

# MATH 437 HW5

Code ▾

Drew Remmenga

Hide

```
library(MASS)
```

```
## Warning: package 'MASS' was built under R version 4.1.3
```

Hide

```
set.seed(437)
mu1=c(0,0,0,0,0,0,0,0,0,0,0,0,0,0)
mu2=c(3,3,3,3,3,3,3,3,3,3,3,3,3)
mu3=c(-3,-3,-3,-3,-3,-3,-3,-3,-3,-3,-3,-3,-3)
v1=c(1,-1,1,-1,1,-1,1,-1,1,-1,1,-1,1)
v2=c(-2,1,-2,1,-2,1,-2,1,-2,1,-2,1,-2,1)/6
X16=mvnrm(16,mu1,diag(14))
X24=mvnrm(24-16,mu2,v1%*t(v1))
X32=mvnrm(32-24,mu3,v1%*t(v1)+v2%*t(v2))
X=rbind(X16,X24,X32)
ev=eigen(cov(X))
y=c()
k=c(1,2,3,4,5,6,7,8,9,10,11,12,13,14)
values=ev$values
for (val in k)
{
  x=seq(1,val)
  y[val]=sum(values[1:val])
}
l=sum(ev$values)
Y=y/l
plot(k,Y)
```

It appears logarithmic.

Hide

```
plot(X)
```

Hide

```
set.seed(438)
X16=mvnrm(16,mu1,diag(14))
X24=mvnrm(24-16,mu2,v1%*t(v1))
X32=mvnrm(32-24,mu3,v1%*t(v1)+v2%*t(v2))
X=rbind(X16,X24,X32)
ev=eigen(cov(X))
y=c()
k=c(1,2,3,4,5,6,7,8,9,10,11,12,13,14)
values=ev$values
for (val in k)
{
  x=seq(1,val)
  y[val]=sum(values[1:val])
}
l=sum(ev$values)
Y=y/l
plot(k,Y)
```

Hide

```
plot(X)
```

Hide

```
set.seed(439)
X16=mvnrm(16,mu1,diag(14))
X24=mvnrm(24-16,mu2,v1%*t(v1))
X32=mvnrm(32-24,mu3,v1%*t(v1)+v2%*t(v2))
X=rbind(X16,X24,X32)
ev=eigen(cov(X))
y=c()
k=c(1,2,3,4,5,6,7,8,9,10,11,12,13,14)
values=ev$values
for (val in k)
{
  x=seq(1,val)
  y[val]=sum(values[1:val])
}
l=sum(ev$values)
Y=y/l
plot(k,Y)
```

Hide

```
plot(X)
```

Hide

```
S=c(14.1,4.3,1.2,.4)
u1=c(0.39, 0.42, 0.44, 0.69)
u2=c(0.40, 0.39, 0.42, -0.72)
s=u1%*t(u1)
s=s*14.1
s
```

```
##           [,1]      [,2]      [,3]      [,4]
## [1,] 2.14461 2.30958 2.41956 3.79431
## [2,] 2.30958 2.48724 2.60568 4.08618
## [3,] 2.41956 2.60568 2.72976 4.28076
## [4,] 3.79431 4.08618 4.28076 6.71301
```

Hide

```
u1[1]+u2[1]
```

```
## [1] 0.79
```

Hide

```
S=diag(S,nrow=4)
u1%*%S%*%u2
```

```
##           [,1]
## [1,] 2.92698
```

u2=c(0.40, 0.39, 0.42, -0.72)

Hide

```
canmed=read.table("~/School/Math437/HW5/Canmed.txt")
canmed=canmed[1:14,1:6]
d=dist(canmed,method="euclidean")
```

```
## Warning in dist(canmed, method = "euclidean"): NAs introduced by coercion
```

Hide

```
d[is.na(d)]=0
clust=hclust(d,method="complete")
plot(clust)
```

Hide

```
canmed=scale(as.numeric(unlist(canmed)))
```

```
## Warning in scale(as.numeric(unlist(canmed))): NAs introduced by coercion
```

Hide

```
canmed[is.na(canmed)]=0
pc = princomp(canmed)
```

Hide

```
S=matrix(data=c(1,.25,0,.25,1,.25,0,.25,1),nrow=3)
s=eigen(S)
s
```

```
## eigen() decomposition
## $values
## [1] 1.3535534 1.0000000 0.6464466
##
## $vectors
##           [,1]      [,2]      [,3]
## [1,] 0.5000000 7.071068e-01 -0.5000000
## [2,] 0.7071068 7.850462e-16 0.7071068
## [3,] 0.5000000 -7.071068e-01 -0.5000000
```

Hide

```
s$vectors%*t(s$vectors)
```

```
##           [,1]      [,2]      [,3]
## [1,] 1.000000e+00 -5.551115e-17 0.000000e+00
## [2,] -5.551115e-17 1.000000e+00 -5.551115e-17
## [3,] 0.000000e+00 -5.551115e-17 1.000000e+00
```