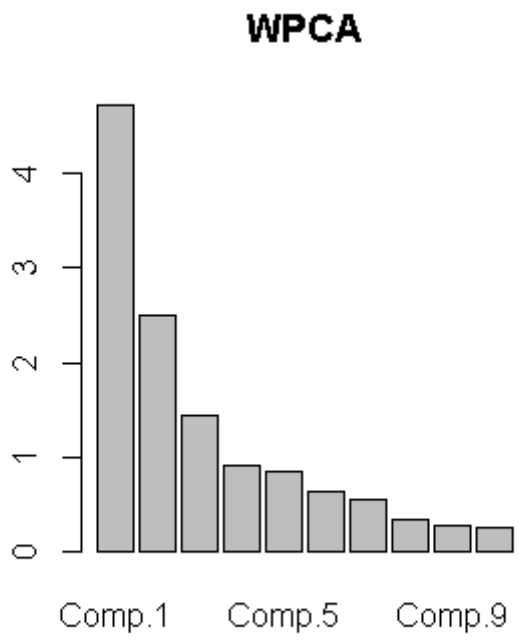
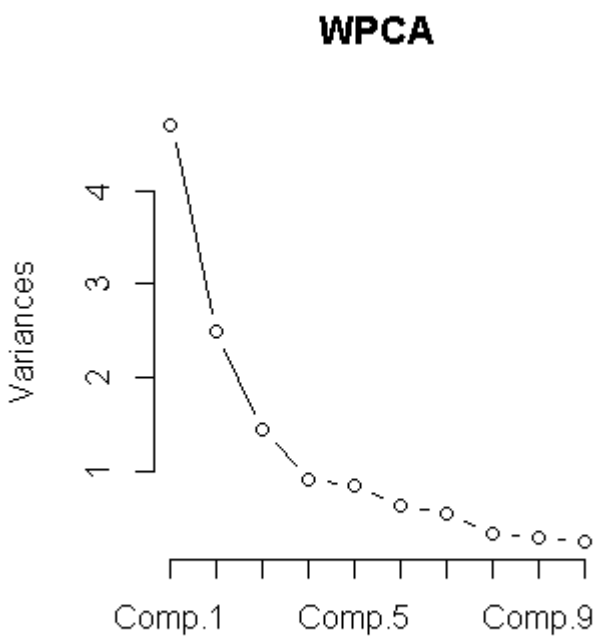
```
> setwd("F:/CL VII/12")
> winedf <- read.csv("F:/CL VII/12/wine.csv")
> head(winedf)
  Wine Alcohol Malic.acid  Ash  Acl  Mg Phenols Flavanoids Nonflavanoid.phenols Proanth
Color.int  Hue   OD Proline
1    1   14.23       1.71 2.43 15.6 127    2.80       3.06                  0.28    2.29
5.64 1.04 3.92    1065
2    1   13.20       1.78 2.14 11.2 100    2.65       2.76                  0.26    1.28
4.38 1.05 3.40    1050
3    1   13.16       2.36 2.67 18.6 101    2.80       3.24                  0.30    2.81
5.68 1.03 3.17    1185
4    1   14.37       1.95 2.50 16.8 113    3.85       3.49                  0.24    2.18
7.80 0.86 3.45    1480
5    1   13.24       2.59 2.87 21.0 118    2.80       2.69                  0.39    1.82
4.32 1.04 2.93     735
.4.20       1.76 2.45 15.2 112    3.27
          0.34    1.97      6.75 1.0
1450
> # Calculate Correlation of all attributes
> cor_mat <- cor(winedf[, -1])
> cor_mat
                        Alcohol  Malic.acid          Ash         Acl          Mg      Ph
enols Flavanoids
Alcohol               1.00000000  0.09439694  0.211544596 -0.31023514  0.27079823  0.289
10112  0.2368149
Malic.acid            0.09439694  1.00000000  0.164045470  0.28850040 -0.05457510 -0.335
16700 -0.4110066
Ash                   0.21154460  0.16404547  1.000000000  0.44336719  0.28658669  0.128
97954  0.1150773
Acl                  -0.31023514  0.28850040  0.443367187  1.00000000 -0.08333309 -0.321
11332 -0.3513699
Mg                    0.27079823 -0.05457510  0.286586691 -0.08333309  1.00000000  0.214
40123  0.1957838
Phenols               0.28910112 -0.33516700  0.128979538 -0.32111332  0.21440123  1.000
00000  0.8645635
Flavanoids            0.23681493 -0.41100659  0.115077279 -0.35136986  0.19578377  0.864
56350  1.0000000
Nonflavanoid.phenols -0.15592947  0.29297713  0.186230446  0.36192172 -0.25629405 -0.449
93530 -0.5378996
Proanth               0.13669791 -0.22074619  0.009651935 -0.19732684  0.23644061  0.612
41308  0.6526918
Color.int             0.54636420  0.24898534  0.258887259  0.01873198  0.19995001 -0.055
13642 -0.1723794
Hue                  -0.07174720 -0.56129569 -0.074666889 -0.27395522  0.05539820  0.433
68134  0.5434786
OD                    0.07234319 -0.36871043  0.003911231 -0.27676855  0.06600394  0.699
94936  0.7871939
