Saul Garcia and Krishna Kalyan

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```
In [74]: %reset

Once deleted, variables cannot be recovered. Proceed (y/[n])? y
```

```
In [6]: %matplotlib inline
        import re
        import nltk
        import pandas as pd
```

```
In [7]: en_corpus = open("../data/en.txt").read()
        es_corpus = open("../data/es.txt").read()
```

```
In [8]: def pre_process(corpus, clean = 'no', char = 'no'):
            decode_corpus = corpus.decode('utf-8')
            token_corpus = nltk.word_tokenize(decode_corpus)

            if char == 'yes':
                token_corpus = []
                for words in decode_corpus:
                    for j in words:
                        token_corpus.append(j)


            if clean == 'yes':
                no_number_corpus = map(lambda x : x.translate('0123456789') , token_corpus)
                lower_corpus = map(lambda x : x.lower(), no_number_corpus)
                token_corpus = map(lambda x : re.sub(r'[^\w\s]','',x), lower_corpus)

            freq_corpus = nltk.FreqDist(token_corpus)

            sorted_corpus = sorted(freq_corpus.items(), key=lambda x: x[1], reverse=True)
            no_space_corpus =  filter(lambda x : len(x[0]) > 0, sorted_corpus)

            headers = ['word', 'frequency']
            df = pd.DataFrame(no_space_corpus, columns=headers)
            df['rank'] = df.index + 1

            return df
```

Questions Covered Below

- Question1: Read Data
- Question2: Read Corpus and tokenize
- Question3: Check Zipf Law, plot

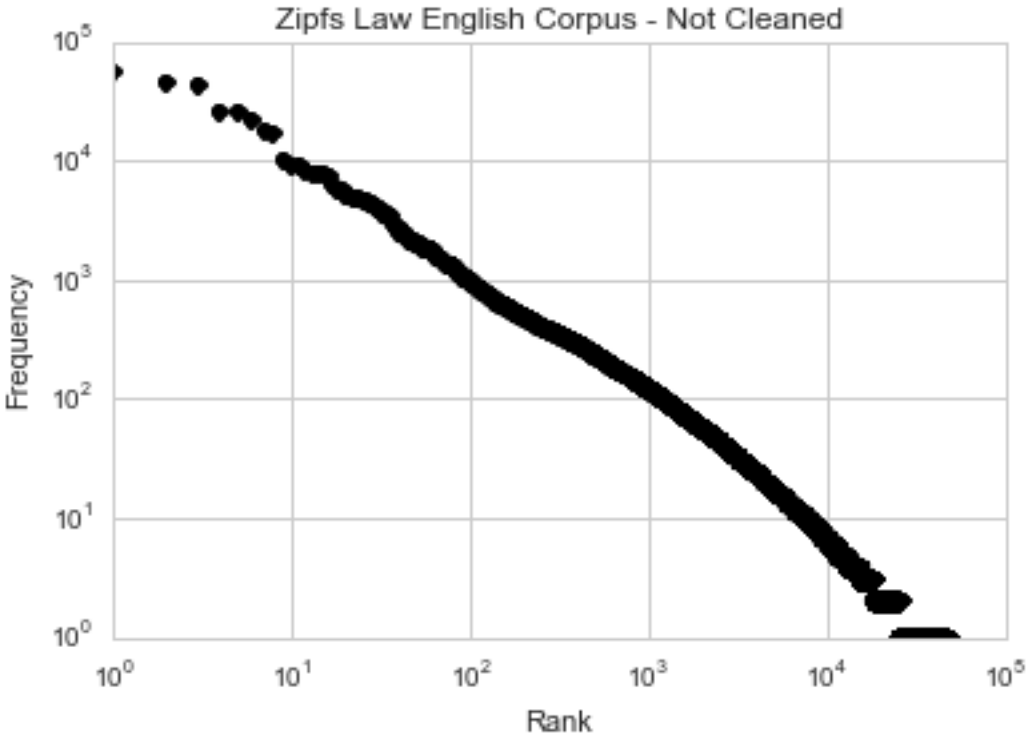
- Question4: Compute proportionality constant, deviation, average.
- Question5: Add more preprocssing steps like lowercase, punctuation and numbers
- Question6: Char Level Zipfs Law

