Exercise3.R

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### Exercise 3  
  
remove(list = ls())  
I = diag(1, nrow = 23, ncol = 23)  
J = matrix(c(rep(1, 23\*23)), nrow = 23, ncol = 23)  
n = 1/230  
H = I-n\*J  
  
# a)  
# i)  
pref = read.table(file = "Preferences.txt", header = T)  
Pref = cbind(Name = pref[,1],pref[,2:21])  
Preferences = as.matrix(Pref[,2:21])  
X = scale(Preferences, center = T, scale = F)  
Q = X%\*%t(X)  
Qlam = eigen(Q)$values[1:2]  
QLam = diag(sqrt(Qlam), nrow = 2, ncol = 2)  
Qe = eigen(Q)$vectors[,1:2]  
Yhat = Qe%\*%QLam  
head(Yhat,4)

## [,1] [,2]  
## [1,] -0.6713242 -0.06986646  
## [2,] -0.4397291 -1.67075200  
## [3,] 1.5584607 -1.47549195  
## [4,] 0.4263072 2.37895190

# ii)  
S = cov(Preferences)  
E = eigen(S)$vectors  
Yhat = X%\*%E  
head(Yhat[,1:2],4)

## [,1] [,2]  
## [1,] 0.6713242 0.06986646  
## [2,] 0.4397291 1.67075200  
## [3,] -1.5584607 1.47549195  
## [4,] -0.4263072 -2.37895190

# b)  
X = scale(Preferences, center = T, scale = F)  
S = cov(X)  
Lam = eigen(S)$values[1:2]  
E = eigen(S)$vectors[,1:2]  
Yhat = X%\*%E  
plot(Yhat, type = "n", asp = 1, xlab = "PC1", ylab = "PC2")  
text(Yhat[,1],Yhat[,2], pref[,1])  
  
# c)  
E\_1 = E[,1]  
E\_2 = E[,2]  
lqa = sqrt(E\_1^2+E\_2^2)  
ra = order(lqa, decreasing = T)  
arrows(0,0,2.5\*E\_1[ra[1:4]],2.5\*E\_2[ra[1:4]], col="red")  
text(3\*E\_1[ra[1:4]],3\*E\_2[ra[1:4]], labels = c("Q4","Q19","Q1","Q18"), col = "red")   
  
# d)   
colMeans(Preferences)

## Q1 Q2 Q3 Q4 Q5 Q6   
## 0.30434783 0.04347826 -0.91304348 -0.04347826 -0.21739130 0.39130435   
## Q7 Q8 Q9 Q10 Q11 Q12   
## -0.47826087 0.13043478 -0.39130435 -0.13043478 0.39130435 -0.56521739   
## Q13 Q14 Q15 Q16 Q17 Q18   
## 0.13043478 0.13043478 0.30434783 -0.21739130 -0.65217391 0.04347826   
## Q19 Q20   
## 0.13043478 -0.47826087

Conformist = c(1,1,-1,-1,-1,1,-1,1,-1,-1,1,-1,1,1,1,-1,-1,1,1,-1)  
Individualist = (-1)\*Conformist  
means = colMeans(Preferences, na.rm = F, dims = 1)  
XC = Conformist-means  
XI = Individualist-means  
YhatC = XC%\*%E  
YhatI = XI%\*%E  
  
text(YhatC[1,1],YhatC[1,2], "conformist", col = "green")  
text(YhatI[1,1],YhatI[1,2], "individualist", col = "green")

