Russell Frank October 7, 2013

Data Science HW 1

1a	2
1b	2
1c	2
1d	2
1e	2
1f	2
1h	3
1i	3
2	3
3	3
4	4
5	4
6	4
7	4

1a.

producer	nominal
release_to_review_time	interval
rating	ordinal
helpfulness	ratio
number_of_votes	ratio
length_of_review_text	ratio

1b. Apple.

1c. 52.9681794471

1d. 52.9681794471

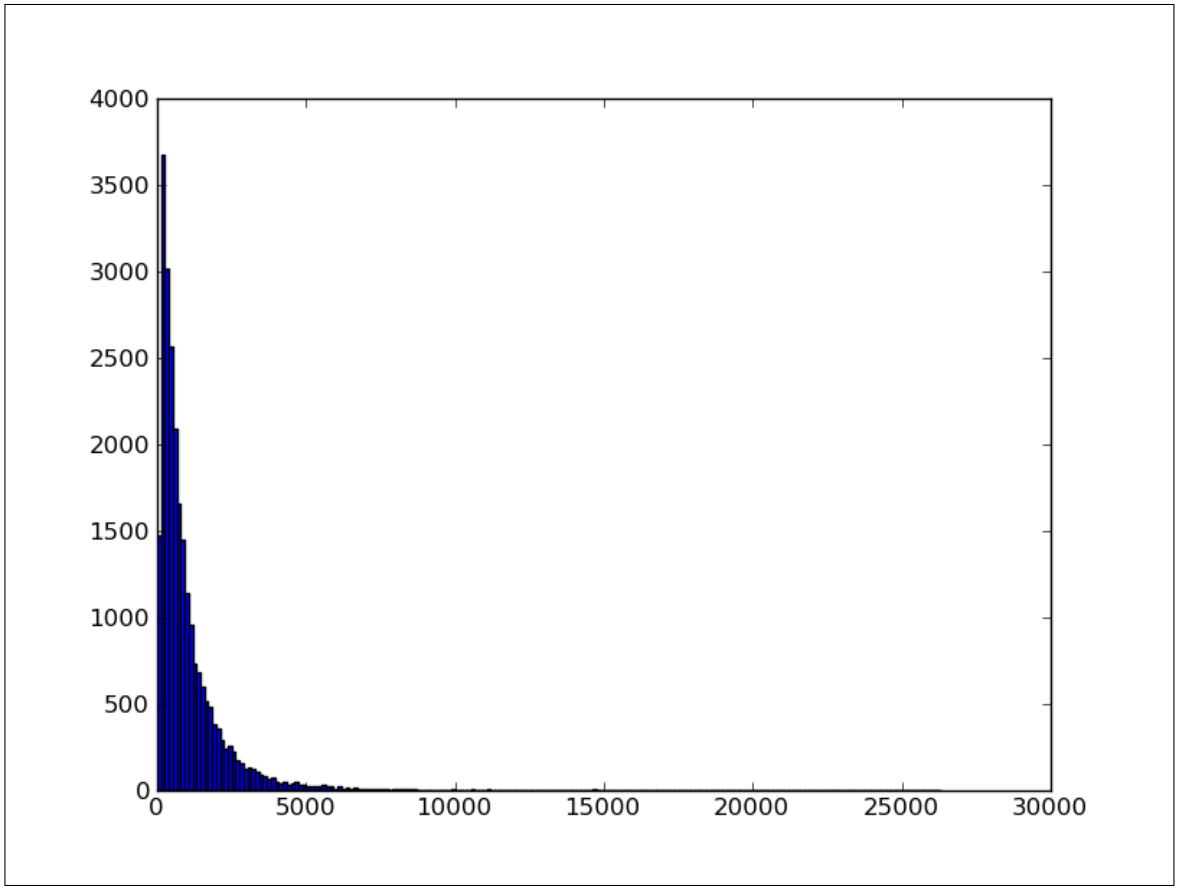
1e.

min	-537
Q1	75.0
median	144
Q3	290.0
max	11686

The interquartile ranges are 215.

A box and whisker plot is a nice way to show quartiles.

1f.