```
In [9]: en_df = pre_process(en_corpus)
        es_df = pre_process(es_corpus)
        en_clean_df = pre_process(en_corpus, clean = 'yes')
        es_clean_df = pre_process(es_corpus, clean = 'yes')
        en_char_df = pre_process(en_corpus, char = 'yes')
        es_char_df = pre_process(es_corpus, char = 'yes')
```

Zipf Law f(x) = c * (rank + b) ^ a

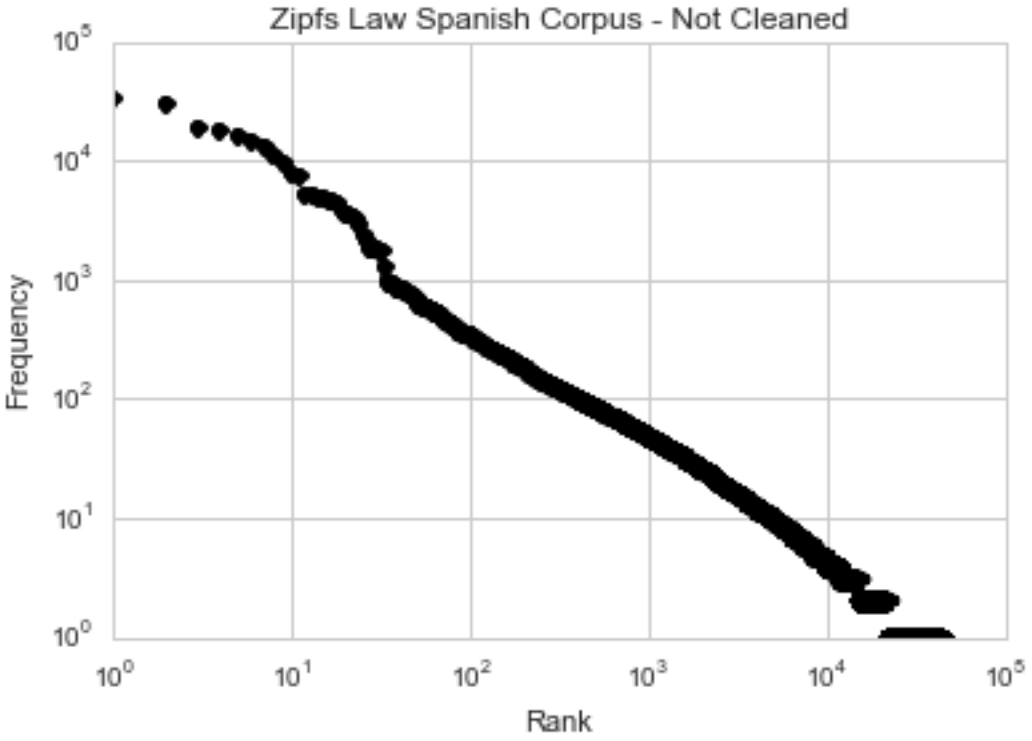
```
In [24]: plt.title('Zipfs Law English Corpus - Not Cleaned')
         plt.xlabel('Rank')
         plt.ylabel('Frequency')
         plt.yscale('log')
         plt.xscale('log')
         plt.plot(en_df['rank'], en_df['frequency'], 'ko')
```

```
Out[24]: [<matplotlib.lines.Line2D at 0x11cfb0410>]
```



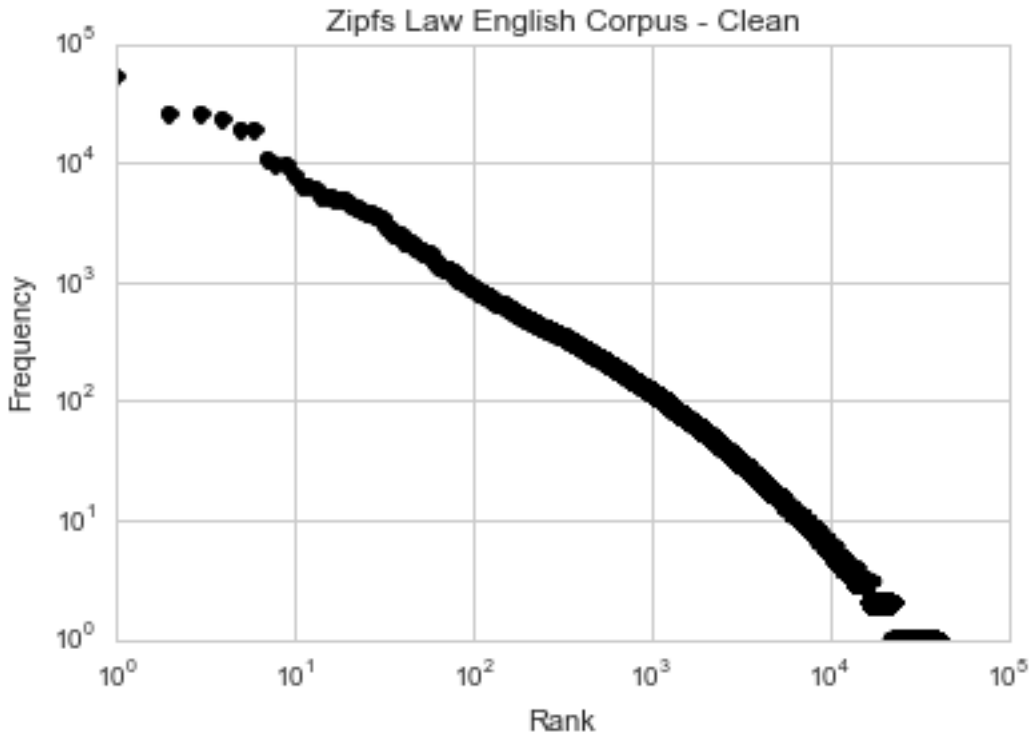

