hw5

October 5, 2023

1 Homework 5

1.1 Question 1 (5 points)

- Read the mpg dataset in a pandas data frame.
- Execute the describe method of the data frame you created.
- What function in R corresponds to describe?

[3]:
```
#!pandoc --version
```

[77]:
```
import pandas as pd
mpg=pd.read_csv('mpg.csv')
mpg.describe()
```

[77]:
```
            displ         year         cyl         cty         hwy
count  234.000000   234.000000  234.000000  234.000000  234.000000
mean     3.471795  2003.500000    5.888889   16.858974   23.440171
std      1.291959     4.509646    1.611534    4.255946    5.954643
min      1.600000  1999.000000    4.000000    9.000000   12.000000
25%      2.400000  1999.000000    4.000000   14.000000   18.000000
50%      3.300000  2003.500000    6.000000   17.000000   24.000000
75%      4.600000  2008.000000    8.000000   19.000000   27.000000
max      7.000000  2008.000000    8.000000   35.000000   44.000000
```

1.1.1 What function in R corresponds to describe?

Summary built in function

1.2 Question 2 (25 points)

This will make you miss the ggplot2 library! :D

Modify the following plot

```
_ = sns.lmplot(
    data = mpg,
    x = "displ",
    y = "hwy",
    ci = None,
    line_kws = {"color": "black"},
    scatter_kws = {"s": 10},
    lowess = True,
    x_jitter = 0.5,
    y_jitter = 0.5
).set(
    title = "Fuel consumption by engine displacement",
    xlabel = "Engine displacement",
    ylabel = "Fuel consumption"
).tight_layout()
```

in such a way that:

1. the points in the plot are colored by the variable `class` in the `mpg` dataset
2. there is a single trend line applied that applies to all points in the plot instead of one trend line for each group defined by the `class` variable in the `mpg` dataset.

Hint: - First, create a `lmplot` and set in that plot `hue = "class"` (to color the points by the "class" variable) and `fit_reg = False` (to suppress the trend line); assign the output of the `lmplot` function to a variable named `lm_plot` (you'll need this in a second). - Next, in the same cell, create a `regplot` and set `scatter = False` (to suppress plotting the points, which are already produced by the previous plot) as well as `ax = lm_plot.ax` (to tell `seaborn` to overlay the new plot to the previous one, rather than creating a new plot). - You should still pass relevant parameters to each of the two components of the plot (`lmplot` and `regplot`) in a sensible way so to get the desired final plot as the result.

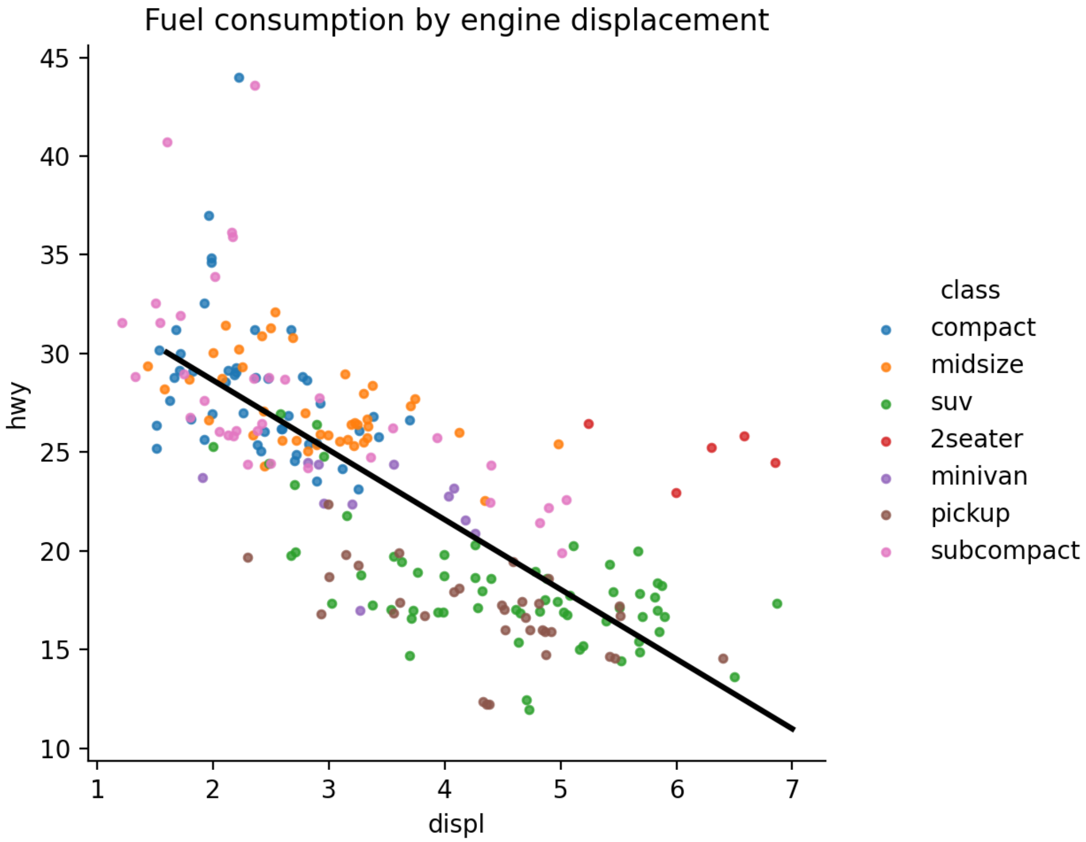
Here's a "skeleton" of the code that you'll need. It's up to you to fill it out!

```
lm_plot = sns.lmplot(
    ... <- configure the lmplot appropriately
).set(
    title = "Fuel consumption by engine displacement",
    xlabel = "Engine displacement",
    ylabel = "Fuel consumption"
).tight_layout()

_ = sns.regplot(
    ... <- configure the regplot appropriately
)
```

