

hw4

chengkan_tao ~ ~

```
devtools::install_github(c('rstudio/rmarkdown', 'yihui/tinytex'))
tinytex::install_tinytex()
```

##hw4

#1 #cluster

```
wine <- read.csv("~/GitHub/DATA MINING/EC0395M/data/wine.csv")
summary(wine)
```

```
## fixed.acidity  volatile.acidity  citric.acid    residual.sugar
## Min.      : 3.800    Min.      :0.0800    Min.      :0.0000    Min.      : 0.600
## 1st Qu.: 6.400    1st Qu.:0.2300    1st Qu.:0.2500    1st Qu.: 1.800
## Median : 7.000    Median :0.2900    Median :0.3100    Median : 3.000
## Mean      : 7.215    Mean      :0.3397    Mean      :0.3186    Mean      : 5.443
## 3rd Qu.: 7.700    3rd Qu.:0.4000    3rd Qu.:0.3900    3rd Qu.: 8.100
## Max.      :15.900    Max.      :1.5800    Max.      :1.6600    Max.      :65.800
## chlorides      free.sulfur.dioxide total.sulfur.dioxide    density
## Min.      :0.00900    Min.      : 1.00      Min.      : 6.0      Min.      :0.9871
## 1st Qu.:0.03800    1st Qu.: 17.00      1st Qu.: 77.0      1st Qu.:0.9923
## Median :0.04700    Median : 29.00      Median :118.0      Median :0.9949
## Mean      :0.05603    Mean      : 30.53      Mean      :115.7      Mean      :0.9947
## 3rd Qu.:0.06500    3rd Qu.: 41.00      3rd Qu.:156.0      3rd Qu.:0.9970
## Max.      :0.61100    Max.      :289.00      Max.      :440.0      Max.      :1.0390
##      pH      sulphates      alcohol      quality
## Min.      :2.720    Min.      :0.2200    Min.      : 8.00    Min.      :3.000
```

```
## 1st Qu.:3.110 1st Qu.:0.4300 1st Qu.: 9.50 1st Qu.:5.000
## Median :3.210 Median :0.5100 Median :10.30 Median :6.000
## Mean :3.219 Mean :0.5313 Mean :10.49 Mean :5.818
## 3rd Qu.:3.320 3rd Qu.:0.6000 3rd Qu.:11.30 3rd Qu.:6.000
## Max. :4.010 Max. :2.0000 Max. :14.90 Max. :9.000
## color
## Length:6497
## Class :character
## Mode :character
##
##
##
```

```
W = wine[,-(12:13)]
wine_scale = scale(W, center=TRUE, scale=TRUE)

mu = attr(W,"scaled:center")
sigma = attr(W,"scaled:scale")
cluster1 = kmeanspp(W, 2, nstart=25)
cluster1$center
```

```
## fixed.acidity volatile.acidity citric.acid residual.sugar chlorides
## 1 7.623219 0.4086378 0.2908725 3.076425 0.06580983
## 2 6.904812 0.2871659 0.3397642 7.244809 0.04859257
## free.sulfur.dioxide total.sulfur.dioxide density pH sulphates
## 1 18.39868 63.26318 0.9945736 3.254882 0.5724145
## 2 39.75590 155.69246 0.9947903 3.190808 0.4999485
## alcohol
## 1 10.79722
## 2 10.25932
```

```
cluster1$center[1,]*sigma + mu
```

```
## numeric(0)
```

```
cluster1$center[2,]*sigma + mu
```

```
## numeric(0)
```

```
which(cluster1$cluster == 1)
```

```
##      [1]      1      2      3      4      5      6      7      8      9     10     11     12     13     14
##     [15]     17     18     19     20     21     22     23     24     25     26     27     28     29     30
##     [29]     31     32     34     35     36     37     38     39     40     41     42     43     44     45
##     [43]     46     48     49     50     51     52     53     55     56     57     59     60     61     63
##     [57]     64     65     66     67     68     69     70     71     72     73     74     75     76     77
##     [71]     78     79     81     82     83     84     85     86     88     90     94     95     96     97
##     [85]     98     99    100    101    102    103    104    105    106    107    108    109    111    112
##     [99]    113    114    115    116    117    118    119    120    121    122    123    124    125    126
##    [113]    127    128    129    130    132    133    134    135    136    137    138    139    140    141
##    [127]    142    143    144    145    147    148    149    150    151    152    153    154    159    160
##    [141]    161    162    163    166    167    168    169    170    171    172    173    174    175    176
##    [155]    177    178    179    180    181    182    183    184    185    186    187    188    192    194
##    [169]    195    197    198    199    200    201    203    204    205    206    207    209    210    211
##    [183]    212    213    214    215    217    218    219    221    222    223    224    225    226    227
##    [197]    228    229    230    231    232    233    234    235    236    237    238    239    240    241
##    [211]    242    243    244    245    246    247    248    249    250    251    252    253    254    255
##    [225]    257    258    259    260    261    262    263    264    265    266    267    268    269    270
##    [239]    271    272    273    274    275    276    277    278    279    280    281    282    283    284
##    [253]    285    286    287    288    289    290    291    292    293    294    295    296    297    298
##    [267]    299    300    301    302    303    304    305    306    307    308    309    310    311    312
##    [281]    313    315    316    317    318    319    320    321    322    323    324    325    326    327
##    [295]    328    329    330    331    332    334    335    336    337    338    339    340    341    342
##    [309]    343    344    345    346    347    348    349    350    351    352    353    354    356    357
##    [323]    358    359    360    361    362    363    364    365    366    367    368    369    370    371
##    [337]    372    373    374    375    376    377    378    379    380    381    382    383    384    385
##    [351]    386    387    388    389    390    391    392    393    394    395    396    398    399    400
##    [365]    402    403    404    405    406    407    408    409    410    411    412    413    414    417
```

##	[379]	419	420	421	422	423	424	425	426	427	428	429	430	431	432
##	[393]	433	434	435	436	437	438	439	440	441	442	443	444	445	446
##	[407]	447	448	449	450	451	452	453	454	455	456	457	458	459	460
##	[421]	461	462	463	465	466	467	468	469	470	471	472	473	474	475
##	[435]	476	477	478	479	480	481	482	483	484	485	486	487	488	489
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##	[491]	537	538	539	540	541	542	543	544	545	546	547	548	549	550
##	[505]	551	552	553	554	555	556	557	558	559	560	561	564	565	566
##	[519]	567	568	569	570	571	572	573	574	575	576	577	578	579	580
##	[533]	581	582	583	584	585	586	587	588	589	590	591	593	594	595
##	[547]	596	597	598	599	600	601	602	603	604	605	606	607	608	609
##	[561]	610	611	612	613	614	615	616	617	618	619	620	621	622	623
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##	[645]	702	703	704	705	706	707	708	709	710	711	712	713	714	715
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##	[701]	760	761	762	763	764	765	766	767	768	769	770	771	774	775
##	[715]	776	777	778	779	780	781	782	783	784	785	786	787	788	789
##	[729]	791	793	794	795	796	797	798	799	800	801	802	803	804	805
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##	[771]	834	835	836	837	838	839	840	841	842	843	844	845	846	847
##	[785]	848	849	850	851	852	854	855	856	857	858	859	860	861	862
##	[799]	863	864	865	866	867	868	869	870	871	872	873	874	875	876
##	[813]	877	878	879	880	881	882	883	884	885	886	887	888	889	890
##	[827]	891	892	893	894	895	896	897	898	899	900	901	902	903	904

```

## [841] 905 907 908 909 910 911 912 913 914 915 916 917 918 919
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## [2703] 6159 6160 6161 6170 6171 6172 6173 6174 6176 6177 6178 6184 6187 6197
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## [2745] 6308 6310 6313 6315 6316 6319 6320 6321 6324 6326 6329 6330 6334 6335
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## [2773] 6385 6397 6404 6405 6407 6408 6411 6418 6427 6429 6433 6434 6435 6436
## [2787] 6439 6442 6445 6447 6452 6453 6454 6461 6462 6463 6465 6467 6469 6471
## [2801] 6475 6477 6478 6487 6490 6493 6496 6497
```

```
which(cluster1$cluster == 2)
```

```
## [1] 15 16 33 47 54 58 62 80 87 89 91 92 93 110
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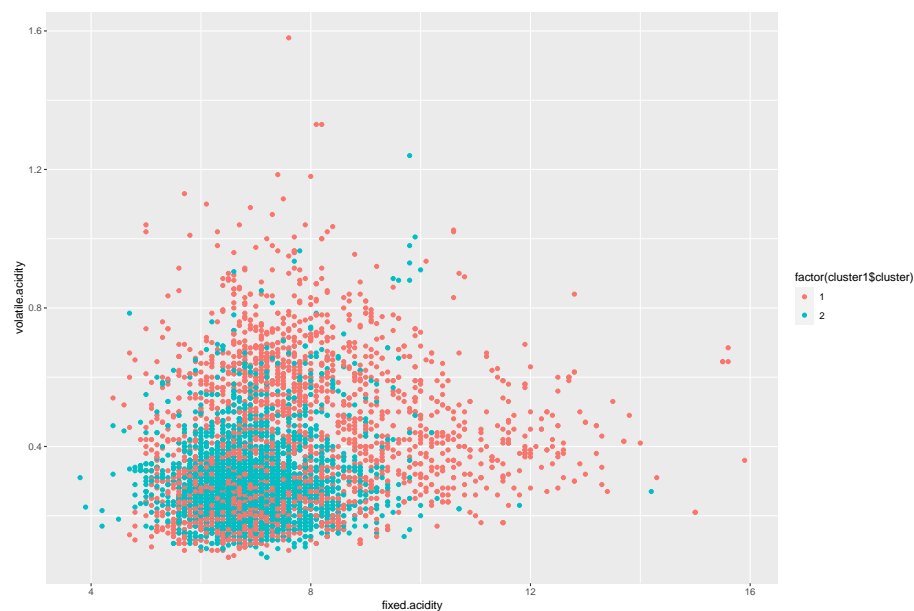
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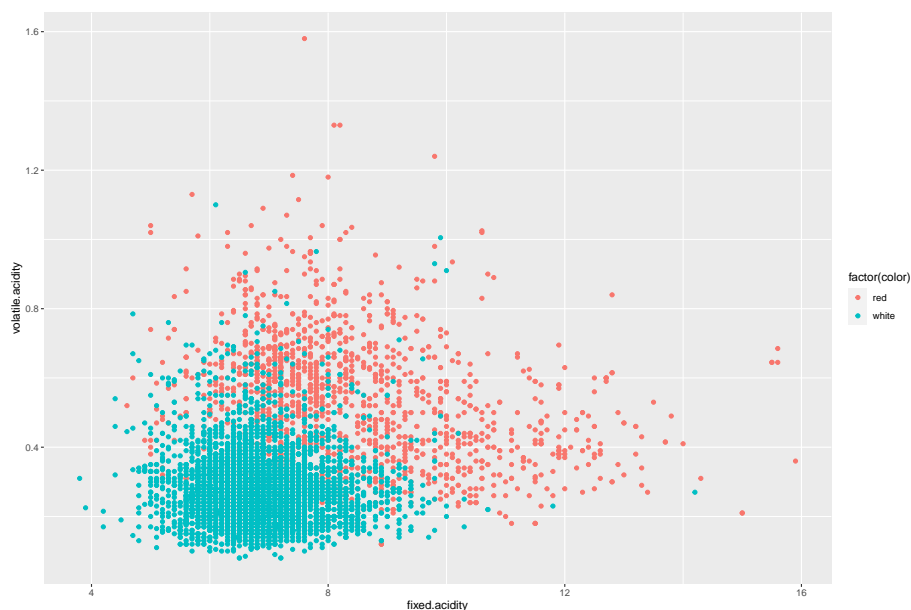
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[3165] 5748 5750 5751 5752 5753 5754 5755 5756 5757 5758 5759 5760 5761 5762
[3179] 5763 5764 5766 5767 5769 5770 5772 5774 5775 5776 5777 5778 5779 5780
[3193] 5782 5785 5787 5788 5791 5797 5798 5802 5803 5804 5806 5807 5810 5811
[3207] 5812 5814 5815 5816 5817 5818 5819 5821 5822 5825 5826 5828 5829 5830
[3221] 5833 5834 5835 5836 5838 5840 5841 5842 5844 5845 5847 5848 5849 5854
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[3277] 5906 5907 5909 5910 5912 5914 5915 5917 5918 5919 5920 5921 5922 5923
[3291] 5925 5926 5927 5928 5929 5930 5931 5932 5933 5934 5935 5936 5937 5938
[3305] 5940 5941 5942 5947 5948 5949 5951 5952 5953 5954 5955 5956 5957 5958
[3319] 5959 5960 5961 5962 5963 5964 5965 5966 5967 5969 5970 5972 5974 5975
[3333] 5976 5978 5979 5980 5981 5982 5984 5985 5986 5989 5990 5991 5992 5993
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[3361] 6009 6010 6012 6014 6015 6016 6017 6018 6019 6020 6021 6022 6023 6024
[3375] 6025 6026 6027 6028 6029 6030 6033 6034 6035 6037 6038 6039 6040 6041
[3389] 6042 6043 6044 6045 6046 6048 6049 6050 6051 6052 6054 6055 6056 6057
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[3417] 6079 6080 6081 6082 6084 6088 6089 6090 6093 6095 6097 6100 6101 6102
[3431] 6104 6105 6108 6110 6114 6115 6119 6120 6121 6123 6124 6125 6126 6129
[3445] 6130 6131 6132 6133 6135 6136 6138 6148 6151 6156 6157 6158 6162 6163
[3459] 6164 6165 6166 6167 6168 6169 6175 6179 6180 6181 6182 6183 6185 6186
[3473] 6188 6189 6190 6191 6192 6193 6194 6195 6196 6198 6200 6201 6202 6203
[3487] 6204 6207 6212 6213 6214 6215 6217 6218 6219 6220 6222 6223 6225 6226
[3501] 6230 6232 6233 6234 6235 6236 6237 6238 6239 6240 6241 6243 6244 6245
[3515] 6248 6251 6252 6254 6255 6256 6257 6258 6261 6262 6263 6264 6265 6266
[3529] 6267 6268 6269 6270 6271 6272 6274 6275 6276 6278 6279 6280 6283 6284


```
## [3543] 6285 6286 6287 6288 6289 6290 6291 6292 6293 6294 6295 6297 6298 6299
## [3557] 6300 6301 6302 6304 6305 6306 6307 6309 6311 6312 6314 6317 6318 6322
## [3571] 6323 6325 6327 6328 6331 6332 6333 6337 6338 6340 6341 6342 6343 6345
## [3585] 6346 6348 6349 6350 6351 6356 6357 6358 6359 6360 6361 6363 6364 6366
## [3599] 6367 6368 6369 6370 6371 6372 6374 6375 6376 6380 6381 6382 6383 6384
## [3613] 6386 6387 6388 6389 6390 6391 6392 6393 6394 6395 6396 6398 6399 6400
## [3627] 6401 6402 6403 6406 6409 6410 6412 6413 6414 6415 6416 6417 6419 6420
## [3641] 6421 6422 6423 6424 6425 6426 6428 6430 6431 6432 6437 6438 6440 6441
## [3655] 6443 6444 6446 6448 6449 6450 6451 6455 6456 6457 6458 6459 6460 6464
## [3669] 6466 6468 6470 6472 6473 6474 6476 6479 6480 6481 6482 6483 6484 6485
## [3683] 6486 6488 6489 6491 6492 6494 6495
```

```
qplot(fixed.acidity, volatile.acidity, data=wine, color=factor(cluster1$cluster))
```



```
qplot(fixed.acidity, volatile.acidity, data=wine, color=factor(color))
```



pre_process:remove quality and color; Z-score. Now I get 2 clusters. Choose two acidities to export 2 figures. I find the method can not distinguishing red wine from white wine well. The figure with fact shows that red points and green points are not mixed obviously.

```
cluster2 = kmeanspp(W, 7, nstart=25)
cluster2$center
```

```
##   fixed.acidity volatile.acidity citric.acid residual.sugar chlorides
## 1      8.448571      0.5121374   0.2714945      2.450000 0.08265165
## 2      6.838459      0.2871852   0.3247685      5.366353 0.04533792
## 3      6.920837      0.2822188   0.3409765      7.195074 0.04927114
## 4      6.939486      0.2865596   0.3516121      8.986974 0.05143224
## 5      7.723570      0.4324407   0.2865830      2.613598 0.07373640
## 6      6.926437      0.3148983   0.3086207      3.798143 0.04803006
## 7      7.030791      0.3069633   0.3606215     10.179802 0.05212147
##   free.sulfur.dioxide total.sulfur.dioxide  density      pH sulphates
## 1           9.410989           23.88022 0.9964969 3.303615 0.6385824
## 2          30.193198          122.64146 0.9934417 3.195166 0.4963748
## 3          39.075414          152.05929 0.9947787 3.193958 0.4900697
```

```
## 4      48.915304      182.81600 0.9960240 3.188166 0.5109229
## 5      19.581590      59.94421 0.9949663 3.268243 0.6056206
## 6      24.540672      95.00531 0.9928397 3.209054 0.5009019
## 7      55.213277      224.39972 0.9968792 3.173107 0.5207345
##      alcohol
## 1 10.592271
## 2 10.770466
## 3 10.250753
## 4  9.790479
## 5 10.662366
## 6 11.033687
## 7  9.545763
```

```
cluster2$center[1,]*sigma + mu
```

```
## numeric(0)
```

```
cluster2$center[2,]*sigma + mu
```

```
## numeric(0)
```

```
which(cluster2$cluster == 1)
```

```
##  [1]    1    5    6    8    9   14   19   23   25   26   27   28   29   30   32
## [16]   36   37   38   39   43   44   45   48   49   51   52   53   57   63   65
## [31]   66   67   68   70   71   76   77   78   81   86   88   90   94   97   98
## [46]   99  100  102  103  105  117  118  123  124  127  128  129  130  134  135
## [61]  144  149  151  159  161  162  163  171  172  173  175  177  178  179  180
## [76]  181  188  194  195  198  200  201  204  205  206  207  210  211  213  215
## [91]  218  223  224  228  230  234  235  236  237  238  239  240  242  244  245
## [106]  246  249  250  251  252  253  255  257  260  263  265  266  268  269  270
## [121]  272  274  277  278  279  281  282  292  294  296  298  299  300  302  303
## [136]  304  306  308  309  310  311  323  327  328  329  330  331  332  335  336
## [151]  337  340  341  342  343  344  345  347  348  350  351  352  353  356  358
```

## [166]	359	360	363	364	365	366	367	368	370	372	376	378	379	381	383
## [181]	384	386	393	395	396	400	402	404	405	406	407	408	409	414	417
## [196]	419	424	428	429	430	431	433	434	436	438	441	442	443	444	445
## [211]	446	448	449	450	451	452	453	454	456	457	459	461	462	463	465
## [226]	466	468	469	474	475	476	477	478	479	480	481	482	483	484	485
## [241]	486	487	488	490	492	493	496	497	499	501	504	505	506	507	508
## [256]	514	515	517	518	519	521	530	531	532	533	534	535	536	537	538
## [271]	539	540	542	543	545	547	548	550	551	555	556	557	558	559	561
## [286]	566	567	568	569	571	573	577	580	581	582	583	584	586	590	594
## [301]	595	597	598	599	600	601	602	603	604	606	607	610	612	613	614
## [316]	618	619	620	623	627	628	629	631	632	636	639	641	643	645	646
## [331]	647	648	649	651	654	655	657	659	660	661	663	664	667	668	669
## [346]	670	672	674	675	676	677	678	681	682	684	686	687	688	689	690
## [361]	691	697	698	700	702	703	705	707	708	709	710	713	716	719	721
## [376]	725	726	728	729	731	732	733	735	736	737	740	741	743	746	749
## [391]	750	751	752	754	755	757	758	759	762	763	764	770	774	775	776
## [406]	778	779	782	784	794	795	799	800	802	805	806	807	808	809	810
## [421]	811	812	813	814	816	817	818	821	823	824	825	826	827	828	830
## [436]	831	832	835	839	840	841	842	846	847	848	849	850	851	852	856
## [451]	859	860	863	867	868	869	874	875	876	877	881	882	883	886	887
## [466]	893	900	901	902	903	904	905	908	910	911	912	913	914	915	916
## [481]	921	925	929	930	931	932	934	935	938	940	941	942	945	946	947
## [496]	948	949	950	951	952	953	954	955	956	957	959	960	961	962	963
## [511]	964	965	967	970	971	972	973	974	975	979	980	981	982	984	985
## [526]	986	987	989	990	991	997	998	999	1000	1001	1003	1004	1006	1007	1008
## [541]	1009	1011	1012	1013	1014	1015	1016	1017	1020	1021	1022	1023	1024	1025	1027
## [556]	1030	1031	1032	1033	1034	1036	1037	1040	1041	1042	1043	1044	1049	1050	1053
## [571]	1054	1057	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1071	1074	1077
## [586]	1078	1079	1081	1087	1088	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101
## [601]	1102	1103	1104	1105	1107	1108	1109	1111	1113	1114	1116	1117	1118	1119	1120
## [616]	1121	1122	1123	1124	1125	1126	1127	1131	1133	1134	1135	1137	1138	1143	1144
## [631]	1147	1148	1149	1150	1151	1153	1154	1156	1160	1161	1162	1163	1164	1165	1166
## [646]	1170	1171	1173	1178	1182	1186	1187	1188	1190	1191	1192	1193	1194	1198	1201

```
## [661] 1202 1203 1210 1211 1213 1214 1215 1216 1219 1224 1225 1228 1234 1235 1237
## [676] 1238 1239 1240 1243 1246 1248 1249 1250 1251 1253 1254 1255 1259 1260 1262
## [691] 1264 1266 1267 1268 1275 1277 1278 1280 1283 1285 1287 1288 1291 1293 1294
## [706] 1298 1299 1300 1301 1303 1308 1312 1313 1318 1323 1325 1326 1327 1328 1329
## [721] 1333 1335 1336 1337 1338 1339 1340 1341 1342 1343 1344 1345 1346 1347 1348
## [736] 1349 1355 1356 1357 1360 1361 1363 1365 1366 1370 1372 1375 1377 1379 1380
## [751] 1381 1382 1387 1388 1391 1392 1393 1396 1397 1399 1400 1403 1404 1406 1407
## [766] 1411 1412 1413 1415 1416 1417 1418 1419 1421 1424 1425 1426 1428 1433 1434
## [781] 1438 1439 1441 1443 1444 1447 1448 1450 1451 1452 1455 1456 1459 1460 1462
## [796] 1463 1464 1468 1471 1472 1479 1480 1481 1482 1483 1484 1485 1486 1487 1488
## [811] 1489 1490 1491 1492 1493 1495 1496 1498 1499 1500 1501 1504 1505 1506 1507
## [826] 1508 1509 1510 1512 1513 1519 1520 1522 1526 1527 1528 1531 1532 1533 1535
## [841] 1536 1538 1539 1541 1544 1545 1546 1547 1548 1550 1551 1552 1554 1555 1556
## [856] 1557 1558 1563 1564 1565 1568 1570 1571 1572 1576 1577 1578 1579 1580 1581
## [871] 1582 1583 1585 1588 1591 1592 1594 2119 2126 2166 2305 2340 2473 2513 2515
## [886] 2596 2714 3136 3144 4115 4118 4205 4209 4273 4354 4488 4584 4694 4695 4719
## [901] 4741 4938 4948 5159 5171 5310 5362 5501 6118 6122
```