```
In [11]: plt.title('Zipfs Law Spanish Corpus - Not Cleaned')
         plt.xlabel('Rank')
         plt.ylabel('Frequency')
         plt.yscale('log')
         plt.xscale('log')
         plt.plot(es_df['rank'], es_df['frequency'], 'ko')
```

Out[11]: [<matplotlib.lines.Line2D at 0x11aaebe50>]



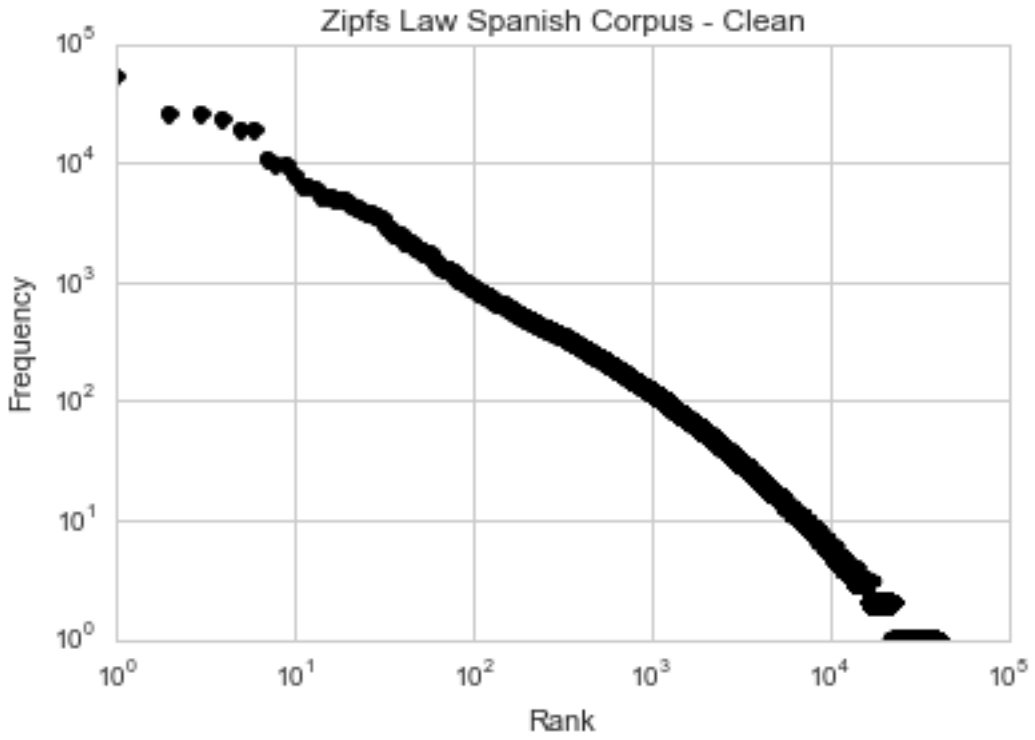
In [12]:
```
plt.title('Zipfs Law English Corpus - Clean')
plt.xlabel('Rank')
plt.ylabel('Frequency')
plt.yscale('log')
plt.xscale('log')
plt.plot(en_clean_df['rank'], en_clean_df['frequency'], 'ko')
```

Out[12]: [<matplotlib.lines.Line2D at 0x11afaf710>]



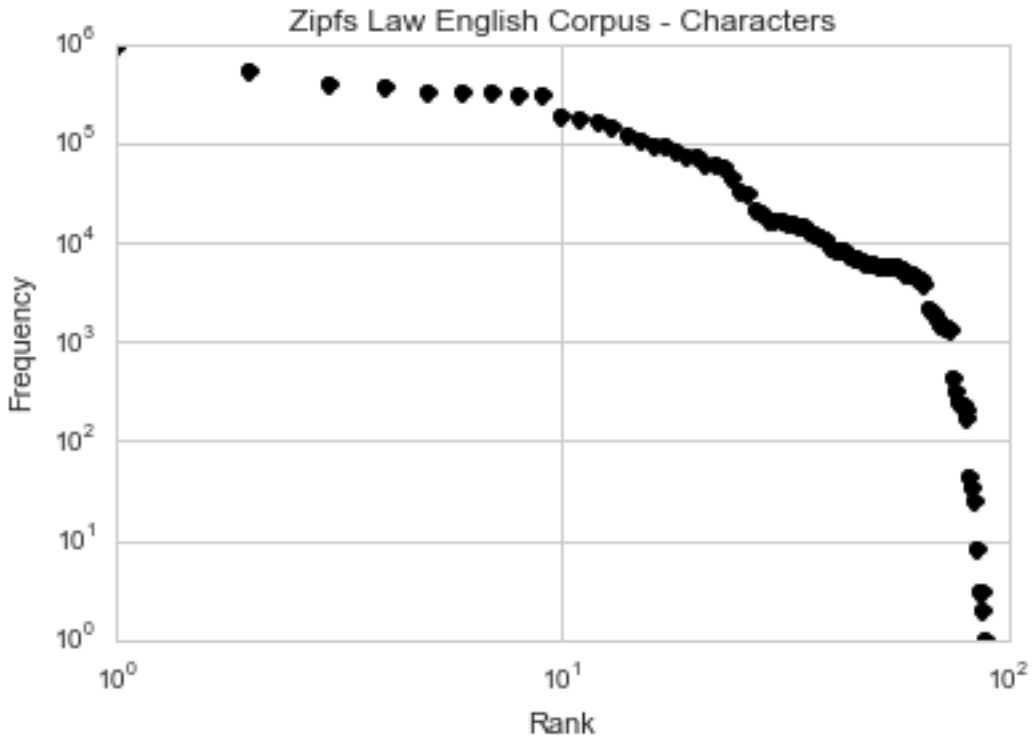

