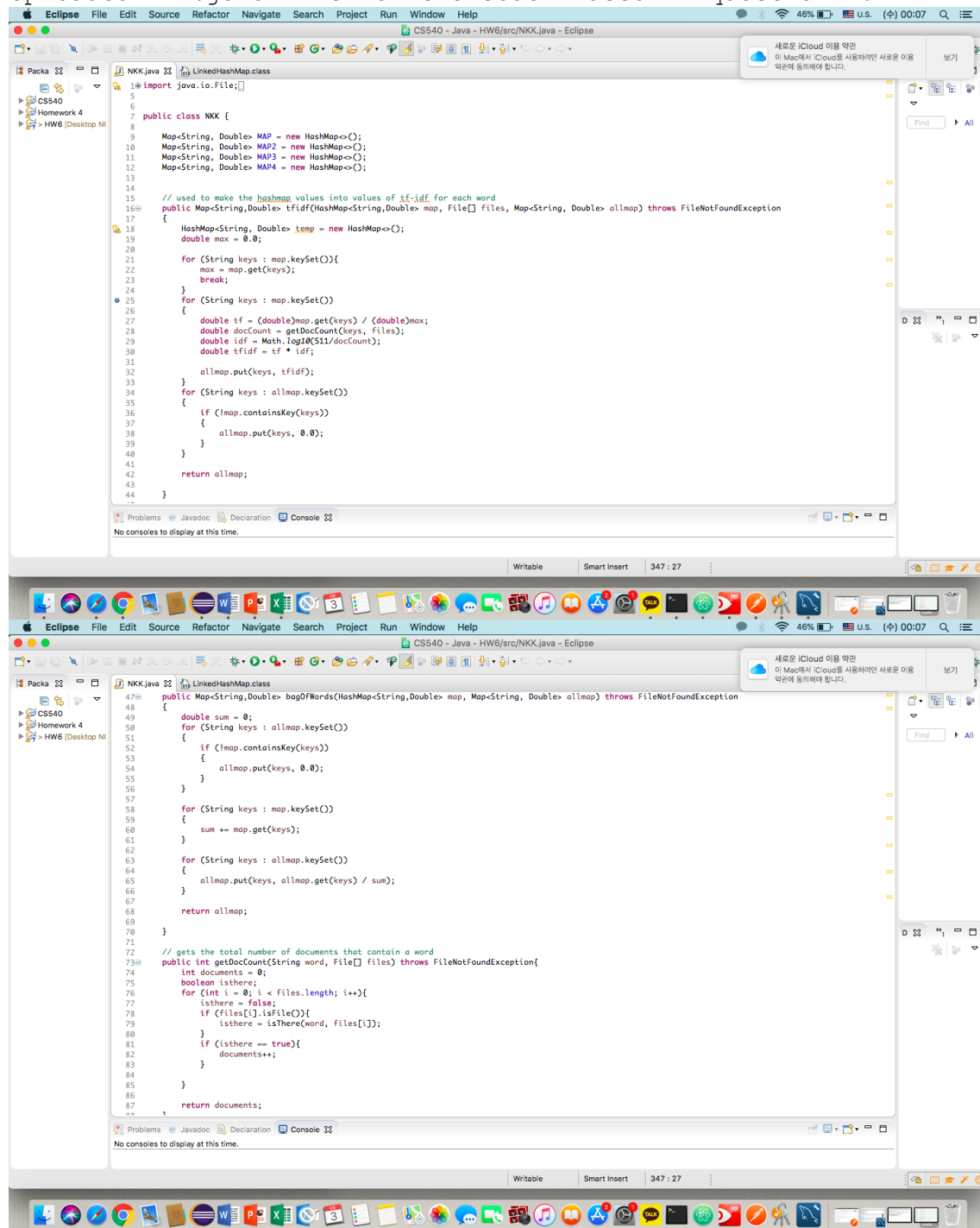


HW6

Uploaded nkk.java file for the code I used in question 1.



```
1 import java.io.File;
2
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6
7 public class NKK {
8
9     Map<String, Double> MAP = new HashMap<>();
10    Map<String, Double> MAP2 = new HashMap<>();
11    Map<String, Double> MAP3 = new HashMap<>();
12    Map<String, Double> MAP4 = new HashMap<>();
13
14
15    // used to make the hashmap values into values of tf-idf for each word
16    public Map<String, Double> tfidf(HashMap<String, Double> map, File[] files, Map<String, Double> allmap) throws FileNotFoundException {
17        HashMap<String, Double> temp = new HashMap<>();
18        double max = 0.0;
19
20        for (String keys : map.keySet()) {
21            max = map.get(keys);
22            break;
23        }
24        for (String keys : map.keySet()) {
25            double tf = (double)map.get(keys) / (double)max;
26            double docCount = getDocCount(keys, files);
27            double idf = Math.log(511/docCount);
28            double tfidf = tf * idf;
29
30            allmap.put(keys, tfidf);
31        }
32        for (String keys : allmap.keySet()) {
33            if (!map.containsKey(keys)) {
34                allmap.put(keys, 0.0);
35            }
36        }
37        return allmap;
38    }
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48    public Map<String, Double> bagOfWords(HashMap<String, Double> map, Map<String, Double> allmap) throws FileNotFoundException {
49        double sum = 0;
50        for (String keys : allmap.keySet()) {
51            if (!map.containsKey(keys)) {
52                allmap.put(keys, 0.0);
53            }
54        }
55        for (String keys : map.keySet()) {
56            sum += map.get(keys);
57        }
58        for (String keys : allmap.keySet()) {
59            allmap.put(keys, allmap.get(keys) / sum);
60        }
61        return allmap;
62    }
63
64
65    // gets the total number of documents that contain a word
