DATA203 Foundational Python (Prof. Maull) / Fall 2025 / HW4

Points Possible	Due Date	Time Commitment (estimated)
25	Thursday, December 5 @ midnight	*up to* 15 hours

- **GRADING:** Grading will be aligned with the completeness of the objectives.
- **INDEPENDENT WORK:** Copying, cheating, plagiarism and academic dishonesty *are not tolerated* by University or course policy. Please see the syllabus for the full departmental and University statement on the academic code of honor.

OBJECTIVES

- Continue the African-American poetry digital humanities exploration in Python and Pandas.
- Explore thematic shifts over time.
- Build a supervised learning poem classifier.

WHAT TO TURN IN

You will enjoy the highest benefits of the starter notebook if you clone the HW Github repository from your Jupyter Hub terminal with the command:

```
git clone https://github.com/kmhuads/f25_data203.git
```

If you have already cloned the notebook, go to the folder where you cloned it, open your Jupyter terminal, and type:

```
git pull
```

This will ensure you have the most updated files and starter notebook.

Once you have cloned or pulled the repository, you can edit the starter notebook with your solution code.

When you are done with your work, it will be best to zip your `hw2` folder and all sub-folders with the terminal command (one level outside your notebook folder):

```
zip -r data203_hw4_maull.zip ./hw4
```

This will produce the file with all necessary supporting files (notebooks, data output, etc.) then download it from the Jupyter Hub to your local machine, then upload the `.zip` to Teams.

If are confused on how to do this, please ask, or visit one of the many tutorials on the basics of using zip in Linux.

If you choose not to use the provided notebook, you will still need to turn in a `.ipynb` Jupyter Notebook and corresponding files according to the instructions in this homework.

ASSIGNMENT TASKS

(35%) Continue the African-American poetry digital humanities exploration in Python and Pandas.

Last time we learned a lot about the African American Poetry: A Digital Anthology dataset and research.

We loaded the dataset and started some exploratory inquiry into it.

This time we are going to go deeper into the text and eventually end up building a rudimentary model to classify the poems

As the English language continued to grow concommitant with the increase in literacy in the United States, influences can be seen on writing – whether novels, poems, newspaper articles or personal letters.

We will withhold interest in the historical trajectory of African-American literacy and AAVE (African-American Verncular English) among postbellum African-American writing, but we will not curb our curiosities at a high level – we have a limited dataset and quite some scholarly naïveté in this research area (but we can still have fun exploring).

§ Task: 1.1 Explore poem length changes over time.

In this part you will write a function `mean_word_count()`.

It will take a the DataFrame – the same one as before. This time, though, the function will return the mean word count for the `text` column of the dataset.

NOTE: To get an accurate word count, you will need to remove punctuation. **Use the code you wrote in HW2** to properly remoce punctionation, otherwise you will lose some points for the wrong answer.

Here is the detailed function requirement specification:

function **NAME**: `mean_word_count`

function **INPUT**

- a Pandas DataFrame (the Poetry dataset from HW3)

function **OUTPUT**

- `None` if the mean cannot be computed,
- otherwise, the mean word count of the `text` column of the dataset

Code Example:

```
df = pd.read_csv( [the HW3 poetry dataset] )
mean_word_count(df)
```

Output:

```
122.3
```

§ Task: 1.2 Write a second function `median_word_count()` which computes the median word count.

This will be a very simple change to your `mean_word_count()` code.

§ Task: 1.4 Use `word_count()` to determine the word counts specified below:

To complete the next part, please review the `DataFrame.query()` method. You will need it!

Show the code:

1. to compute the word count for poems before 1910 (`year` is less than 1910),
2. to compute the word count for poems between 1910 and 1919,
3. to compute the word count for poems after 1919 (`year` greater than 1919).

Answer:

1. What general trend did you observe in word count?

§ Task: 1.5 Plot the mean word counts for all years (1900-1928) using a bar plot.

The x-axis is the year and y-axis the word count.

To complete this, you will need to:

1. learn to use `DataFrame.groupby()`,
2. learn to use `DataFrame.apply()` with `mean_word_count()` (not `word_count()` to simplify your life),
3. use `DataFrame.plot.bar()`.