```
In [13]: plt.title('Zipfs Law Spanish Corpus - Clean')
         plt.xlabel('Rank')
         plt.ylabel('Frequency')
         plt.yscale('log')
         plt.xscale('log')
         plt.plot(en_clean_df['rank'], en_clean_df['frequency'], 'ko')
```

```
Out[13]: [<matplotlib.lines.Line2D at 0x11b226c50>]
```

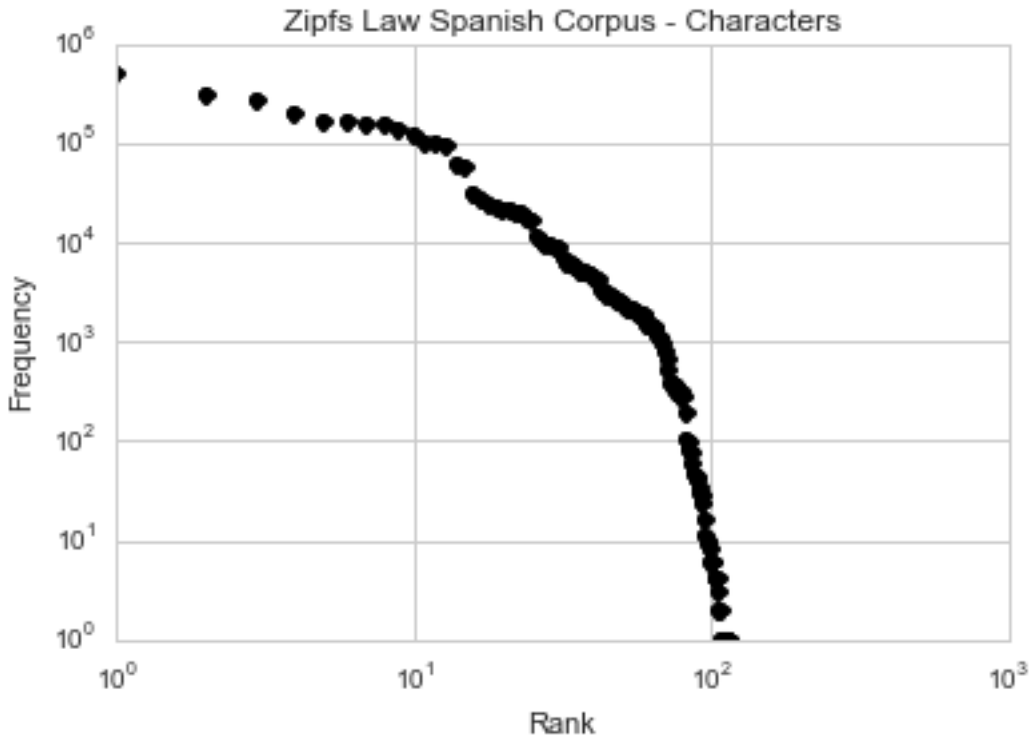



