeball  Yes

                 Industry Entrepreneur Gender    Amount Equity  Corcoran  \
0              Healthcare              Female   $50,000    55%       1.0
1       Food and Beverage                Male  $460,000    50%       1.0
2       Business Services                Male       NaN    NaN       0.0
3        Lifestyle / Home                Male       NaN    NaN       0.0
4       Uncertain / Other                Male       NaN    NaN       0.0
..                    …                 …       …    …       …
490  Children / Education              Female  $100,000    10%       0.0
491      Fitness / Sports                Male  $225,000     8%       0.0
492     Uncertain / Other              Female       NaN    NaN       0.0
493       Green/CleanTech                Male  $300,000    20%       0.0
494      Fitness / Sports                Male  $500,000    20%       0.0

     Cuban  Greiner  Herjavec  John  O'Leary  Harrington  Guest  \
0      0.0      0.0       0.0   0.0      0.0         0.0    0.0
```

```
1      0.0      0.0       0.0   1.0      0.0         0.0    0.0
2      0.0      0.0       0.0   0.0      0.0         0.0    0.0
3      0.0      0.0       0.0   0.0      0.0         0.0    0.0
4      0.0      0.0       0.0   0.0      0.0         0.0    0.0
..     …      …       …   …      …         …    …
490    1.0      0.0       0.0   0.0      0.0         0.0    0.0
491    1.0      0.0       1.0   0.0      0.0         0.0    1.0
492    0.0      0.0       0.0   0.0      0.0         0.0    0.0
493    1.0      0.0       0.0   0.0      0.0         0.0    0.0
494    0.0      0.0       0.0   1.0      0.0         0.0    0.0

                                       Details / Notes
0                                                  NaN
1                                                  NaN
2                                                  NaN
3                                                  NaN
4                                                  NaN
..                                                 …
490                                                NaN
491  10% royalty until $500K; then converts to 5% e…
492                                                NaN
493                                                NaN
494                                                NaN

[495 rows x 17 columns]
```

Notice that Amount and Equity are currently being treated as categorical variables (`dtype: object`). Can you figure out why this is? Clean up these columns and cast them to numeric types (i.e., a `dtype` of `int` or `float`) because we'll need to perform mathematical operations on these columns.

[4]:
```
# Cleaning the "Amount" and "Equity" columns and changing them to float data␣
↪type
sharktank_df['Amount'] = sharktank_df['Amount'].str.replace('$','')
sharktank_df['Amount'] = sharktank_df['Amount'].str.replace(',','')
sharktank_df['Amount'] = sharktank_df['Amount'].astype(float)

sharktank_df['Equity'] = sharktank_df['Equity'].str.replace('%','')
sharktank_df['Equity'] = sharktank_df['Equity'].astype(float)

sharktank_df
```

```
C:\Users\nitya\AppData\Local\Temp\ipykernel_16732\945289602.py:2: FutureWarning:
The default value of regex will change from True to False in a future version.
In addition, single character regular expressions will *not* be treated as
literal strings when regex=True.
  sharktank_df['Amount'] = sharktank_df['Amount'].str.replace('$','')
```

```
[4]:      Season  No. in series                     Company Deal  \
     0       1.0            1.0             Ava the Elephant  Yes   
     1       1.0            1.0        Mr. Tod's Pie Factory  Yes   
     2       1.0            1.0                      Wispots   No   
     3       1.0            1.0  College Foxes Packing Boxes   No   
     4       1.0            1.0                    Ionic Ear   No   
     ..      …            …                          …  …   
     490     6.0           28.0                 You Kick Ass  Yes   
     491     6.0           29.0                  Shark Wheel  Yes   
     492     6.0           29.0                    Gato Cafe   No   
     493     6.0           29.0             Sway Motorsports  Yes   
     494     6.0           29.0                    Spikeball  Yes   

                      Industry Entrepreneur Gender    Amount  Equity  Corcoran  \
     0              Healthcare              Female   50000.0    55.0       1.0   
     1       Food and Beverage                Male  460000.0    50.0       1.0   
     2       Business Services                Male       NaN     NaN       0.0   
     3        Lifestyle / Home                Male       NaN     NaN       0.0   
     4       Uncertain / Other                Male       NaN     NaN       0.0   
     ..                    …                  …       …     …       …   
     490  Children / Education              Female  100000.0    10.0       0.0   
     491      Fitness / Sports                Male  225000.0     8.0       0.0   
     492     Uncertain / Other              Female       NaN     NaN       0.0   
     493       Green/CleanTech                Male  300000.0    20.0       0.0   
     494      Fitness / Sports                Male  500000.0    20.0       0.0   