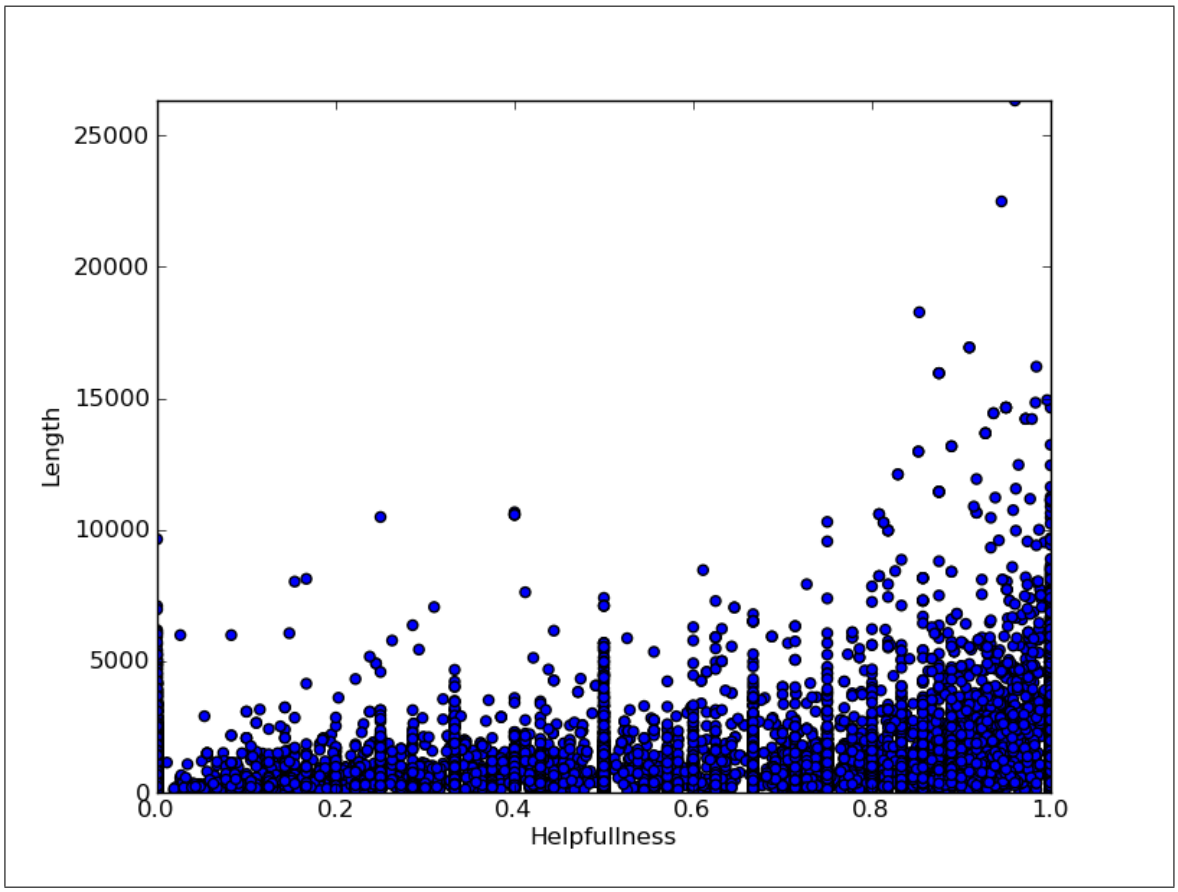
1g. Yes, it is obviously skewed, looking at the histogram.
'Sony', '1516', '0', '0', '5', '0.96', '25', '26332'
'Asus', '101', '0', '1', '5', '0.945', '128', '22492'

'Lenovo', '231', '0', '0', '3', '0.853', '34', '18275'

1h. 0.25054940649068008

So, there is a correlation between the length of reviews and their helpfullness. In general, lengthier reviews are more helpful. Shorter reviews don't have enough information to be helpful.

1i.



2.

$w = 0.216, x = 0.064$
$y = 0.84, z = 0.64$

We went over the theorems regarding AND and OR constructions for families of hash functions in class.

3a.

$u = [1, -1, 1]$
$v = [1, -1, 1]$
$w = [-1, 1, 1]$

Basically, each bit in the sketch is 1 if the dot product between the vector in question and the hyperplane is > 0 and -1 if the dot product is < 0.

3b.

Similarity sketch(u) sketch(v): 1.0
Similarity sketch(u) sketch(w): -0.333333333333

4a.

The Mahalanobis distance reduces to the Euclidean distance when the covariance matrix is the identity. This is the case when the covariance is 0 between each different random variable, and obviously the ones on the diagonal correspond to the covariance between a random variable and itself, which is 1.

4b.
When the covariance matrix is a diagonal matrix, the Mahalanobis distance reduces to the normalized Euclidean distance. In this case, we have random variables which have some differing variance; and the normalized Euclidean distance is exactly what it sounds like: a normalized distance. The inverse of this diagonal matrix is therefore going to be $\frac{1}{\delta}$, where δ is the variance of the corresponding variable. Since it's in the denominator, it ends up dividing each component of the distance, resulting in a normalized distance.

5a.

Signature of document 1 : 5 2 0
Signature of document 2 : 1 2 1
Signature of document 3 : 1 2 4
Signature of document 4 : 1 2 0

5b. Only the last function is a true permutation.

5c.

s 1 and s 2 estimation 0.333333333333 actual 0.0
s 1 and s 3 estimation 0.333333333333 actual 0.0
s 1 and s 4 estimation 0.666666666667 actual 0.25
s 2 and s 3 estimation 0.666666666667 actual 0.0
s 2 and s 4 estimation 0.666666666667 actual 0.25
s 3 and s 4 estimation 0.666666666667 actual 0.25

6.

A
and Mrs. Dursely
of number four
to say that
that they were
B
for the first
the first time
an argument had
at number four

The jaccard similarity is 0. There is no intersection of the shingles.

7. The logit function transforms values in the range 0 to 1 to the entire real line.