66    public int getDocCount(String word, File[] files) throws FileNotFoundException {
67        int documents = 0;
68        boolean isThere;
69        for (int i = 0; i < files.length; i++) {
70            isThere = false;
71            if (files[i].isFile()) {
72                isThere = isThere(word, files[i]);
73            }
74            if (isThere == true) {
75                documents++;
76            }
77        }
78        return documents;
79    }
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2
```

The screenshot shows the Eclipse IDE with the file `NKK.java` open. The `isThere` method is implemented using a `Scanner` to read lines from a file and a nested loop to check for a word. The `makeDict` method is also shown, using a `HashMap` to store word frequencies.

```
89
90 // returns true if a word is present in the document
91 public boolean isThere(String word, File file) throws FileNotFoundException
92 {
93     boolean isThere = false;
94
95     Scanner scr = new Scanner(file);
96     while (scr.hasNextLine()) {
97         String[] line = scr.nextLine().split(" ");
98         for (int i = 0; i < line.length; i++)
99         {
100             String s = line[i];
101             if (s.equals(word))
102             {
103                 isThere = true;
104                 break;
105             }
106         }
107     }
108     return isThere;
109 }
110
111 // make a dictionary with key value pairs for each of the files
112 public void makeDict(File file) throws FileNotFoundException
113 {
114     Scanner scr = new Scanner(file);
115     while (scr.hasNextLine()) {
116         String[] line = scr.nextLine().split(" ");
117         for (int i = 0; i < line.length; i++)
118         {
119             String s = line[i];
120             if (!MAP.containsKey(s))
121             {
122                 MAP.put(s, 1.0);
123             }
124             else
125             {
126                 MAP.put(s, MAP.get(s) + 1);
127             }
128         }
129     }
130 }
```