          Cuban  Greiner  Herjavec  John  O'Leary  Harrington  Guest  \
     0      0.0      0.0       0.0   0.0      0.0         0.0    0.0   
     1      0.0      0.0       0.0   1.0      0.0         0.0    0.0   
     2      0.0      0.0       0.0   0.0      0.0         0.0    0.0   
     3      0.0      0.0       0.0   0.0      0.0         0.0    0.0   
     4      0.0      0.0       0.0   0.0      0.0         0.0    0.0   
     ..     …      …       …   …      …         …    …   
     490    1.0      0.0       0.0   0.0      0.0         0.0    0.0   
     491    1.0      0.0       1.0   0.0      0.0         0.0    1.0   
     492    0.0      0.0       0.0   0.0      0.0         0.0    0.0   
     493    1.0      0.0       0.0   0.0      0.0         0.0    0.0   
     494    0.0      0.0       0.0   1.0      0.0         0.0    0.0   

                                            Details / Notes  
     0                                                  NaN  
     1                                                  NaN  
     2                                                  NaN  
     3                                                  NaN  
     4                                                  NaN  
     ..                                                 …  
     490                                                NaN  
```

```
491  10% royalty until $500K; then converts to 5% e…
492                                               NaN
493                                               NaN
494                                               NaN

[495 rows x 17 columns]
```

### 1.3 Question 1. Which Company was Worth the Most?

The valuation of a company is how much it is worth. If someone invests \$10,000 for a 40% equity stake in the company, then this means the company must be valued at $25,000, since 40% of \$25,000 is \$10,000.

Calculate the valuation of each company that was funded. Which company was most valuable? Is it the same as the company that received the largest total investment from the sharks?

[5]:
```
# Selecting the funded companies from the data
funded_companies = sharktank_df[sharktank_df['Deal'] == 'Yes']

# Adding a column that shows valuation for each funded company from the data
funded_companies['Valuation'] = funded_companies['Amount'] /␣
 ↪(funded_companies['Equity'] / 100)

# The company with highest valuation
most_valuable_company = funded_companies.loc[funded_companies['Valuation'].
 ↪idxmax(), 'Company']

# The company that received the largest investment
highest_investment_company = funded_companies.loc[funded_companies['Amount'].
 ↪idxmax(), 'Company']

print(f"Company with the highest Valuation is: {most_valuable_company}")
print()
print(f"Comapny that received the largest investment is:␣
 ↪{highest_investment_company}")
print()

# Implementing a Check if they are the same companies or not
if most_valuable_company == highest_investment_company:
    print("Yes, the company with the highest valuation is the same as the␣
 ↪company that received the largest investment.")
else:
    print("No, the company with the highest valuation is the not same as the␣
 ↪company that received the largest investment.")

funded_companies
```

```
Company with the highest Valuation is: The Wall DoctoRX
```

```
Comapny that received the largest investment is: AirCar

No, the company with the highest valuation is the not same as the company that
received the largest investment.
```

```
C:\Users\nitya\AppData\Local\Temp\ipykernel_16732\4149249056.py:5:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  funded_companies['Valuation'] = funded_companies['Amount'] /
(funded_companies['Equity'] / 100)
```

[5]:

```
     Season  No. in series               Company Deal             Industry  \
0       1.0            1.0      Ava the Elephant  Yes           Healthcare
1       1.0            1.0  Mr. Tod's Pie Factory  Yes     Food and Beverage
5       1.0            2.0        A Perfect Pear  Yes     Food and Beverage
6       1.0            2.0       Classroom Jams  Yes  Children / Education
10      1.0            3.0          Turbobaster  Yes     Food and Beverage
..      …            …                   …   …                   …
489     6.0           28.0        SynDaver Labs  Yes           Healthcare
490     6.0           28.0         You Kick Ass  Yes  Children / Education
491     6.0           29.0          Shark Wheel  Yes      Fitness / Sports
493     6.0           29.0     Sway Motorsports  Yes       Green/CleanTech
494     6.0           29.0            Spikeball  Yes      Fitness / Sports