Proline               0.64372004 -0.19201056  0.223626264 -0.44059693  0.39335085  0.498
11488  0.4941931
                     Nonflavanoid.phenols      Proanth   Color.int         Hue
OD    Proline
Alcohol                       -0.1559295  0.136697912  0.54636420 -0.07174720  0.072343
187  0.6437200
Malic.acid                     0.2929771 -0.220746187  0.24898534 -0.56129569 -0.368710
428 -0.1920106
Ash                            0.1862304  0.009651935  0.25888726 -0.07466689  0.003911
231  0.2236263
Acl                            0.3619217 -0.197326836  0.01873198 -0.27395522 -0.276768
549 -0.4405969
Mg                            -0.2562940  0.236440610  0.19995001  0.05539820  0.066003
936  0.3933508
Phenols                       -0.4499353  0.612413084 -0.05513642  0.43368134  0.699949
365  0.4981149
Flavanoids                    -0.5378996  0.652691769 -0.17237940  0.54347857  0.787193
902  0.4941931
Nonflavanoid.phenols           1.0000000 -0.365845099  0.13905701 -0.26263963 -0.503269
596 -0.3113852
Proanth                       -0.3658451  1.000000000 -0.02524993  0.29554425  0.519067
096  0.3304167
```

```
Color.int                      0.1390570 -0.025249931  1.00000000 -0.52181319 -0.428814
942  0.3161001
Hue                           -0.2626396  0.295544253 -0.52181319  1.00000000  0.565468
293  0.2361834
OD                            -0.5032696  0.519067096 -0.42881494  0.56546829  1.000000
000  0.3127611
Proline                       -0.3113852  0.330416700  0.31610011  0.23618345  0.312761
075  1.0000000
> WPCA <- princomp(winedf[, -1], cor = T, scores = T, covmat = NULL)
> summary(WPCA)
Importance of components:
                          Comp.1    Comp.2    Comp.3    Comp.4     Comp.5     Comp.6
Comp.7     Comp.8     Comp.9
Standard deviation     2.1692972 1.5801816 1.2025273 0.9586313 0.92370351 0.80103498 0.7
4231281 0.59033665 0.53747553
Proportion of Variance 0.3619885 0.1920749 0.1112363 0.0706903 0.06563294 0.04935823 0.0
4238679 0.02680749 0.02222153
Cumulative Proportion  0.3619885 0.5540634 0.6652997 0.7359900 0.80162293 0.85098116 0.8
9336795 0.92017544 0.94239698
                          Comp.10    Comp.11    Comp.12     Comp.13
Standard deviation     0.50090167 0.47517222 0.41081655 0.321524394
Proportion of Variance 0.01930019 0.01736836 0.01298233 0.007952149
Cumulative Proportion  0.96169717 0.97906553 0.99204785 1.000000000
> plot(WPCA)
```