```
In [14]: plt.title('Zipfs Law English Corpus - Characters')
         plt.xlabel('Rank')
         plt.ylabel('Frequency')
         plt.yscale('log')
         plt.xscale('log')
         plt.plot(en_char_df['rank'], en_char_df['frequency'], 'ko')
```

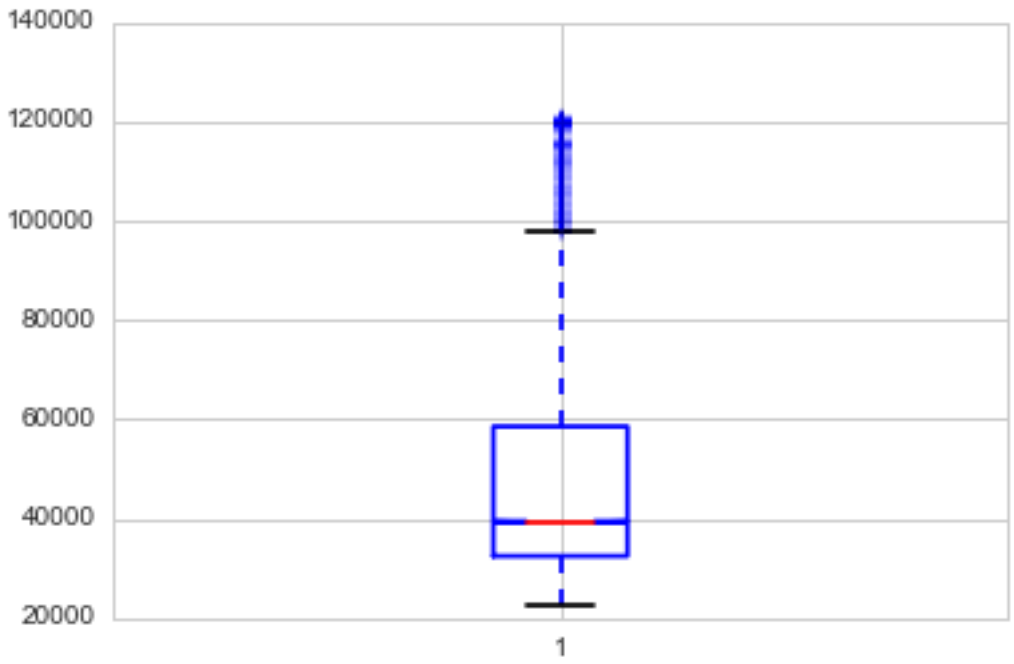
```
Out[14]: [<matplotlib.lines.Line2D at 0x11b98f3d0>]
```




```
In [15]: plt.title('Zipfs Law Spanish Corpus - Characters')
         plt.xlabel('Rank')
         plt.ylabel('Frequency')
         plt.yscale('log')
         plt.xscale('log')
         plt.plot(es_char_df['rank'], es_char_df['frequency'], 'ko')