    Entrepreneur Gender     Amount  Equity  Corcoran  Cuban  Greiner  \
0                Female    50000.0    55.0       1.0    0.0      0.0
1                  Male   460000.0    50.0       1.0    0.0      0.0
5                Female   500000.0    50.0       0.0    0.0      0.0
6                  Male   250000.0    10.0       1.0    1.0      0.0
10               Female    35000.0   100.0       0.0    0.0      0.0
..                  …        …      …       …     …      …
489                Male  3000000.0    25.0       0.0    0.0      0.0
490              Female   100000.0    10.0       0.0    1.0      0.0
491                Male   225000.0     8.0       0.0    1.0      0.0
493                Male   300000.0    20.0       0.0    1.0      0.0
494                Male   500000.0    20.0       0.0    0.0      0.0

     Herjavec  John  O'Leary  Harrington  Guest  \
0         0.0   0.0      0.0         0.0    0.0
1         0.0   1.0      0.0         0.0    0.0
5         1.0   0.0      1.0         0.0    0.0
6         1.0   1.0      1.0         0.0    0.0
10        0.0   0.0      0.0         1.0    0.0
```

```
..        …   …      …         …    …
489       1.0   0.0      0.0         0.0    0.0
490       0.0   0.0      0.0         0.0    0.0
491       1.0   0.0      0.0         0.0    1.0
493       0.0   0.0      0.0         0.0    0.0
494       0.0   1.0      0.0         0.0    0.0

                                       Details / Notes     Valuation
0                                                  NaN  9.090909e+04
1                                                  NaN  9.200000e+05
5                                                  NaN  1.000000e+06
6                                                  NaN  2.500000e+06
10                                          2% royalty  3.500000e+04
..                                                 …           …
489                                                NaN  1.200000e+07
490                                                NaN  1.000000e+06
491  10% royalty until $500K; then converts to 5% e…  2.812500e+06
493                                                NaN  1.500000e+06
494                                                NaN  2.500000e+06

[249 rows x 18 columns]
```

Company can receive a large investment but give away a big equity portion, resulting in a lower valuation.

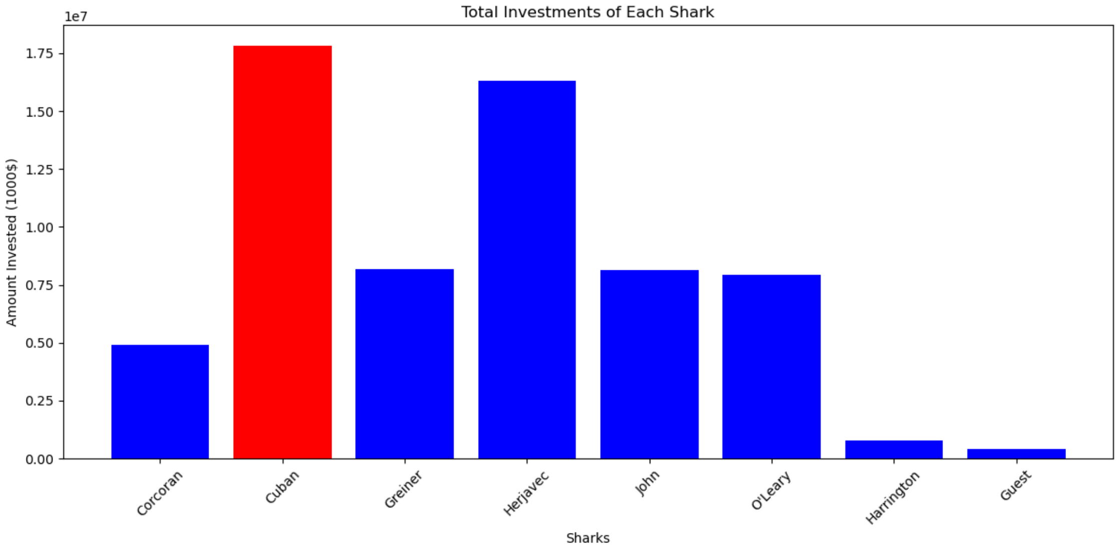
## 1.4 Question 2. Which Shark Invested the Most?

Calculate the total amount of money that each shark invested over the 6 seasons. Which shark invested the most total money over the 6 seasons?

*Hint:* If $n$ sharks funded a given venture, then the amount that each shark invested is the total amount divided by $n$.