```
which(cluster2$cluster == 2)
```

```
## [1] 33 47 54 58 62 80 87 89 92 93 131 155 156 157
## [15] 158 164 165 182 189 191 193 196 208 216 243 256 314 333
## [29] 397 401 415 416 418 464 498 523 525 562 563 578 596 621
## [43] 694 695 712 724 742 790 792 853 906 968 978 1018 1019 1185
## [57] 1189 1236 1390 1420 1559 1560 1561 1562 1601 1606 1608 1609 1615 1619
## [71] 1622 1624 1628 1629 1633 1635 1651 1653 1654 1659 1660 1664 1665 1666
## [85] 1680 1705 1722 1726 1736 1742 1745 1749 1752 1757 1758 1759 1760 1770
## [99] 1773 1787 1792 1793 1803 1804 1806 1807 1811 1812 1813 1838 1846 1849
## [113] 1858 1860 1873 1880 1881 1899 1908 1915 1916 1917 1918 1921 1922 1923
## [127] 1931 1933 1938 1941 1945 1948 1951 1952 1953 1962 1965 1976 1979 1984
## [141] 1986 1992 2007 2008 2019 2041 2042 2047 2048 2049 2051 2053 2054 2055
## [155] 2057 2060 2065 2073 2077 2085 2086 2106 2114 2120 2121 2125 2127 2129
## [169] 2148 2152 2154 2157 2161 2163 2179 2181 2184 2187 2188 2189 2191 2193
## [183] 2194 2195 2197 2198 2202 2203 2204 2205 2210 2212 2213 2214 2215 2219
```

```

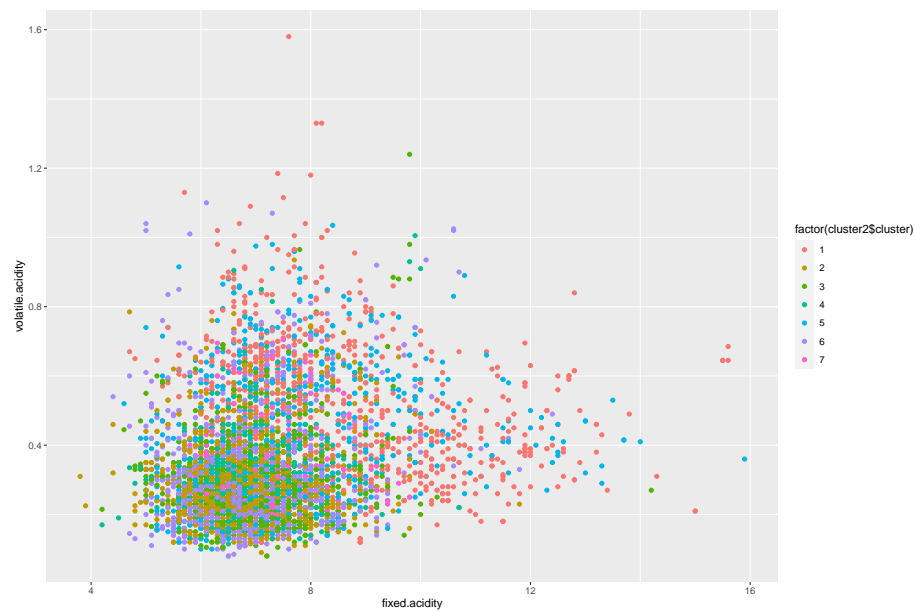
## [197] 2222 2224 2225 2232 2236 2240 2253 2255 2257 2261 2265 2273 2286 2289
## [211] 2290 2301 2303 2304 2308 2311 2312 2319 2322 2324 2325 2326 2330 2335
## [225] 2339 2342 2345 2354 2363 2365 2368 2369 2370 2374 2385 2386 2387 2388
## [239] 2389 2390 2398 2404 2411 2415 2417 2418 2419 2423 2427 2430 2432 2434
## [253] 2435 2439 2440 2444 2445 2452 2454 2455 2463 2465 2466 2472 2476 2478
## [267] 2479 2481 2482 2483 2491 2492 2493 2494 2501 2507 2516 2517 2529 2537
## [281] 2543 2544 2550 2553 2555 2556 2563 2571 2574 2575 2576 2585 2589 2603
## [295] 2615 2620 2621 2625 2628 2640 2649 2651 2653 2655 2656 2658 2660 2665
## [309] 2667 2671 2672 2675 2677 2680 2686 2687 2689 2693 2698 2699 2701 2703
## [323] 2706 2719 2721 2723 2724 2729 2731 2733 2734 2738 2742 2743 2744 2748
## [337] 2756 2757 2759 2761 2765 2767 2770 2771 2772 2779 2780 2781 2783 2790
## [351] 2791 2793 2796 2797 2809 2818 2821 2822 2831 2833 2837 2838 2843 2844
## [365] 2866 2871 2873 2875 2878 2887 2888 2896 2897 2905 2908 2911 2920 2921
## [379] 2925 2931 2939 2940 2942 2945 2950 2951 2959 2962 2967 2970 2974 2975
## [393] 2976 2977 2978 2979 2984 2985 2986 2988 2990 2994 2996 3002 3003 3005
## [407] 3009 3013 3014 3016 3018 3020 3024 3025 3030 3041 3042 3043 3045 3051
## [421] 3057 3059 3060 3063 3069 3073 3079 3081 3084 3085 3090 3097 3100 3102
## [435] 3103 3104 3105 3110 3111 3112 3114 3115 3121 3135 3149 3151 3158 3162
## [449] 3165 3173 3177 3180 3182 3189 3192 3194 3196 3200 3205 3206 3207 3210
## [463] 3213 3214 3219 3221 3223 3224 3227 3230 3232 3235 3250 3252 3262 3265
## [477] 3267 3269 3279 3289 3295 3300 3302 3305 3311 3313 3314 3317 3324 3328
## [491] 3332 3333 3361 3363 3375 3384 3386 3388 3391 3394 3396 3397 3405 3406
## [505] 3408 3411 3416 3417 3419 3421 3452 3464 3467 3484 3486 3489 3501 3506
## [519] 3509 3512 3514 3521 3522 3548 3561 3566 3570 3572 3613 3616 3618 3619
## [533] 3634 3644 3646 3650 3662 3663 3665 3669 3675 3676 3678 3679 3680 3682
## [547] 3688 3693 3694 3696 3703 3705 3717 3718 3719 3721 3724 3729 3734 3736
## [561] 3740 3741 3751 3760 3762 3764 3772 3776 3777 3781 3784 3787 3789 3790
## [575] 3793 3795 3806 3808 3809 3811 3812 3814 3817 3819 3820 3828 3830 3855
## [589] 3856 3857 3859 3861 3870 3874 3894 3899 3900 3901 3903 3906 3909 3911
## [603] 3914 3916 3920 3922 3925 3926 3927 3928 3933 3935 3948 3952 3955 3956
## [617] 3959 3960 3965 3990 3992 4003 4004 4009 4013 4020 4023 4025 4039 4047
## [631] 4048 4052 4064 4067 4069 4075 4080 4086 4087 4088 4093 4094 4097 4098
## [645] 4100 4102 4103 4109 4139 4144 4147 4150 4159 4161 4163 4167 4169 4170

```

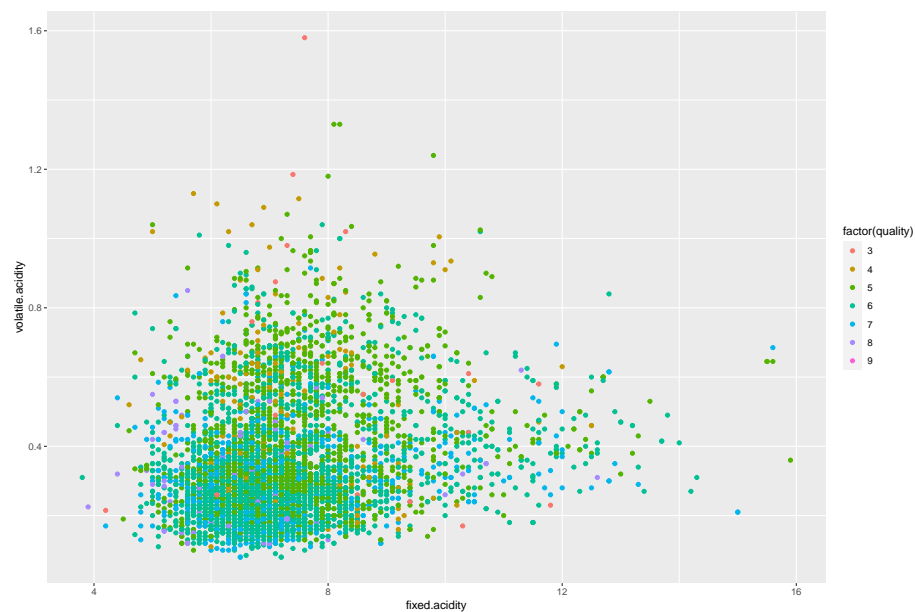
[659] 4179 4190 4197 4200 4202 4203 4204 4212 4215 4216 4217 4218 4222 4223
[673] 4226 4227 4245 4247 4257 4262 4265 4267 4268 4272 4274 4275 4279 4280
[687] 4282 4284 4286 4289 4290 4295 4299 4301 4302 4303 4307 4323 4327 4332
[701] 4336 4338 4341 4347 4349 4351 4352 4363 4365 4368 4371 4374 4375 4376
[715] 4377 4380 4393 4396 4398 4399 4405 4411 4416 4419 4420 4433 4434 4456
[729] 4459 4465 4466 4467 4468 4470 4474 4482 4484 4489 4504 4516 4517 4519
[743] 4523 4524 4529 4533 4540 4544 4555 4560 4561 4563 4564 4565 4566 4567
[757] 4572 4573 4574 4576 4577 4578 4579 4580 4585 4586 4587 4592 4593 4594
[771] 4595 4596 4598 4599 4600 4601 4604 4618 4622 4626 4628 4631 4643 4646
[785] 4648 4655 4657 4662 4665 4668 4670 4673 4676 4679 4693 4697 4698 4699
[799] 4700 4702 4703 4704 4710 4712 4713 4714 4715 4721 4724 4726 4729 4732
[813] 4733 4734 4737 4738 4739 4744 4745 4746 4748 4751 4754 4755 4756 4757
[827] 4758 4759 4761 4762 4763 4765 4766 4767 4769 4772 4773 4774 4781 4782
[841] 4785 4787 4788 4790 4792 4793 4795 4796 4797 4798 4799 4801 4803 4807
[855] 4812 4816 4822 4826 4829 4834 4838 4840 4841 4842 4845 4846 4850 4868
[869] 4870 4873 4874 4877 4879 4880 4881 4882 4885 4886 4887 4894 4898 4908
[883] 4920 4924 4925 4928 4929 4940 4950 4954 4955 4962 4966 4967 4969 4970
[897] 4971 4973 4975 4980 4981 4982 4985 4990 4991 4993 5001 5005 5009 5011
[911] 5024 5028 5032 5037 5039 5041 5045 5048 5049 5050 5051 5052 5054 5058
[925] 5062 5065 5066 5072 5081 5085 5091 5092 5093 5094 5098 5099 5100 5101
[939] 5104 5105 5107 5112 5118 5119 5124 5125 5126 5129 5138 5141 5150 5151
[953] 5152 5153 5155 5156 5158 5174 5175 5177 5178 5181 5187 5188 5189 5194
[967] 5195 5196 5202 5203 5212 5217 5218 5219 5221 5223 5226 5230 5231 5232
[981] 5233 5237 5240 5243 5244 5248 5249 5250 5255 5257 5259 5260 5265 5267
[995] 5274 5278 5281 5282 5284 5289 5291 5293 5294 5296 5301 5307 5317 5318
[1009] 5321 5322 5324 5325 5326 5329 5332 5333 5334 5337 5338 5346 5354 5355
[1023] 5359 5364 5370 5371 5376 5381 5394 5398 5402 5407 5412 5416 5417 5418
[1037] 5419 5420 5426 5428 5430 5431 5432 5433 5435 5439 5442 5451 5453 5454
[1051] 5466 5480 5481 5482 5484 5488 5489 5491 5492 5494 5498 5499 5511 5518
[1065] 5520 5532 5543 5546 5553 5558 5559 5562 5563 5566 5569 5571 5576 5577
[1079] 5584 5588 5593 5594 5595 5596 5598 5599 5600 5601 5603 5604 5605 5607
[1093] 5610 5612 5617 5631 5632 5633 5634 5638 5642 5643 5644 5645 5647 5648
[1107] 5650 5653 5656 5657 5658 5662 5663 5665 5675 5676 5680 5681 5689 5692

```
## [1121] 5696 5699 5705 5720 5730 5733 5735 5736 5746 5748 5752 5763 5764 5767
## [1135] 5769 5777 5778 5780 5787 5788 5802 5807 5810 5817 5821 5822 5829 5830
## [1149] 5833 5834 5835 5836 5838 5840 5844 5845 5847 5848 5854 5855 5856 5857
## [1163] 5858 5859 5861 5866 5867 5872 5873 5874 5875 5876 5879 5880 5881 5882
## [1177] 5887 5889 5890 5892 5894 5896 5903 5904 5905 5907 5909 5912 5914 5915
## [1191] 5918 5919 5922 5923 5951 5955 5961 5962 5963 5964 5966 5967 5968 5969
## [1205] 5970 5972 5976 5978 5979 5982 5989 6001 6012 6014 6017 6018 6019 6020
## [1219] 6021 6022 6023 6024 6025 6026 6038 6039 6041 6043 6044 6045 6046 6048
## [1233] 6050 6058 6059 6062 6063 6073 6074 6075 6079 6080 6084 6088 6089 6090
## [1247] 6104 6111 6112 6115 6132 6133 6138 6141 6151 6154 6156 6158 6159 6162
## [1261] 6163 6164 6168 6169 6175 6179 6180 6181 6186 6188 6189 6193 6194 6195
## [1275] 6196 6198 6200 6201 6203 6206 6215 6217 6218 6220 6222 6223 6230 6235
## [1289] 6237 6240 6241 6244 6251 6258 6262 6263 6264 6265 6267 6268 6269 6276
## [1303] 6280 6283 6285 6286 6295 6297 6298 6305 6306 6307 6311 6312 6314 6317
## [1317] 6318 6322 6325 6327 6328 6333 6337 6338 6342 6354 6356 6357 6359 6360
## [1331] 6361 6363 6364 6366 6374 6375 6376 6382 6383 6386 6387 6389 6390 6391
## [1345] 6392 6398 6399 6400 6402 6403 6406 6412 6414 6415 6417 6419 6421 6423
## [1359] 6425 6426 6430 6431 6432 6438 6440 6452 6457 6459 6460 6466 6468 6470
## [1373] 6473 6474 6476 6481 6486 6488 6489 6491 6492 6495
```

```
qplot(fixed.acidity, volatile.acidity, data=wine, color=factor(cluster2$cluster))
```

```
qplot(fixed.acidity, volatile.acidity, data=wine, color=factor(quality))
```



Now I get 7 clusters. Choose two acidities to export 2 figures. I hardly see all 7 colors in the quality picture and there are obviously many colors in cluster picture. So it can not distinguish different qualities.

```
#pca
```

```
pc_W = prcomp(W, rank=1)
summary(pc_W)
```

```
## Importance of first k=1 (out of 11) components:
##                               PC1
## Standard deviation      58.0698
## Proportion of Variance  0.9538
## Cumulative Proportion   0.9538
```

```
pc_W$rotation
```

```
##                               PC1
## fixed.acidity      -7.407964e-03
## volatile.acidity   -1.184329e-03
## citric.acid         4.868693e-04
## residual.sugar     4.101972e-02
## chlorides          -1.681987e-04
## free.sulfur.dioxide 2.304818e-01
## total.sulfur.dioxide 9.721668e-01
## density            1.772339e-06
## pH                 -6.555205e-04
## sulphates          -7.043386e-04
## alcohol            -5.451737e-03
```

PCA explains about 95% variance and cumulative proportion is about 95%.
We find coef of free.sulfur.dioxide and total.sulfur.dioxide is relatively large.
So the component explains more about these two.

```
#2
```

```
social_marketing = read.csv("~/GitHub/DATA MINING/EC0395M/data/social_marketing.csv")
```

```
S = social_marketing[, -1]
S = S[, -36]
S_scale = scale(S, center=TRUE, scale=TRUE)
```

pre-process:remove users and adult;Z-score

#a(PCA)