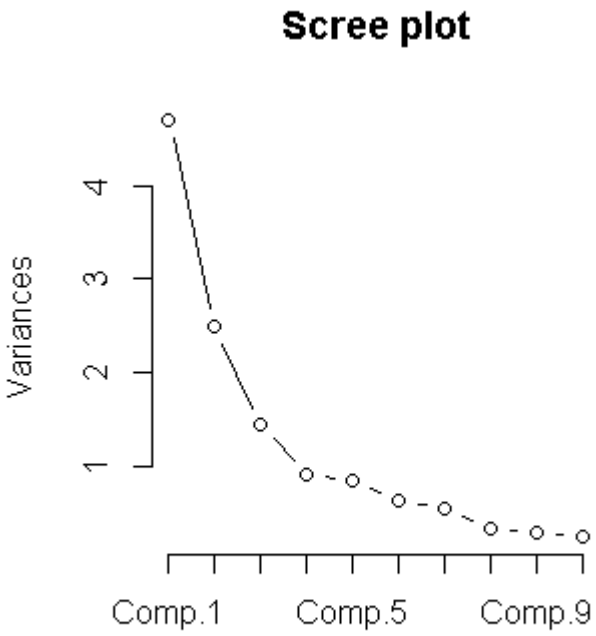



```
> loadings(WPCA)

Loadings:
                Comp.1 Comp.2 Comp.3 Comp.4 Comp.5 Comp.6 Comp.7 Comp.8 Comp.9 Comp
.10 Comp.11 Comp.12 Comp.13
Alcohol          0.144  0.484  0.207         0.266  0.214         0.396  0.509  0.2
12   0.226   0.266
Malic.acid      -0.245  0.225        -0.537         0.537 -0.421               -0.3
09          -0.122
Ash                     0.316 -0.626  0.214  0.143  0.154  0.149 -0.170 -0.308
0.499          -0.141
Acl             -0.239        -0.612                -0.101  0.287  0.428  0.200
-0.479
Mg               0.142  0.300 -0.131  0.352 -0.727        -0.323 -0.156  0.271
Phenols          0.395        -0.146 -0.198  0.149               -0.406  0.286 -0.3
```

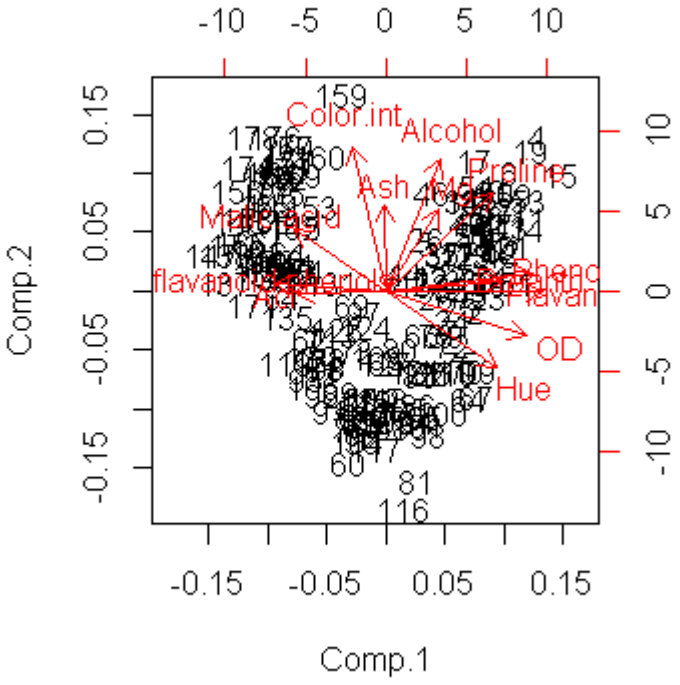
```
20  -0.304   0.304  -0.464
Flavanoids            0.423        -0.151 -0.152  0.109               -0.187        -0.1
63                   0.832
Nonflavanoid.phenols -0.299        -0.170  0.203  0.501 -0.259 -0.595 -0.233  0.196  0.2
16  -0.117           0.114
Proanth               0.313        -0.149 -0.399 -0.137 -0.534 -0.372  0.368 -0.209  0.1
34   0.237          -0.117
Color.int                    0.530  0.137               -0.419  0.228               -0.2
91          -0.604
Hue                   0.297 -0.279         0.428  0.174  0.106 -0.232  0.437        -0.5
22          -0.259
OD                    0.376 -0.164 -0.166 -0.184  0.101  0.266                0.137  0.5
24          -0.601  -0.157
Proline               0.287  0.365  0.127  0.232  0.158  0.120         0.120 -0.576  0.1
62  -0.539

                Comp.1 Comp.2 Comp.3 Comp.4 Comp.5 Comp.6 Comp.7 Comp.8 Comp.9 Comp.10 Co
mp.11 Comp.12 Comp.13
SS loadings      1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000   1.000
1.000   1.000   1.000
Proportion Var   0.077  0.077  0.077  0.077  0.077  0.077  0.077  0.077  0.077   0.077
0.077   0.077   0.077
Cumulative Var   0.077  0.154  0.231  0.308  0.385  0.462  0.538  0.615  0.692   0.769
0.846   0.923   1.000
> plot(WPCA, t='l')
```




```
> screeplot(WPCA, type="line", main="Scree plot")
```




```
> biplot(WPCA)
```




```
> WPCA$scores[1:10, 1]
 [1] 3.316751 2.209465 2.516740 3.757066 1.008908 3.050254 2.449090 2.059437 2.510874 2.
753628
> attributes(WPCA)
$names
[1] "sdev"     "loadings" "center"   "scale"    "n.obs"    "scores"   "call"
```

```
$class
[1] "princomp"


>
```