[78]:

```
import seaborn as sns
import pandas as pd
import matplotlib.pyplot as plt
lm_plot = sns.lmplot(
    data = mpg,
    x = "displ",
    y = "hwy",
    ci = None,
    line_kws = {"color": "black"},
    scatter_kws = {"s": 10},
    hue="class",
    fit_reg=False,
    lowess = True,
    x_jitter = 0.5,
    y_jitter = 0.5
).set(
    title = "Fuel consumption by engine displacement",
    xlabel = "Engine displacement",
    ylabel = "Fuel consumption"
).tight_layout()
s=sns.regplot(
    data = mpg,
    x = "displ",
    y = "hwy",
    scatter=False,
    line_kws = {"color": "black"},
    ax=lm_plot.ax,ci=None
)
plt.show()
```



[ ]:

```
#!pip install seaborn==0.12.2
```

1.3 Question 3 (20 points)

Use the `plotnine` library to recreate this `ggplot2` plot (from lab 1) in Python:

```
ggplot(data = diamonds, mapping = aes(x = color, fill = clarity)) +
  geom_bar(position = "dodge") +
  scale_fill_brewer(palette = "Set2") +
  labs(
    x = "Color",
    y = element_blank(),
    fill = "Diamond clarity",
    title = "Clarity distribution by color"
  )
```

Hint: this stackoverflow discussion might come in handy to set the palette colors. Also, note that the variable `clarity` is actually an ordered categorical variable (to see this, read the docs in R for the `diamonds` dataset with `? diamonds`). We can create a `pandas` equivalent of an R factor by using the `pandas.Categorical` class (see the docs here). To get the same ordering that we got in R for the dodged bars, you will need to transform the `clarity` variable in the `diamonds` dataset that you read with `pandas` to a `pandas.Categorical` variable.