The screenshot shows the Eclipse IDE with the file `NKK.java` open. The `isThere` method has been refactored to use a `HashMap` to store word frequencies. The `makeDict` method is also shown, using a `HashMap` to store word frequencies.

```
120
121 for (int i = 0; i < line.length; i++)
122 {
123     String s = line[i];
124     if (!MAP.containsKey(s))
125     {
126         MAP.put(s, 1.0);
127     }
128     else
129     {
130         MAP.put(s, MAP.get(s) + 1);
131     }
132 }
133
134 // same thing but saves it into another variable, i know this is bad code but time has limited me from making it more optimal
135 public void makeDict2(File file) throws FileNotFoundException
136 {
137     Scanner scr = new Scanner(file);
138     while (scr.hasNextLine()) {
139         String[] line = scr.nextLine().split(" ");
140         for (int i = 0; i < line.length; i++)
141         {
142             String s = line[i];
143             if (!MAP2.containsKey(s))
144             {
145                 MAP2.put(s, 1.0);
146             }
147             else
148             {
149                 MAP2.put(s, MAP2.get(s) + 1);
150             }
151         }
152     }
153 }
154
155 // also the same
156 }
```

```
Eclipse File Edit Source Refactor Navigate Search Project Run Window Help
CS540 - Java - HW6/src/NKK.java - Eclipse

Packa  NKK.java  LinkedHashMap.class
160 // also the same
161 public void makeDict3(File file) throws FileNotFoundException
162 {
163     Scanner scr = new Scanner(file);
164     while (scr.hasNextLine()) {
165         String[] line = scr.nextLine().split(" ");
166         for (int i = 0; i < line.length; i++)
167         {
168             String s = line[i];
169             if (!MAP3.containsKey(s))
170             {
171                 MAP3.put(s, 1.0);
172             }
173             else
174             {
175                 MAP3.put(s, MAP3.get(s) + 1);
176             }
177         }
178     }
179 }
180 // also the same
181 public void makeDict4(File file) throws FileNotFoundException
182 {
183     Scanner scr = new Scanner(file);
184     while (scr.hasNextLine()) {
185         String[] line = scr.nextLine().split(" ");
186         for (int i = 0; i < line.length; i++)
187         {
188             String s = line[i];
189             if (!MAP4.containsKey(s))
190             {
191                 MAP4.put(s, 1.0);
192             }
193             else
194             {
195                 MAP4.put(s, MAP4.get(s) + 1);
196             }
197         }
198     }
199 }
200 }

Problems Javadoc Declaration Console
No consoles to display at this time.
```

```
Eclipse File Edit Source Refactor Navigate Search Project Run Window Help
CS540 - Java - HW6/src/NKK.java - Eclipse

Packa  NKK.java  LinkedHashMap.class
282 public static void main(String args[]) throws FileNotFoundException {
283     int count = 0;
284     File folder = new File("/Users/StevenChoi/Desktop/news");
285     File[] listOffiles = folder.listFiles();
286     NKK a = new NKK();
287
288     // reads each file from the folder and makes a dictionary for them
289     for (int i = 0; i < listOffiles.length; i++)
290     {
291         if (listOffiles[i].getName().equals("098.txt"))
292         {
293             a.makeDict2(listOffiles[i]);
294         }
295         if (listOffiles[i].getName().equals("297.txt"))
296         {
297             a.makeDict3(listOffiles[i]);
298         }
299         a.makeDict(listOffiles[i]);
300         a.makeDict4(listOffiles[i]);
301     }
302
303     // bagOfWords representation for cosine similarity
304     HashMap<String, Double> sorted = new HashMap<>();
305     sorted = a.sortMap(a.MAP2);
306     Map<String, Double> tf = new HashMap<>();
307     tf = a.bagOfWords(sorted, a.MAP3);
308     HashMap<String, Double> sorttf = a.sortMapDouble(tf);
309
310     HashMap<String, Double> sorted2 = new HashMap<>();
311     sorted2 = a.sortMap(a.MAP3);
312     Map<String, Double> tf2 = new HashMap<>();
313     tf2 = a.bagOfWords(sorted2, a.MAP4);
314     HashMap<String, Double> sorttf2 = a.sortMapDouble(tf2);
315
316     double sim = cosineSimilarity(sorttf, sorttf2);
317     System.out.println(sim);
318
319     // tf-idf representation for cosine similarity
320     HashMap<String, Double> sorted = new HashMap<>();
321
322 }
```

Eclipse File Edit Source Refactor Navigate Search Project Run Window Help

CS540 - Java - HW6/src/NKK.java - Eclipse

새로운 iCloud 이용 약관
이 Mac에서 iCloud를 사용하려면 새로운 이용
약관에 동의해야 합니다.