```
[6]: import matplotlib.pyplot as plt

# Adding a column to show how many sharks that invested in each venture
sharktank_df['num_sharks'] = sharktank_df[shark_columns].sum(axis=1)

# Adding a column to show the amount each shark invested for each venture
sharktank_df['each_shark_investment'] = sharktank_df['Amount'] /␣
  ↪sharktank_df['num_sharks']

# Calculating the total investment made by each shark
shark_investments = {shark: (sharktank_df[shark] *␣
  ↪sharktank_df['each_shark_investment']).sum() for shark in shark_columns}

# Finding the shark who made the max investment
max_shark = max(shark_investments, key=shark_investments.get)
```

```
###### VISUALIZATION ######

sharks = list(shark_investments.keys())
investments = list(shark_investments.values())

plt.figure(figsize=(12, 6))
plt.bar(sharks, investments, color='blue')
plt.title('Total Investments of Each Shark')
plt.ylabel('Amount Invested (1000$)')
plt.xlabel('Sharks')

# Rotating the X-Label ticks for better layout
plt.xticks(rotation=45)
plt.tight_layout()

# Highlighting the shark with the most investment
plt.bar(max_shark, shark_investments[max_shark], color='red')
plt.show()
```



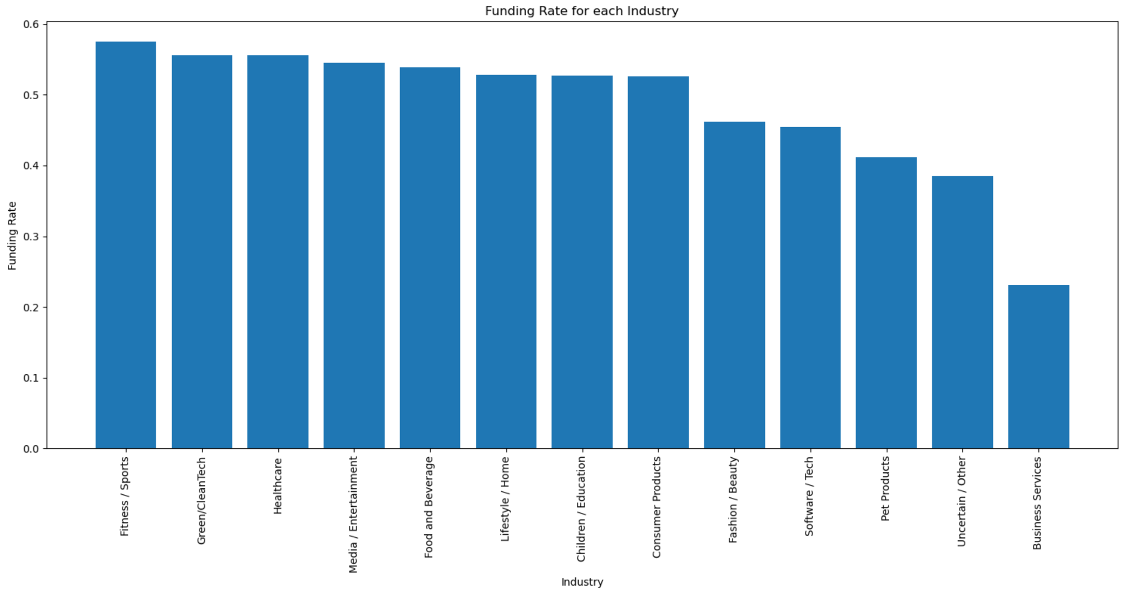
Based on the following graph cuban invested the most.

### 1.5 Question 3. Do the Sharks Prefer Certain Industries?

Calculate the funding rate (the proportion of companies that were funded) for each industry. Make a visualization showing this information.

[7]:
```
# Counting the number of companies present under each industry
total_companies = sharktank_df['Industry'].value_counts()
```

```python
# Counting the the number companies funded per industry
funded_counts = funded_companies['Industry'].value_counts()

# Calculating the funding rate for each industry
funding_rate = (funded_counts / total_companies).fillna(0)

import matplotlib.pyplot as plt

# Sort industries by funding rate for clearer visualization
sorted_indices = funding_rate.sort_values(ascending=False).index
sorted_values = funding_rate.sort_values(ascending=False).values

###### VISUALIZATION ######

plt.figure(figsize=(15, 8))
plt.bar(sorted_indices, sorted_values)
plt.title('Funding Rate for each Industry')
plt.ylabel('Funding Rate')
plt.xlabel('Industry')

