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In [154]:
```
%matplotlib inline
from scipy.optimize import curve_fit
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import math
sns.set_style("darkgrid")
```

Pre Prcessing Steps Done:

- Create index using novels corpus.
- Use the java program `CountWords3.java` to get all the terms in novels corpus contains with their counts.
- Remove Numbers
- Remove Urls
- Remove Dates
- Remove long tail of 1s

In [155]:
```
header_row = ['word','frequency']
data = pd.read_table('../Data/CountWordsNovels_v1.txt', sep =' ',names=header_row)
# Add plus 1 to the rank since index starts from 0
data['rank'] = data.index + 1
data.head()
```

Out[155]:

	word	frequency	rank
0	i	37789	1
1	he	27976	2
2	his	27824	3
3	had	20869	4
4	you	17540	5

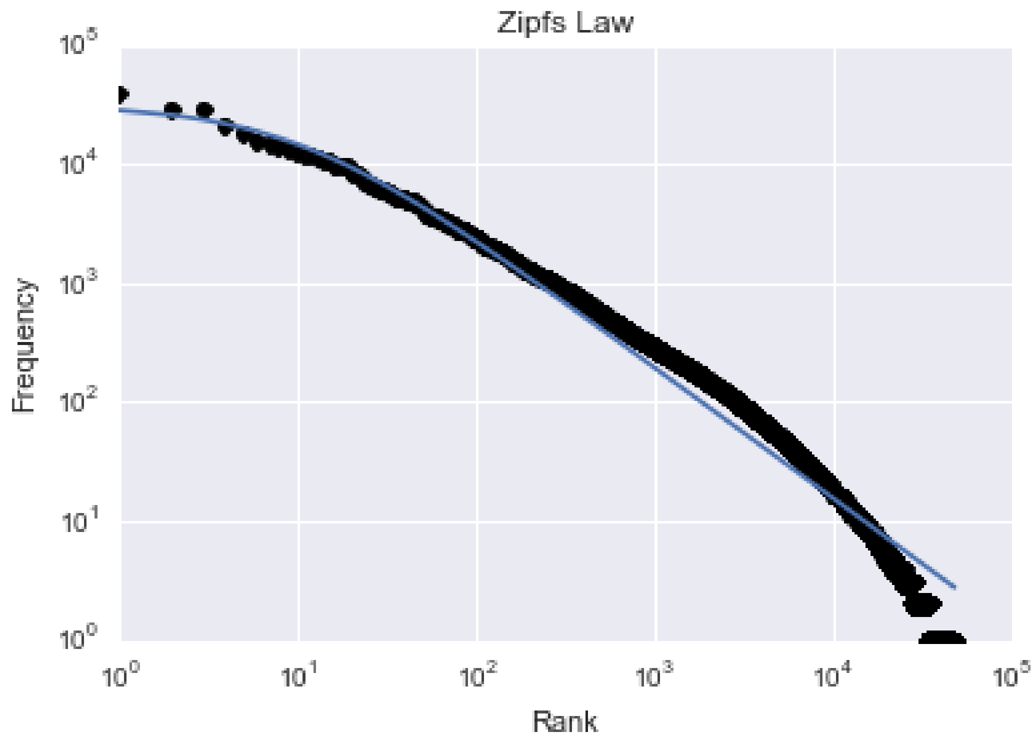
Zips Law
`f(x) =  c * (rank + b) ^ a`
We checked different values for parameter `b` to estimate the best value for our model.

In [156]:
```
def zipf(rank,c,b,a):
    # Hardcoded the value of b as 5, (using b instead of 5 curve fit give us invalid values)
    return c * (rank + 10) ** a
popt, pcov = curve_fit(zipf, data['rank'], data['frequency'])
```

In [157]:
```
plt.title('Zipfs Law ')
plt.xlabel('Rank')
plt.ylabel('Frequency')
plt.yscale('log')
```

```
plt.xscale('log')
plt.plot(data['rank'], data['frequency'], 'ko')
plt.plot(data['rank'], zipf(data['rank'],*popt))
```

Out[157]: [<matplotlib.lines.Line2D at 0x1137aa550>]



In [158]:
```
print "Estimated Values \na =", popt[0],"\nb =", 10,"\nc =", popt[2]
```

```
Estimated Values
a = 394749.592424
b = 10
c = -1.10008529515
```

Most Frequent terms and the tail are noisy, even though the model fits the data and satisfies Zips Law.
Heaps Law
d = k * N ˆ beta

Pre Prcessing Steps Done:

- Create indices containing different numbers of novels 5,10,15,20,25,30,33
- Use the java program `CountWords3.java` to count the total number of words in each index, and the number of different words in each.
- Summarize this result in `Occurences.txt`.