```
PCA = prcomp(S, rank = 25)
summary(PCA)
```

Importance of first k=25 (out of 35) components:

##	PC1	PC2	PC3	PC4	PC5	PC6	PC7
## Standard deviation	5.204	4.3366	3.8224	3.7751	3.60915	3.21484	2.13445
## Proportion of Variance	0.197	0.1368	0.1063	0.1037	0.09477	0.07519	0.03315
## Cumulative Proportion	0.197	0.3338	0.4401	0.5438	0.63855	0.71374	0.74688

##	PC8	PC9	PC10	PC11	PC12	PC13	PC14
## Standard deviation	2.02790	1.9654	1.64898	1.44434	1.3058	1.28844	1.26664
## Proportion of Variance	0.02992	0.0281	0.01978	0.01518	0.0124	0.01208	0.01167
## Cumulative Proportion	0.77680	0.8049	0.82469	0.83986	0.8523	0.86434	0.87602

##	PC15	PC16	PC17	PC18	PC19	PC20	PC21
## Standard deviation	1.23018	1.21508	1.12948	1.08622	1.07052	0.9879	0.96805
## Proportion of Variance	0.01101	0.01074	0.00928	0.00858	0.00834	0.0071	0.00682
## Cumulative Proportion	0.88703	0.89777	0.90705	0.91563	0.92397	0.9311	0.93789

##	PC22	PC23	PC24	PC25
## Standard deviation	0.9449	0.92273	0.90207	0.87675
## Proportion of Variance	0.0065	0.00619	0.00592	0.00559
## Cumulative Proportion	0.9444	0.95058	0.95650	0.96209

PCA\$rotation

##	PC1	PC2	PC3	PC4
## chatter	8.378214e-02	-6.174191e-01	0.2098424320	-2.822335e-01
## current_events	1.674159e-02	-5.632912e-02	-0.0115812400	-1.808149e-02

## travel	7.695835e-03	-1.026331e-01	-0.4025788448	-1.435401e-01
## photo_sharing	1.319226e-01	-4.784785e-01	0.1650226451	-4.058605e-02
## uncategorized	2.524194e-02	-2.636770e-02	-0.0002772280	1.937378e-02
## tv_film	5.841700e-03	-3.274876e-02	-0.0603065038	5.395565e-02
## sports_fandom	2.150119e-02	-5.979609e-02	-0.1540480426	2.103356e-03
## politics	7.855807e-03	-1.707515e-01	-0.6454330269	-2.945579e-01
## food	9.520390e-02	-1.096227e-02	-0.1226959490	1.204546e-02
## family	1.999620e-02	-4.336626e-02	-0.0488658209	1.315718e-02
## home_and_garden	1.529853e-02	-1.889831e-02	-0.0148082641	2.444508e-03
## music	2.478234e-02	-4.491014e-02	-0.0069108848	3.330925e-02
## news	1.821346e-02	-6.363232e-02	-0.3250987085	-1.339472e-01
## online_gaming	1.582047e-02	-1.210165e-01	-0.2096664371	5.521776e-01
## shopping	5.245776e-02	-2.497451e-01	0.0833668506	-9.233466e-02
## health_nutrition	8.084203e-01	2.731846e-01	-0.0357570506	-7.492853e-02
## college_uni	5.809341e-03	-1.672853e-01	-0.2416820056	6.018810e-01
## sports_playing	1.942219e-02	-4.783535e-02	-0.0532964580	1.171318e-01
## cooking	3.404960e-01	-2.701754e-01	0.1201688199	2.505047e-01
## eco	3.919133e-02	-2.446805e-02	-0.0102322691	-1.015239e-02
## computers	1.599238e-02	-6.153781e-02	-0.1623196660	-6.517510e-02
## business	1.321894e-02	-3.705935e-02	-0.0192092509	-1.039257e-02
## outdoors	1.446175e-01	3.630464e-02	-0.0383171996	-1.636515e-02
## crafts	2.138992e-02	-2.954208e-02	-0.0239637023	-5.452839e-05
## automotive	6.333243e-03	-7.133848e-02	-0.1026859866	-4.307617e-02
## art	1.932406e-02	-2.482856e-02	-0.0464991904	4.532431e-02
## religion	2.786024e-02	-3.740819e-02	-0.1195171864	1.769256e-02
## beauty	6.000190e-02	-1.107452e-01	0.0334091146	7.361617e-02
## parenting	2.929595e-02	-4.021324e-02	-0.0868959813	4.782986e-03
## dating	3.977646e-02	-6.350775e-02	-0.0321249809	-2.931498e-02
## school	2.176223e-02	-5.554714e-02	-0.0387298505	-4.912358e-03
## personal_fitness	3.873710e-01	1.057182e-01	-0.0202079856	-3.672955e-02
## fashion	9.682518e-02	-1.739833e-01	0.0598489531	1.179924e-01
## small_business	5.572071e-03	-2.838564e-02	-0.0159919322	3.956432e-03
## spam	4.184748e-05	-4.449165e-06	-0.0004071343	-5.755789e-06

##	PC5	PC6	PC7	PC8
## chatter	0.4304124727	-0.0268308096	0.002848676	-6.134761e-02
## current_events	0.0111623049	-0.0220125707	0.014682887	6.610392e-02
## travel	-0.0746116731	0.1659759550	0.497258638	-1.642654e-01
## photo_sharing	-0.0252509955	0.0332494864	-0.024674523	4.661281e-02
## uncategorized	-0.0128737545	0.0044430161	0.045729654	6.885845e-02
## tv_film	0.0245271239	-0.0141662267	0.267962237	6.462738e-01
## sports_fandom	-0.0529501649	-0.5535517568	-0.151099330	4.227566e-03
## politics	-0.1015581626	0.2256755478	-0.050856424	-7.846229e-02
## food	-0.0122697377	-0.3761468876	0.128643090	-1.511336e-02
## family	-0.0084757517	-0.1783636558	-0.017119962	-1.896016e-02
## home_and_garden	-0.0005503747	-0.0170233190	0.008740088	4.001119e-02
## music	-0.0127086973	-0.0105031166	0.050814456	1.028135e-01
## news	-0.0655965701	0.0258415070	-0.574476245	2.940264e-01
## online_gaming	0.2565659893	0.0636005870	-0.121252644	-1.714871e-01
## shopping	0.1157630777	-0.0101762596	0.011714243	6.587809e-02
## health_nutrition	0.2239942512	0.0443132166	0.001406400	-5.171718e-03
## college_uni	0.2826091790	0.0704305655	0.029743583	4.077394e-02
## sports_playing	0.0421910635	-0.0010429773	-0.001984380	-1.196173e-02
## cooking	-0.6487873740	0.1209257986	-0.041366570	-3.361388e-02
## eco	0.0158368741	-0.0194711733	0.016635729	1.629883e-02
## computers	-0.0336334008	0.0454293937	0.148865915	-1.209625e-01
## business	-0.0010100000	-0.0053465584	0.040122014	1.639835e-02
## outdoors	0.0229620102	-0.0052523662	-0.051455895	2.516931e-02
## crafts	0.0011801730	-0.0593389098	0.061183023	6.961791e-02
## automotive	-0.0022009205	-0.0450520514	-0.384387615	1.572485e-01
## art	-0.0036839329	-0.0176675790	0.260033486	5.668988e-01
## religion	-0.0638426432	-0.4822151009	0.145912348	-9.281045e-02
## beauty	-0.2136141988	-0.0282300529	0.004862478	-4.040745e-03
## parenting	-0.0431558725	-0.3485969760	0.035638146	-7.697907e-02
## dating	0.0301399194	-0.0141635493	0.113350049	-1.146170e-01
## school	-0.0304017856	-0.2199004051	0.045739227	-3.288925e-02
## personal_fitness	0.1061318621	-0.0013271102	-0.007179710	-3.373159e-03

## fashion	-0.3021157633	0.0269303952	0.028941285	-2.325264e-02
## small_business	-0.0001538433	-0.0037002336	0.037419564	4.614891e-02
## spam	0.0001756367	-0.0001202546	0.000660931	5.161111e-05
##	PC9	PC10	PC11	PC12
## chatter	0.3294727444	-0.3719511837	0.0401375298	-0.2029691504
## current_events	-0.0115659210	0.0026238791	-0.0845685313	0.2604040689
## travel	-0.0722832365	-0.0585749799	-0.0098262222	-0.1548942692
## photo_sharing	-0.5617219271	0.5699736343	0.0171665200	-0.2531882213
## uncategorized	0.0611498228	0.0367253705	-0.0867902238	0.0099601635
## tv_film	0.0523055493	-0.0239397931	-0.2075729041	-0.0737911421
## sports_fandom	-0.0314052690	-0.0302878125	-0.0542091928	-0.1154309763
## politics	-0.0504336762	-0.0274343383	0.0324292716	0.1132519819
## food	-0.0455597873	-0.0661834192	0.0784510351	0.0493542912
## family	-0.0291932375	-0.0094904836	0.0355470248	0.0031338008
## home_and_garden	0.0261765431	0.0334756188	-0.0090293467	0.0254120481
## music	0.0010806039	-0.0285399461	-0.3212358692	-0.0092314378
## news	0.1217880715	0.0507811021	-0.0186115904	-0.0749930005
## online_gaming	-0.0075688120	0.0147028800	0.5373621282	0.0276437432
## shopping	-0.2132355897	-0.0460675088	-0.0377369381	0.8049805206
## health_nutrition	-0.0320376426	0.0089446859	-0.0367794872	-0.1447979621
## college_uni	-0.0057689857	-0.0361393752	-0.4819116690	-0.0097661642
## sports_playing	0.0270053931	0.0253712684	-0.0178548992	-0.0044336958
## cooking	0.1165629798	-0.2816354955	0.0301183978	0.0144384202
## eco	-0.0140687171	0.0193199968	0.0056316194	0.0306026891
## computers	-0.0350367671	-0.0049467963	-0.0128274566	-0.0085014257
## business	0.0073456536	0.0237838964	-0.0234113706	0.0265051083
## outdoors	0.0224874744	0.0385825017	-0.0645445628	0.0242683712
## crafts	0.0206767887	0.0221153470	0.0600233346	0.0185172425
## automotive	0.0279943200	0.0153925936	-0.0183320229	0.0085101998
## art	0.0671977735	0.0090584077	0.5272255943	0.0054411197
## religion	-0.0438880148	-0.0250454668	-0.0584082880	0.0436455571
## beauty	0.0672524947	0.0148285320	-0.0249808366	-0.0083450525
## parenting	-0.0180787581	-0.0003476316	0.0489983602	-0.0245578975

## dating	0.6494225300	0.6430403745	-0.0394372239	0.1371652920
## school	0.0977116171	0.1119101902	0.0402317920	0.0322951149
## personal_fitness	-0.0175426814	0.0248842569	0.0511208614	0.2525106856
## fashion	0.1871610803	0.0778804393	-0.0256407878	0.0575290102
## small_business	0.0090091003	0.0162693594	-0.0223796758	0.0100659484
## spam	0.0003227949	-0.0004953133	0.0006067228	-0.0009971496
##	PC13	PC14	PC15	PC16
## chatter	0.049546578	0.0555825863	0.0147291500	0.0080645728
## current_events	0.130206241	0.0179221341	0.9065664354	0.2440499330
## travel	0.198493520	-0.5754882352	0.0649221178	-0.1718429022
## photo_sharing	0.051106576	0.0669382037	0.0193966441	-0.0083357881
## uncategorized	0.023341103	0.0077467799	-0.0378680801	-0.0050529949
## tv_film	0.025594619	0.0557640753	-0.0694304707	0.0518875907
## sports_fandom	-0.030650812	-0.3360635406	-0.1703763825	0.5862067138
## politics	-0.185868792	0.4886043022	-0.0970131015	0.2704964846
## food	0.035490453	0.3084681667	0.0473683955	-0.5386232022
## family	-0.022899644	-0.0030281388	0.0334464376	-0.0398772365
## home_and_garden	0.007518287	0.0007175025	0.0007707399	-0.0023196618
## music	0.033208442	0.0325705558	-0.0180684045	-0.0198926055
## news	0.129163954	-0.2471547439	0.0821925555	-0.3526394384
## online_gaming	0.006955276	-0.0749563479	0.0596355660	0.0234705971
## shopping	-0.249771301	-0.2872275484	-0.1956751182	-0.1018281297
## health_nutrition	-0.393121659	-0.0856113267	0.1058446792	-0.0052975012
## college_uni	-0.021203289	0.0729371615	-0.0525005011	-0.0120248791
## sports_playing	0.010906279	-0.0061502890	-0.0007774240	-0.0133595488
## cooking	-0.015193813	-0.0012898062	-0.0349684327	0.0228736248
## eco	0.004219678	0.0011175095	0.0097253446	-0.0088882997
## computers	-0.010119785	-0.0279979623	0.0058269427	-0.0005357637
## business	0.011929622	0.0001047081	-0.0109431036	0.0182779884
## outdoors	0.088328170	-0.0029342708	-0.0547496652	-0.0236452828
## crafts	0.001392460	0.0029258075	0.0086510706	-0.0137091466
## automotive	0.006621939	-0.1016999465	0.0365660327	-0.1051881609
## art	-0.082996304	0.0142343505	-0.0100450039	0.0896217545

## religion	-0.038549132	0.1239967952	0.0814565357	-0.1226146423
## beauty	0.013856471	0.0056916837	0.0457489592	0.0016438974
## parenting	0.016446541	0.0454285348	0.0144345246	-0.0842630378
## dating	-0.064861773	-0.0360391553	-0.0454666962	0.0067589886
## school	-0.033039417	0.0215291180	-0.0013607677	-0.0087225810
## personal_fitness	0.801065063	0.1312868344	-0.2120147773	0.1405799594
## fashion	-0.022908859	-0.0048041885	0.0204696116	-0.0253740927
## small_business	0.003348415	0.0110981010	-0.0051772971	0.0084707386
## spam	0.001269619	-0.0003470813	0.0012969376	0.0010904011
##	PC17	PC18	PC19	PC20
## chatter	-0.0175877606	-0.0184424962	-0.001412116	0.0263061498
## current_events	0.1045409927	0.0260384454	0.024927684	0.0026034578
## travel	0.0073990582	-0.0053578200	0.019850563	-0.1418048967
## photo_sharing	0.0266510166	0.0405524181	0.028158494	0.0302716014
## uncategorized	0.0099945388	0.0651518041	-0.017152135	-0.0907252714
## tv_film	0.0030344440	0.2135692186	-0.490046955	0.0178487046
## sports_fandom	0.3375644056	-0.0810694328	-0.003020518	0.0513742699
## politics	-0.0007340080	-0.0110157038	-0.043409094	-0.0266576148
## food	0.6211965394	-0.0867943689	-0.016845440	-0.0752756183
## family	-0.1478783301	0.0581074066	-0.030745902	-0.1440534394
## home_and_garden	-0.0200488335	0.0125200360	0.014669040	-0.0011806392
## music	0.0009799900	0.0403287052	-0.270521014	-0.0230142138
## news	-0.0341509782	-0.0081109978	0.057163187	0.4529001680
## online_gaming	-0.0026561499	0.1269434565	-0.427536152	0.0239135371
## shopping	0.0136859126	0.0158256052	-0.025047689	0.0532601507
## health_nutrition	-0.0395559840	-0.0543103953	-0.025324975	0.0135211053
## college_uni	-0.0077042374	-0.1356862661	0.427516252	0.0001505794
## sports_playing	-0.0076761350	0.0435041315	-0.035640983	0.0375049034
## cooking	0.0853726250	0.3895007654	0.142789664	0.0152903754
## eco	-0.0055821189	0.0047703705	-0.017995984	-0.0328692562
## computers	0.0116001107	-0.0004934380	-0.004222880	0.1049593258
## business	-0.0024586273	-0.0070076464	0.008625577	-0.0126721450
## outdoors	0.0273165341	0.0228062848	-0.095971965	-0.1333276576

## crafts	-0.0202839076	-0.0058578639	-0.005687201	0.0342087588
## automotive	-0.1357636129	0.0219070858	0.018279432	-0.8068924556
## art	-0.0653560702	-0.1635326744	0.429656572	-0.0223639822
## religion	-0.5655301577	0.1426927822	-0.006413485	0.1822583213
## beauty	-0.0516790656	-0.1813546693	-0.078417308	-0.0732074120
## parenting	-0.2695553013	0.0474491673	0.049782207	-0.0551903072
## dating	0.0988859236	0.2114215815	0.058948804	-0.0098103301
## school	-0.0659081206	0.0109168542	0.044294384	-0.0637504919
## personal_fitness	-0.0743571623	-0.0485460515	0.048465380	0.0080234872
## fashion	-0.1288315891	-0.7785520558	-0.279996428	0.0205266461
## small_business	-0.0034875622	0.0005242826	0.004853120	-0.0050310660
## spam	-0.0007520482	-0.0008726087	0.001795965	-0.0017686437
##	PC21	PC22	PC23	PC24
## chatter	0.0165297109	0.007552224	0.007108433	0.0180868526
## current_events	-0.0291364300	0.003685935	0.002422337	0.0455043831
## travel	0.0317756593	0.005085090	-0.043611918	0.0235976596
## photo_sharing	0.0272149748	0.008953814	-0.019259110	0.0228749036
## uncategorized	-0.0013304916	0.267094721	0.382946022	-0.2052546317
## tv_film	-0.0468422239	-0.122613117	-0.267189888	0.0930975059
## sports_fandom	0.0814453315	0.025541747	-0.014437002	0.0167332504
## politics	-0.0117101636	-0.005068483	-0.010726807	0.0082889360
## food	0.0834897233	0.007248842	-0.052454510	-0.0056710348
## family	0.0108281612	-0.881202713	0.288638412	-0.1449771953
## home_and_garden	0.0154914216	0.023338894	0.032742143	0.0001413346
## music	-0.0908878118	0.216110102	0.344091893	-0.3190723650
## news	-0.0400146503	-0.016717878	0.041154978	-0.0410223397
## online_gaming	0.0085674225	0.083685447	0.021044253	-0.0347251015
## shopping	-0.0409052750	0.003891256	-0.013597181	-0.0007121221
## health_nutrition	-0.0166214057	0.005401604	-0.058769989	-0.0758712793
## college_uni	-0.0155941564	-0.056478520	-0.043291163	0.0408058623
## sports_playing	0.0058746152	-0.022726056	0.062764421	-0.0222093635
## cooking	0.0171969170	-0.019264826	-0.063267323	0.0665525993
## eco	-0.0220342356	0.016249494	0.007495273	0.0700358390

## computers	-0.0374566962	0.003492623	0.103940090	-0.1227342639
## business	-0.0257352631	0.006103430	0.015395866	-0.0018748633
## outdoors	0.0210128572	0.061199023	0.612797306	0.6754784829
## crafts	0.0006202844	-0.002818685	0.085534623	-0.0712017062
## automotive	0.1547085048	0.120342610	-0.190668593	-0.0399488460
## art	0.0354516883	0.071958255	0.173114251	-0.0175567844
## religion	0.5017326413	0.177654644	-0.033381881	0.0589569993
## beauty	-0.1068474629	0.070432265	0.227347558	-0.3852137278
## parenting	-0.7963257709	0.083432412	-0.123131580	0.2181245811
## dating	0.0448072470	-0.043310776	-0.073786302	0.0374778444
## school	-0.1935496573	0.066184965	0.039023804	-0.2935076290
## personal_fitness	0.0212372346	-0.034445121	-0.099406065	-0.1059710661
## fashion	0.0534643123	-0.053371434	-0.112856974	0.1567813803
## small_business	-0.0111899917	-0.006508075	0.019331007	-0.0354934395
## spam	-0.0005627957	0.002151637	0.002045882	0.0018183478
##	PC25			
## chatter	0.0026930882			
## current_events	-0.0245454364			
## travel	-0.0019013094			
## photo_sharing	-0.0004510037			
## uncategorized	-0.5259978073			
## tv_film	-0.1368385658			
## sports_fandom	0.0384527175			
## politics	0.0013729243			
## food	0.0336994796			
## family	-0.0012152863			
## home_and_garden	-0.0152802798			
## music	0.4857879193			
## news	-0.0260932221			
## online_gaming	0.0179095455			
## shopping	0.0088674102			
## health_nutrition	-0.0016872567			
## college_uni	-0.0231260593			

```
## sports_playing -0.0348248857
## cooking -0.0152562609
## eco 0.0424306246
## computers -0.0115825583
## business 0.0121028888
## outdoors -0.0469923780
## crafts -0.0359523643
## automotive 0.0473798956
## art 0.1642709428
## religion 0.0530965198
## beauty 0.2376338099
## parenting 0.1173416574
## dating 0.1561709766
## school -0.5641976666
## personal_fitness 0.0135338792
## fashion -0.1063951516
## small_business 0.0014729008
## spam -0.0003095499
```

```
#b(PCA)
```

```
PCA = prcomp(S, scale = TRUE)
summary(PCA)
```

```
## Importance of components:
```

```
##          PC1      PC2      PC3      PC4      PC5      PC6      PC7
## Standard deviation  2.1180 1.6982 1.59388 1.53435 1.4802 1.36873 1.28483
## Proportion of Variance 0.1282 0.0824 0.07258 0.06726 0.0626 0.05353 0.04717
## Cumulative Proportion 0.1282 0.2106 0.28315 0.35042 0.4130 0.46654 0.51371
##          PC8      PC9      PC10     PC11     PC12     PC13     PC14
## Standard deviation  1.19277 1.07039 1.01463 1.00387 0.96465 0.9612 0.94343
## Proportion of Variance 0.04065 0.03274 0.02941 0.02879 0.02659 0.0264 0.02543
## Cumulative Proportion 0.55436 0.58709 0.61651 0.64530 0.67189 0.6983 0.72372
##          PC15     PC16     PC17     PC18     PC19     PC20     PC21
```

```
## Standard deviation      0.93210 0.91692 0.90056 0.85245 0.80865 0.75339 0.69788
## Proportion of Variance 0.02482 0.02402 0.02317 0.02076 0.01868 0.01622 0.01392
## Cumulative Proportion  0.74854 0.77256 0.79573 0.81650 0.83518 0.85140 0.86531
##                          PC22    PC23    PC24    PC25    PC26    PC27    PC28
## Standard deviation      0.6873 0.65379 0.64986 0.63961 0.63687 0.61708 0.60198
## Proportion of Variance 0.0135 0.01221 0.01207 0.01169 0.01159 0.01088 0.01035
## Cumulative Proportion  0.8788 0.89102 0.90309 0.91477 0.92636 0.93724 0.94760
##                          PC29    PC30    PC31    PC32    PC33    PC34    PC35
## Standard deviation      0.59477 0.58730 0.55063 0.48577 0.47581 0.43814 0.42179
## Proportion of Variance 0.01011 0.00985 0.00866 0.00674 0.00647 0.00548 0.00508
## Cumulative Proportion  0.95770 0.96756 0.97622 0.98296 0.98943 0.99492 1.00000
```

PCA\$rotation

```
##              PC1              PC2              PC3              PC4
## chatter      -0.126055935  0.197160650 -0.074771374  0.112885243
## current_events -0.097217122  0.064026561 -0.052242093  0.030005563
## travel       -0.116635191  0.039930622 -0.424318222 -0.145351426
## photo_sharing -0.180621015  0.302873717  0.010819697  0.150895718
## uncategorized -0.094200589  0.146613439  0.030466572  0.020041604
## tv_film      -0.097693398  0.079240433 -0.086163963  0.090197917
## sports_fandom -0.287934699 -0.317132909  0.052131293  0.056398899
## politics     -0.130570693  0.013781854 -0.489904789 -0.197389014
## food         -0.297044398 -0.237942551  0.111530176 -0.073967550
## family       -0.244274961 -0.196358068  0.049397456  0.072411408
## home_and_garden -0.115574367  0.046885704 -0.021240230 -0.009339063
## music        -0.124279494  0.144147613  0.012341225  0.082491957
## news         -0.127843729 -0.036315393 -0.336040712 -0.177460632
## online_gaming -0.073924700  0.083529851 -0.055048426  0.221580273
## shopping     -0.133298002  0.209681082 -0.047136368  0.103136475
## health_nutrition -0.124306699  0.146647423  0.225338189 -0.463908651
## college_uni   -0.094369136  0.115817617 -0.085312611  0.256231563
## sports_playing -0.130473803  0.108429722 -0.042497389  0.175857833
## cooking      -0.189094224  0.314139027  0.194555099  0.009415159
```

## eco	-0.145013010	0.085488421	0.029314055	-0.122696797
## computers	-0.143276242	0.037327158	-0.367088364	-0.138289463
## business	-0.135269390	0.098626526	-0.105114621	0.012017847
## outdoors	-0.142205762	0.113841097	0.140135212	-0.414238284
## crafts	-0.193585253	-0.021643276	-0.002364302	0.023225557
## automotive	-0.131218017	-0.031568353	-0.190858995	-0.039178283
## art	-0.097872182	0.060379573	-0.049919084	0.062383736
## religion	-0.297315598	-0.316365187	0.093267779	0.065728421
## beauty	-0.201723685	0.208445011	0.150819655	0.146236894
## parenting	-0.293976079	-0.295185876	0.089245808	0.046938002
## dating	-0.105213673	0.071507702	-0.031357095	-0.028153389
## school	-0.280629304	-0.197675757	0.081725942	0.085516310
## personal_fitness	-0.137515323	0.144710555	0.217188846	-0.444722419
## fashion	-0.184124119	0.279635145	0.138868887	0.137351380
## small_business	-0.118553228	0.094253467	-0.100706279	0.079139911
## spam	-0.009193867	-0.003456678	-0.013193510	-0.016180124
##	PC5	PC6	PC7	PC8
## chatter	-0.193272289	0.461091633	-0.1069244177	0.070772644
## current_events	-0.058418194	0.139095618	0.0370818517	-0.054710833
## travel	-0.007531084	-0.163698806	0.0850519576	0.307004358
## photo_sharing	-0.229875962	0.211792595	-0.1252271864	0.022240492
## uncategorized	0.060593183	-0.036899806	0.1847120815	-0.049280709
## tv_film	0.210093734	0.061271567	0.5113952219	-0.219244002
## sports_fandom	-0.032537504	0.009145761	-0.0669781634	-0.109440772
## politics	-0.057176801	-0.128979335	-0.0631131272	0.015052286
## food	0.066620231	0.016949079	0.0393761992	0.090119658
## family	-0.010804763	0.047511784	-0.1002274972	-0.022189364
## home_and_garden	0.037677428	0.037894022	0.0913263009	-0.099057298
## music	0.066149523	-0.010836430	0.1506325421	-0.088550855
## news	-0.024365208	-0.093309478	-0.1424092999	-0.462808539
## online_gaming	0.476094505	-0.010064761	-0.2900748264	0.060357864
## shopping	-0.197639115	0.426836423	-0.0823453101	0.034023730
## health_nutrition	0.168429463	0.080447765	-0.0339394824	0.037185052

## college_uni	0.486718820	0.005257879	-0.1853338221	0.042507783
## sports_playing	0.370629397	-0.025895832	-0.2179288913	0.064191071
## cooking	-0.122186140	-0.358357208	-0.0594522830	-0.049939061
## eco	0.015771781	0.178530437	-0.0009581843	0.042954023
## computers	-0.057413825	-0.139400534	-0.0118047532	0.357871292
## business	-0.051626907	0.074965570	0.0927693109	0.138050455
## outdoors	0.147831200	0.035517108	-0.0619869070	-0.076299484
## crafts	0.036738587	0.079124867	0.2394479578	0.028532494
## automotive	-0.057378906	0.059077246	-0.2435344260	-0.585975602
## art	0.163679602	0.026201554	0.4912076060	-0.164226561
## religion	-0.021500520	-0.027223357	0.0246750101	0.101885146
## beauty	-0.186020629	-0.367013310	-0.0234801886	-0.062201539
## parenting	-0.041641186	-0.013581012	-0.0359767774	0.060830320
## dating	-0.010296312	0.003408343	0.0283358355	0.165742656
## school	-0.089572518	0.012394200	0.0203637952	0.078190420
## personal_fitness	0.157756329	0.095472619	-0.0394275571	0.037032426
## fashion	-0.171251003	-0.357607921	-0.0324293375	-0.019975185
## small_business	0.032217879	0.049499255	0.2044406285	0.012652422
## spam	0.016895446	0.003258187	0.0348107880	0.008610779
##	PC9	PC10	PC11	PC12
## chatter	-0.107878895	0.008094250	0.009316641	0.084097866
## current_events	0.101331309	-0.130688842	-0.102525036	-0.705114173
## travel	0.106993835	-0.012830676	0.008499723	-0.017695486
## photo_sharing	0.132281370	-0.032915417	0.074761021	0.065613345
## uncategorized	-0.271709414	0.138113864	-0.329195779	0.218884083
## tv_film	0.113389311	0.085278466	-0.010222890	0.008125718
## sports_fandom	0.030522464	0.025981564	-0.055483635	0.024796738
## politics	0.040057835	0.004854583	0.018694759	0.009925086
## food	0.110156724	0.020429261	0.000935098	-0.006032921
## family	0.101540744	0.002154263	0.056732870	0.020996151
## home_and_garden	-0.283913557	-0.173429322	-0.039286868	-0.546406847
## music	0.197158391	0.288357953	-0.629820678	-0.008847470
## news	-0.076823790	0.024807375	0.035861322	0.045706240

## online_gaming	0.004872794	-0.069619435	0.127719230	0.006866492
## shopping	0.135359880	0.012224409	0.052949766	0.066502833
## health_nutrition	0.039198103	0.016109197	0.038134630	-0.001785695
## college_uni	0.041667822	0.010553332	-0.050505843	-0.007374175
## sports_playing	-0.063975913	0.020959411	0.030196332	-0.015439488
## cooking	0.110634328	-0.045416597	0.084187449	-0.001847923
## eco	0.092078133	-0.187288428	-0.001953922	-0.014830717
## computers	0.099843429	-0.023512278	-0.030133387	-0.022979008
## business	-0.039845221	0.286675483	0.012142642	0.100586398
## outdoors	-0.021887042	0.043788283	-0.059756521	0.040866379
## crafts	-0.037810360	-0.071535634	0.308393531	0.166066182
## automotive	-0.079910699	0.008582245	0.004706665	0.104335373
## art	0.039596732	-0.137973499	0.413360352	0.044696875
## religion	0.068288356	0.015834292	-0.069183103	-0.033206096
## beauty	0.034838121	-0.033565015	0.041981558	-0.025232975
## parenting	0.038062986	-0.004220524	-0.033761193	0.016358781
## dating	-0.755714072	0.054763870	-0.003403982	-0.011560161
## school	-0.248410837	0.015244056	0.004238900	0.025389437
## personal_fitness	0.034671613	0.012550792	0.037987437	-0.007412252
## fashion	-0.043311061	-0.048274512	0.086325262	-0.007037760
## small_business	-0.020118775	-0.082586168	-0.154929700	0.060000885
## spam	-0.025190485	-0.821299613	-0.356023340	0.277438972
##	PC13	PC14	PC15	PC16
## chatter	0.003136743	-0.0684615338	-1.054013e-02	-0.065989690
## current_events	0.616169576	0.0784905623	-1.085900e-01	-0.072508478
## travel	-0.021164823	-0.0855664896	-3.596923e-02	-0.003564644
## photo_sharing	-0.073277790	-0.0723825752	1.687186e-02	-0.059929228
## uncategorized	0.117893167	-0.4432065683	-2.441916e-01	-0.110035603
## tv_film	-0.007551426	-0.0099718200	-4.554493e-03	0.090027707
## sports_fandom	-0.006388262	0.0073028856	1.940858e-02	0.008039848
## politics	-0.008238770	-0.0345885861	-2.812806e-02	-0.010378618
## food	-0.016212796	-0.0317917364	-9.960232e-03	-0.031314741
## family	-0.034760383	0.0109575839	4.119319e-03	-0.112464337

## home_and_garden	-0.602706740	-0.2408974263	3.185487e-01	-0.006601885
## music	-0.031082603	-0.0554487901	5.807448e-02	0.112758246
## news	0.039604926	0.0258842583	-1.197639e-02	0.010981366
## online_gaming	0.025391703	-0.0005856063	8.755486e-04	0.003398527
## shopping	-0.081269633	-0.1251472601	2.601064e-02	-0.092134009
## health_nutrition	0.014981950	0.0181297563	3.026668e-02	-0.089857459
## college_uni	0.008129676	0.0013403803	1.698558e-02	0.015414032
## sports_playing	0.030802998	-0.0123238623	4.581238e-05	-0.011710297
## cooking	-0.011890436	0.0023084339	1.384899e-02	-0.013049360
## eco	-0.183158488	0.1375875071	-4.878622e-01	0.713716190
## computers	-0.048705603	-0.1264008875	-4.070974e-02	-0.062268780
## business	0.162250054	0.3414548623	6.490473e-01	0.329628031
## outdoors	0.026327530	0.0260035111	6.413166e-02	-0.078945770
## crafts	0.216297172	-0.2718841674	4.056277e-02	-0.134703158
## automotive	0.034494650	0.0437061053	8.317254e-03	0.028682023
## art	0.016299490	0.0087813849	3.282910e-03	0.053953402
## religion	-0.024069874	-0.0316161282	-3.565197e-03	0.003276451
## beauty	0.015271997	0.0189820121	-1.635838e-02	0.015001722
## parenting	-0.024881795	0.0008454687	1.661696e-03	0.030219105
## dating	0.144342058	0.1535825969	-1.149640e-01	0.103843498
## school	0.045067336	0.0558608766	-4.196536e-02	0.012152785
## personal_fitness	0.023010203	0.0286236329	5.256116e-02	-0.106298820
## fashion	0.017508796	0.0435977284	-1.038489e-02	0.052998463
## small_business	-0.254058368	0.6639870713	-2.302010e-01	-0.494393944
## spam	0.153931997	0.0015436875	2.839543e-01	0.046084879
##	PC17	PC18	PC19	PC20
## chatter	0.090259723	0.144472198	-5.862353e-03	-3.238847e-03
## current_events	-0.111834895	-0.047236059	-2.413298e-05	-8.319644e-03
## travel	-0.002088431	0.087913092	2.331518e-02	-3.846415e-04
## photo_sharing	-0.019751405	0.068519106	-4.166593e-02	6.752537e-03
## uncategorized	-0.610877520	-0.127801947	1.913774e-02	-1.442906e-02
## tv_film	0.086213871	0.275090524	6.369697e-02	9.489074e-02
## sports_fandom	-0.035632627	0.015004257	-1.266356e-01	1.903385e-02

## politics	0.003039867	0.026883965	-1.100219e-02	6.092885e-05
## food	-0.037922905	0.080655668	-1.786015e-01	-2.943715e-02
## family	-0.073318593	0.041944623	9.058918e-01	4.095181e-03
## home_and_garden	-0.056094471	-0.153315544	9.560689e-03	-1.060884e-02
## music	0.467329931	-0.024531654	4.996883e-02	-7.196329e-02
## news	0.042882322	-0.022795701	-2.988908e-02	4.663916e-02
## online_gaming	-0.039601655	-0.023688806	-3.740834e-02	-3.683235e-01
## shopping	-0.013097505	0.122702589	-8.281518e-02	-1.476979e-03
## health_nutrition	0.010342237	0.050265919	-5.906085e-03	-2.054101e-02
## college_uni	-0.001689319	-0.002265047	-2.925155e-02	-3.174672e-01
## sports_playing	0.027833593	0.024363373	-5.385311e-02	8.448332e-01
## cooking	-0.032839075	0.006673589	-8.942184e-03	-8.190681e-03
## eco	-0.075613695	-0.251170221	5.146325e-02	2.915395e-02
## computers	0.019744720	0.040231933	6.675036e-03	-5.465548e-02
## business	-0.330495207	-0.209749811	1.855366e-02	7.038237e-03
## outdoors	0.051074812	0.061636235	3.957148e-02	-4.251458e-03
## crafts	0.374696526	-0.692284980	9.758322e-04	3.285672e-03
## automotive	-0.016872899	-0.050194399	-5.807935e-02	-7.169124e-02
## art	-0.088561868	0.305223772	-2.233151e-02	-5.993230e-02
## religion	-0.031435988	0.018362746	-7.328790e-02	3.328593e-02
## beauty	0.020720575	-0.001231257	-8.857784e-03	8.961196e-03
## parenting	-0.053176118	0.035675639	-1.470929e-01	6.650848e-04
## dating	0.271374655	0.169646737	1.518376e-01	-6.140007e-02
## school	0.073813592	0.177970793	-2.128392e-01	-9.482873e-02
## personal_fitness	-0.008783048	0.039775275	-2.797277e-02	-2.566788e-02
## fashion	0.049691849	0.034198644	1.866055e-02	-4.987715e-02
## small_business	-0.102395946	-0.248642938	-5.499140e-02	1.083797e-02
## spam	0.018210694	0.075891660	2.973867e-02	3.749483e-02
##	PC21	PC22	PC23	PC24
## chatter	-0.132006004	-0.0468423454	0.102016716	0.094478859
## current_events	0.019324871	0.0167759852	0.014300330	-0.018785019
## travel	0.004357286	0.0452006966	-0.077789719	-0.023807080
## photo_sharing	0.051694660	0.0624706957	0.163142729	0.270369730

## uncategorized	0.015341208	-0.0298095329	0.005870389	-0.036447802
## tv_film	-0.069129560	0.2134689004	-0.178147405	0.571984571
## sports_fandom	-0.098883460	0.1449871646	0.077348427	0.053970927
## politics	0.009708841	-0.0114381487	-0.102640907	-0.059435434
## food	-0.379475545	-0.1665808614	-0.525673731	-0.131287161
## family	0.099365679	-0.0807684676	-0.054393585	-0.029716226
## home_and_garden	0.019742229	-0.0062573086	-0.011385644	-0.001057997
## music	0.060727696	-0.2087413945	0.129384895	-0.272413635
## news	-0.043052604	-0.0517437322	-0.136967587	-0.044840728
## online_gaming	0.009145823	-0.0048841051	0.026422110	-0.050464329
## shopping	-0.044125297	0.0921236671	-0.277982048	-0.345565252
## health_nutrition	-0.007212749	-0.2436707955	0.040598918	0.110948926
## college_uni	-0.027444176	0.0794122694	-0.065999310	0.103623636
## sports_playing	0.070485899	-0.0732496999	0.029995572	-0.080865561
## cooking	-0.006265251	-0.0647202665	-0.043653309	0.036107260
## eco	0.049710463	0.0169150111	-0.027723646	-0.013478282
## computers	0.068053736	-0.0397518160	0.269075237	0.131914090
## business	0.013766236	-0.0179580943	-0.019330854	-0.007053179
## outdoors	0.165236289	0.7526573346	0.039960165	-0.232698616
## crafts	0.025500225	0.0356754542	-0.025512703	0.036282178
## automotive	-0.005131101	-0.1358040230	0.145776450	0.086666418
## art	0.048516796	-0.1650819450	0.304778881	-0.462738123
## religion	-0.131608204	0.0944586248	0.077247950	0.022364341
## beauty	-0.048427977	0.0465202265	0.010440622	-0.044353139
## parenting	-0.166558709	0.0746983172	0.495652978	0.025869925
## dating	-0.297768893	0.0160158994	0.028744093	-0.029405176
## school	0.783944054	-0.1280192721	-0.212702660	0.075055543
## personal_fitness	-0.016838194	-0.3274837332	0.072516719	0.172171380
## fashion	-0.089952998	0.0557534821	-0.107908991	-0.001878428
## small_business	-0.007361302	0.0003845028	0.006067574	-0.026908363
## spam	-0.016623081	-0.0185648805	-0.045165963	0.013439078
##	PC25	PC26	PC27	PC28
## chatter	0.1401797146	0.2069468740	-0.0043065846	-0.3094159463

## current_events	0.0107300716	-0.0005099622	0.0002024668	0.0274172093
## travel	-0.2085372085	0.2319657527	0.3329438788	-0.0596368593
## photo_sharing	0.2397461605	0.3807505926	-0.1111641800	0.2964624220
## uncategorized	-0.0066940979	0.0277048402	-0.0201935804	0.0138418977
## tv_film	-0.0931279719	-0.1240822229	0.0535586997	-0.0399085744
## sports_fandom	-0.1192563130	-0.0811161800	-0.5863220824	-0.1309816436
## politics	-0.1223271951	0.1954779293	0.0068455366	0.0053551099
## food	0.4896015484	0.1095622583	0.0895021728	0.0368478462
## family	0.0069504504	0.0158274097	0.0101525505	0.0038589008
## home_and_garden	0.0096590637	0.0216215191	0.0123831625	-0.0097850314
## music	0.0335229703	0.0705841299	-0.0323929057	0.0555106606
## news	-0.1593564945	0.2156449375	-0.3564343648	0.0467354695
## online_gaming	-0.0260026684	0.0460574285	-0.0388281889	-0.0261920651
## shopping	-0.4141237829	-0.4250189334	0.0331422678	0.0322297870
## health_nutrition	-0.1077624291	-0.0445732631	-0.0171032047	-0.0213884476
## college_uni	-0.0632884418	-0.0113177727	0.0010360363	-0.0295679223
## sports_playing	0.0458551788	-0.0353850777	0.0266657129	0.0201772961
## cooking	-0.0580263960	-0.0398459291	-0.0205889677	0.1281558595
## eco	0.0114468473	-0.0114885115	-0.0212732181	-0.0251970931
## computers	0.3609009941	-0.5264160675	-0.2442671196	-0.0055633000
## business	0.0270185652	-0.0173805405	-0.0139888098	-0.0158018831
## outdoors	0.2209207669	0.0438054531	0.0657066067	-0.0032834951
## crafts	-0.0163864311	-0.0025857102	0.0243852294	0.0051944897
## automotive	0.2311622236	-0.3294338859	0.4652835342	0.0183215579
## art	0.1186862627	0.0441508513	-0.0863147946	0.0253388988
## religion	-0.1096880974	-0.1186165986	0.1290044351	0.1013689201
## beauty	0.0094607622	0.0102586671	0.0716423056	-0.7461343134
## parenting	-0.2735004752	0.1614493641	0.2728108619	0.1019590221
## dating	-0.0344703611	-0.0671155634	-0.0219381697	0.0665433478
## school	-0.0043410203	0.0292519057	0.0506305511	-0.0100616388
## personal_fitness	-0.2047207975	-0.0124552963	-0.0266720164	-0.0669607943
## fashion	-0.0604342916	-0.0987848699	-0.0086383207	0.4220077836
## small_business	-0.0002718852	-0.0051425158	0.0008223558	0.0070984084

## spam	-0.0182141075	-0.0048612446	-0.0090282810	0.0002616641
##	PC29	PC30	PC31	PC32
## chatter	-0.139694639	-0.6018604509	0.1261340126	0.0038557771
## current_events	-0.008051439	0.0022758231	-0.0248944134	-0.0006252119
## travel	0.359677974	-0.1147244363	-0.2426528688	0.4479525387
## photo_sharing	0.232660014	0.4654449286	0.0192725171	0.0323268148
## uncategorized	-0.006873979	-0.0042008987	-0.0003793047	-0.0038980700
## tv_film	-0.120085035	0.0275453094	-0.0319631229	-0.0580173838
## sports_fandom	0.413273877	-0.1570947571	-0.3851620124	-0.0608679707
## politics	0.014640843	0.0002523996	0.0886763673	-0.7690746208
## food	-0.129653545	0.0752982861	-0.1293077654	0.0102534278
## family	-0.044593714	0.0105463984	-0.0466417561	-0.0050485071
## home_and_garden	-0.005048138	-0.0195544517	-0.0230316357	-0.0029956124
## music	0.035984673	0.0087278217	-0.0191111888	-0.0077829594
## news	-0.325005766	0.0840172917	0.2513113360	0.4148691118
## online_gaming	-0.019807653	0.0162202102	0.0052419620	-0.0055714900
## shopping	-0.071647359	0.2149304698	-0.0618379897	0.0132466009
## health_nutrition	0.042687388	0.0049708027	0.0100628743	-0.0254436873
## college_uni	-0.008605270	-0.0032307133	0.0538977784	0.0047513526
## sports_playing	0.005871662	-0.0127634964	-0.0283323918	-0.0108748436
## cooking	-0.016824624	-0.1091085844	-0.0371622358	-0.0941776875
## eco	-0.012168128	-0.0140136204	0.0035995779	0.0060005097
## computers	-0.231784620	0.0525586778	0.0324460806	0.1060204616
## business	-0.025077886	0.0026822635	0.0157832913	0.0169438007
## outdoors	-0.036321069	-0.0556247842	0.0090243536	0.0067590208
## crafts	-0.005258545	-0.0002917321	-0.0276911350	-0.0140111985
## automotive	0.239249414	-0.0269672067	-0.1329432441	-0.0014337346
## art	0.091844978	-0.0267011000	0.0462321235	-0.0064369116
## religion	0.297847785	-0.0432290708	0.7631279100	0.0412461403
## beauty	-0.019999219	0.2652481428	0.0793303545	0.0113797600
## parenting	-0.492364723	0.0917701899	-0.2462009917	-0.0323985811
## dating	0.101778281	0.2373081414	-0.0353977076	-0.0234516387
## school	-0.078897432	-0.0147978193	-0.0153069992	0.0091556860

## personal_fitness	0.068257667	0.0111375554	0.0257694200	0.0229049151
## fashion	-0.059859534	-0.4061498074	-0.0391337227	0.0383910977
## small_business	-0.004962913	-0.0142507877	-0.0036384835	0.0120644873
## spam	-0.006820867	0.0260206496	0.0070905734	-0.0053315768
##	PC33	PC34	PC35	
## chatter	-0.091369988	0.009605350	0.0104797221	
## current_events	-0.011210780	0.005407430	-0.0062698297	
## travel	-0.054489798	0.014350864	-0.0175387793	
## photo_sharing	0.079012003	-0.021445130	-0.0343189884	
## uncategorized	0.021894061	0.022334397	-0.0208485187	
## tv_film	-0.022247789	0.160285122	-0.0533361533	
## sports_fandom	-0.004632750	-0.009726729	-0.0146854437	
## politics	0.085406334	-0.008491533	-0.0110085367	
## food	0.008600360	0.010521751	0.0360137785	
## family	0.010629229	-0.014916957	0.0112218303	
## home_and_garden	-0.001283348	0.007562866	-0.0085624011	
## music	0.002906630	0.074364165	-0.0208624378	
## news	-0.039760431	-0.016445876	-0.0092503579	
## online_gaming	-0.033649311	0.630025881	-0.2295112350	
## shopping	-0.003709106	0.015640643	-0.0036805481	
## health_nutrition	-0.143567073	-0.264853910	-0.6802219194	
## college_uni	0.022585630	-0.664132230	0.2306898163	
## sports_playing	0.022349617	0.004655613	-0.0045052241	
## cooking	-0.726823876	0.054058257	0.2686934666	
## eco	-0.002329649	-0.001605708	0.0190482825	
## computers	0.010921434	0.008068331	0.0184297963	
## business	-0.011122538	0.015489947	-0.0199614994	
## outdoors	0.005257897	0.034664668	0.0714073526	
## crafts	-0.009525074	-0.019907213	0.0095615248	
## automotive	0.002330883	-0.002368940	0.0039260202	
## art	0.015461415	-0.093717636	0.0415909522	
## religion	-0.051297983	0.051947716	-0.0196836595	
## beauty	0.192322223	-0.026954661	-0.0898066310	

```
## parenting      -0.008503660 -0.035285794 -0.0059906950
## dating         -0.101094929  0.006446417  0.0421415037
## school         -0.006044439 -0.014993689  0.0005685706
## personal_fitness 0.341739253  0.196147232  0.5531539825
## fashion        0.503773341 -0.027342856 -0.1651657040
## small_business -0.008097429  0.021340786 -0.0170687423
## spam           -0.002695001  0.004114380 -0.0074360112
```

I run 2 PCA. When I choose rank as 4, I find the cumulative proportion is too low. So rank is equal to 25 now and the cumulative proportion is nearly 96%. In the second PCA, I get 36 components and the cumulative proportion is equal to 100%. Then I find that there are too many PCS in both 2 analysis. I cannot list the groups one by one. In each component, if most coefficients have the same sign(positive or negative), I will choose 3 categories with highest absolute values as a group.