# Rotating the X-Label ticks for better layout
plt.xticks(rotation=90)
plt.tight_layout()
plt.show()
```



By calculating the financing rate for each industry to find the preferences in that sector. Then we represent the data using a bar chart with financing rates on the y-axis and industries on the x-axis.

This displays the industries that the sharks like.

### 1.6 Submission Instructions

Once you are finished, follow these steps:

1. Restart the kernel and re-run this notebook from beginning to end by going to `Kernel > Restart Kernel and Run All Cells`.
2. If this process stops halfway through, that means there was an error. Correct the error and repeat Step 1 until the notebook runs from beginning to end.
3. Double check that there is a number next to each code cell and that these numbers are in order.

Then, submit your lab as follows:

1. Go to `File > Export Notebook As > PDF`.
2. Double check that the entire notebook, from beginning to end, is in this PDF file. (If the notebook is cut off, try first exporting the notebook to HTML and printing to PDF.)
3. Upload the Notebook (ipynb) to canvas (one submission per group).
4. Demo your lab by next Tuesday for full credit.

# 2b

October 17, 2023

## 1 Evidence of Discrimination?

The Department of Developmental Services (DDS) in California is responsible for allocating funds to support over 250,000 developmentally-disabled residents. The data set `ca_dds_expenditures.csv` contains data about 1,000 of these residents. The data comes from a discrimination lawsuit which alleged that California's Department of Developmental Services (DDS) privileged white (non-Hispanic) residents over Hispanic residents in allocating funds. We will focus on comparing the allocation of funds (i.e., expenditures) for these two ethnicities only, although there are other ethnicities in this data set.

There are 6 variables in this data set:

- Id: 5-digit, unique identification code for each consumer (similar to a social security number and used for identification purposes)

- Age Cohort: Binned age variable represented as six age cohorts (0-5, 6-12, 13-17, 18-21, 22-50, and 51+)
- Age: Unbinned age variable
- Gender: Male or Female
- Expenditures: Dollar amount of annual expenditures spent on each consumer
- Ethnicity: Eight ethnic groups (American Indian, Asian, Black, Hispanic, Multi-race, Native Hawaiian, Other, and White non-Hispanic)

### 1.1 GROUP DETAILS

1. MEMBER-1: MANAN KUMAR (SID: 862393075)
2. MEMBER-2: NITYASH GAUTAM (SID: 862395403)

## 2 Question 1

Read in the data set. Make a graphic that compares the *average* expenditures by the DDS on Hispanic residents and white (non-Hispanic) residents. Comment on what you see.

```
[1]: import pandas as pd

     # Reading the Dataset
     df = pd.read_csv('ca_dds_expenditures.csv')
     df
```

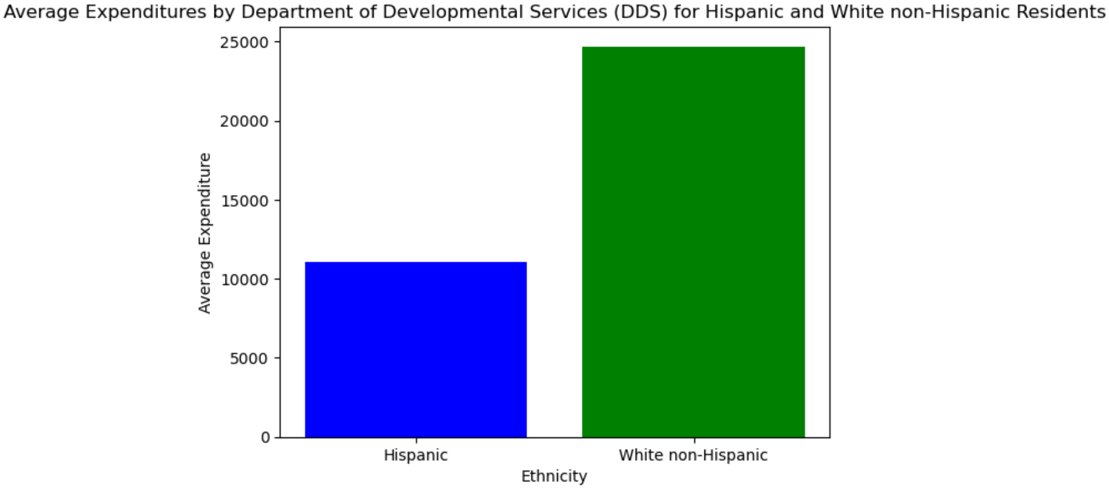
[1]:

```
        Id Age Cohort  Age  Gender  Expenditures           Ethnicity
0    10210   13 to 17   17  Female          2113  White not Hispanic
1    10409   22 to 50   37    Male         41924  White not Hispanic
2    10486     0 to 5    3    Male          1454            Hispanic
3    10538   18 to 21   19  Female          6400            Hispanic
4    10568   13 to 17   13    Male          4412  White not Hispanic
..     …          …  …    …            …                  …
995  99622        51+   86  Female         57055  White not Hispanic
996  99715   18 to 21   20    Male          7494            Hispanic
997  99718   13 to 17   17  Female          3673          Multi Race
998  99791    6 to 12   10    Male          3638            Hispanic
999  99898   22 to 50   23    Male         26702  White not Hispanic

[1000 rows x 6 columns]
```

[2]:

```python
# Calculating the Average Expenditures of "Hispanics" and "White Not Hispanics"
avg_expenditure_hispanic = df[df['Ethnicity'] == 'Hispanic']['Expenditures'].
 ↪mean()
avg_expenditure_white = df[df['Ethnicity'] == 'White not␣
 ↪Hispanic']['Expenditures'].mean()

print('$',avg_expenditure_hispanic)
print('$',avg_expenditure_white)

####### VISUALIZATIONS #######

import matplotlib.pyplot as plt

plt.bar('Hispanic', avg_expenditure_hispanic, color='blue')
plt.bar('White non-Hispanic', avg_expenditure_white, color='green')
plt.xlabel('Ethnicity')
plt.ylabel('Average Expenditure')
plt.title('Average Expenditures by Department of Developmental Services (DDS)␣
 ↪for Hispanic and White non-Hispanic Residents')
plt.show()
```

```
$ 11065.56914893617
$ 24697.54862842893
```



The above graph shows that the average expenditure of Hispanics is less than the average expenditure of White non-hispanics

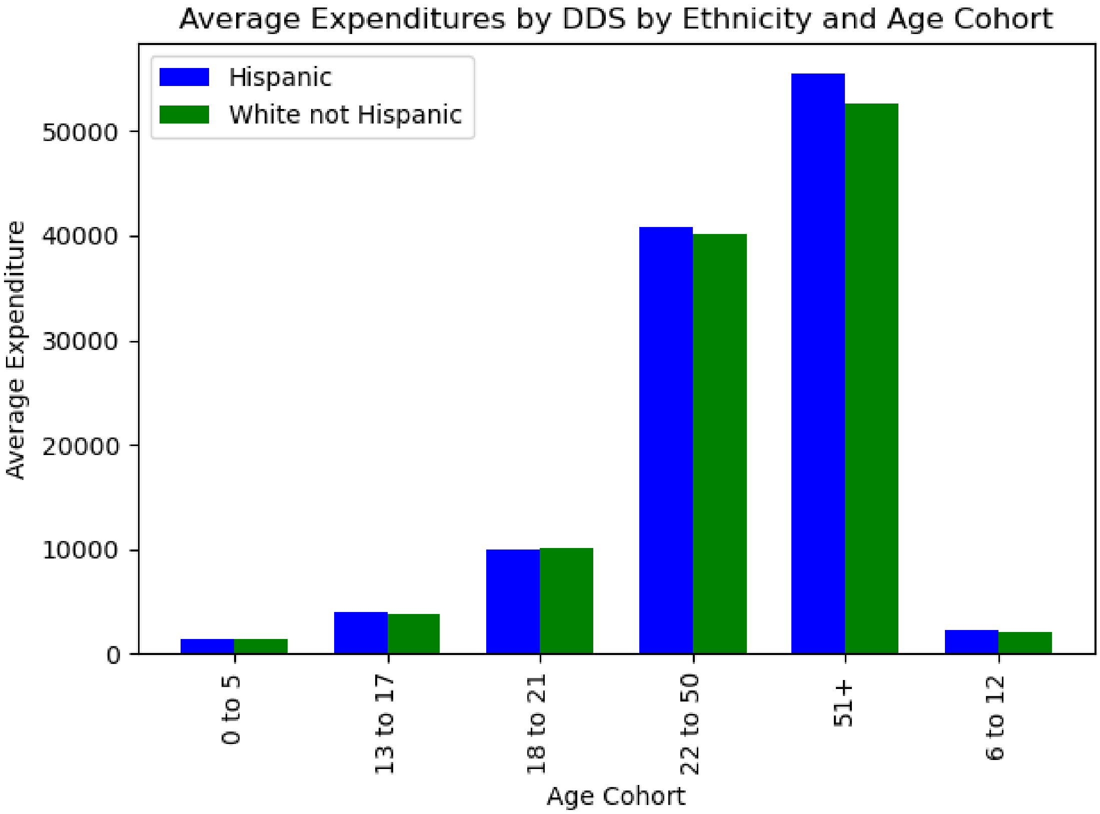
# 3 Question 2

Now, calculate the average expenditures by ethnicity and age cohort. Make a graphic that compares the average expenditure on Hispanic residents and white (non-Hispanic) residents, *within each age cohort.*

Comment on what you see. How do these results appear to contradict the results you obtained in Question 1?

[3]:
```python
import numpy as np
import matplotlib.pyplot as plt