Out[15]: [<matplotlib.lines.Line2D at 0x11ced3210>]
```

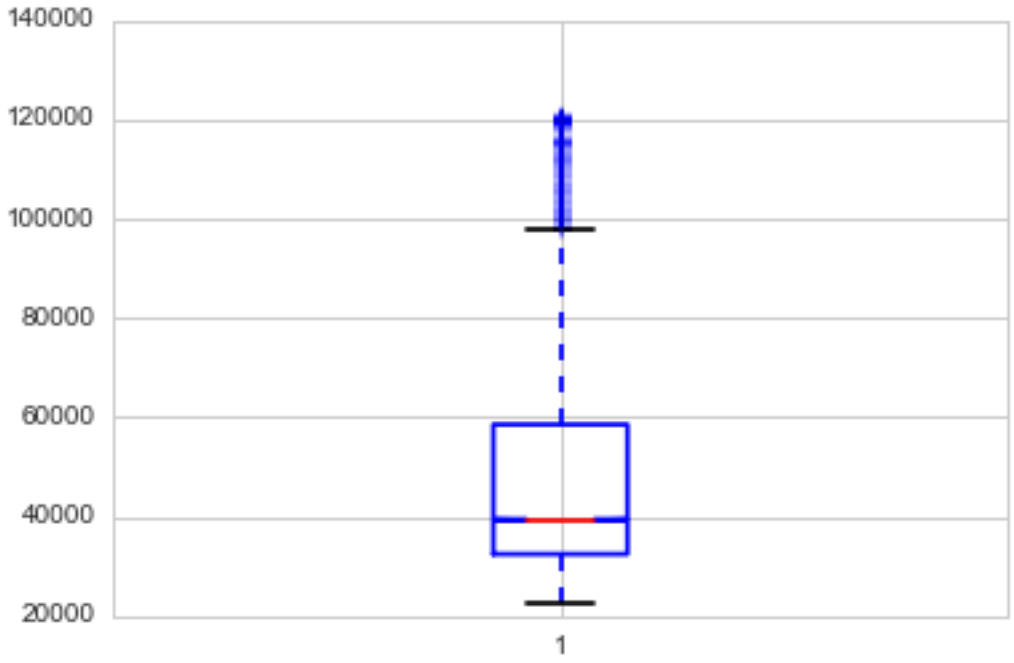



```
In [27]: en_clean_df['K'] = en_clean_df['frequency']*en_clean_df['rank']
         es_clean_df['K'] = es_clean_df['frequency']*es_clean_df['rank']

In [38]: plt.boxplot(en_clean_df['K'],'-')
         print "Boxplot English Corpus K"

Boxplot English Corpus K
```




```
In [37]: plt.boxplot(en_clean_df['K'],'-')
         print "Boxplot Spanish Corpus K"
```

```
Boxplot Spanish Corpus K
```



```
In [39]: en_clean_df['K'].describe()

Out[39]: count     39930.000000
         mean      49018.568695
         std       24328.985981
         min       22497.000000
         25%       32479.250000
         50%       39406.000000
         75%       58563.750000
         max      121500.000000
         Name: K, dtype: float64

In [40]: es_clean_df['K'].describe()

Out[40]: count    38376.000000
         mean     35337.260658
         std       8185.550050
         min      20206.000000
         25%      29282.000000
         50%      35091.500000
         75%      40854.000000
         max      70532.000000
         Name: K, dtype: float64

In [50]: en_char_df['K'] = en_char_df['frequency']*en_char_df['rank']
         es_char_df['K'] = es_char_df['frequency']*es_char_df['rank']
         print en_char_df['K'].describe(), "\n##############\n", es_char_df['K'].describe()

count         89.000000
mean      621047.224719
std       656906.877798
min           89.000000
25%       136077.000000
50%       311490.000000
75%      1038168.000000
max      2637441.000000
Name: K, dtype: float64
##############
count       115.000000
mean      222734.373913
std       318760.200905
min          109.000000
25%         5662.000000
50%       107502.000000
75%       268026.000000
max      1185456.000000
Name: K, dtype: float64
```

0.1 Results

In this exercise we computed the frequency and rank for an english and a spanish corpus. We treated the corpus with different methods in order to tokenize them first by word (clean and unclean), and later on by characters. By plotting frequency vs. rank, we discover an exponentially decreasing curve for each of them, which represents the distribution of words in a corpus. We computed the log-log plot in order to see weather or not these distribution follows the Zipf's law, and found really interesting results.

By Zipf's law is stated that the Frequency of a word is inversely proportional to its rank in the frequency table. This was prooven by our plots since what it appeared to be an exponential curve, turned into an almost straight line for both spanish and english word tokens. We also to model the K given the formula: $f = K/r$. We ended up having as results a big variance, which can be due to the many words with frequency 1.

By realizing this exercise we can really believe that both english and spanish language follow the empiric law of Zipf's law. These results can not be stated for the character tokenization level, in this case, it does not appear to follow the Zipf's law.

In [ ]: