

```

# scaling1.r

d0=read.table("P1-4.txt")
names(d0)=c("sales","profit","assets")

# only sales and profit
d1=d0[,c(1,2)]

# no centering, no scaling
#=====

pr1=prcomp(d1,center=F,scale=F)
names(pr1)
# [1] "sdev"      "rotation" "center"    "scale"     "x"

rot = pr1$rotation
as.matrix(d1)%*%rot
#           PC1      PC2
# [1,] -109.31806 -8.0512140
# [2,] -153.20956 -3.9531452
# [3,]  -95.61630 -3.0253929
# [4,]  -66.39404 -8.6875789
# [5,]  -63.54104 -4.2881256
# [6,] -265.18004 -3.4461289
# [7,] -265.81530  3.4197684
# [8,] -285.38543  7.8608183
# [9,]  -92.36463 -0.4751719
# [10,] -166.03325  2.5880293

d1x = pr1$x
d1x
#           PC1      PC2
# [1,] -109.31806 -8.0512140
# [2,] -153.20956 -3.9531452
# [3,]  -95.61630 -3.0253929
# [4,]  -66.39404 -8.6875789
# [5,]  -63.54104 -4.2881256
# [6,] -265.18004 -3.4461289
# [7,] -265.81530  3.4197684
# [8,] -285.38543  7.8608183

```

```

# [9,] -92.36463 -0.4751719
# [10,] -166.03325  2.5880293

# covariance matrix

var(d1)
      sales    profit
sales 7476.4532 303.61862
profit 303.6186  26.19032

var(d1x)
      PC1      PC2
PC1 7475.6278 -313.58116
PC2 -313.5812  27.01573

# correlation

cor(d1x)
#      PC1      PC2
#PC1 1.0000000 -0.6977788
#PC2 -0.6977788  1.0000000

# still correlated

# centering (default), prcomp() agrees with eigen()
#=====

pr2=prcomp(d1)
pr2$sdev^2 # [1] 7488.80605  13.83751

eigen(var(d1))
# $values
# [1] 7488.80605  13.83751

# $vectors
#      [,1]      [,2]
# [1,] -0.99917338  0.04065165
# [2,] -0.04065165 -0.99917338

d2x = pr2$x
var(d2x)

```

```
#           PC1           PC2
# PC1  7.488806e+03 -3.446818e-14
# PC2 -3.446818e-14  1.383751e+01
```

```
apply(d2x,2,var)
      PC1      PC2
7488.80605 13.83751
```

```
# PCs uncorrelated
# but sum of eigenvals do not add up to p=2
```

```
# centering and scaling
```

```
#=====
```

```
pr3=prcomp(d1,scale=T)
d3x = pr3$x
var(d3x)
#           PC1           PC2
# PC1 1.686136e+00 7.378598e-19
# PC2 7.378598e-19 3.138640e-01
```

```
sum(diag(var(d3x)))  # [1] 2
```