# Grouping the Data by Age and Ethinicity; calculating mean of expenditures;␣
 ↪unstacking the heirarchial grouped data
grouped = df.groupby(['Ethnicity', 'Age Cohort'])['Expenditures'].mean().
 ↪unstack()

# Initializing variables for 'Avg Hispanic Expenditures' and 'White Not␣
 ↪Hispanics Expedintures'
hispanic_averages = grouped.loc['Hispanic']
white_averages = grouped.loc['White not Hispanic']

# Getting the Age Cohorts
age_cohorts = hispanic_averages.index

# Bar width and index initialization for plotting purposes
bar_width = 0.35
```

```
index = np.arange(len(age_cohorts))

####### VISUALIZATIONS #######

fig, ax = plt.subplots()
bar1 = ax.bar(index, hispanic_averages, bar_width, label='Hispanic',␣
 ↪color='blue')
bar2 = ax.bar(index + bar_width, white_averages, bar_width, label='White not␣
 ↪Hispanic', color='green')

ax.set_xlabel('Age Cohort')
ax.set_ylabel('Average Expenditure')
ax.set_title('Average Expenditures by DDS by Ethnicity and Age Cohort')
ax.set_xticks(index + bar_width / 2)
ax.set_xticklabels(age_cohorts, rotation=90)
ax.legend()

plt.tight_layout()
plt.show()
```



Inference from the graph is that Hispanics in each age cohort have generally a higher expenditure than White Not Hispanics

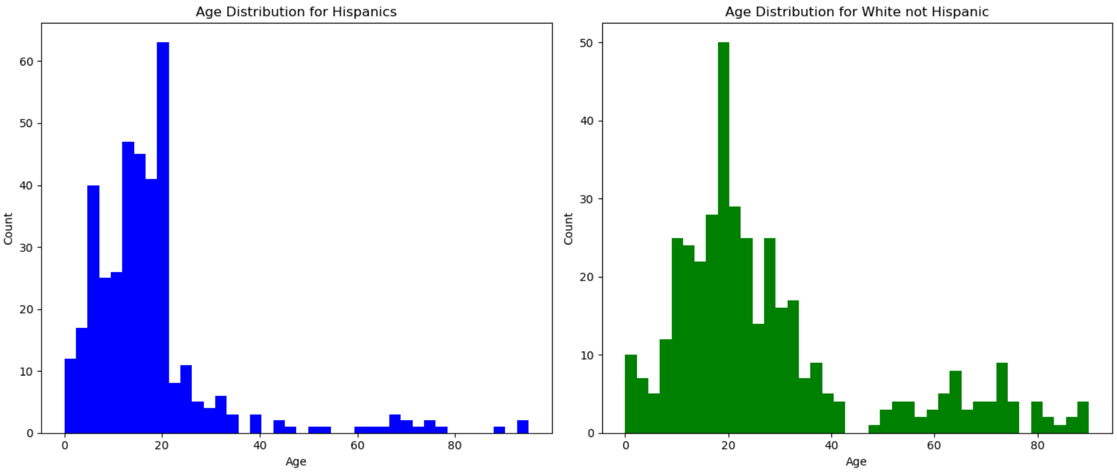
# 4 Question 3

Can you explain the discrepancy between the two analyses you conducted above (i.e., Questions 1 and 2)? Try to tell a complete story that interweaves tables, graphics, and explanation.

*Hint:* You might want to consider looking at:

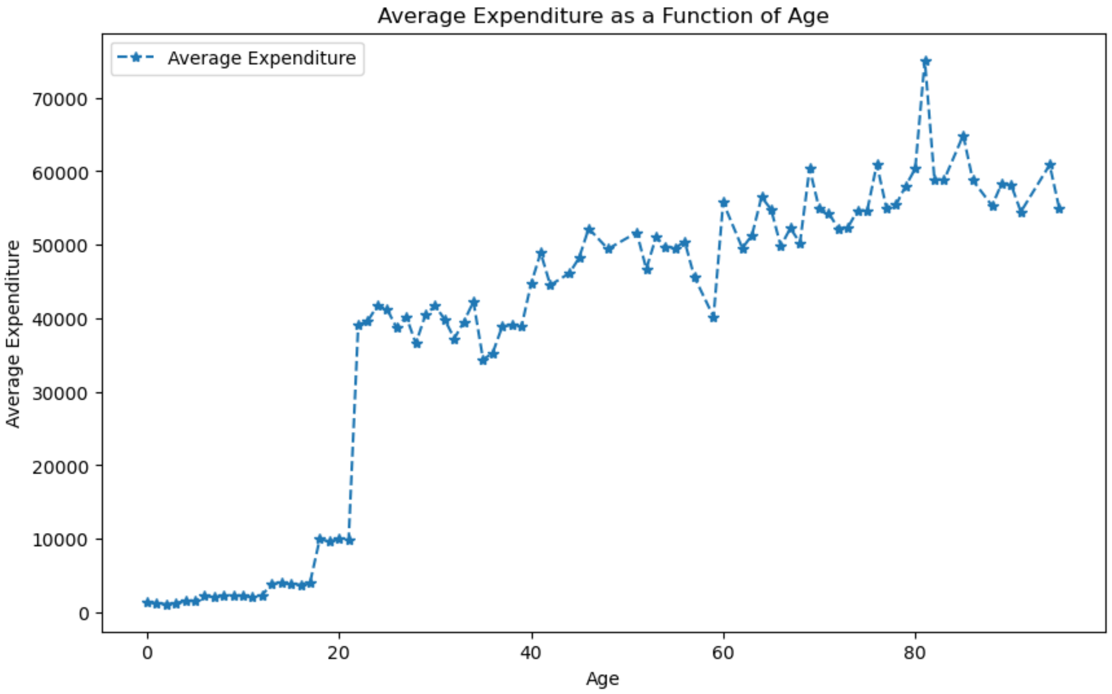
- the distributions of ages of Hispanics and whites
- the average expenditure as a function of age

[4]:
```
# Initializing the Subplot details
fig, (ax1, ax2) = plt.subplots(1, 2, figsize=(14, 6))