Find All

LinkedHashMap class

```
241 public HashMap<String, Double> sortMapDouble(Map<String, Double> map)
242 {
243     List<Map.Entry<String, Double>> list = new LinkedList<Map.Entry<String, Double>>(map.entrySet());
244
245     Collections.sort(list, new Comparator<Map.Entry<String, Double>>() {
246         public int compare(Map.Entry<String, Double> o1,
247                             Map.Entry<String, Double> o2)
248         {
249             return (o2.getValue()).compareTo(o1.getValue());
250         }
251     });
252
253     HashMap<String, Double> temp = new LinkedHashMap<String, Double>();
254     for (Map.Entry<String, Double> as : list) {
255         temp.put(as.getKey(), as.getValue());
256     }
257     return temp;
258 }
259
260 // function to get the cosine similarity
261 public static double cosineSimilarity(Map<String, Double> map1, Map<String, Double> map2)
262 {
263     double sum = 0.0;
264     double normA = 0.0;
265     double normB = 0.0;
266
267     for (int i = 0; i < map1.size(); i++){
268         Object key1 = map1.keySet().toArray()[i];
269         Object key2 = map2.keySet().toArray()[i];
270         double val1 = map1.get(key1);
271         double val2 = map2.get(key2);
272         sum += val1 * val2;
273         normA += Math.pow(map1.get(key1), 2);
274         normB += Math.pow(map2.get(key2), 2);
275     }
276
277     return sum / (Math.sqrt(normA) * Math.sqrt(normB));
278 }
279
280
281
```

Problems Javadoc Declaration Console

No consoles to display at this time.

Writable Smart Insert 347 : 27

Eclipse File Edit Source Refactor Navigate Search Project Run Window Help

CS540 - Java - HW6/src/NKK.java - Eclipse

새로운 iCloud 이용 약관
이 Mac에서 iCloud를 사용하려면 새로운 이용
약관에 동의해야 합니다.

Find All

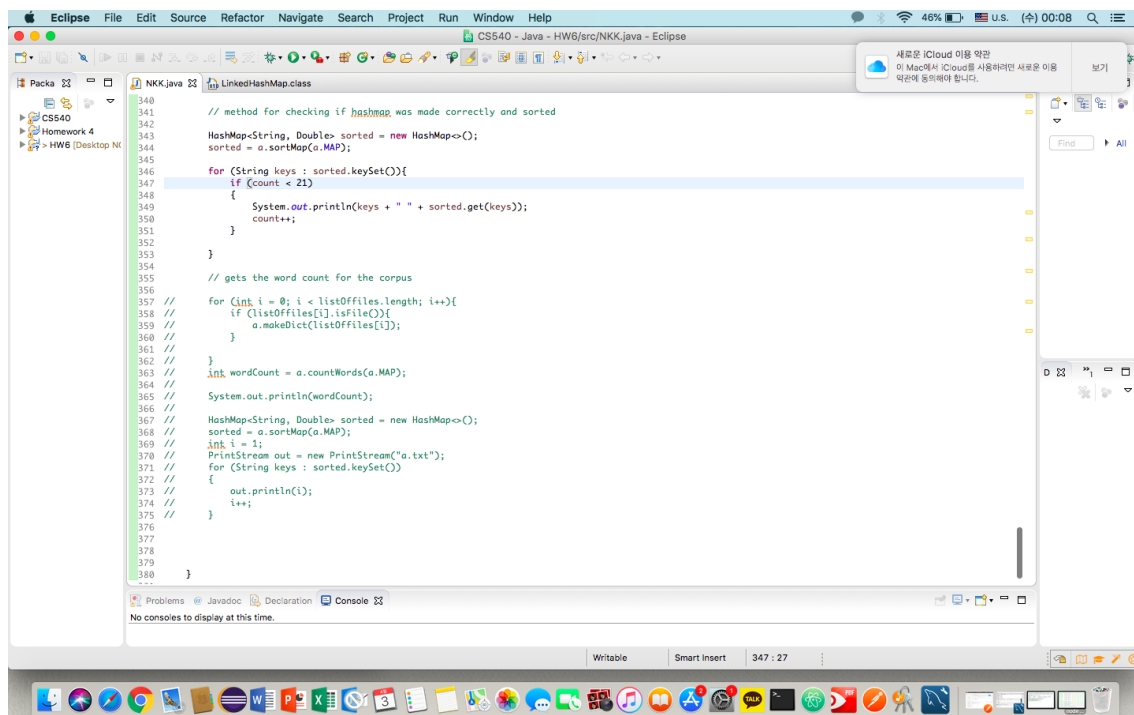
LinkedList class

```
301 }
302
303 // bagOfWords representation for cosine similarity
304 HashMap<String, Double> sorted = new HashMap<>();
305 sorted = a.sortMap(a.MAP2);
306 Map<String, Double> tf = new HashMap<>();
307 tf = a.bagOfWords(sorted, a.MAP3);
308 HashMap<String, Double> sorttf = a.sortMapDouble(tf);
309
310 HashMap<String, Double> sorted2 = new HashMap<>();
311 sorted2 = a.sortMap(a.MAP3);
312 Map<String, Double> tf2 = new HashMap<>();
313 tf2 = a.bagOfWords(sorted2, a.MAP4);
314 HashMap<String, Double> sorttf2 = a.sortMapDouble(tf2);
315
316 double sim = cosineSimilarity(sorttf, sorttf2);
317 System.out.println(sim);
318
319
320 // tf-idf representation for cosine similarity
321 HashMap<String, Double> sorted = new HashMap<>();
322 sorted = a.sortMap(a.MAP2);
323 Map<String, Double> tf = new HashMap<>();
324 tf = a.tfidf(sorted, listOffiles, a.MAP);
325 // tf = a.tfidf(sorted, listOffiles, a.MAP);
326 HashMap<String, Double> sorttf = a.sortMapDouble(tf);
327
328 HashMap<String, Double> sorted2 = new HashMap<>();
329 sorted2 = a.sortMap(a.MAP3);
330 Map<String, Double> tf2 = new HashMap<>();
331 tf2 = a.tfidf(sorted2, listOffiles, a.MAP4);
332 HashMap<String, Double> sorttf2 = a.sortMapDouble(tf2);
333
334 double sim = cosineSimilarity(sorttf, sorttf2);
335 System.out.println(sim);
336
337
338
339
340 // method for checking if hashmap was made correctly and sorted
341
```

Problems Javadoc Declaration Console

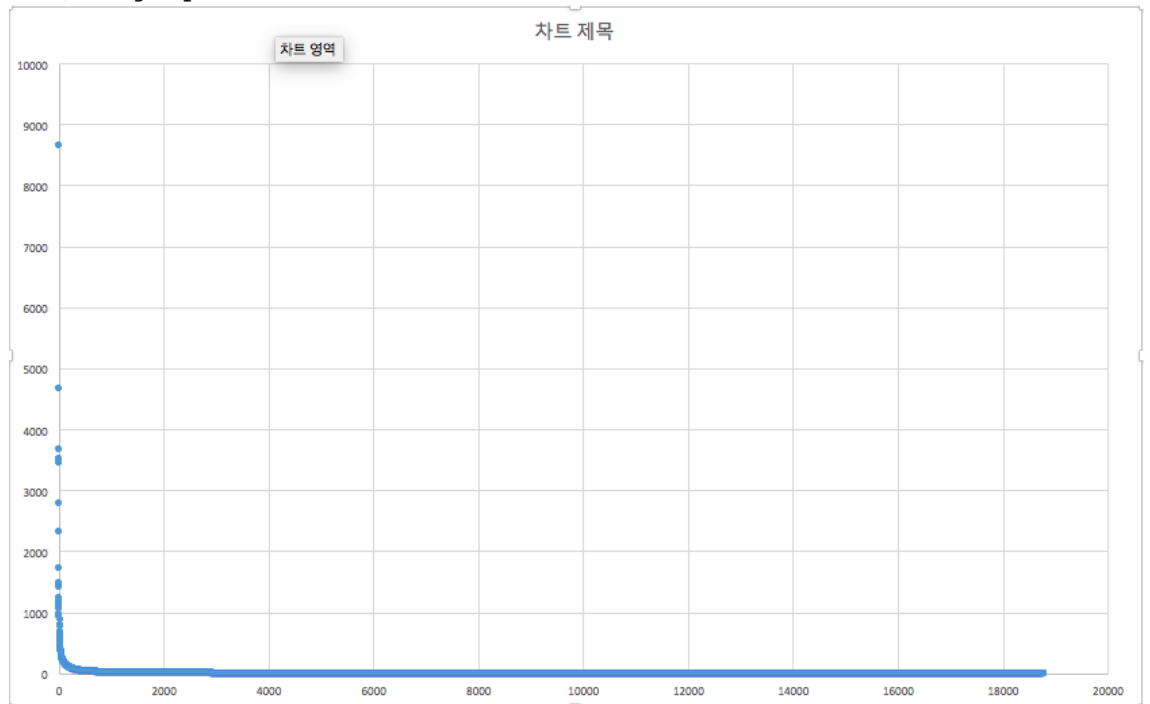
No consoles to display at this time.

Writable Smart Insert 347 : 27

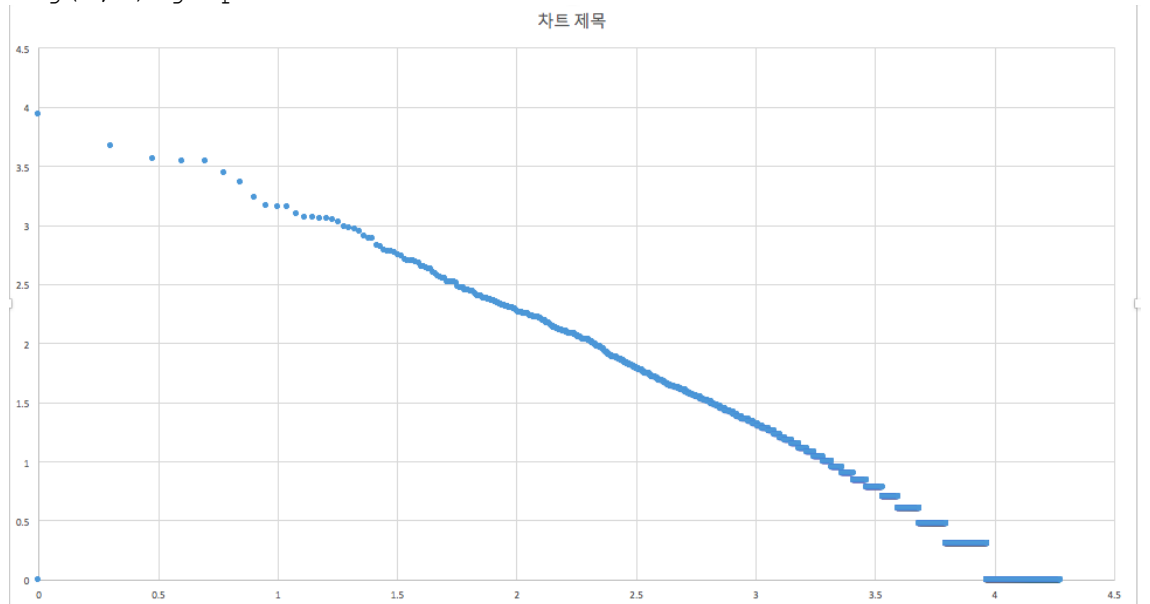


```
1. Computer word types : 18788
   Computer word tokens : 170581
2. the 8651
   to 4663
   a 3673
   in 3521
   and 3446
   of 2792
   for 1771
   is 1470
   on 1432
   was 1421
   he 1244
   with 1166
   have 1152
   at 1137
   I 1126
   his1 111
   that 1060
   has 965
   be 950
   but 931
```

3. (r,c) graph



log(r,c) graph



the shape of the graph with raw data is fairly simple with it descending as the rank gets lowered, however, without a large graph it is hard to look at the trends and statistics of the graph since it follows a raw form.

With the graph with the log of data, the plot points have more range and is easier to see the trends of the graph rather than looking at the graph is the raw data. The log

graph shows more variety and trends by graphing the log of data rather than the raw data itself.

4. contract = 0.5473102011324538

Ronaldo
contract
United
World.
tomorrow.
first-team.
Trafford.
five-year-deal,
knows,"
club.
knows
"Nobody
resolved
agreeing
star,
sides."
renew
future."
News
Portugal

5. bag of words = 0.9988489496852295
tf-idf = 0.9886336595935993

the values are different because for bag of words, it corresponds to the word count / total word count of that document, whereas the tf-idf value corresponds to how important a word in that document is for the entire corpus, therefore since the two values correspond to different aspects of the corpus and the documents, they are different.

6. The first major issue with my computer words is that I didn't eliminate any periods, commas, or quotations that would make the words more unique when I. and I is actually the same word.

The second major issue with my computer words is that I did not eliminate any articles and useless words such as, the, a, and, it, and other irrelevant particles that will just add up the word count and other data forms in the corpus. Only accounting the specific words that matter should allow us to have more exact data without any irrelevant elements inside it.

QUESTION 2

Used excel commands to find the required data with the given data.

For question 1, used average() and stdev commans

For question 2 I used the data from question 1 as well as the given data to get the centered and normalized data using the formula. Then, I used excel visual basic to get the eigenvectors and eigenvalues.

For question 4, I used the normalized data of the cars to create a covariance matrix and used the MMULT() excel command to get the product of the first two eigenvectors. Then, I made the graph with the output.

1. 11 dimensions

mean of retail: 32511.3314

mean of horsepower: 213.2191

2. **first** **second** **third**

eigenvalue	7.1673	1.8266	0.8345
Retail(\$)	0.2753	0.4441	0.2590
Dealer(\$)	0.2735	0.4463	0.2615
Engine(L)	0.3452	-0.0135	0.0644
Cylinders	0.3329	0.0928	0.1161
Horsepower	0.3190	0.2805	0.0945
CityMPG	-0.3079	-0.0165	0.5473
HighwayMPG	-0.3051	-0.0301	0.6052
Weight(lb)	0.3352	-0.1593	-0.1148
Wheelbase(in)	0.2639	-0.4314	0.24169
Length(in)	0.2504	-0.4385	0.31258
Width(in)	0.2918	-0.3333	0.0538
Weight(lb)	0.3352	-0.1593	-0.1148