[4]:

```
#!pip install plotnine
```

[6]:

```
from plotnine import *
import pandas as pd
```

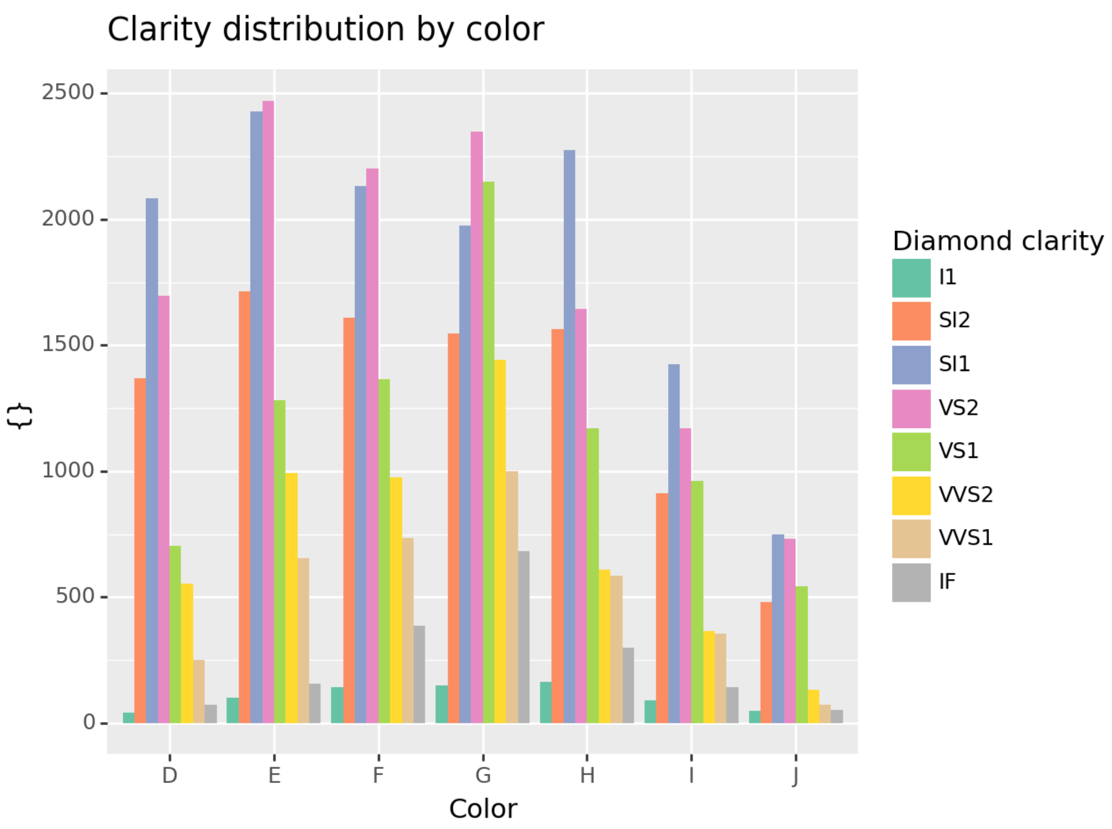
[7]:

```
diamonds=pd.read_csv('diamonds.csv')
```

[24]:

```
# Define the desired order for clarity levels
clarity_order = ['I1', 'SI2', 'SI1', 'VS2', 'VS1', 'VVS2', 'VVS1', 'IF']
diamonds['clarity'] = pd.Categorical(diamonds['clarity'],␣
 ↪categories=clarity_order, ordered=True)

(ggplot(data = diamonds, mapping = aes(x = 'color', fill = 'clarity')) +
  geom_bar(position = "dodge") +
  scale_fill_brewer(type="qual", palette = "Set2") +
  labs(
    x = "Color",
    y = element_blank(),
    fill = "Diamond clarity",
    title = "Clarity distribution by color"
  ))
```



```
[24]: <Figure Size: (640 x 480)>
```

```
[6]: #!pip install plotnine
```

1.4 Question 4 (25 points)

Solve again exercises 1 and 4 of Homework 2, but this time use `pandas`!

You are encouraged to use the published solutions of Homework 2 and “translate” them from R’s `tidyverse/dplyr` to Python’s `pandas`.

You might find this “translation guide” helpful!

```
[40]: # Load the flights and airlines datasets (assuming you have them as CSV files)
flights = pd.read_csv('flights.csv')  # Replace with your dataset filename
airlines = pd.read_csv('airlines.csv')  # Replace with your dataset filename

# Filter flights that occurred between July and November
flights = flights[(flights['month'] >= 7) & (flights['month'] <= 11)]

# Calculate the gain
flights['gain'] = flights['arr_delay'] - flights['dep_delay']
```

```
# Group by airline and compute average gain (ignoring NAs)
#Note: missing values are automatically skipped when calculating the mean. You␣
 ↪do not need to specify a parameter to skip them.
average_gain = flights.groupby('carrier')['gain'].mean().reset_index()

# Sort by average_gain in decreasing order
average_gain = average_gain.sort_values(by='gain', ascending=False)

# Join with the airlines dataset
average_gain = average_gain.merge(airlines, left_on='carrier',␣
 ↪right_on='carrier', how='left')

result_tibble = average_gain[['gain', 'name']]
# Rename the columns to match the R solution
result_tibble.columns = ['average_gain', 'name']

# Display the resulting tibble
print(result_tibble)
```

```
    average_gain                        name
0       1.285235  AirTran Airways Corporation
1       0.545455       Frontier Airlines Inc.
2       0.063590                    Envoy Air
3      -0.909774       Hawaiian Airlines Inc.
4      -2.837182              US Airways Inc.
5      -2.846154         SkyWest Airlines Inc.
6      -3.017921            Mesa Airlines Inc.
7      -4.905070              JetBlue Airways
8      -5.787007     ExpressJet Airlines Inc.
9      -7.960461         Delta Air Lines Inc.
10     -8.571100       Southwest Airlines Co.
11     -8.669899       American Airlines Inc.
12     -9.621162        United Air Lines Inc.
13     -9.875375               Virgin America
14    -10.288170           Endeavor Air Inc.
15    -22.211409         Alaska Airlines Inc.
```

[44]:

```
# Read the transactions.csv dataset
transactions = pd.read_csv("transactions.csv")

# Reshape the data to be tidy
transactions = pd.melt(transactions, id_vars=['person', 'month'],␣
 ↪var_name='transaction_type', value_name='amount')

# Filter the data for Jenna or John
transactions = transactions[transactions['person'].isin(['jenna', 'john'])]
```

```python
# Get the unique months in which either Jenna or John had a transaction
unique_months = transactions['month'].unique()

# Create a pandas DataFrame with the unique months
result_tibble = pd.DataFrame({'month': unique_months})

# Display the resulting tibble
print(result_tibble)
```

```
   month
0      1
1      3
```

1.5 Question 5 (25 points)

Solve again exercises 1 and 2 of Homework 3, but this time use `pandas`!

You are encouraged to use the published solutions of Homework 3 and “translate” them from R’s `tidyverse`/`dplyr` to Python’s `pandas`.

Again, you might find this “translation guide” helpful!

[53]:

```python
# Read the datasets
dinners = pd.read_csv("dinners.csv")
drinks = pd.read_csv("drinks.csv")
food = pd.read_csv("food.csv")
persons = pd.read_csv("persons.csv")

# Merge the datasets to create the dinners_explicit tibble
dinners_explicit = pd.merge(dinners, drinks, left_on="drink_id",␣
 ↪right_on="item_id", how="left")
dinners_explicit = dinners_explicit.rename(columns={"price": "drink_price",␣
 ↪"item_name": "drink"})

dinners_explicit = pd.merge(dinners_explicit, food, left_on="food_id",␣
 ↪right_on="food_id", how="left")
dinners_explicit = dinners_explicit.rename(columns={"price": "food_price",␣
 ↪"name": "food"})

dinners_explicit = pd.merge(dinners_explicit, persons, left_on="person_id",␣
 ↪right_on="id", how="left")

# Select the specified columns
dinners_explicit = dinners_explicit[["drink", "drink_price", "food",␣
 ↪"food_price", "first_name", "last_name", "age"]]

# Display the resulting tibble
```

```
dinners_explicit
```

[53]:

```
              drink drink_price       food food_price first_name    last_name  \
0               NaN         NaN      pasta     $8.50      Valter  Evangelista
1               NaN         NaN  ice cream     $4.50       Polly       Verity
2             water      $1.00         NaN        NaN        NaN          NaN
3              beer      $5.00        cake     $4.50       Aysha      Freitas
4               NaN         NaN      pizza       $12       Rayno     Van Kann
5             water      $1.00        fish    $15.00      Valter  Evangelista
6               NaN         NaN      pizza       $12       Rayno     Van Kann
7   sparkling water      $2.00   ice cream     $4.50      Ksenya        Dunai
8              soda      $2.50    pop corn     $1.50       Polly       Verity
9             water      $1.00       salad     $5.00       Aysha      Freitas
10             wine      $9.00         NaN        NaN        NaN          NaN
11             soda      $2.50       salad     $5.00         NaN          NaN
12             beer      $5.00        cake     $4.50       Aysha      Freitas
13              NaN         NaN      steak    $12.00         NaN          NaN
14             wine      $9.00         NaN        NaN     Valter  Evangelista
15             wine      $9.00    pop corn     $1.50         NaN          NaN
16              NaN         NaN       fish    $15.00         NaN          NaN
17            water      $1.00       fries     $3.00       Polly       Verity
18  sparkling water      $2.00      burger     $5.00       Polly       Verity
19             soda      $2.50       steak    $12.00       Polly       Verity
20              NaN         NaN      fries     $3.00      Valter  Evangelista
21              NaN         NaN        NaN        NaN        NaN          NaN
22              NaN         NaN      pasta     $8.50         NaN          NaN
23             soda      $2.50       pasta     $8.50         NaN          NaN
24  sparkling water      $2.00       salad     $5.00         NaN          NaN
25  sparkling water      $2.00       pizza       $12       Rayno     Van Kann
26  sparkling water      $2.00   ice cream     $4.50         NaN          NaN
27  sparkling water      $2.00        fish    $15.00         NaN          NaN
28              NaN         NaN      fries     $3.00       Polly       Verity
29             beer      $5.00       pasta     $8.50      Valter  Evangelista
30            water      $1.00      burger     $5.00         NaN          NaN
31              NaN         NaN      pasta     $8.50       Rayno     Van Kann
32              NaN         NaN      salad     $5.00       Aysha      Freitas
33              NaN         NaN      fries     $3.00         NaN          NaN
34             soda      $2.50        cake     $4.50         NaN          NaN
35  sparkling water      $2.00        fish    $15.00         NaN          NaN
36             soda      $2.50         NaN        NaN        NaN          NaN
37             beer      $5.00    pop corn     $1.50         NaN          NaN
38             wine      $9.00        fish    $15.00         NaN          NaN
39              NaN         NaN      salad     $5.00         NaN          NaN
40             soda      $2.50         NaN        NaN        NaN          NaN
41              NaN         NaN      fries     $3.00         NaN          NaN
42             wine      $9.00       pizza       $12       Polly       Verity
43             soda      $2.50         NaN        NaN       Aysha      Freitas
```

```
44            water      $1.00       pizza       $12         NaN          NaN
45            water      $1.00       fries     $3.00       Polly       Verity
46              NaN         NaN   pop corn     $1.50         NaN          NaN
47             soda      $2.50       pizza       $12       Rayno     Van Kann
48  sparkling water      $2.00       pizza       $12       Aysha      Freitas
49              NaN         NaN      steak    $12.00       Polly       Verity

     age
0   34.0
1   61.0
2    NaN
3   55.0
4   29.0
5   34.0
6   29.0
7   31.0
8   61.0
9   55.0
10   NaN
11   NaN
12  55.0
13   NaN
14  34.0
15   NaN
16   NaN
17  61.0
18  61.0
19  61.0
20  34.0
21   NaN
22   NaN
23   NaN
24   NaN
25  29.0
26   NaN
27   NaN
28  61.0
29  34.0
30   NaN
31  29.0
32  55.0
33   NaN
34   NaN
35   NaN
36   NaN
37   NaN
38   NaN
```

```
39   NaN
40   NaN
41   NaN
42  61.0
43  55.0
44   NaN
45  61.0
46   NaN
47  29.0
48  55.0
49  61.0
```

[81]:

```
# Assuming you have the 'dinners_explicit' DataFrame from the previous steps

# Create a summary tibble for the two most popular drinks
top2_drinks = dinners_explicit['drink'].value_counts().reset_index()
top2_drinks.columns = ['drink', 'n']
top2_drinks = top2_drinks.head(2)

# Create a summary tibble for the two most popular foods
top2_foods = dinners_explicit['food'].value_counts().reset_index()
top2_foods.columns = ['food', 'n']
top2_foods = top2_foods.head(2)

# Display the summary tibbles
print("Top 2 Drinks:")
top2_drinks
```

```
Top 2 Drinks:
```

[81]:

```
            drink  n
0            soda  9
1  sparkling water  8
```

[82]:

```
print("\nTop 2 Foods:")
top2_foods
```

```

Top 2 Foods:
```

[82]:

```
    food  n
0  pizza  7
1  fries  6
```

[5]:

```
#!pip install nbconvert
```