# Histogram plotting for Hispanics
ax1.hist(df[df['Ethnicity'] == 'Hispanic']['Age'], bins=40, color='blue')
ax1.set_title('Age Distribution for Hispanics')
ax1.set_ylabel('Count')
ax1.set_xlabel('Age')

# Histogram plotting for White (not Hispanic)
ax2.hist(df[df['Ethnicity'] == 'White not Hispanic']['Age'], bins=40,␣
  ↪color='green')
ax2.set_title('Age Distribution for White not Hispanic')
ax2.set_ylabel('Count')
ax2.set_xlabel('Age')

plt.tight_layout()
plt.show()
```



[5]:

```
# Group by Age and calculate the mean expenditure for each age
avg_expenditure_age = df.groupby('Age')['Expenditures'].mean()

####### VISUALIZATIONS #######

plt.figure(figsize=(10,6))
plt.plot(avg_expenditure_age, '--*', label='Average Expenditure')
plt.xlabel('Age')
plt.ylabel('Average Expenditure')
plt.title('Average Expenditure as a Function of Age')
plt.legend()
plt.show()
```



The above visualization shows that as the age inceares the Avergae Expenditure increases as well. Now, Refering back to the previous Histograms we can clearly see that the White Not Hispanics have a higher number of people present in the higher age groups as compared to the Hispanics. This explains the discrepancy, why the White Not Hispanics had a higher Average Expenditures while per Hispanics had higher for each Age Cohorts.

### 4.1 Submission Instructions

Once you are finished, follow these steps:

1. Restart the kernel and re-run this notebook from beginning to end by going to `Kernel > Restart Kernel and Run All Cells`.

2. If this process stops halfway through, that means there was an error. Correct the error and repeat Step 1 until the notebook runs from beginning to end.
3. Double check that there is a number next to each code cell and that these numbers are in order.

Then, submit your lab as follows:

1. Go to `File > Export Notebook As > PDF`.
2. Double check that the entire notebook, from beginning to end, is in this PDF file. (If the notebook is cut off, try first exporting the notebook to HTML and printing to PDF.)
3. Upload your Notebook (ipynb) to canvas (one submission per group).
4. Demo your lab.