```
#c(correlation matrix)
```

```
cor = cor(S)
cor
```

```
##          chatter current_events      travel photo_sharing
## chatter      1.000000000      0.156211163  0.014666814  0.536266603
## current_events 0.156211163      1.000000000  0.050946163  0.145952862
## travel        0.014666814      0.050946163  1.000000000  0.024067950
## photo_sharing 0.536266603      0.145952862  0.024067950  1.000000000
## uncategorized 0.066993440      0.029674226  0.030865562  0.096398099
## tv_film       0.012898633      0.077673464  0.096989954  0.021170912
## sports_fandom 0.014392631      0.061780370 -0.008709190  0.019921002
## politics      0.051448378      0.068282733  0.660210000  0.039766998
## food          -0.004704080      0.059767526  0.075142216  0.006802181
## family        0.079170381      0.063367006  0.017534763  0.098587939
## home_and_garden 0.070157596      0.053511465  0.040931872  0.083955114
## music         0.091317767      0.072366139  0.038640317  0.146188166
## news          -0.001163561      0.060284226  0.250616947 -0.011980028
```

## online_gaming	0.004784789	-0.001645689	0.013222873	0.037234010
## shopping	0.583373219	0.150143619	0.019907780	0.535621020
## health_nutrition	0.003727738	0.019863015	-0.011922499	0.034804791
## college_uni	0.033991439	0.030952662	0.053835136	0.061494841
## sports_playing	0.061073951	0.030720781	0.054961948	0.098696993
## cooking	0.002081642	0.046716479	0.017597488	0.360590994
## eco	0.155117735	0.076903468	0.061434287	0.173411683
## computers	0.072489571	0.054824859	0.602934879	0.093000186
## business	0.166106904	0.074580868	0.161845668	0.178636351
## outdoors	-0.006597319	0.017898948	0.027133231	0.032783874
## crafts	0.111741452	0.073723629	0.086953794	0.110945709
## automotive	0.133767354	0.072444806	-0.002784110	0.115249028
## art	-0.005076772	0.053477246	0.086394257	0.024752344
## religion	-0.023111699	0.067694509	0.063933064	0.003299888
## beauty	0.026364231	0.070112215	0.012565524	0.317965902
## parenting	0.020742516	0.050237162	0.042341130	0.041169648
## dating	0.184452453	0.031045863	0.086756030	0.028511721
## school	0.116678625	0.068047127	0.022199544	0.106209238
## personal_fitness	0.032747707	0.038388654	-0.005299245	0.062523682
## fashion	0.063314293	0.055906219	0.026015648	0.347248795
## small_business	0.116730623	0.065497930	0.116950707	0.138112387
## spam	0.004603242	0.019402989	0.022773349	-0.008664858
##	uncategorized	tv_film	sports_fandom	politics
## chatter	0.0669934396	0.0128986328	0.0143926306	0.051448378
## current_events	0.0296742259	0.0776734640	0.0617803698	0.068282733
## travel	0.0308655618	0.0969899543	-0.0087091896	0.660210000
## photo_sharing	0.0963980989	0.0211709116	0.0199210022	0.039766998
## uncategorized	1.0000000000	0.1632789878	-0.0005287314	-0.001143143
## tv_film	0.1632789878	1.0000000000	0.0307587998	0.032254541
## sports_fandom	-0.0005287314	0.0307587998	1.0000000000	0.067097905
## politics	-0.0011431434	0.0322545409	0.0670979049	1.000000000
## food	0.0353476665	0.0806833248	0.5326383665	0.059017379
## family	-0.0046281840	0.0217763915	0.4378103823	0.045470650

## home_and_garden	0.0742591369	0.1065910522	0.0848219920	0.057986105
## music	0.1439077049	0.2748322309	0.0545375138	0.007545661
## news	0.0037403342	0.0674405581	0.2002896757	0.561842213
## online_gaming	0.0236016809	0.0353318018	0.0247608769	-0.006917410
## shopping	0.0553125510	0.0416246434	0.0262612699	0.046393973
## health_nutrition	0.0798559719	-0.0017906843	-0.0112292550	-0.016851900
## college_uni	0.0947186290	0.2042182554	0.0264564138	0.008964787
## sports_playing	0.0838301172	0.1032631811	0.0710499117	0.032736511
## cooking	0.1612570088	0.0006017955	0.0076921174	-0.007322368
## eco	0.0472320334	0.0628254703	0.0858508297	0.064256293
## computers	0.0266392164	-0.0054859445	0.0506332951	0.572150641
## business	0.0659654221	0.1011473763	0.0681327694	0.150675278
## outdoors	0.0939022767	0.0289285413	0.0622176473	0.073373236
## crafts	0.0891965709	0.1846894463	0.2011885972	0.058597842
## automotive	0.0139164228	0.0205075271	0.2396464725	0.285508994
## art	0.1064475118	0.4987718266	0.0223195336	0.025625587
## religion	0.0170384882	0.0450275641	0.6379748428	0.032529266
## beauty	0.1373705347	0.0167831053	0.1228632403	-0.011292710
## parenting	0.0062680638	-0.0017880905	0.6077181198	0.044281427
## dating	0.1270238084	0.0041708935	0.0169255299	0.078288457
## school	0.0582599351	0.0250222744	0.4931061924	0.027795499
## personal_fitness	0.0847295855	-0.0004447435	0.0142720768	-0.008096476
## fashion	0.1414087167	0.0176088683	0.0307672871	-0.006793131
## small_business	0.0848320319	0.1887982408	0.0486622355	0.105261525
## spam	0.0138980529	-0.0042106462	0.0089574643	0.009438922
##	food	family	home_and_garden	music
## chatter	-0.004704080	0.079170381	0.07015760	0.0913177669
## current_events	0.059767526	0.063367006	0.05351146	0.0723661388
## travel	0.075142216	0.017534763	0.04093187	0.0386403172
## photo_sharing	0.006802181	0.098587939	0.08395511	0.1461881658
## uncategorized	0.035347667	-0.004628184	0.07425914	0.1439077049
## tv_film	0.080683325	0.021776392	0.10659105	0.2748322309
## sports_fandom	0.532638366	0.437810382	0.08482199	0.0545375138

## politics	0.059017379	0.045470650	0.05798610	0.0075456607
## food	1.000000000	0.375533627	0.08921731	0.0721457958
## family	0.375533627	1.000000000	0.06504292	0.0351173712
## home_and_garden	0.089217308	0.065042916	1.00000000	0.0632560502
## music	0.072145796	0.035117371	0.06325605	1.0000000000
## news	0.064499690	0.094370314	0.08137338	0.0155152209
## online_gaming	0.045756746	0.082462535	0.03037615	0.0234658858
## shopping	0.020982946	0.084098539	0.07322790	0.1059920572
## health_nutrition	0.223043246	0.026603921	0.06612165	0.0512084191
## college_uni	0.048260040	0.068586525	0.06022031	0.1881590868
## sports_playing	0.089333676	0.099209710	0.06847339	0.1080771385
## cooking	0.067684449	0.055368653	0.07302935	0.1699371547
## eco	0.148171958	0.085396673	0.07238756	0.0699570243
## computers	0.112482997	0.062071539	0.05303950	0.0425994678
## business	0.076995867	0.063453202	0.04751696	0.1024759787
## outdoors	0.190841529	0.057691067	0.07788630	0.0871445544
## crafts	0.238647962	0.171104760	0.07652389	0.0778324671
## automotive	0.059687427	0.149865803	0.07189290	0.0297480759
## art	0.101791832	0.030163186	0.10488798	0.0202095405
## religion	0.591318063	0.452768549	0.09439831	0.0753480995
## beauty	0.102454336	0.118087188	0.07316316	0.1769706252
## parenting	0.544948125	0.420578018	0.08011189	0.0440734267
## dating	0.033434336	0.017710590	0.10761722	0.0098874584
## school	0.432403928	0.334689575	0.10006929	0.0518095525
## personal_fitness	0.223856925	0.038185942	0.07695813	0.0513248587
## fashion	0.036963917	0.062704099	0.07612052	0.1604436447
## small_business	0.063499437	0.062871670	0.08015803	0.1220162157
## spam	0.001482766	-0.006802752	0.02160085	0.0005284301
##		news online_gaming	shopping health_nutrition	
## chatter	-0.001163561	0.0047847889	0.583373219	0.0037277381
## current_events	0.060284226	-0.0016456887	0.150143619	0.0198630146
## travel	0.250616947	0.0132228733	0.019907780	-0.0119224993
## photo_sharing	-0.011980028	0.0372340099	0.535621020	0.0348047911

## uncategorized	0.003740334	0.0236016809	0.055312551	0.0798559719
## tv_film	0.067440558	0.0353318018	0.041624643	-0.0017906843
## sports_fandom	0.200289676	0.0247608769	0.026261270	-0.0112292550
## politics	0.561842213	-0.0069174099	0.046393973	-0.0168519001
## food	0.064499690	0.0457567463	0.020982946	0.2230432459
## family	0.094370314	0.0824625354	0.084098539	0.0266039206
## home_and_garden	0.081373376	0.0303761455	0.073227895	0.0661216523
## music	0.015515221	0.0234658858	0.105992057	0.0512084191
## news	1.000000000	-0.0023217561	-0.011813142	0.0184723484
## online_gaming	-0.002321756	1.0000000000	-0.007932408	-0.0000176422
## shopping	-0.011813142	-0.0079324080	1.000000000	0.0314086858
## health_nutrition	0.018472348	-0.0000176422	0.031408686	1.0000000000
## college_uni	-0.006632975	0.7728392923	0.029046828	-0.0277788561
## sports_playing	0.037554057	0.4912993420	0.039791700	0.0447899666
## cooking	0.013169882	0.0353209993	0.086908714	0.2489527151
## eco	0.039161408	0.0275257081	0.165475294	0.2208463589
## computers	0.211780215	0.0142759909	0.069347702	0.0235923180
## business	0.052022707	0.0032965473	0.160388318	0.0330434015
## outdoors	0.140731385	0.0056496732	0.018558832	0.6082253668
## crafts	0.053261774	0.0417262775	0.107245497	0.0797254552
## automotive	0.555417450	0.0483166936	0.115744356	-0.0238249985
## art	0.041357011	0.0828918943	0.032911113	0.0319408677
## religion	0.022945910	0.0057441594	0.007956775	0.0106622133
## beauty	0.017223284	0.0045270085	0.068034649	0.0069553398
## parenting	0.078897406	0.0226973412	0.020248306	0.0292332391
## dating	0.052065729	0.0228324583	0.004068363	0.0751908487
## school	0.052728222	-0.0008595235	0.076918012	0.0066410255
## personal_fitness	0.028739368	0.0119043235	0.054419081	0.8099023568
## fashion	0.002132337	0.0360133351	0.096854665	0.0297479557
## small_business	0.047598846	0.0419629288	0.112662828	-0.0093025415
## spam	-0.001800012	0.0058670252	-0.019251616	0.0023958243
##	college_uni	sports_playing	cooking	eco
## chatter	0.0339914391	0.061073951	0.0020816423	0.15511774

## current_events	0.0309526621	0.030720781	0.0467164788	0.07690347
## travel	0.0538351360	0.054961948	0.0175974884	0.06143429
## photo_sharing	0.0614948410	0.098696993	0.3605909943	0.17341168
## uncategorized	0.0947186290	0.083830117	0.1612570088	0.04723203
## tv_film	0.2042182554	0.103263181	0.0006017955	0.06282547
## sports_fandom	0.0264564138	0.071049912	0.0076921174	0.08585083
## politics	0.0089647874	0.032736511	-0.0073223677	0.06425629
## food	0.0482600403	0.089333676	0.0676844485	0.14817196
## family	0.0685865247	0.099209710	0.0553686528	0.08539667
## home_and_garden	0.0602203114	0.068473391	0.0730293453	0.07238756
## music	0.1881590868	0.108077138	0.1699371547	0.06995702
## news	-0.0066329747	0.037554057	0.0131698817	0.03916141
## online_gaming	0.7728392923	0.491299342	0.0353209993	0.02752571
## shopping	0.0290468283	0.039791700	0.0869087138	0.16547529
## health_nutrition	-0.0277788561	0.044789967	0.2489527151	0.22084636
## college_uni	1.0000000000	0.506374768	0.0326211357	0.02999765
## sports_playing	0.5063747684	1.0000000000	0.1134243174	0.04883664
## cooking	0.0326211357	0.113424317	1.0000000000	0.09468926
## eco	0.0299976539	0.048836643	0.0946892641	1.00000000
## computers	0.0357173059	0.055137058	0.0625767717	0.07170567
## business	0.0568632385	0.058557218	0.0904536300	0.06903281
## outdoors	0.0002266462	0.058386618	0.1926335927	0.17481079
## crafts	0.0445461695	0.073583667	0.0683961801	0.08596322
## automotive	0.0392353381	0.046380642	0.0195136512	0.05997131
## art	0.0903808391	0.056542328	0.0555088964	0.06668392
## religion	0.0278312665	0.076103199	0.0339513209	0.09915385
## beauty	0.0196241668	0.093295239	0.6642389459	0.04762071
## parenting	0.0103665861	0.068607722	0.0506783916	0.11429246
## dating	0.0240141334	0.094629504	0.0290986583	0.06553289
## school	-0.0055988726	0.067138279	0.0843002915	0.09004071
## personal_fitness	-0.0215268678	0.051434835	0.2336229315	0.21261355
## fashion	0.0520235384	0.108221244	0.7214026744	0.06381744
## small_business	0.1138833315	0.079653227	0.0727561881	0.07650412

## spam	0.0094529848	-0.008742556	-0.0061781291	0.03141528
##	computers	business	outdoors	crafts
## chatter	0.072489571	0.166106904	-0.0065973195	0.11174145
## current_events	0.054824859	0.074580868	0.0178989481	0.07372363
## travel	0.602934879	0.161845668	0.0271332314	0.08695379
## photo_sharing	0.093000186	0.178636351	0.0327838735	0.11094571
## uncategorized	0.026639216	0.065965422	0.0939022767	0.08919657
## tv_film	-0.005485945	0.101147376	0.0289285413	0.18468945
## sports_fandom	0.050633295	0.068132769	0.0622176473	0.20118860
## politics	0.572150641	0.150675278	0.0733732362	0.05859784
## food	0.112482997	0.076995867	0.1908415291	0.23864796
## family	0.062071539	0.063453202	0.0576910670	0.17110476
## home_and_garden	0.053039498	0.047516956	0.0778863049	0.07652389
## music	0.042599468	0.102475979	0.0871445544	0.07783247
## news	0.211780215	0.052022707	0.1407313846	0.05326177
## online_gaming	0.014275991	0.003296547	0.0056496732	0.04172628
## shopping	0.069347702	0.160388318	0.0185588318	0.10724550
## health_nutrition	0.023592318	0.033043402	0.6082253668	0.07972546
## college_uni	0.035717306	0.056863238	0.0002266462	0.04454617
## sports_playing	0.055137058	0.058557218	0.0583866177	0.07358367
## cooking	0.062576772	0.090453630	0.1926335927	0.06839618
## eco	0.071705671	0.069032814	0.1748107912	0.08596322
## computers	1.000000000	0.145387107	0.0430388875	0.09283321
## business	0.145387107	1.000000000	0.0509135858	0.10165359
## outdoors	0.043038887	0.050913586	1.000000000	0.07239357
## crafts	0.092833206	0.101653592	0.0723935740	1.00000000
## automotive	0.013813021	0.040319930	0.0887386055	0.03397123
## art	-0.003641485	0.085921419	0.0069278190	0.23353456
## religion	0.107529163	0.075390623	0.0426490984	0.23640037
## beauty	0.050833394	0.087306971	0.0414714063	0.09871424
## parenting	0.092961564	0.083133411	0.0613567343	0.20838376
## dating	0.094839229	0.111825266	0.0953960198	0.09845243
## school	0.076726075	0.104868599	0.0428262486	0.21799280

## personal_fitness	0.021830496	0.058177210	0.5677902744	0.09075479
## fashion	0.063047239	0.109494748	0.0557789123	0.08554645
## small_business	0.104650495	0.107021298	0.0081708055	0.09108434
## spam	0.023117451	-0.025491850	0.0215189501	0.01993976
##	automotive	art	religion	beauty
## chatter	0.133767354	-0.005076772	-0.023111699	0.026364231
## current_events	0.072444806	0.053477246	0.067694509	0.070112215
## travel	-0.002784110	0.086394257	0.063933064	0.012565524
## photo_sharing	0.115249028	0.024752344	0.003299888	0.317965902
## uncategorized	0.013916423	0.106447512	0.017038488	0.137370535
## tv_film	0.020507527	0.498771827	0.045027564	0.016783105
## sports_fandom	0.239646473	0.022319534	0.637974843	0.122863240
## politics	0.285508994	0.025625587	0.032529266	-0.011292710
## food	0.059687427	0.101791832	0.591318063	0.102454336
## family	0.149865803	0.030163186	0.452768549	0.118087188
## home_and_garden	0.071892898	0.104887976	0.094398311	0.073163163
## music	0.029748076	0.020209541	0.075348099	0.176970625
## news	0.555417450	0.041357011	0.022945910	0.017223284
## online_gaming	0.048316694	0.082891894	0.005744159	0.004527009
## shopping	0.115744356	0.032911113	0.007956775	0.068034649
## health_nutrition	-0.023824999	0.031940868	0.010662213	0.006955340
## college_uni	0.039235338	0.090380839	0.027831267	0.019624167
## sports_playing	0.046380642	0.056542328	0.076103199	0.093295239
## cooking	0.019513651	0.055508896	0.033951321	0.664238946
## eco	0.059971307	0.066683922	0.099153848	0.047620711
## computers	0.013813021	-0.003641485	0.107529163	0.050833394
## business	0.040319930	0.085921419	0.075390623	0.087306971
## outdoors	0.088738605	0.006927819	0.042649098	0.041471406
## crafts	0.033971234	0.233534563	0.236400370	0.098714237
## automotive	1.000000000	-0.001711121	0.070620972	0.048793819
## art	-0.001711121	1.000000000	0.040783857	0.055029988
## religion	0.070620972	0.040783857	1.000000000	0.144553885
## beauty	0.048793819	0.055029988	0.144553885	1.000000000

## parenting	0.119122238	0.029719842	0.655597304	0.153620364
## dating	0.003453045	0.021181878	0.037641132	0.085459256
## school	0.102745787	0.071435572	0.516217988	0.188665957
## personal_fitness	-0.009861229	0.030535005	0.031587379	0.024227535
## fashion	0.019730231	0.061987356	0.065365540	0.634973942
## small_business	0.033961568	0.154498608	0.061433981	0.091303432
## spam	0.008560904	0.024339269	0.008062977	-0.009135427
##	parenting	dating	school	personal_fitness
## chatter	0.020742516	0.184452453	0.1166786249	0.0327477067
## current_events	0.050237162	0.031045863	0.0680471275	0.0383886537
## travel	0.042341130	0.086756030	0.0221995438	-0.0052992453
## photo_sharing	0.041169648	0.028511721	0.1062092377	0.0625236821
## uncategorized	0.006268064	0.127023808	0.0582599351	0.0847295855
## tv_film	-0.001788090	0.004170894	0.0250222744	-0.0004447435
## sports_fandom	0.607718120	0.016925530	0.4931061924	0.0142720768
## politics	0.044281427	0.078288457	0.0277954990	-0.0080964757
## food	0.544948125	0.033434336	0.4324039280	0.2238569249
## family	0.420578018	0.017710590	0.3346895745	0.0381859420
## home_and_garden	0.080111889	0.107617215	0.1000692908	0.0769581279
## music	0.044073427	0.009887458	0.0518095525	0.0513248587
## news	0.078897406	0.052065729	0.0527282215	0.0287393678
## online_gaming	0.022697341	0.022832458	-0.0008595235	0.0119043235
## shopping	0.020248306	0.004068363	0.0769180117	0.0544190810
## health_nutrition	0.029233239	0.075190849	0.0066410255	0.8099023568
## college_uni	0.010366586	0.024014133	-0.0055988726	-0.0215268678
## sports_playing	0.068607722	0.094629504	0.0671382792	0.0514348348
## cooking	0.050678392	0.029098658	0.0843002915	0.2336229315
## eco	0.114292458	0.065532888	0.0900407104	0.2126135451
## computers	0.092961564	0.094839229	0.0767260752	0.0218304964
## business	0.083133411	0.111825266	0.1048685990	0.0581772096
## outdoors	0.061356734	0.095396020	0.0428262486	0.5677902744
## crafts	0.208383762	0.098452430	0.2179927962	0.0907547913
## automotive	0.119122238	0.003453045	0.1027457872	-0.0098612290

## art	0.029719842	0.021181878	0.0714355719	0.0305350048
## religion	0.655597304	0.037641132	0.5162179885	0.0315873791
## beauty	0.153620364	0.085459256	0.1886659575	0.0242275347
## parenting	1.000000000	0.048094772	0.4996163935	0.0556830580
## dating	0.048094772	1.000000000	0.2324943729	0.0751219669
## school	0.499616394	0.232494373	1.0000000000	0.0289927455
## personal_fitness	0.055683058	0.075121967	0.0289927455	1.0000000000
## fashion	0.070474628	0.164979711	0.1465750199	0.0419365922
## small_business	0.051275509	0.081137520	0.0892821248	0.0092225435
## spam	0.016097412	-0.001926510	0.0062148420	0.0078760698
##	fashion	small_business	spam	
## chatter	0.063314293	0.116730623	0.0046032416	
## current_events	0.055906219	0.065497930	0.0194029891	
## travel	0.026015648	0.116950707	0.0227733485	
## photo_sharing	0.347248795	0.138112387	-0.0086648576	
## uncategorized	0.141408717	0.084832032	0.0138980529	
## tv_film	0.017608868	0.188798241	-0.0042106462	
## sports_fandom	0.030767287	0.048662236	0.0089574643	
## politics	-0.006793131	0.105261525	0.0094389223	
## food	0.036963917	0.063499437	0.0014827661	
## family	0.062704099	0.062871670	-0.0068027516	
## home_and_garden	0.076120516	0.080158027	0.0216008547	
## music	0.160443645	0.122016216	0.0005284301	
## news	0.002132337	0.047598846	-0.0018000119	
## online_gaming	0.036013335	0.041962929	0.0058670252	
## shopping	0.096854665	0.112662828	-0.0192516162	
## health_nutrition	0.029747956	-0.009302541	0.0023958243	
## college_uni	0.052023538	0.113883331	0.0094529848	
## sports_playing	0.108221244	0.079653227	-0.0087425556	
## cooking	0.721402674	0.072756188	-0.0061781291	
## eco	0.063817437	0.076504123	0.0314152819	
## computers	0.063047239	0.104650495	0.0231174511	
## business	0.109494748	0.107021298	-0.0254918495	

```
## outdoors      0.055778912    0.008170806    0.0215189501
## crafts        0.085546453    0.091084342    0.0199397644
## automotive    0.019730231    0.033961568    0.0085609039
## art           0.061987356    0.154498608    0.0243392694
## religion      0.065365540    0.061433981    0.0080629769
## beauty        0.634973942    0.091303432   -0.0091354265
## parenting     0.070474628    0.051275509    0.0160974121
## dating        0.164979711    0.081137520   -0.0019265102
## school        0.146575020    0.089282125    0.0062148420
## personal_fitness 0.041936592    0.009222543    0.0078760698
## fashion       1.000000000    0.092180469   -0.0031873217
## small_business 0.092180469    1.000000000    0.0316621449
## spam          -0.003187322    0.031662145    1.0000000000
```

A easy way to find correlation. We can find some correlated categories through the number in the matrix. For example, coef of correlation between politics and travel is about 0.66021;coef of correlation between religion and sports_fandom is about 0.6379748428. Hence, these two methods can find groups. With these groups, the ad firm knows what audience are interested in, and focus on these categories.

#3

```
playlists_raw = read.csv("C:/Users/30970/Documents/GitHub/DATA MINING/EC0395M/data/playlists_raw.csv")
```

```
## 'data.frame':    289955 obs. of  4 variables:
## $ user      : int  1 1 1 1 1 1 1 1 1 1 ...
## $ artist    : chr  "red hot chili peppers" "the black dahlia murder" "goldfrapp" "dropkick murphys"
## $ sex       : chr  "f" "f" "f" "f" ...
## $ country   : chr  "Germany" "Germany" "Germany" "Germany" ...
```

```
summary(playlists_raw)
```

```
##          user          artist          sex          country
```



```
## Min.      :    1   Length:289955      Length:289955      Length:289955
## 1st Qu.: 4935   Class :character    Class :character    Class :character
## Median : 9838   Mode  :character    Mode  :character    Mode  :character
## Mean    : 9852
## 3rd Qu.:14769
## Max.     :19718
```

```
groceries = read.transactions("C:/Users/30970/Documents/GitHub/DATA MINING/EC0395M/data
groceriesrules = apriori(groceries, parameter=list(support=.005, confidence=.1, maxlen=
```

```
## Apriori
##
## Parameter specification:
## confidence minval smax arem aval originalSupport maxtime support minlen
##           0.1    0.1    1 none FALSE                TRUE         5   0.005      1
## maxlen target  ext
##           2 rules TRUE
##
## Algorithmic control:
## filter tree heap memopt load sort verbose
##     0.1 TRUE TRUE  FALSE TRUE     2     TRUE
##
## Absolute minimum support count: 49
##
## set item appearances ...[0 item(s)] done [0.00s].
## set transactions ...[169 item(s), 9835 transaction(s)] done [0.00s].
## sorting and recoding items ... [120 item(s)] done [0.00s].
## creating transaction tree ... done [0.00s].
## checking subsets of size 1 2 done [0.00s].
## writing ... [763 rule(s)] done [0.00s].
## creating S4 object ... done [0.00s].
```

Thresholds: all the rules have support at least 0.005, have confidence at least 0.1 and maximum length is 2

