

```

> alk <- read.csv2("alkohol.csv", header=T)
> alk <- transform(alk, gF=g*F, gA=g*A, FA=F*A, gFA=g*F*A)

> xa <- alk[,2:8]
> View(xa)
> s <- svd(xa)

$V
      [,1] [,2] [,3] [,4] [,5] [,6] [,7]
[1,] -0.866 -0.439 -0.227 -0.081 -0.0076 0.0019 -0.00049
[2,] -0.233 0.446 0.066 -0.038 -0.8582 -0.0571 -0.03285
[3,] -0.088 -0.089 0.480 0.106 -0.0417 0.8503 -0.13231
[4,] -0.405 0.747 0.012 0.196 0.4879 0.0314 0.01916
[5,] -0.142 -0.179 0.750 0.372 0.0163 -0.4909 0.07737
[6,] -0.041 0.058 0.226 -0.524 0.0459 0.0686 0.81380
[7,] -0.057 0.081 0.316 -0.727 0.1460 -0.1648 -0.55928

> (lambda=s$d^2)
[1] 175.50094185 36.15169261 25.69199153 4.48622117 1.59451271 0.49736292
[7] 0.05727721

> lambda/sum(lambda)
[1] 0.7193251162 0.1481748201 0.1053036787 0.0183876595 0.0065354238 0.0020385397
[7] 0.0002347619

> library("car")

> w <- s$u %*% D
> colnames(w) <- 1:7
> print(w, digits=2)
      1 2 3 4 5 6 7
[1,] -1.83 0.63 1.62 -0.696 -0.2112 0.23953 0.18539
[2,] -2.71 0.75 2.13 -0.840 0.1744 -0.13381 -0.09255
[3,] -2.57 0.73 2.05 -0.816 0.1101 -0.07159 -0.04623
[4,] -1.40 -0.89 1.16 0.484 -0.0304 0.21465 -0.03236
[5,] -1.30 -0.83 1.11 0.455 -0.0312 0.26354 -0.04005
[6,] -1.50 -0.95 1.21 0.513 -0.0295 0.16576 -0.02468
[7,] -1.40 -0.89 1.16 0.484 -0.0304 0.21465 -0.03236
[8,] -2.81 -1.76 1.89 0.891 -0.0182 -0.46985 0.07527
[9,] -3.03 1.12 -0.41 0.216 0.1985 0.01630 0.00822
[10,] -1.63 0.79 -0.17 0.089 -0.3298 -0.02041 -0.01232
[11,] -1.76 0.82 -0.19 0.101 -0.2818 -0.01708 -0.01045
[12,] -1.38 0.72 -0.13 0.066 -0.4259 -0.02709 -0.01605
[13,] -1.25 0.69 -0.11 0.055 -0.4739 -0.03043 -0.01792
[14,] -2.14 0.91 -0.26 0.136 -0.1377 -0.00706 -0.00485
[15,] -1.38 0.72 -0.13 0.066 -0.4259 -0.02709 -0.01605
[16,] -2.27 0.94 -0.28 0.147 -0.0897 -0.00373 -0.00298
[17,] -2.39 0.97 -0.30 0.159 -0.0417 -0.00039 -0.00112
[18,] -2.39 0.97 -0.30 0.159 -0.0417 -0.00039 -0.00112
[19,] -3.03 1.12 -0.41 0.216 0.1985 0.01630 0.00822
[20,] -1.25 0.69 -0.11 0.055 -0.4739 -0.03043 -0.01792
[21,] -2.77 1.06 -0.36 0.193 0.1024 0.00963 0.00448
[22,] -4.04 1.37 -0.58 0.309 0.5827 0.04300 0.02315
[23,] -3.03 1.12 -0.41 0.216 0.1985 0.01630 0.00822
[24,] -0.95 -0.48 -0.25 -0.089 -0.0084 0.00213 -0.00054
[25,] -1.99 -1.01 -0.52 -0.186 -0.0176 0.00445 -0.00113
[26,] -2.34 -1.18 -0.61 -0.219 -0.0207 0.00522 -0.00133

```

```
[27,] -1.21 -0.61 -0.32 -0.113 -0.0107 0.00271 -0.00069
[28,] -1.90 -0.97 -0.50 -0.178 -0.0168 0.00425 -0.00108
[29,] -1.73 -0.88 -0.45 -0.162 -0.0153 0.00387 -0.00099
[30,] -2.42 -1.23 -0.64 -0.227 -0.0214 0.00542 -0.00138
[31,] -4.50 -2.28 -1.18 -0.421 -0.0398 0.01006 -0.00256
[32,] -3.55 -1.80 -0.93 -0.332 -0.0314 0.00793 -0.00202
```

```
> mw <- lm(m~w[,1]+w[,2]+w[,3]+w[,4]+w[,5]+w[,6]+w[,7])
> summary(mw)
```

Call:

```
lm(formula = m ~ w[, 1] + w[, 2] + w[, 3] + w[, 4] + w[, 5] +
    w[, 6] + w[, 7])
```

Residuals:

```
      Min       1Q   Median       3Q      Max
-2.4286 -0.6189 -0.0466  0.5150  3.6516
```

Coefficients:

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  -1.6597      0.9996  -1.660 0.109876
w[, 1]        -1.8360      0.4089  -4.490 0.000152 ***
w[, 2]        -1.6995      0.2088  -8.138 2.33e-08 ***
w[, 3]        -0.4930      0.2708  -1.820 0.081188 .
w[, 4]        -0.5496      0.6143  -0.895 0.379803
w[, 5]        -2.1520      1.4523  -1.482 0.151395
w[, 6]         2.4025      1.9570   1.228 0.231495
w[, 7]        -3.0348      5.3726  -0.565 0.577405
```

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```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Residual standard error: 1.254 on 24 degrees of freedom

Multiple R-squared: 0.8277, Adjusted R-squared: 0.7774

F-statistic: 16.47 on 7 and 24 DF, p-value: 9.354e-08

```
> vif(mw)
```

```
      w[, 1]  w[, 2]  w[, 3]  w[, 4]  w[, 5]  w[, 6]  w[, 7]
2.455492 1.002286 1.186175 1.072158 2.018171 1.198348 1.048347
```

```
> mw0 <- lm(m~w[,1]+w[,2]+w[,3]+w[,4]+w[,5]+w[,6]+w[,7]-1)
> summary(mw0)
```

Call:

```
lm(formula = m ~ w[, 1] + w[, 2] + w[, 3] + w[, 4] + w[, 5] +
    w[, 6] + w[, 7] - 1)
```

Residuals:

```
      Min       1Q   Median       3Q      Max
-2.6901 -0.6189 -0.0534  0.4548  4.1150
```

Coefficients:

```
              Estimate Std. Error t value Pr(>|t|)
w[, 1]  -1.17565      0.09794 -12.003 7.14e-12 ***
w[, 2]  -1.71653      0.21580  -7.954 2.61e-08 ***
w[, 3]  -0.67573      0.25599  -2.640  0.0141 *
w[, 4]  -0.82102      0.61260  -1.340  0.1922
w[, 5]  -0.39300      1.02756  -0.382  0.7054
w[, 6]   1.04647      1.83985   0.569  0.5746
```

```
w[, 7] -1.07022    5.42162  -0.197   0.8451
```

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 1.298 on 25 degrees of freedom
```

```
Multiple R-squared:  0.8965, Adjusted R-squared:  0.8676
```

```
F-statistic: 30.95 on 7 and 25 DF,  p-value: 8.662e-11
```

```
> gamma <- coef(mw0)
```

```
> print(gamma,digits=4)
```

```
w[, 1] w[, 2] w[, 3] w[, 4] w[, 5] w[, 6] w[, 7]
-1.1756 -1.7165 -0.6757 -0.8210 -0.3930  1.0465 -1.0702
```

```
beta3 <- s$v[,1:3] %*% gamma[1:3]
```

```
> print(beta3,digits=2)
```

```
g      [1,]  1.924
F      [2,] -0.537
A      [3,] -0.068
g:F    [4,] -0.815
g:A    [5,] -0.033
F:A    [6,] -0.205
g:F:A  [7,] -0.285
```

```
> V.beta3 <- s$v[,1:3] %*% (diag(s$d^(-2))[1:3,1:3]) %*% t(s$v[,1:3]) * 1.298^2
```

```
> print(V.beta3,digits=2)
```

```
      [,1]      [,2]      [,3]      [,4]      [,5]      [,6]      [,7]
[1,]  0.0195 -0.00818 -0.00459 -0.0121 -0.00632 -0.0042 -0.0059
[2,] -0.0082  0.01009  0.00042  0.0165 -0.00017  0.0023  0.0032
[3,] -0.0046  0.00042  0.01558 -0.0024  0.02449  0.0069  0.0097
[4,] -0.0121  0.01650 -0.00236  0.0276 -0.00507  0.0024  0.0033
[5,] -0.0063 -0.00017  0.02449 -0.0051  0.03857  0.0107  0.0149
[6,] -0.0042  0.00228  0.00691  0.0024  0.01069  0.0035  0.0049
[7,] -0.0059  0.00318  0.00966  0.0033  0.01493  0.0049  0.0069
```

```
> print(sqrt(diag(V.beta3)),digits=2)
```

```
[1] 0.140 0.100 0.125 0.166 0.196 0.059 0.083
```

```
> summary(lm(m~g*F*A-1,data=alk))
```

```
Call:
```

```
lm(formula = m ~ g * F * A - 1, data = alk)
```

```
Residuals:
```

```
      Min       1Q   Median       3Q      Max
-2.6901 -0.6189 -0.0534  0.4548  4.1150
```

```
Coefficients:
```

```
      Estimate Std. Error t value Pr(>|t|)
g          1.9963    0.1486  13.437 6.12e-13 ***
F         -0.1939    0.9116  -0.213  0.8332
A          0.8924    1.7273   0.517  0.6099
g:F       -1.1556    0.5546  -2.084  0.0476 *
g:A       -0.9409    1.0403  -0.904  0.3744
```

```
F:A    -0.5921    4.4262   -0.134    0.8947
g:F:A   0.6808    3.0845    0.221    0.8271
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Residual standard error: 1.298 on 25 degrees of freedom

Multiple R-squared: 0.8965, Adjusted R-squared: 0.8676

F-statistic: 30.95 on 7 and 25 DF, p-value: 8.662e-11