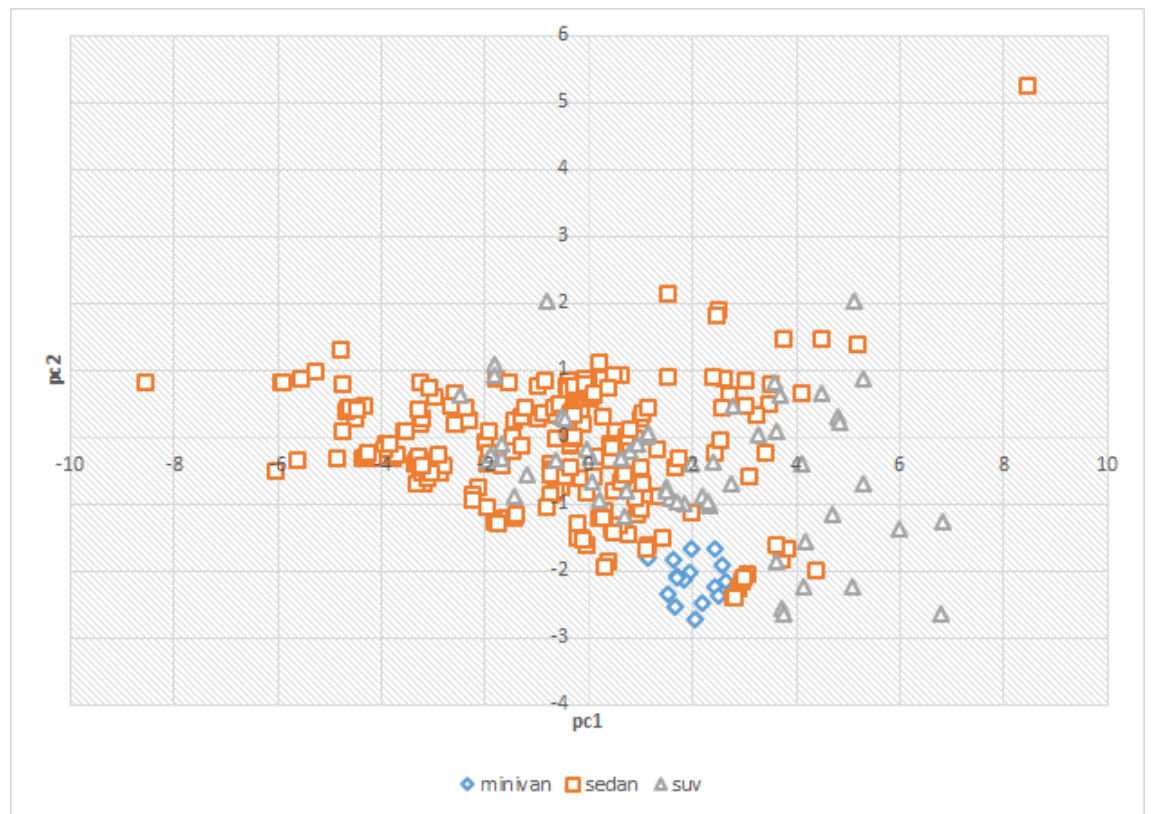
3.

Retail(\$)	0.2753
Dealer(\$)	0.2735
Engine(L)	0.3452
Cylinders	0.3329
Horsepower	0.3190
CityMPG	-0.3079
HighwayMPG	-0.3051
Weight(lb)	0.3352
Wheelbase(in)	0.2639
Length(in)	0.2504
Width(in)	0.2918

Retail, dealer, engine, cylinders, horsepower, weight, wheelbase, length, and width had positive coordinates.

Positive coordinates show how important each principle is and that value had a pattern of positive correlation. The

higher the eigenvalue, the larger variation in that dimension and the more important and dominant the component is.



4.

5. The minivans seem to be clustered most strongly according to the plot.

The eigenvalues of pc1 and pc2 were strongly dominant, therefore it is safe to assume that the plot successfully represents the original data correctly.

The plots for the sedan and SUV seems to be spread out over pc1, whereas the plots for the minivan are more clustered. Therefore, the data for the minivan are highly correlated to each other. Also, since the plots for the minivan are clustered, they are more likely to be the best merchandise. Since the plots for the sedan and SUV are not clustered as much, they are not correlated to each other, therefore has more fluctuation in the merchandise.