```
#RULES
```

```
inspect(groceriesrules)
```

##	lhs	rhs	support
## [1]	{}	=> {bottled water}	0.110523640
## [2]	{}	=> {tropical fruit}	0.104931368
## [3]	{}	=> {root vegetables}	0.108998475
## [4]	{}	=> {soda}	0.174377224
## [5]	{}	=> {yogurt}	0.139501779
## [6]	{}	=> {rolls/buns}	0.183934926
## [7]	{}	=> {other vegetables}	0.193492628
## [8]	{}	=> {whole milk}	0.255516014
## [9]	{cake bar}	=> {whole milk}	0.005592272
## [10]	{dishes}	=> {other vegetables}	0.005998983
## [11]	{dishes}	=> {whole milk}	0.005287239
## [12]	{mustard}	=> {whole milk}	0.005185562
## [13]	{pot plants}	=> {whole milk}	0.006914082
## [14]	{chewing gum}	=> {soda}	0.005388917
## [15]	{chewing gum}	=> {whole milk}	0.005083884
## [16]	{canned fish}	=> {other vegetables}	0.005083884
## [17]	{pasta}	=> {whole milk}	0.006100661
## [18]	{herbs}	=> {root vegetables}	0.007015760
## [19]	{herbs}	=> {other vegetables}	0.007727504
## [20]	{herbs}	=> {whole milk}	0.007727504
## [21]	{processed cheese}	=> {soda}	0.005287239
## [22]	{processed cheese}	=> {other vegetables}	0.005490595
## [23]	{processed cheese}	=> {whole milk}	0.007015760
## [24]	{semi-finished bread}	=> {other vegetables}	0.005185562
## [25]	{semi-finished bread}	=> {whole milk}	0.007117438
## [26]	{beverages}	=> {yogurt}	0.005490595
## [27]	{beverages}	=> {rolls/buns}	0.005388917
## [28]	{beverages}	=> {other vegetables}	0.005185562
## [29]	{beverages}	=> {whole milk}	0.006812405

## [30]	{ice cream}	=> {soda}	0.006100661
## [31]	{ice cream}	=> {other vegetables}	0.005083884
## [32]	{ice cream}	=> {whole milk}	0.005897306
## [33]	{detergent}	=> {other vegetables}	0.006405694
## [34]	{detergent}	=> {whole milk}	0.008947636
## [35]	{pickled vegetables}	=> {other vegetables}	0.006405694
## [36]	{pickled vegetables}	=> {whole milk}	0.007117438
## [37]	{baking powder}	=> {other vegetables}	0.007320793
## [38]	{baking powder}	=> {whole milk}	0.009252669
## [39]	{flour}	=> {other vegetables}	0.006304016
## [40]	{flour}	=> {whole milk}	0.008439248
## [41]	{soft cheese}	=> {yogurt}	0.005998983
## [42]	{soft cheese}	=> {rolls/buns}	0.005388917
## [43]	{soft cheese}	=> {other vegetables}	0.007117438
## [44]	{soft cheese}	=> {whole milk}	0.007524148
## [45]	{specialty bar}	=> {soda}	0.007219115
## [46]	{specialty bar}	=> {rolls/buns}	0.005592272
## [47]	{specialty bar}	=> {other vegetables}	0.005592272
## [48]	{specialty bar}	=> {whole milk}	0.006507372
## [49]	{misc. beverages}	=> {bottled water}	0.005287239
## [50]	{misc. beverages}	=> {soda}	0.007320793
## [51]	{misc. beverages}	=> {other vegetables}	0.005592272
## [52]	{misc. beverages}	=> {whole milk}	0.007015760
## [53]	{grapes}	=> {tropical fruit}	0.006100661
## [54]	{grapes}	=> {other vegetables}	0.009049314
## [55]	{grapes}	=> {whole milk}	0.007320793
## [56]	{cat food}	=> {yogurt}	0.006202339
## [57]	{cat food}	=> {other vegetables}	0.006507372
## [58]	{cat food}	=> {whole milk}	0.008845958
## [59]	{specialty chocolate}	=> {soda}	0.006304016
## [60]	{specialty chocolate}	=> {rolls/buns}	0.005592272
## [61]	{specialty chocolate}	=> {other vegetables}	0.006100661
## [62]	{specialty chocolate}	=> {whole milk}	0.008032537

## [63]	{meat}	=> {sausage}	0.005287239
## [64]	{meat}	=> {root vegetables}	0.005083884
## [65]	{meat}	=> {soda}	0.005490595
## [66]	{meat}	=> {yogurt}	0.005287239
## [67]	{meat}	=> {rolls/buns}	0.006914082
## [68]	{meat}	=> {other vegetables}	0.009964413
## [69]	{meat}	=> {whole milk}	0.009964413
## [70]	{frozen meals}	=> {tropical fruit}	0.005490595
## [71]	{frozen meals}	=> {soda}	0.006202339
## [72]	{frozen meals}	=> {yogurt}	0.006202339
## [73]	{frozen meals}	=> {other vegetables}	0.007524148
## [74]	{frozen meals}	=> {whole milk}	0.009862735
## [75]	{hard cheese}	=> {sausage}	0.005185562
## [76]	{hard cheese}	=> {root vegetables}	0.005592272
## [77]	{hard cheese}	=> {yogurt}	0.006405694
## [78]	{hard cheese}	=> {rolls/buns}	0.005897306
## [79]	{hard cheese}	=> {other vegetables}	0.009456024
## [80]	{hard cheese}	=> {whole milk}	0.010066090
## [81]	{butter milk}	=> {pip fruit}	0.005083884
## [82]	{butter milk}	=> {tropical fruit}	0.005490595
## [83]	{butter milk}	=> {root vegetables}	0.005083884
## [84]	{butter milk}	=> {yogurt}	0.008540925
## [85]	{butter milk}	=> {rolls/buns}	0.007625826
## [86]	{butter milk}	=> {other vegetables}	0.010371124
## [87]	{butter milk}	=> {whole milk}	0.011591256
## [88]	{candy}	=> {tropical fruit}	0.005388917
## [89]	{candy}	=> {soda}	0.008642603
## [90]	{candy}	=> {yogurt}	0.005490595
## [91]	{candy}	=> {rolls/buns}	0.007117438
## [92]	{candy}	=> {other vegetables}	0.006914082
## [93]	{candy}	=> {whole milk}	0.008235892
## [94]	{ham}	=> {white bread}	0.005083884
## [95]	{white bread}	=> {ham}	0.005083884

## [96] {ham}	=> {tropical fruit}	0.005388917
## [97] {ham}	=> {yogurt}	0.006710727
## [98] {ham}	=> {rolls/buns}	0.006914082
## [99] {ham}	=> {other vegetables}	0.009150991
## [100] {ham}	=> {whole milk}	0.011489578
## [101] {sliced cheese}	=> {sausage}	0.007015760
## [102] {sliced cheese}	=> {tropical fruit}	0.005287239
## [103] {sliced cheese}	=> {root vegetables}	0.005592272
## [104] {sliced cheese}	=> {soda}	0.005083884
## [105] {sliced cheese}	=> {yogurt}	0.008032537
## [106] {sliced cheese}	=> {rolls/buns}	0.007625826
## [107] {sliced cheese}	=> {other vegetables}	0.009049314
## [108] {sliced cheese}	=> {whole milk}	0.010777834
## [109] {UHT-milk}	=> {bottled water}	0.007320793
## [110] {UHT-milk}	=> {soda}	0.007625826
## [111] {UHT-milk}	=> {yogurt}	0.007422471
## [112] {UHT-milk}	=> {rolls/buns}	0.006405694
## [113] {UHT-milk}	=> {other vegetables}	0.008134215
## [114] {oil}	=> {root vegetables}	0.007015760
## [115] {oil}	=> {yogurt}	0.005287239
## [116] {oil}	=> {rolls/buns}	0.005083884
## [117] {oil}	=> {other vegetables}	0.009964413
## [118] {oil}	=> {whole milk}	0.011286223
## [119] {onions}	=> {whipped/sour cream}	0.005083884
## [120] {onions}	=> {citrus fruit}	0.005592272
## [121] {onions}	=> {bottled water}	0.005897306
## [122] {onions}	=> {tropical fruit}	0.005693950
## [123] {onions}	=> {root vegetables}	0.009456024
## [124] {onions}	=> {soda}	0.005287239
## [125] {onions}	=> {yogurt}	0.007219115
## [126] {onions}	=> {rolls/buns}	0.006812405
## [127] {onions}	=> {other vegetables}	0.014234875
## [128] {onions}	=> {whole milk}	0.012099644

## [129] {berries}	=> {whipped/sour cream}	0.009049314
## [130] {whipped/sour cream}	=> {berries}	0.009049314
## [131] {berries}	=> {citrus fruit}	0.005388917
## [132] {berries}	=> {tropical fruit}	0.006710727
## [133] {berries}	=> {root vegetables}	0.006609049
## [134] {berries}	=> {soda}	0.007320793
## [135] {berries}	=> {yogurt}	0.010574479
## [136] {berries}	=> {rolls/buns}	0.006609049
## [137] {berries}	=> {other vegetables}	0.010269446
## [138] {berries}	=> {whole milk}	0.011794611
## [139] {hamburger meat}	=> {sausage}	0.005185562
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## [141] {hamburger meat}	=> {soda}	0.005795628
## [142] {hamburger meat}	=> {yogurt}	0.006507372
## [143] {hamburger meat}	=> {rolls/buns}	0.008642603
## [144] {hamburger meat}	=> {other vegetables}	0.013828165
## [145] {hamburger meat}	=> {whole milk}	0.014743264
## [146] {hygiene articles}	=> {napkins}	0.006100661
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## [148] {hygiene articles}	=> {citrus fruit}	0.005287239
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## [151] {hygiene articles}	=> {tropical fruit}	0.006710727
## [152] {hygiene articles}	=> {root vegetables}	0.005388917
## [153] {hygiene articles}	=> {soda}	0.007015760
## [154] {hygiene articles}	=> {yogurt}	0.007320793
## [155] {hygiene articles}	=> {rolls/buns}	0.005897306
## [156] {hygiene articles}	=> {other vegetables}	0.009557702
## [157] {hygiene articles}	=> {whole milk}	0.012811388
## [158] {salty snack}	=> {fruit/vegetable juice}	0.005998983
## [159] {salty snack}	=> {whipped/sour cream}	0.005185562
## [160] {salty snack}	=> {pastry}	0.005185562
## [161] {salty snack}	=> {shopping bags}	0.005998983

## [162] {salty snack}	=> {sausage}	0.005287239
## [163] {salty snack}	=> {tropical fruit}	0.005592272
## [164] {salty snack}	=> {soda}	0.009354347
## [165] {salty snack}	=> {yogurt}	0.006202339
## [166] {salty snack}	=> {other vegetables}	0.010777834
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## [168] {sugar}	=> {margarine}	0.005490595
## [169] {sugar}	=> {pastry}	0.005185562
## [170] {sugar}	=> {root vegetables}	0.006405694
## [171] {sugar}	=> {soda}	0.007320793
## [172] {sugar}	=> {yogurt}	0.006914082
## [173] {sugar}	=> {rolls/buns}	0.007015760
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## [175] {sugar}	=> {whole milk}	0.015048297
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## [177] {chocolate}	=> {waffles}	0.005795628
## [178] {waffles}	=> {whipped/sour cream}	0.005083884
## [179] {waffles}	=> {pastry}	0.007015760
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## [188] {long life bakery product}	=> {chocolate}	0.005287239
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## [190] {long life bakery product}	=> {fruit/vegetable juice}	0.006202339
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## [195]	{long life bakery product}	=>	{tropical fruit}	0.006304016
## [196]	{long life bakery product}	=>	{root vegetables}	0.005287239
## [197]	{long life bakery product}	=>	{soda}	0.007625826
## [198]	{long life bakery product}	=>	{yogurt}	0.008744281
## [199]	{long life bakery product}	=>	{rolls/buns}	0.007930859
## [200]	{long life bakery product}	=>	{other vegetables}	0.010676157
## [201]	{long life bakery product}	=>	{whole milk}	0.013523132
## [202]	{dessert}	=>	{curd}	0.005185562
## [203]	{dessert}	=>	{fruit/vegetable juice}	0.005998983
## [204]	{dessert}	=>	{pastry}	0.005388917
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## [206]	{dessert}	=>	{sausage}	0.005897306
## [207]	{dessert}	=>	{bottled water}	0.005185562
## [208]	{dessert}	=>	{tropical fruit}	0.006304016
## [209]	{dessert}	=>	{root vegetables}	0.005795628
## [210]	{dessert}	=>	{soda}	0.009862735
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## [212]	{dessert}	=>	{rolls/buns}	0.006812405
## [213]	{dessert}	=>	{other vegetables}	0.011591256
## [214]	{dessert}	=>	{whole milk}	0.013726487
## [215]	{canned beer}	=>	{shopping bags}	0.011387900
## [216]	{shopping bags}	=>	{canned beer}	0.011387900
## [217]	{canned beer}	=>	{bottled water}	0.008032537
## [218]	{canned beer}	=>	{soda}	0.013828165
## [219]	{canned beer}	=>	{rolls/buns}	0.011286223
## [220]	{canned beer}	=>	{other vegetables}	0.009049314
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## [222]	{cream cheese}	=>	{curd}	0.005083884
## [223]	{cream cheese}	=>	{domestic eggs}	0.005083884
## [224]	{cream cheese}	=>	{fruit/vegetable juice}	0.005693950
## [225]	{cream cheese}	=>	{whipped/sour cream}	0.006405694
## [226]	{cream cheese}	=>	{pip fruit}	0.006100661
## [227]	{cream cheese}	=>	{citrus fruit}	0.005693950

## [228] {cream cheese}	=> {shopping bags}	0.005592272
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## [241] {pork}	=> {chicken}	0.005795628
## [242] {chicken}	=> {butter}	0.005795628
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## [244] {chicken}	=> {newspapers}	0.005185562
## [245] {chicken}	=> {domestic eggs}	0.006202339
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## [251] {chicken}	=> {tropical fruit}	0.006405694
## [252] {chicken}	=> {root vegetables}	0.010879512
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## [258] {white bread}	=> {frankfurter}	0.005185562
## [259] {white bread}	=> {domestic eggs}	0.005795628
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## [264] {white bread}	=> {pastry}	0.005592272
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## [290] {chocolate}	=> {whole milk}	0.016675140
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## [293] {coffee}	=> {pip fruit}	0.006914082

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## [308] {frozen vegetables}	=> {frankfurter}	0.005083884
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## [312] {frozen vegetables}	=> {domestic eggs}	0.005185562
## [313] {frozen vegetables}	=> {fruit/vegetable juice}	0.007829181
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## [316] {whipped/sour cream}	=> {frozen vegetables}	0.007930859
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## [327] {frozen vegetables}	=> {other vegetables}	0.017793594
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## [331] {beef}	=> {margarine}	0.006202339
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## [351] {beef}	=> {whole milk}	0.021250635
## [352] {curd}	=> {margarine}	0.006304016
## [353] {margarine}	=> {curd}	0.006304016
## [354] {curd}	=> {butter}	0.006812405
## [355] {butter}	=> {curd}	0.006812405
## [356] {curd}	=> {newspapers}	0.005693950
## [357] {curd}	=> {domestic eggs}	0.006507372
## [358] {domestic eggs}	=> {curd}	0.006507372
## [359] {curd}	=> {whipped/sour cream}	0.010472801

## [360] {whipped/sour cream}	=> {curd}	0.010472801
## [361] {curd}	=> {pip fruit}	0.007829181
## [362] {pip fruit}	=> {curd}	0.007829181
## [363] {curd}	=> {pastry}	0.007524148
## [364] {curd}	=> {citrus fruit}	0.007117438
## [365] {curd}	=> {shopping bags}	0.005388917
## [366] {curd}	=> {sausage}	0.007625826
## [367] {curd}	=> {bottled water}	0.006100661
## [368] {curd}	=> {tropical fruit}	0.010269446
## [369] {curd}	=> {root vegetables}	0.010879512
## [370] {curd}	=> {soda}	0.008134215
## [371] {curd}	=> {yogurt}	0.017285206
## [372] {yogurt}	=> {curd}	0.017285206
## [373] {curd}	=> {rolls/buns}	0.010066090
## [374] {curd}	=> {other vegetables}	0.017183528
## [375] {curd}	=> {whole milk}	0.026131164
## [376] {whole milk}	=> {curd}	0.026131164
## [377] {napkins}	=> {newspapers}	0.006202339
## [378] {napkins}	=> {domestic eggs}	0.005998983
## [379] {napkins}	=> {fruit/vegetable juice}	0.006914082
## [380] {napkins}	=> {whipped/sour cream}	0.007219115
## [381] {whipped/sour cream}	=> {napkins}	0.007219115
## [382] {napkins}	=> {pip fruit}	0.006710727
## [383] {napkins}	=> {pastry}	0.007015760
## [384] {napkins}	=> {citrus fruit}	0.007625826
## [385] {napkins}	=> {shopping bags}	0.007219115
## [386] {napkins}	=> {sausage}	0.006710727
## [387] {napkins}	=> {bottled water}	0.008642603
## [388] {napkins}	=> {tropical fruit}	0.010066090
## [389] {napkins}	=> {root vegetables}	0.009964413
## [390] {napkins}	=> {soda}	0.011997966
## [391] {napkins}	=> {yogurt}	0.012302999
## [392] {napkins}	=> {rolls/buns}	0.011692933

## [393] {napkins}	=> {other vegetables}	0.014438231
## [394] {napkins}	=> {whole milk}	0.019725470
## [395] {pork}	=> {frankfurter}	0.005897306
## [396] {frankfurter}	=> {pork}	0.005897306
## [397] {pork}	=> {margarine}	0.006405694
## [398] {margarine}	=> {pork}	0.006405694
## [399] {pork}	=> {newspapers}	0.006609049
## [400] {pork}	=> {whipped/sour cream}	0.008235892
## [401] {whipped/sour cream}	=> {pork}	0.008235892
## [402] {pork}	=> {pip fruit}	0.006100661
## [403] {pork}	=> {pastry}	0.006304016
## [404] {pork}	=> {citrus fruit}	0.006507372
## [405] {pork}	=> {shopping bags}	0.006405694
## [406] {pork}	=> {sausage}	0.006507372
## [407] {pork}	=> {bottled water}	0.007422471
## [408] {pork}	=> {tropical fruit}	0.008540925
## [409] {pork}	=> {root vegetables}	0.013624809
## [410] {root vegetables}	=> {pork}	0.013624809
## [411] {pork}	=> {soda}	0.011896289
## [412] {pork}	=> {yogurt}	0.009557702
## [413] {pork}	=> {rolls/buns}	0.011286223
## [414] {pork}	=> {other vegetables}	0.021657346
## [415] {other vegetables}	=> {pork}	0.021657346
## [416] {pork}	=> {whole milk}	0.022165735
## [417] {frankfurter}	=> {brown bread}	0.007117438
## [418] {brown bread}	=> {frankfurter}	0.007117438
## [419] {frankfurter}	=> {margarine}	0.006405694
## [420] {margarine}	=> {frankfurter}	0.006405694
## [421] {frankfurter}	=> {domestic eggs}	0.007015760
## [422] {domestic eggs}	=> {frankfurter}	0.007015760
## [423] {frankfurter}	=> {whipped/sour cream}	0.006202339
## [424] {frankfurter}	=> {pip fruit}	0.007219115
## [425] {frankfurter}	=> {pastry}	0.008337570

## [426] {frankfurter}	=> {citrus fruit}	0.006507372
## [427] {frankfurter}	=> {shopping bags}	0.008235892
## [428] {frankfurter}	=> {sausage}	0.010066090
## [429] {sausage}	=> {frankfurter}	0.010066090
## [430] {frankfurter}	=> {bottled water}	0.007320793
## [431] {frankfurter}	=> {tropical fruit}	0.009456024
## [432] {frankfurter}	=> {root vegetables}	0.010167768
## [433] {frankfurter}	=> {soda}	0.011286223
## [434] {frankfurter}	=> {yogurt}	0.011184545
## [435] {frankfurter}	=> {rolls/buns}	0.019217082
## [436] {rolls/buns}	=> {frankfurter}	0.019217082
## [437] {frankfurter}	=> {other vegetables}	0.016471784
## [438] {frankfurter}	=> {whole milk}	0.020538892
## [439] {margarine}	=> {bottled beer}	0.006100661
## [440] {butter}	=> {bottled beer}	0.005795628
## [441] {bottled beer}	=> {bottled water}	0.015760041
## [442] {bottled water}	=> {bottled beer}	0.015760041
## [443] {bottled beer}	=> {tropical fruit}	0.008235892
## [444] {bottled beer}	=> {root vegetables}	0.009659380
## [445] {bottled beer}	=> {soda}	0.016980173
## [446] {bottled beer}	=> {yogurt}	0.009252669
## [447] {bottled beer}	=> {rolls/buns}	0.013624809
## [448] {bottled beer}	=> {other vegetables}	0.016166751
## [449] {bottled beer}	=> {whole milk}	0.020437214
## [450] {brown bread}	=> {margarine}	0.006507372
## [451] {margarine}	=> {brown bread}	0.006507372
## [452] {butter}	=> {brown bread}	0.005795628
## [453] {brown bread}	=> {newspapers}	0.007625826
## [454] {brown bread}	=> {domestic eggs}	0.006812405
## [455] {domestic eggs}	=> {brown bread}	0.006812405
## [456] {brown bread}	=> {fruit/vegetable juice}	0.008337570
## [457] {fruit/vegetable juice}	=> {brown bread}	0.008337570
## [458] {brown bread}	=> {pip fruit}	0.007625826

## [459] {pip fruit}	=> {brown bread}	0.007625826
## [460] {brown bread}	=> {pastry}	0.009659380
## [461] {pastry}	=> {brown bread}	0.009659380
## [462] {brown bread}	=> {citrus fruit}	0.008337570
## [463] {citrus fruit}	=> {brown bread}	0.008337570
## [464] {brown bread}	=> {shopping bags}	0.009252669
## [465] {brown bread}	=> {sausage}	0.010676157
## [466] {sausage}	=> {brown bread}	0.010676157
## [467] {brown bread}	=> {bottled water}	0.008235892
## [468] {brown bread}	=> {tropical fruit}	0.010676157
## [469] {tropical fruit}	=> {brown bread}	0.010676157
## [470] {brown bread}	=> {root vegetables}	0.010167768
## [471] {brown bread}	=> {soda}	0.012608033
## [472] {brown bread}	=> {yogurt}	0.014539908
## [473] {yogurt}	=> {brown bread}	0.014539908
## [474] {brown bread}	=> {rolls/buns}	0.012608033
## [475] {brown bread}	=> {other vegetables}	0.018708693
## [476] {brown bread}	=> {whole milk}	0.025216065
## [477] {margarine}	=> {butter}	0.006710727
## [478] {butter}	=> {margarine}	0.006710727
## [479] {margarine}	=> {newspapers}	0.007117438
## [480] {margarine}	=> {domestic eggs}	0.008337570
## [481] {domestic eggs}	=> {margarine}	0.008337570
## [482] {margarine}	=> {fruit/vegetable juice}	0.006202339
## [483] {margarine}	=> {whipped/sour cream}	0.006812405
## [484] {margarine}	=> {pip fruit}	0.008540925
## [485] {pip fruit}	=> {margarine}	0.008540925
## [486] {margarine}	=> {pastry}	0.006812405
## [487] {margarine}	=> {citrus fruit}	0.007930859
## [488] {margarine}	=> {sausage}	0.007117438
## [489] {margarine}	=> {bottled water}	0.010269446
## [490] {margarine}	=> {tropical fruit}	0.009354347
## [491] {margarine}	=> {root vegetables}	0.011082867

## [492] {root vegetables}	=> {margarine}	0.011082867
## [493] {margarine}	=> {soda}	0.010167768
## [494] {margarine}	=> {yogurt}	0.014234875
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## [496] {margarine}	=> {rolls/buns}	0.014743264
## [497] {margarine}	=> {other vegetables}	0.019725470
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## [501] {butter}	=> {domestic eggs}	0.009659380
## [502] {domestic eggs}	=> {butter}	0.009659380
## [503] {butter}	=> {fruit/vegetable juice}	0.008032537
## [504] {fruit/vegetable juice}	=> {butter}	0.008032537
## [505] {butter}	=> {whipped/sour cream}	0.010167768
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## [507] {butter}	=> {pip fruit}	0.007320793
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## [509] {butter}	=> {citrus fruit}	0.009150991
## [510] {citrus fruit}	=> {butter}	0.009150991
## [511] {butter}	=> {sausage}	0.008642603
## [512] {butter}	=> {bottled water}	0.008947636
## [513] {butter}	=> {tropical fruit}	0.009964413
## [514] {butter}	=> {root vegetables}	0.012913066
## [515] {root vegetables}	=> {butter}	0.012913066
## [516] {butter}	=> {soda}	0.008845958
## [517] {butter}	=> {yogurt}	0.014641586
## [518] {yogurt}	=> {butter}	0.014641586
## [519] {butter}	=> {rolls/buns}	0.013421454
## [520] {butter}	=> {other vegetables}	0.020030503
## [521] {other vegetables}	=> {butter}	0.020030503
## [522] {butter}	=> {whole milk}	0.027554652
## [523] {whole milk}	=> {butter}	0.027554652
## [524] {domestic eggs}	=> {newspapers}	0.006914082

## [525] {newspapers}	=> {fruit/vegetable juice}	0.008235892
## [526] {fruit/vegetable juice}	=> {newspapers}	0.008235892
## [527] {whipped/sour cream}	=> {newspapers}	0.007219115
## [528] {newspapers}	=> {pastry}	0.008439248
## [529] {newspapers}	=> {citrus fruit}	0.008337570
## [530] {citrus fruit}	=> {newspapers}	0.008337570
## [531] {newspapers}	=> {sausage}	0.008032537
## [532] {newspapers}	=> {bottled water}	0.011286223
## [533] {bottled water}	=> {newspapers}	0.011286223
## [534] {newspapers}	=> {tropical fruit}	0.011794611
## [535] {tropical fruit}	=> {newspapers}	0.011794611
## [536] {newspapers}	=> {root vegetables}	0.011489578
## [537] {root vegetables}	=> {newspapers}	0.011489578
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## [541] {newspapers}	=> {rolls/buns}	0.019725470
## [542] {rolls/buns}	=> {newspapers}	0.019725470
## [543] {newspapers}	=> {other vegetables}	0.019318760
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## [545] {whole milk}	=> {newspapers}	0.027351296
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## [547] {fruit/vegetable juice}	=> {domestic eggs}	0.008032537
## [548] {domestic eggs}	=> {whipped/sour cream}	0.009964413
## [549] {whipped/sour cream}	=> {domestic eggs}	0.009964413
## [550] {domestic eggs}	=> {pip fruit}	0.008642603
## [551] {pip fruit}	=> {domestic eggs}	0.008642603
## [552] {domestic eggs}	=> {pastry}	0.009049314
## [553] {pastry}	=> {domestic eggs}	0.009049314
## [554] {domestic eggs}	=> {citrus fruit}	0.010371124
## [555] {citrus fruit}	=> {domestic eggs}	0.010371124
## [556] {domestic eggs}	=> {shopping bags}	0.009049314
## [557] {domestic eggs}	=> {sausage}	0.009557702

## [558] {sausage}	=> {domestic eggs}	0.009557702
## [559] {domestic eggs}	=> {bottled water}	0.009150991
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## [561] {tropical fruit}	=> {domestic eggs}	0.011387900
## [562] {domestic eggs}	=> {root vegetables}	0.014336553
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## [566] {yogurt}	=> {domestic eggs}	0.014336553
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## [568] {domestic eggs}	=> {other vegetables}	0.022267412
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## [583] {fruit/vegetable juice}	=> {bottled water}	0.014234875
## [584] {bottled water}	=> {fruit/vegetable juice}	0.014234875
## [585] {fruit/vegetable juice}	=> {tropical fruit}	0.013726487
## [586] {tropical fruit}	=> {fruit/vegetable juice}	0.013726487
## [587] {fruit/vegetable juice}	=> {root vegetables}	0.011997966
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## [591] {fruit/vegetable juice}	=> {yogurt}	0.018708693
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## [593] {fruit/vegetable juice}	=> {rolls/buns}	0.014539908
## [594] {fruit/vegetable juice}	=> {other vegetables}	0.021047280
## [595] {other vegetables}	=> {fruit/vegetable juice}	0.021047280
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## [604] {whipped/sour cream}	=> {sausage}	0.009049314
## [605] {whipped/sour cream}	=> {bottled water}	0.008744281
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## [608] {whipped/sour cream}	=> {root vegetables}	0.017081851
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## [610] {whipped/sour cream}	=> {soda}	0.011591256
## [611] {whipped/sour cream}	=> {yogurt}	0.020742247
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## [613] {whipped/sour cream}	=> {rolls/buns}	0.014641586
## [614] {whipped/sour cream}	=> {other vegetables}	0.028876462
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## [619] {pastry}	=> {pip fruit}	0.010676157
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## [624] {sausage}	=> {pip fruit}	0.010777834
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## [626] {pip fruit}	=> {tropical fruit}	0.020437214
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## [633] {pip fruit}	=> {rolls/buns}	0.013929842
## [634] {pip fruit}	=> {other vegetables}	0.026131164
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## [638] {pastry}	=> {citrus fruit}	0.009761057
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## [640] {pastry}	=> {shopping bags}	0.011896289
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## [644] {pastry}	=> {bottled water}	0.008947636
## [645] {pastry}	=> {tropical fruit}	0.013218099
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## [647] {pastry}	=> {root vegetables}	0.010981190
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## [649] {pastry}	=> {soda}	0.021047280
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## [651] {pastry}	=> {yogurt}	0.017691917
## [652] {yogurt}	=> {pastry}	0.017691917
## [653] {pastry}	=> {rolls/buns}	0.020945602
## [654] {rolls/buns}	=> {pastry}	0.020945602
## [655] {pastry}	=> {other vegetables}	0.022572445
## [656] {other vegetables}	=> {pastry}	0.022572445

## [657] {pastry}	=> {whole milk}	0.033248602
## [658] {whole milk}	=> {pastry}	0.033248602
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## [660] {citrus fruit}	=> {sausage}	0.011286223
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## [664] {citrus fruit}	=> {tropical fruit}	0.019928826
## [665] {tropical fruit}	=> {citrus fruit}	0.019928826
## [666] {citrus fruit}	=> {root vegetables}	0.017691917
## [667] {root vegetables}	=> {citrus fruit}	0.017691917
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## [669] {citrus fruit}	=> {yogurt}	0.021657346
## [670] {yogurt}	=> {citrus fruit}	0.021657346
## [671] {citrus fruit}	=> {rolls/buns}	0.016776817
## [672] {citrus fruit}	=> {other vegetables}	0.028876462
## [673] {other vegetables}	=> {citrus fruit}	0.028876462
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## [675] {whole milk}	=> {citrus fruit}	0.030503305
## [676] {shopping bags}	=> {sausage}	0.015658363
## [677] {sausage}	=> {shopping bags}	0.015658363
## [678] {shopping bags}	=> {bottled water}	0.010981190
## [679] {shopping bags}	=> {tropical fruit}	0.013523132
## [680] {tropical fruit}	=> {shopping bags}	0.013523132
## [681] {shopping bags}	=> {root vegetables}	0.012811388
## [682] {root vegetables}	=> {shopping bags}	0.012811388
## [683] {shopping bags}	=> {soda}	0.024605999
## [684] {soda}	=> {shopping bags}	0.024605999
## [685] {shopping bags}	=> {yogurt}	0.015251652
## [686] {yogurt}	=> {shopping bags}	0.015251652
## [687] {shopping bags}	=> {rolls/buns}	0.019522115
## [688] {rolls/buns}	=> {shopping bags}	0.019522115
## [689] {shopping bags}	=> {other vegetables}	0.023182511

## [690] {other vegetables}	=> {shopping bags}	0.023182511
## [691] {shopping bags}	=> {whole milk}	0.024504321
## [692] {sausage}	=> {bottled water}	0.011997966
## [693] {bottled water}	=> {sausage}	0.011997966
## [694] {sausage}	=> {tropical fruit}	0.013929842
## [695] {tropical fruit}	=> {sausage}	0.013929842
## [696] {sausage}	=> {root vegetables}	0.014946619
## [697] {root vegetables}	=> {sausage}	0.014946619
## [698] {sausage}	=> {soda}	0.024300966
## [699] {soda}	=> {sausage}	0.024300966
## [700] {sausage}	=> {yogurt}	0.019623793
## [701] {yogurt}	=> {sausage}	0.019623793
## [702] {sausage}	=> {rolls/buns}	0.030604982
## [703] {rolls/buns}	=> {sausage}	0.030604982
## [704] {sausage}	=> {other vegetables}	0.026944586
## [705] {other vegetables}	=> {sausage}	0.026944586
## [706] {sausage}	=> {whole milk}	0.029893238
## [707] {whole milk}	=> {sausage}	0.029893238
## [708] {bottled water}	=> {tropical fruit}	0.018505338
## [709] {tropical fruit}	=> {bottled water}	0.018505338
## [710] {bottled water}	=> {root vegetables}	0.015658363
## [711] {root vegetables}	=> {bottled water}	0.015658363
## [712] {bottled water}	=> {soda}	0.028978139
## [713] {soda}	=> {bottled water}	0.028978139
## [714] {bottled water}	=> {yogurt}	0.022979156
## [715] {yogurt}	=> {bottled water}	0.022979156
## [716] {bottled water}	=> {rolls/buns}	0.024199288
## [717] {rolls/buns}	=> {bottled water}	0.024199288
## [718] {bottled water}	=> {other vegetables}	0.024809354
## [719] {other vegetables}	=> {bottled water}	0.024809354
## [720] {bottled water}	=> {whole milk}	0.034367056
## [721] {whole milk}	=> {bottled water}	0.034367056
## [722] {tropical fruit}	=> {root vegetables}	0.021047280

## [723] {root vegetables}	=> {tropical fruit}	0.021047280
## [724] {tropical fruit}	=> {soda}	0.020843925
## [725] {soda}	=> {tropical fruit}	0.020843925
## [726] {tropical fruit}	=> {yogurt}	0.029283172
## [727] {yogurt}	=> {tropical fruit}	0.029283172
## [728] {tropical fruit}	=> {rolls/buns}	0.024605999
## [729] {rolls/buns}	=> {tropical fruit}	0.024605999
## [730] {tropical fruit}	=> {other vegetables}	0.035892222
## [731] {other vegetables}	=> {tropical fruit}	0.035892222
## [732] {tropical fruit}	=> {whole milk}	0.042297916
## [733] {whole milk}	=> {tropical fruit}	0.042297916
## [734] {root vegetables}	=> {soda}	0.018607016
## [735] {soda}	=> {root vegetables}	0.018607016
## [736] {root vegetables}	=> {yogurt}	0.025826131
## [737] {yogurt}	=> {root vegetables}	0.025826131
## [738] {root vegetables}	=> {rolls/buns}	0.024300966
## [739] {rolls/buns}	=> {root vegetables}	0.024300966
## [740] {root vegetables}	=> {other vegetables}	0.047381800
## [741] {other vegetables}	=> {root vegetables}	0.047381800
## [742] {root vegetables}	=> {whole milk}	0.048906965
## [743] {whole milk}	=> {root vegetables}	0.048906965
## [744] {soda}	=> {yogurt}	0.027351296
## [745] {yogurt}	=> {soda}	0.027351296
## [746] {soda}	=> {rolls/buns}	0.038332486
## [747] {rolls/buns}	=> {soda}	0.038332486
## [748] {soda}	=> {other vegetables}	0.032740214
## [749] {other vegetables}	=> {soda}	0.032740214
## [750] {soda}	=> {whole milk}	0.040061007
## [751] {whole milk}	=> {soda}	0.040061007
## [752] {yogurt}	=> {rolls/buns}	0.034367056
## [753] {rolls/buns}	=> {yogurt}	0.034367056
## [754] {yogurt}	=> {other vegetables}	0.043416370
## [755] {other vegetables}	=> {yogurt}	0.043416370

## [756]	{yogurt}	=>	{whole milk}	0.056024403
## [757]	{whole milk}	=>	{yogurt}	0.056024403
## [758]	{rolls/buns}	=>	{other vegetables}	0.042602949
## [759]	{other vegetables}	=>	{rolls/buns}	0.042602949
## [760]	{rolls/buns}	=>	{whole milk}	0.056634469
## [761]	{whole milk}	=>	{rolls/buns}	0.056634469
## [762]	{other vegetables}	=>	{whole milk}	0.074834774
## [763]	{whole milk}	=>	{other vegetables}	0.074834774
##	confidence	coverage	lift	count
## [1]	0.1105236	1.00000000	1.00000000	1087
## [2]	0.1049314	1.00000000	1.00000000	1032
## [3]	0.1089985	1.00000000	1.00000000	1072
## [4]	0.1743772	1.00000000	1.00000000	1715
## [5]	0.1395018	1.00000000	1.00000000	1372
## [6]	0.1839349	1.00000000	1.00000000	1809
## [7]	0.1934926	1.00000000	1.00000000	1903
## [8]	0.2555160	1.00000000	1.00000000	2513
## [9]	0.4230769	0.01321810	1.6557746	55
## [10]	0.3410405	0.01759024	1.7625502	59
## [11]	0.3005780	0.01759024	1.1763569	52
## [12]	0.4322034	0.01199797	1.6914924	51
## [13]	0.4000000	0.01728521	1.5654596	68
## [14]	0.2560386	0.02104728	1.4683033	53
## [15]	0.2415459	0.02104728	0.9453259	50
## [16]	0.3378378	0.01504830	1.7459985	50
## [17]	0.4054054	0.01504830	1.5866145	60
## [18]	0.4312500	0.01626843	3.9564774	69
## [19]	0.4750000	0.01626843	2.4548739	76
## [20]	0.4750000	0.01626843	1.8589833	76
## [21]	0.3190184	0.01657346	1.8294729	52
## [22]	0.3312883	0.01657346	1.7121497	54
## [23]	0.4233129	0.01657346	1.6566981	69
## [24]	0.2931034	0.01769192	1.5148042	51

## [25]	0.4022989	0.01769192	1.5744565	70
## [26]	0.2109375	0.02602949	1.5120775	54
## [27]	0.2070312	0.02602949	1.1255679	53
## [28]	0.1992188	0.02602949	1.0295935	51
## [29]	0.2617188	0.02602949	1.0242753	67
## [30]	0.2439024	0.02501271	1.3987058	60
## [31]	0.2032520	0.02501271	1.0504381	50
## [32]	0.2357724	0.02501271	0.9227303	58
## [33]	0.3333333	0.01921708	1.7227185	63
## [34]	0.4656085	0.01921708	1.8222281	88
## [35]	0.3579545	0.01789527	1.8499648	63
## [36]	0.3977273	0.01789527	1.5565650	70
## [37]	0.4137931	0.01769192	2.1385471	72
## [38]	0.5229885	0.01769192	2.0467935	91
## [39]	0.3625731	0.01738688	1.8738342	62
## [40]	0.4853801	0.01738688	1.8996074	83
## [41]	0.3511905	0.01708185	2.5174623	59
## [42]	0.3154762	0.01708185	1.7151511	53
## [43]	0.4166667	0.01708185	2.1533981	70
## [44]	0.4404762	0.01708185	1.7238692	74
## [45]	0.2639405	0.02735130	1.5136181	71
## [46]	0.2044610	0.02735130	1.1115940	55
## [47]	0.2044610	0.02735130	1.0566861	55
## [48]	0.2379182	0.02735130	0.9311284	64
## [49]	0.1863799	0.02836807	1.6863354	52
## [50]	0.2580645	0.02836807	1.4799210	72
## [51]	0.1971326	0.02836807	1.0188120	55
## [52]	0.2473118	0.02836807	0.9678917	69
## [53]	0.2727273	0.02236909	2.5991015	60
## [54]	0.4045455	0.02236909	2.0907538	89
## [55]	0.3272727	0.02236909	1.2808306	72
## [56]	0.2663755	0.02328419	1.9094778	61
## [57]	0.2794760	0.02328419	1.4443753	64

## [58]	0.3799127	0.02328419	1.4868448	87
## [59]	0.2073579	0.03040163	1.1891338	62
## [60]	0.1839465	0.03040163	1.0000629	55
## [61]	0.2006689	0.03040163	1.0370881	60
## [62]	0.2642140	0.03040163	1.0340410	79
## [63]	0.2047244	0.02582613	2.1790742	52
## [64]	0.1968504	0.02582613	1.8059922	50
## [65]	0.2125984	0.02582613	1.2191869	54
## [66]	0.2047244	0.02582613	1.4675398	52
## [67]	0.2677165	0.02582613	1.4554959	68
## [68]	0.3858268	0.02582613	1.9940128	98
## [69]	0.3858268	0.02582613	1.5099906	98
## [70]	0.1935484	0.02836807	1.8445236	54
## [71]	0.2186380	0.02836807	1.2538220	61
## [72]	0.2186380	0.02836807	1.5672774	61
## [73]	0.2652330	0.02836807	1.3707653	74
## [74]	0.3476703	0.02836807	1.3606593	97
## [75]	0.2116183	0.02450432	2.2524519	51
## [76]	0.2282158	0.02450432	2.0937519	55
## [77]	0.2614108	0.02450432	1.8738886	63
## [78]	0.2406639	0.02450432	1.3084187	58
## [79]	0.3858921	0.02450432	1.9943505	93
## [80]	0.4107884	0.02450432	1.6076815	99
## [81]	0.1818182	0.02796136	2.4034702	50
## [82]	0.1963636	0.02796136	1.8713531	54
## [83]	0.1818182	0.02796136	1.6680801	50
## [84]	0.3054545	0.02796136	2.1896104	84
## [85]	0.2727273	0.02796136	1.4827378	75
## [86]	0.3709091	0.02796136	1.9169159	102
## [87]	0.4145455	0.02796136	1.6223854	114
## [88]	0.1802721	0.02989324	1.7180002	53
## [89]	0.2891156	0.02989324	1.6579897	85
## [90]	0.1836735	0.02989324	1.3166389	54

## [91]	0.2380952	0.02989324	1.2944537	70
## [92]	0.2312925	0.02989324	1.1953557	68
## [93]	0.2755102	0.02989324	1.0782502	81
## [94]	0.1953125	0.02602949	4.6398513	50
## [95]	0.1207729	0.04209456	4.6398513	50
## [96]	0.2070312	0.02602949	1.9730158	53
## [97]	0.2578125	0.02602949	1.8480947	66
## [98]	0.2656250	0.02602949	1.4441249	68
## [99]	0.3515625	0.02602949	1.8169297	90
## [100]	0.4414062	0.02602949	1.7275091	113
## [101]	0.2863071	0.02450432	3.0474349	69
## [102]	0.2157676	0.02450432	2.0562739	52
## [103]	0.2282158	0.02450432	2.0937519	55
## [104]	0.2074689	0.02450432	1.1897705	50
## [105]	0.3278008	0.02450432	2.3497968	79
## [106]	0.3112033	0.02450432	1.6919208	75
## [107]	0.3692946	0.02450432	1.9085720	89
## [108]	0.4398340	0.02450432	1.7213560	106
## [109]	0.2188450	0.03345196	1.9800740	72
## [110]	0.2279635	0.03345196	1.3073010	75
## [111]	0.2218845	0.03345196	1.5905496	73
## [112]	0.1914894	0.03345196	1.0410712	63
## [113]	0.2431611	0.03345196	1.2566944	80
## [114]	0.2500000	0.02806304	2.2936101	69
## [115]	0.1884058	0.02806304	1.3505620	52
## [116]	0.1811594	0.02806304	0.9849104	50
## [117]	0.3550725	0.02806304	1.8350697	98
## [118]	0.4021739	0.02806304	1.5739675	111
## [119]	0.1639344	0.03101169	2.2869434	50
## [120]	0.1803279	0.03101169	2.1787771	55
## [121]	0.1901639	0.03101169	1.7205725	58
## [122]	0.1836066	0.03101169	1.7497776	56
## [123]	0.3049180	0.03101169	2.7974523	93

##	[124]	0.1704918	0.03101169	0.9777183	52
##	[125]	0.2327869	0.03101169	1.6687019	71
##	[126]	0.2196721	0.03101169	1.1942927	67
##	[127]	0.4590164	0.03101169	2.3722681	140
##	[128]	0.3901639	0.03101169	1.5269647	119
##	[129]	0.2721713	0.03324860	3.7968855	89
##	[130]	0.1262411	0.07168277	3.7968855	89
##	[131]	0.1620795	0.03324860	1.9582948	53
##	[132]	0.2018349	0.03324860	1.9234941	66
##	[133]	0.1987768	0.03324860	1.8236655	65
##	[134]	0.2201835	0.03324860	1.2626849	72
##	[135]	0.3180428	0.03324860	2.2798477	104
##	[136]	0.1987768	0.03324860	1.0806907	65
##	[137]	0.3088685	0.03324860	1.5962805	101
##	[138]	0.3547401	0.03324860	1.3883281	116
##	[139]	0.1559633	0.03324860	1.6600639	51
##	[140]	0.1865443	0.03324860	1.7114399	61
##	[141]	0.1743119	0.03324860	0.9996255	57
##	[142]	0.1957187	0.03324860	1.4029832	64
##	[143]	0.2599388	0.03324860	1.4132109	85
##	[144]	0.4159021	0.03324860	2.1494470	136
##	[145]	0.4434251	0.03324860	1.7354101	145
##	[146]	0.1851852	0.03294357	3.5364977	60
##	[147]	0.1165049	0.05236401	3.5364977	60
##	[148]	0.1604938	0.03294357	1.9391361	52
##	[149]	0.1574074	0.03294357	1.5976283	51
##	[150]	0.1728395	0.03294357	1.5638239	56
##	[151]	0.2037037	0.03294357	1.9413042	66
##	[152]	0.1635802	0.03294357	1.5007572	53
##	[153]	0.2129630	0.03294357	1.2212774	69
##	[154]	0.2222222	0.03294357	1.5929705	72
##	[155]	0.1790123	0.03294357	0.9732374	58
##	[156]	0.2901235	0.03294357	1.4994032	94

##	[157]	0.3888889	0.03294357	1.5219746	126
##	[158]	0.1586022	0.03782410	2.1938849	59
##	[159]	0.1370968	0.03782410	1.9125486	51
##	[160]	0.1370968	0.03782410	1.5409677	51
##	[161]	0.1586022	0.03782410	1.6097545	59
##	[162]	0.1397849	0.03782410	1.4878625	52
##	[163]	0.1478495	0.03782410	1.4090111	55
##	[164]	0.2473118	0.03782410	1.4182576	92
##	[165]	0.1639785	0.03782410	1.1754581	61
##	[166]	0.2849462	0.03782410	1.4726465	106
##	[167]	0.2956989	0.03782410	1.1572618	110
##	[168]	0.1621622	0.03385867	2.7688626	54
##	[169]	0.1531532	0.03385867	1.7214414	51
##	[170]	0.1891892	0.03385867	1.7357049	63
##	[171]	0.2162162	0.03385867	1.2399338	72
##	[172]	0.2042042	0.03385867	1.4638107	68
##	[173]	0.2072072	0.03385867	1.1265245	69
##	[174]	0.3183183	0.03385867	1.6451186	106
##	[175]	0.4444444	0.03385867	1.7393996	148
##	[176]	0.1507937	0.03843416	3.0390483	57
##	[177]	0.1168033	0.04961871	3.0390483	57
##	[178]	0.1322751	0.03843416	1.8452850	50
##	[179]	0.1825397	0.03843416	2.0517460	69
##	[180]	0.1428571	0.03843416	1.4499484	54
##	[181]	0.1587302	0.03843416	1.5127046	60
##	[182]	0.1719577	0.03843416	1.5776154	65
##	[183]	0.2486772	0.03843416	1.4260879	94
##	[184]	0.1957672	0.03843416	1.4033312	74
##	[185]	0.2380952	0.03843416	1.2944537	90
##	[186]	0.2619048	0.03843416	1.3535645	99
##	[187]	0.3306878	0.03843416	1.2941961	125
##	[188]	0.1413043	0.03741739	2.8478038	52
##	[189]	0.1065574	0.04961871	2.8478038	52

## [190]	0.1657609	0.03741739	2.2929088	61
## [191]	0.1548913	0.03741739	2.1607886	57
## [192]	0.1576087	0.03741739	1.7715217	58
## [193]	0.1440217	0.03741739	1.4617686	53
## [194]	0.1440217	0.03741739	1.5329587	53
## [195]	0.1684783	0.03741739	1.6056044	62
## [196]	0.1413043	0.03741739	1.2963883	52
## [197]	0.2038043	0.03741739	1.1687555	75
## [198]	0.2336957	0.03741739	1.6752163	86
## [199]	0.2119565	0.03741739	1.1523452	78
## [200]	0.2853261	0.03741739	1.4746096	105
## [201]	0.3614130	0.03741739	1.4144438	133
## [202]	0.1397260	0.03711235	2.6225295	51
## [203]	0.1616438	0.03711235	2.2359594	59
## [204]	0.1452055	0.03711235	1.6321096	53
## [205]	0.1671233	0.03711235	1.6962410	61
## [206]	0.1589041	0.03711235	1.6913657	58
## [207]	0.1397260	0.03711235	1.2642185	51
## [208]	0.1698630	0.03711235	1.6188011	62
## [209]	0.1561644	0.03711235	1.4327208	57
## [210]	0.2657534	0.03711235	1.5240145	97
## [211]	0.2657534	0.03711235	1.9050182	97
## [212]	0.1835616	0.03711235	0.9979706	67
## [213]	0.3123288	0.03711235	1.6141636	114
## [214]	0.3698630	0.03711235	1.4475140	135
## [215]	0.1465969	0.07768175	1.4879052	112
## [216]	0.1155831	0.09852567	1.4879052	112
## [217]	0.1034031	0.07768175	0.9355749	79
## [218]	0.1780105	0.07768175	1.0208356	136
## [219]	0.1452880	0.07768175	0.7898878	111
## [220]	0.1164921	0.07768175	0.6020495	89
## [221]	0.1138743	0.07768175	0.4456642	87
## [222]	0.1282051	0.03965430	2.4062928	50

##	[223]	0.1282051	0.03965430	2.0206690	50
##	[224]	0.1435897	0.03965430	1.9862238	56
##	[225]	0.1615385	0.03965430	2.2535188	63
##	[226]	0.1538462	0.03965430	2.0337055	60
##	[227]	0.1435897	0.03965430	1.7348957	56
##	[228]	0.1410256	0.03965430	1.4313593	55
##	[229]	0.1410256	0.03965430	1.5010684	55
##	[230]	0.1487179	0.03965430	1.3455759	58
##	[231]	0.1820513	0.03965430	1.7349558	71
##	[232]	0.1897436	0.03965430	1.7407912	74
##	[233]	0.1717949	0.03965430	0.9851910	67
##	[234]	0.3128205	0.03965430	2.2424123	122
##	[235]	0.2512821	0.03965430	1.3661465	98
##	[236]	0.3461538	0.03965430	1.7889769	135
##	[237]	0.4153846	0.03965430	1.6256696	162
##	[238]	0.1563981	0.04290798	3.2519564	66
##	[239]	0.1395349	0.04809354	3.2519564	66
##	[240]	0.1350711	0.04290798	2.3428998	57
##	[241]	0.1005291	0.05765125	2.3428998	57
##	[242]	0.1350711	0.04290798	2.4374755	57
##	[243]	0.1045872	0.05541434	2.4374755	57
##	[244]	0.1208531	0.04290798	1.5141274	51
##	[245]	0.1445498	0.04290798	2.2782803	61
##	[246]	0.1682464	0.04290798	2.3470976	71
##	[247]	0.1007092	0.07168277	2.3470976	71
##	[248]	0.1611374	0.04290798	1.9469124	68
##	[249]	0.1232227	0.04290798	1.3115755	52
##	[250]	0.1232227	0.04290798	1.1148995	52
##	[251]	0.1492891	0.04290798	1.4227309	63
##	[252]	0.2535545	0.04290798	2.3262206	107
##	[253]	0.1943128	0.04290798	1.1143244	82
##	[254]	0.1943128	0.04290798	1.3929055	82
##	[255]	0.2251185	0.04290798	1.2239029	95

##	[256]	0.4170616	0.04290798	2.1554393	176
##	[257]	0.4099526	0.04290798	1.6044106	173
##	[258]	0.1231884	0.04209456	2.0888931	51
##	[259]	0.1376812	0.04209456	2.1700228	57
##	[260]	0.1763285	0.04209456	2.4390869	73
##	[261]	0.1026723	0.07229283	2.4390869	73
##	[262]	0.1304348	0.04209456	1.8196115	54
##	[263]	0.1570048	0.04209456	2.0754604	65
##	[264]	0.1328502	0.04209456	1.4932367	55
##	[265]	0.1763285	0.04209456	1.7896706	73
##	[266]	0.1714976	0.04209456	1.8254099	71
##	[267]	0.2077295	0.04209456	1.9796699	86
##	[268]	0.1884058	0.04209456	1.7285177	78
##	[269]	0.2439614	0.04209456	1.3990437	101
##	[270]	0.2149758	0.04209456	1.5410258	89
##	[271]	0.1545894	0.04209456	0.8404569	64
##	[272]	0.3260870	0.04209456	1.6852681	135
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##	[274]	0.1250000	0.04961871	2.2557339	61
##	[275]	0.1119266	0.05541434	2.2557339	61
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##	[277]	0.1372951	0.04961871	1.8991521	67
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##	[281]	0.1639344	0.04961871	1.6638752	80
##	[282]	0.1331967	0.04961871	1.4177378	65
##	[283]	0.1168033	0.04961871	1.0568172	57
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## [301]	0.1716287	0.05805796	0.9842382	98
## [302]	0.1681261	0.05805796	1.2051896	96
## [303]	0.1891419	0.05805796	1.0283085	108
## [304]	0.2311734	0.05805796	1.1947400	132
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## [310]	0.1205074	0.04809354	2.1746611	57
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## [314]	0.1082982	0.07229283	2.2518235	77
## [315]	0.1649049	0.04809354	2.3004813	78
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## [317]	0.1522199	0.04809354	2.0122076	72
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## [335]	0.1220930	0.05246568	1.5296623	63
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## [349]	0.3759690	0.05246568	1.9430662	194
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##	[374]	0.3225191	0.05327911	1.6668288	169
##	[375]	0.4904580	0.05327911	1.9194805	257
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## [454] 0.1050157 0.06487036 1.6551749 67
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## [538] 0.1834395 0.07981698 1.0519693 144
## [539] 0.1923567 0.07981698 1.3788834 151
## [540] 0.1100583 0.13950178 1.3788834 151
## [541] 0.2471338 0.07981698 1.3435934 194
## [542] 0.1072416 0.18393493 1.3435934 194
## [543] 0.2420382 0.07981698 1.2508912 190
## [544] 0.3426752 0.07981698 1.3411103 269
## [545] 0.1070434 0.25551601 1.3411103 269
## [546] 0.1266026 0.06344687 1.7512464 79
## [547] 0.1111111 0.07229283 1.7512464 79
## [548] 0.1570513 0.06344687 2.1909211 98
## [549] 0.1390071 0.07168277 2.1909211 98
## [550] 0.1362179 0.06344687 1.8006768 85
## [551] 0.1142473 0.07564820 1.8006768 85
## [552] 0.1426282 0.06344687 1.6031410 89