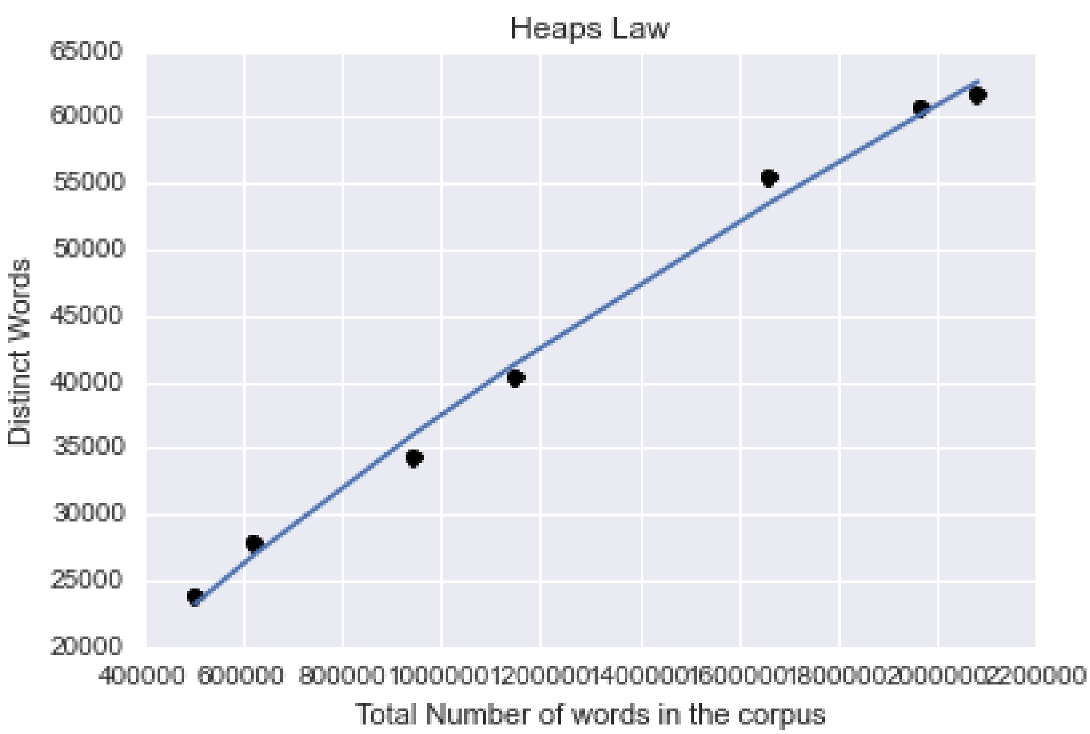
In [159]:
```
heaps_data = pd.read_table('../Data/Occurences.txt', sep =',')
heaps_data.head()
```

```
Out[159]:    Number of novels  Distinct words  Word occurrences
          0                 5           23866            504762
          1                10           27827            622554
          2                15           34224            947652
          3                20           40351           1146950
          4                25           55392           1661664
```

```
In [160]: def heaps(x, K, b):
              return K * x ** b
          popt1, pcov1 = curve_fit(heaps, heaps_data['Word occurrences'], heaps_data['Distinct words'])
```

```
In [161]: plt.title('Heaps Law')
          plt.ylabel('Distinct Words')
          plt.xlabel('Total Number of words in the corpus')
          plt.plot(heaps_data['Word occurrences'], heaps_data['Distinct words'], 'ko')
          plt.plot(heaps_data['Word occurrences'], heaps(heaps_data['Word occurrences'],*popt1))
```

```
Out[161]: [<matplotlib.lines.Line2D at 0x1173b3990>]
```




```
In [162]: print "Estimated Values \nk = ", popt1[0],"\nbeta =", popt1[1]
```

```
Estimated Values
k =  2.34317753123
beta = 0.700676171957
```

Our model fits the data well and satisfies Heaps Law.