Answer:

1. Did you learn anything new by plotting all years?

§ Task: BONUS: Plot both mean and median word counts on the same bar plot.

This will be worth and extra 2 points bonus.

(35%) Explore thematic shifts over time.

You, by now, have noticed that the `theme` column of the data contains a large amount of useful information.

I have provided a function in the starter notebook called `get_theme_tuples()` which takes a DataFrame and returns list of tuples of the form `(year, theme)`. This list will become valuable to you for this part of the assignment.

§ Task: 2.1 Convert the output of `get_theme_tuples()` to a proper DataFrame.

This will require you create the DataFrame directly from the tuple (as mentioned in lecture). You may also want to use the `DataFrame.rename()` method chained to the DataFrame to rename the columns `0` and `1` to `year` and `theme`.

Your final DataFrame will look something like:

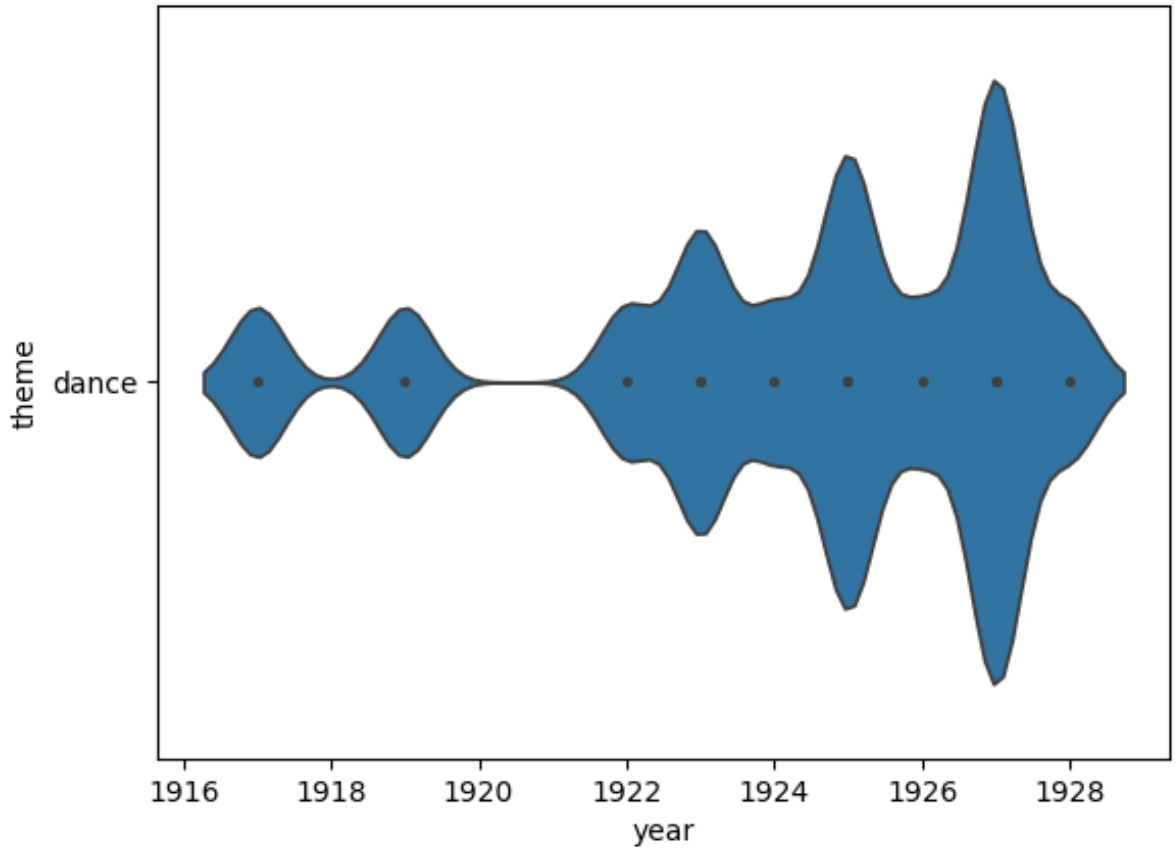
	year	theme
0	1900	spanish-american war
1	1900	empire
2	1900	slavery
3	1900	frederick douglass
4	1900	civil war
…	…	…

§ Task: 2.2 Make a Seaborn violin plot for the theme `"religion"`.

Study violin plots here:

- Seaborn violin plots documentation

Your plot will look something like this (the example is for `"dance"` which unsurprisingly shows an increase in dance themes during the Harlem Renaissance):



§ Task: 2.3 Write a function called `plot_themes` which takes the theme DataFrame and a `theme_list` list as input and returns the violin plot for all themes in `theme_list`.

Do not overthink it. The violin plot will do nearly all the work for you. You just need to make sure that the DataFrame you send to it *only* contains the rows with the themes in `theme_list`.

Review `DataFrame.query()` … this is a one line code implementation.

Here is the function requirement specification:

function **NAME**: `plot_themes`

function **INPUT**

- `df`: a Pandas DataFrame of themes with columns `year` and `theme`
- `theme_list`: a list of themes (e.g. `["hbcu", "world war i", "civil war"]`)

function **OUTPUT**

- an empy plot if the themes cannot be found,
- otherwise, the Seaborn violin plot of the themes

Code Example:

```
df_themes = pd.read_csv( [the HW3 poetry dataset] )
plot_themes(df_themes, theme_list=["labor"])
```

Output:

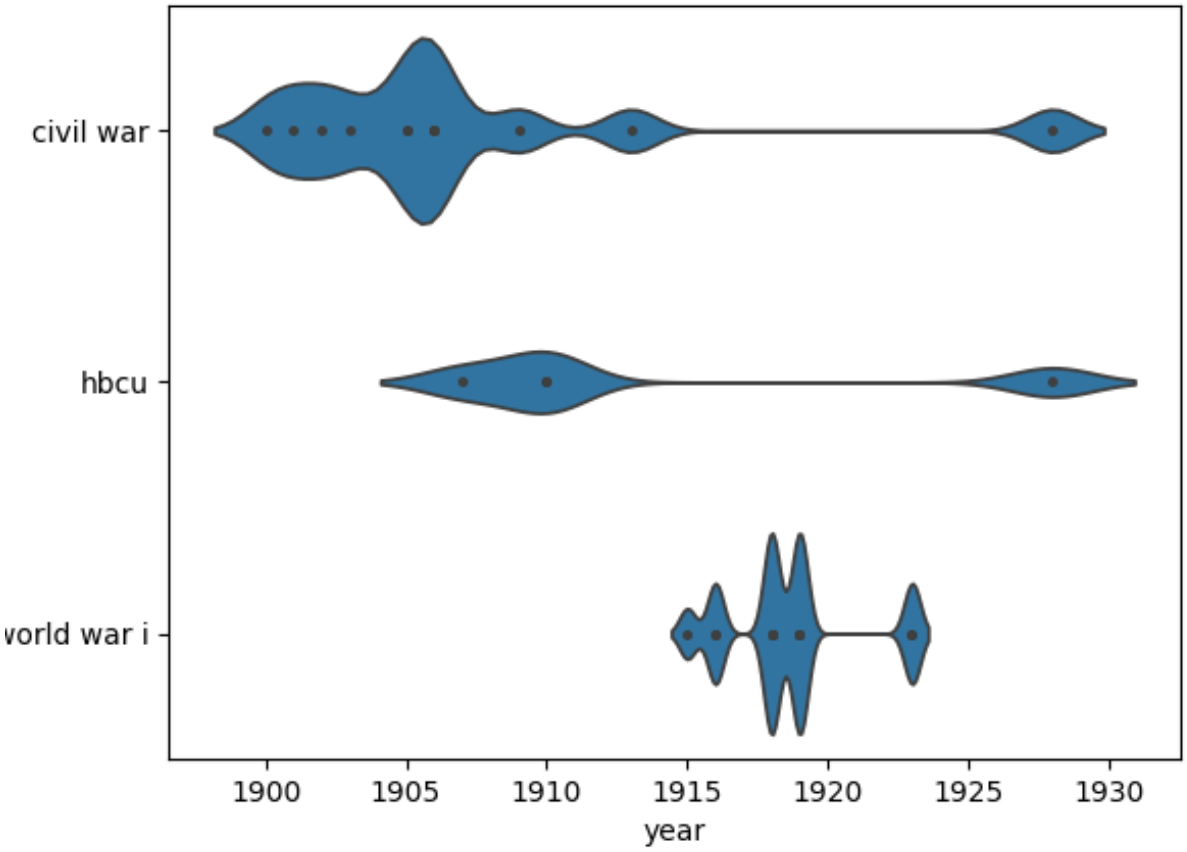
```
# the Seaborn violin plot
```

§ Task: 2.4 Plot the violin plots using your `plot_themes()` function.

Produce the violin plot for:

- `theme_list=['harlem', 'africa', 'music', 'religion', 'racism']`

All of the plots will appear on the same graph like this example:



§ Task: BONUS: (*up to +2 points*) Explain why there may be some issues with the themes *as is*. Provide concrete _examples and propose a solution on what to do about it.

§ Task: BONUS: (*up to +2 points*) Write the code which provides the top 15 most common themes over all years.

(30%) Build a supervised learning poem classifier.

We learned in lecture that predictions are the basis for machine learning algorithms.

We would like to predict the price of a house, the weather next week and even the outcome of the NBA finals.

Obviously, the more inputs there are in the system, the more complex the model required to make a prediction. The outcome of a football game, for example, depends on so many more factors than is typical to account for, and furthermore the inconsistency of human performance and randomness of other factors (e.g. fumbles, in-game injuries, etc.) make accurate predictions very difficult indeed.

We are going to leave those complex interactions alone and work on a simple prediction model using some Python libraries which with greatly simplify our efforts.

§ Task: 3.1 Review `fasttext` and install `fasttext-numpy2` for text classification.

`fasttext` is an open source library developed by Facebook Research which provides text classification tools that are accessible and easy to use. Familiarize yourself with its capabilities here:

- `fasttext`: Library for fast text representation and classification.

Unfortunately, this module is no longer being maintained and as is, no longer works with the latest version of Numpy (which is required for correct operation). This is the nature of open source software, for better or worse, but it does not diminish its value or utility.

Instead of trying to roll back to an older and less performant version of Numpy, we are going to rely on a fork of the `fasttext` libary which fixes it for the current version of Numpy. This is the benefit of open source software – those who can fix things that the original developers do not, can do so and allow others to benefit!

This library is called `fasttext-numpy2` and it can be found here:

- `fasttext-numpy2` fork of `fasttext` by Simon Ging (thank you!)

Install `fasttext-numpy2` with:

```
!pip install fasttext-numpy2
```

§ Task: 3.2 Prepare a training dataset for `fasttext-numpy2`.

In order to run the classifier you need two files: (1) a training set which contains the data which are labeled *examples* of the classes you're trying to learn, and (2) an unlabeled test set of data which have not been seen by the classifier.

The unlabeled data will be assigned labels once the classifier has been trained.

Use the provided function `make_training_set()` to make a labeled dataset. Make sure your file is named `train.txt` (which is the default file name in the provided function).

Now you will have a training set file.

§ Task: 3.3 Use the provided `test.txt` file and `run_classifier()` function to produce a new DataFrame.

The output will contain the labels and confidence from the classifier.

You may want to run the classifier like this:

```
df_clf = run_classifier()
```

in order to obtain the dataset which contains labels of the unlabeled data within the `test.txt` file. You will likely want to store this as a variable so you can use it in the next part.

§ Task: 3.4 Explain why you think the classifier is doing a good job or not.

Take 2 random poems labeled `political` and 2 that are labeled `notpolitical`.

HINT: `df_clf.query('label="political"').sample(2)` will return 2 random politically classified poems.

Answer:

For each poem print it in your notebook and explain why you think the label fits or does not fit. There is an example in the starter notebook on what this should look like.