```

```

## [553] 0.1017143 0.08896797 1.6031410 89
## [554] 0.1634615 0.06344687 1.9749929 102
## [555] 0.1253071 0.08276563 1.9749929 102
## [556] 0.1426282 0.06344687 1.4476248 89
## [557] 0.1506410 0.06344687 1.6034139 94
## [558] 0.1017316 0.09395018 1.6034139 94
## [559] 0.1442308 0.06344687 1.3049766 90
## [560] 0.1794872 0.06344687 1.7105198 112
## [561] 0.1085271 0.10493137 1.7105198 112
## [562] 0.2259615 0.06344687 2.0730706 141
## [563] 0.1315299 0.10899847 2.0730706 141
## [564] 0.1955128 0.06344687 1.1212062 122
## [565] 0.2259615 0.06344687 1.6197753 141
## [566] 0.1027697 0.13950178 1.6197753 141
## [567] 0.2467949 0.06344687 1.3417510 154
## [568] 0.3509615 0.06344687 1.8138238 219
## [569] 0.1150815 0.19349263 1.8138238 219
## [570] 0.4727564 0.06344687 1.8502027 295
## [571] 0.1173896 0.25551601 1.8502027 295
## [572] 0.1251758 0.07229283 1.7462469 89
## [573] 0.1262411 0.07168277 1.7462469 89
## [574] 0.1322082 0.07229283 1.7476710 94
## [575] 0.1263441 0.07564820 1.7476710 94
## [576] 0.1181435 0.07229283 1.3279325 84
## [577] 0.1434599 0.07229283 1.7333271 102
## [578] 0.1253071 0.08276563 1.7333271 102
## [579] 0.1476793 0.07229283 1.4988918 105
## [580] 0.1083591 0.09852567 1.4988918 105
## [581] 0.1392405 0.07229283 1.4820675 99
## [582] 0.1071429 0.09395018 1.4820675 99
## [583] 0.1969058 0.07229283 1.7815715 140
## [584] 0.1287948 0.11052364 1.7815715 140
## [585] 0.1898734 0.07229283 1.8095010 135

```

```

## [586] 0.1308140 0.10493137 1.8095010 135
## [587] 0.1659634 0.07229283 1.5226216 118
## [588] 0.1100746 0.10899847 1.5226216 118
## [589] 0.2545710 0.07229283 1.4598869 181
## [590] 0.1055394 0.17437722 1.4598869 181
## [591] 0.2587904 0.07229283 1.8551049 184
## [592] 0.1341108 0.13950178 1.8551049 184
## [593] 0.2011252 0.07229283 1.0934583 143
## [594] 0.2911392 0.07229283 1.5046529 207
## [595] 0.1087756 0.19349263 1.5046529 207
## [596] 0.3684951 0.07229283 1.4421604 262
## [597] 0.1042579 0.25551601 1.4421604 262
## [598] 0.1290780 0.07168277 1.7062934 91
## [599] 0.1223118 0.07564820 1.7062934 91
## [600] 0.1049645 0.07168277 1.1798014 74
## [601] 0.1517730 0.07168277 1.8337690 107
## [602] 0.1314496 0.08276563 1.8337690 107
## [603] 0.1106383 0.07168277 1.1229388 78
## [604] 0.1262411 0.07168277 1.3437030 89
## [605] 0.1219858 0.07168277 1.1037079 86
## [606] 0.1929078 0.07168277 1.8384188 136
## [607] 0.1317829 0.10493137 1.8384188 136
## [608] 0.2382979 0.07168277 2.1862496 168
## [609] 0.1567164 0.10899847 2.1862496 168
## [610] 0.1617021 0.07168277 0.9273122 114
## [611] 0.2893617 0.07168277 2.0742510 204
## [612] 0.1486880 0.13950178 2.0742510 204
## [613] 0.2042553 0.07168277 1.1104760 144
## [614] 0.4028369 0.07168277 2.0819237 284
## [615] 0.1492380 0.19349263 2.0819237 284
## [616] 0.4496454 0.07168277 1.7597542 317
## [617] 0.1261441 0.25551601 1.7597542 317
## [618] 0.1411290 0.07564820 1.5862903 105

```

```

## [619] 0.1200000 0.08896797 1.5862903 105
## [620] 0.1827957 0.07564820 2.2085942 136
## [621] 0.1670762 0.08276563 2.2085942 136
## [622] 0.1236559 0.07564820 1.2550629 92
## [623] 0.1424731 0.07564820 1.5164752 106
## [624] 0.1147186 0.09395018 1.5164752 106
## [625] 0.1397849 0.07564820 1.2647516 104
## [626] 0.2701613 0.07564820 2.5746476 201
## [627] 0.1947674 0.10493137 2.5746476 201
## [628] 0.2056452 0.07564820 1.8866793 153
## [629] 0.1427239 0.10899847 1.8866793 153
## [630] 0.1760753 0.07564820 1.0097378 131
## [631] 0.2379032 0.07564820 1.7053777 177
## [632] 0.1290087 0.13950178 1.7053777 177
## [633] 0.1841398 0.07564820 1.0011138 137
## [634] 0.3454301 0.07564820 1.7852365 257
## [635] 0.1350499 0.19349263 1.7852365 257
## [636] 0.3978495 0.07564820 1.5570432 296
## [637] 0.1177875 0.25551601 1.5570432 296
## [638] 0.1097143 0.08896797 1.3256020 96
## [639] 0.1179361 0.08276563 1.3256020 96
## [640] 0.1337143 0.08896797 1.3571517 117
## [641] 0.1207430 0.09852567 1.3571517 117
## [642] 0.1405714 0.08896797 1.4962338 123
## [643] 0.1331169 0.09395018 1.4962338 123
## [644] 0.1005714 0.08896797 0.9099540 88
## [645] 0.1485714 0.08896797 1.4158915 130
## [646] 0.1259690 0.10493137 1.4158915 130
## [647] 0.1234286 0.08896797 1.1323881 108
## [648] 0.1007463 0.10899847 1.1323881 108
## [649] 0.2365714 0.08896797 1.3566647 207
## [650] 0.1206997 0.17437722 1.3566647 207
## [651] 0.1988571 0.08896797 1.4254810 174

```

```

## [652] 0.1268222 0.13950178 1.4254810 174
## [653] 0.2354286 0.08896797 1.2799558 206
## [654] 0.1138751 0.18393493 1.2799558 206
## [655] 0.2537143 0.08896797 1.3112349 222
## [656] 0.1166579 0.19349263 1.3112349 222
## [657] 0.3737143 0.08896797 1.4625865 327
## [658] 0.1301234 0.25551601 1.4625865 327
## [659] 0.1179361 0.08276563 1.1970090 96
## [660] 0.1363636 0.08276563 1.4514463 111
## [661] 0.1201299 0.09395018 1.4514463 111
## [662] 0.1633907 0.08276563 1.4783323 133
## [663] 0.1223551 0.11052364 1.4783323 133
## [664] 0.2407862 0.08276563 2.2947022 196
## [665] 0.1899225 0.10493137 2.2947022 196
## [666] 0.2137592 0.08276563 1.9611211 174
## [667] 0.1623134 0.10899847 1.9611211 174
## [668] 0.1547912 0.08276563 0.8876799 126
## [669] 0.2616708 0.08276563 1.8757521 213
## [670] 0.1552478 0.13950178 1.8757521 213
## [671] 0.2027027 0.08276563 1.1020349 165
## [672] 0.3488943 0.08276563 1.8031403 284
## [673] 0.1492380 0.19349263 1.8031403 284
## [674] 0.3685504 0.08276563 1.4423768 300
## [675] 0.1193792 0.25551601 1.4423768 300
## [676] 0.1589267 0.09852567 1.6916065 154
## [677] 0.1666667 0.09395018 1.6916065 154
## [678] 0.1114551 0.09852567 1.0084278 108
## [679] 0.1372549 0.09852567 1.3080445 133
## [680] 0.1288760 0.10493137 1.3080445 133
## [681] 0.1300310 0.09852567 1.1929613 126
## [682] 0.1175373 0.10899847 1.1929613 126
## [683] 0.2497420 0.09852567 1.4321939 242
## [684] 0.1411079 0.17437722 1.4321939 242

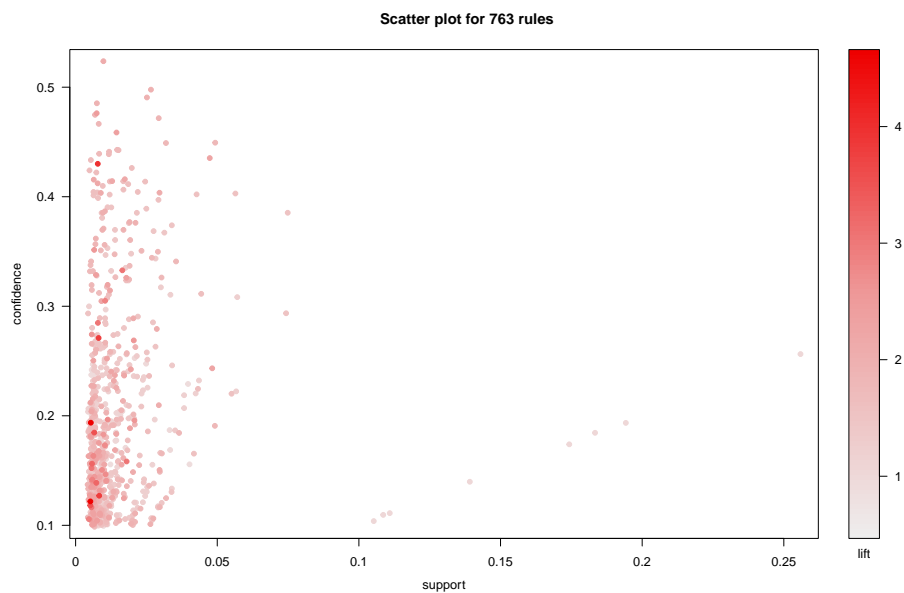
```

```
## [685] 0.1547988 0.09852567 1.1096544 150
## [686] 0.1093294 0.13950178 1.1096544 150
## [687] 0.1981424 0.09852567 1.0772419 192
## [688] 0.1061360 0.18393493 1.0772419 192
## [689] 0.2352941 0.09852567 1.2160366 228
## [690] 0.1198108 0.19349263 1.2160366 228
## [691] 0.2487100 0.09852567 0.9733637 241
## [692] 0.1277056 0.09395018 1.1554598 118
## [693] 0.1085557 0.11052364 1.1554598 118
## [694] 0.1482684 0.09395018 1.4130036 137
## [695] 0.1327519 0.10493137 1.4130036 137
## [696] 0.1590909 0.09395018 1.4595700 147
## [697] 0.1371269 0.10899847 1.4595700 147
## [698] 0.2586580 0.09395018 1.4833245 239
## [699] 0.1393586 0.17437722 1.4833245 239
## [700] 0.2088745 0.09395018 1.4972889 193
## [701] 0.1406706 0.13950178 1.4972889 193
## [702] 0.3257576 0.09395018 1.7710480 301
## [703] 0.1663903 0.18393493 1.7710480 301
## [704] 0.2867965 0.09395018 1.4822091 265
## [705] 0.1392538 0.19349263 1.4822091 265
## [706] 0.3181818 0.09395018 1.2452520 294
## [707] 0.1169916 0.25551601 1.2452520 294
## [708] 0.1674333 0.11052364 1.5956459 182
## [709] 0.1763566 0.10493137 1.5956459 182
## [710] 0.1416743 0.11052364 1.2997827 154
## [711] 0.1436567 0.10899847 1.2997827 154
## [712] 0.2621895 0.11052364 1.5035766 285
## [713] 0.1661808 0.17437722 1.5035766 285
## [714] 0.2079117 0.11052364 1.4903873 226
## [715] 0.1647230 0.13950178 1.4903873 226
## [716] 0.2189512 0.11052364 1.1903734 238
## [717] 0.1315644 0.18393493 1.1903734 238
```

```
## [718] 0.2244710 0.11052364 1.1601012 244
## [719] 0.1282186 0.19349263 1.1601012 244
## [720] 0.3109476 0.11052364 1.2169396 338
## [721] 0.1345006 0.25551601 1.2169396 338
## [722] 0.2005814 0.10493137 1.8402220 207
## [723] 0.1930970 0.10899847 1.8402220 207
## [724] 0.1986434 0.10493137 1.1391592 205
## [725] 0.1195335 0.17437722 1.1391592 205
## [726] 0.2790698 0.10493137 2.0004746 288
## [727] 0.2099125 0.13950178 2.0004746 288
## [728] 0.2344961 0.10493137 1.2748863 242
## [729] 0.1337756 0.18393493 1.2748863 242
## [730] 0.3420543 0.10493137 1.7677896 353
## [731] 0.1854966 0.19349263 1.7677896 353
## [732] 0.4031008 0.10493137 1.5775950 416
## [733] 0.1655392 0.25551601 1.5775950 416
## [734] 0.1707090 0.10899847 0.9789636 183
## [735] 0.1067055 0.17437722 0.9789636 183
## [736] 0.2369403 0.10899847 1.6984751 254
## [737] 0.1851312 0.13950178 1.6984751 254
## [738] 0.2229478 0.10899847 1.2121013 239
## [739] 0.1321172 0.18393493 1.2121013 239
## [740] 0.4347015 0.10899847 2.2466049 466
## [741] 0.2448765 0.19349263 2.2466049 466
## [742] 0.4486940 0.10899847 1.7560310 481
## [743] 0.1914047 0.25551601 1.7560310 481
## [744] 0.1568513 0.17437722 1.1243678 269
## [745] 0.1960641 0.13950178 1.1243678 269
## [746] 0.2198251 0.17437722 1.1951242 377
## [747] 0.2084024 0.18393493 1.1951242 377
## [748] 0.1877551 0.17437722 0.9703476 322
## [749] 0.1692065 0.19349263 0.9703476 322
## [750] 0.2297376 0.17437722 0.8991124 394
```

```
## [751] 0.1567847 0.25551601 0.8991124 394
## [752] 0.2463557 0.13950178 1.3393633 338
## [753] 0.1868436 0.18393493 1.3393633 338
## [754] 0.3112245 0.13950178 1.6084566 427
## [755] 0.2243826 0.19349263 1.6084566 427
## [756] 0.4016035 0.13950178 1.5717351 551
## [757] 0.2192598 0.25551601 1.5717351 551
## [758] 0.2316197 0.18393493 1.1970465 419
## [759] 0.2201787 0.19349263 1.1970465 419
## [760] 0.3079049 0.18393493 1.2050318 557
## [761] 0.2216474 0.25551601 1.2050318 557
## [762] 0.3867578 0.19349263 1.5136341 736
## [763] 0.2928770 0.25551601 1.5136341 736
```

```
plot(groceriesrules)
```



There are few points with darker color. Most of these points (high lift) have less confidence and less support.

```
#4 #train PRO-PROCESS
```



```

train_dirs = Sys.glob('C:/Users/30970/Documents/GitHub/DATA MINING/EC0395M/data/ReutersC
file_list = NULL
labels_train = NULL
for(author in train_dirs) {
  author_name = substring(author, first=77)
  files_to_add = Sys.glob(paste0(author, '/*.txt'))
  file_list = append(file_list, files_to_add)
  labels_train = append(labels_train, rep(author_name, length(files_to_add)))
}
corpus_train = Corpus(DirSource(train_dirs))
corpus_train = corpus_train %>% tm_map(., content_transformer(tolower)) %>%
  tm_map(., content_transformer(removeNumbers)) %>%
  tm_map(., content_transformer(removeNumbers)) %>%
  tm_map(., content_transformer(removePunctuation)) %>%
  tm_map(., content_transformer(stripWhitespace)) %>%
  tm_map(., content_transformer(removeWords), stopwords("SMART"))

```

#test PRO-PROCESS

```

test_dirs = Sys.glob('C:/Users/30970/Documents/GitHub/DATA MINING/EC0395M/data/ReutersC
file_list = NULL
labels_test = NULL
for(author in test_dirs) {
  author_name = substring(author, first=77)
  files_to_add = Sys.glob(paste0(author, '/*.txt'))
  file_list = append(file_list, files_to_add)
  labels_test = append(labels_test, rep(author_name, length(files_to_add)))
}
corpus_test = Corpus(DirSource(test_dirs))
corpus_test = corpus_test %>% tm_map(., content_transformer(tolower)) %>%
  tm_map(., content_transformer(removeNumbers)) %>%
  tm_map(., content_transformer(removePunctuation)) %>%
  tm_map(., content_transformer(stripWhitespace)) %>%

```

```
tm_map(., content_transformer(removeWords), stopwords("SMART"))
```

pre-process: In the both sets, make everything lowercase, and remove numbers, punctuation, excess white-space, stopwords. Roll two directories together into a single corpus.

```
DTM_train = DocumentTermMatrix(corpus_train)
DTM_test = DocumentTermMatrix(corpus_test,
                               control = list(dictionary=Terms(DTM_train)))
```

doc-term-matrix for train and test sets. And the test matrix has the same terms with train test. I fail to figure out a way to add a pseudo-word to the training set.

```
sort = labels_train[seq(1,2500,50)]

foreach(i=1:50) %do%
{
  y_train = 0 + {labels_train==sort[i]}
  y_test = 0 + {labels_test==sort[i]}
  logit = cv.gamlr(DTM_train, y_train, family='binomial', nfold=5)
  yhat_test = predict(logit, DTM_test, type='response')
  xtabs(~ {yhat_test > 0.75} + y_test)
}
```

```
## [[1]]
##               y_test
## {   yhat_test > 0.75 }    0
##               FALSE 2336
##               TRUE   164
##
## [[2]]
##               y_test
## {   yhat_test > 0.75 }    0
```

```

##                                FALSE 2500
##
## [[3]]
##                                y_test
## {      yhat_test > 0.75 }      0
##                                FALSE 2489
##                                TRUE  11
##
## [[4]]
##                                y_test
## {      yhat_test > 0.75 }      0
##                                FALSE 2497
##                                TRUE   3
##
## [[5]]
##                                y_test
## {      yhat_test > 0.75 }      0
##                                FALSE 2500
##
## [[6]]
##                                y_test
## {      yhat_test > 0.75 }      0
##                                FALSE 2495
##                                TRUE   5
##
## [[7]]
##                                y_test
## {      yhat_test > 0.75 }      0
##                                FALSE 2496
##                                TRUE   4
##
## [[8]]
##                                y_test

```

```

## {      yhat_test > 0.75 }      0
##                                     FALSE 2500
##
## [[9]]
##                                     y_test
## {      yhat_test > 0.75 }      0
##                                     FALSE 2500
##
## [[10]]
##                                     y_test
## {      yhat_test > 0.75 }      0
##                                     FALSE 2496
##                                     TRUE   4
##
## [[11]]
##                                     y_test
## {      yhat_test > 0.75 }      0
##                                     FALSE 2499
##                                     TRUE   1
##
## [[12]]
##                                     y_test
## {      yhat_test > 0.75 }      0
##                                     FALSE 2500
##
## [[13]]
##                                     y_test
## {      yhat_test > 0.75 }      0
##                                     FALSE 2498
##                                     TRUE   2
##
## [[14]]
##                                     y_test

```



```

##                                y_test
## {      yhat_test > 0.75 }      0
##                                FALSE 2500
##
## [[33]]
##                                y_test
## {      yhat_test > 0.75 }      0
##                                FALSE 2500
##
## [[34]]
##                                y_test
## {      yhat_test > 0.75 }      0
##                                FALSE 2500
##
## [[35]]
##                                y_test
## {      yhat_test > 0.75 }      0
##                                FALSE 2500
##
## [[36]]
##                                y_test
## {      yhat_test > 0.75 }      0
##                                FALSE 2500
##
## [[37]]
##                                y_test
## {      yhat_test > 0.75 }      0
##                                FALSE 2500
##
## [[38]]
##                                y_test
## {      yhat_test > 0.75 }      0
##                                FALSE 2500

```



```

##
## [[39]]
##                                y_test
## {   yhat_test > 0.75 }      0
##                                FALSE 2500
##
## [[40]]
##                                y_test
## {   yhat_test > 0.75 }      0
##                                FALSE 2500
##
## [[41]]
##                                y_test
## {   yhat_test > 0.75 }      0
##                                FALSE 2500
##
## [[42]]
##                                y_test
## {   yhat_test > 0.75 }      0
##                                FALSE 2500
##
## [[43]]
##                                y_test
## {   yhat_test > 0.75 }      0
##                                FALSE 2500
##
## [[44]]
##                                y_test
## {   yhat_test > 0.75 }      0
##                                FALSE 2500
##
## [[45]]
##                                y_test

```

```

## {      yhat_test > 0.75 }      0
##                                     FALSE 2500
##
## [[46]]
##                                     y_test
## {      yhat_test > 0.75 }      0
##                                     FALSE 2500
##
## [[47]]
##                                     y_test
## {      yhat_test > 0.75 }      0
##                                     FALSE 2500
##
## [[48]]
##                                     y_test
## {      yhat_test > 0.75 }      0
##                                     FALSE 2500
##
## [[49]]
##                                     y_test
## {      yhat_test > 0.75 }      0
##                                     FALSE 2489
##                                     TRUE   11
##
## [[50]]
##                                     y_test
## {      yhat_test > 0.75 }      0
##                                     FALSE 2500

```

The method is lasso logistic regression. However my result is too terrible. In each table, more than 2000 False and less than 500 true show that it is not identical with my expectation. I can change the threshold to get a better result. But it is still a bad result.