# HW Chapter 2 Assumptions

## by Ledin Menjivar

### Normality

##help.search("normality")  
##install.packages("mvnormtest")  
library(mvnormtest)  
data(attitude)

library()  
data()  
attach(attitude)  
head(attitude, n=10)

## rating complaints privileges learning raises critical advance  
## 1 43 51 30 39 61 92 45  
## 2 63 64 51 54 63 73 47  
## 3 71 70 68 69 76 86 48  
## 4 61 63 45 47 54 84 35  
## 5 81 78 56 66 71 83 47  
## 6 43 55 49 44 54 49 34  
## 7 58 67 42 56 66 68 35  
## 8 71 75 50 55 70 66 41  
## 9 72 82 72 67 71 83 31  
## 10 67 61 45 47 62 80 41

mydata <- t(attitude)  
mshapiro.test(mydata)

##   
## Shapiro-Wilk normality test  
##   
## data: Z  
## W = 0.82704, p-value = 0.0002126

#install.packages("normtest")  
library(normtest)  
jb.norm.test(attitude)

##   
## Jarque-Bera test for normality  
##   
## data: attitude  
## JB = 2.6059, p-value = 0.024

##install.packages("normwhn.test")  
library(normwhn.test)  
normality.test1(attitude)

## [1] "sk"  
## [1] -0.37659696 -0.22665528 0.39890076 -0.05685234 0.20784850 -0.91094446  
## [7] 0.89476113  
## [1] "k"  
## [1] 2.390517 2.485446 2.770972 1.901284 2.569297 3.388175 3.708895  
## [1] "rtb1"  
## [1] -0.39953884 0.15918414 0.68213961 -0.01154936 -0.21090169 -0.62580414  
## [7] 0.61203447  
## [1] "b2"  
## [1] 2.174653 2.770865 3.699421 2.291471 2.838553 3.154168 3.684754  
## [1] "z1"  
## [1] -1.02518803 0.41544780 1.69082757 -0.03024275 -0.54905030 -1.56346957  
## [7] 1.53191792  
## [1] "z2"  
## [1] -1.25427220 0.49125566 0.71855585 -0.36330561 0.55022248 0.02143833  
## [7] 0.95044570  
## [1] "H0: data do not have skewness"  
## [1] "pvalsk"  
## [1] 0.30527448 0.67781412 0.09086974 0.97587346 0.58297093 0.11794219 0.12554269  
## [1] "H0: data do not have negative skewness"  
## [1] "pskneg"  
## [1] 0.15263724 0.66109294 0.95456513 0.48793673 0.29148547 0.05897109 0.93722865  
## [1] "H0: data do not have positive skewness"  
## [1] "pskpos"  
## [1] 0.84736276 0.33890706 0.04543487 0.51206327 0.70851453 0.94102891 0.06277135  
## [1] "H0: data do not have kurtosis"  
## [1] "pvalk"  
## [1] 0.2097431 0.6232456 0.4724146 0.7163766 0.5821668 0.9828960 0.3418858  
## [1] "H0: data do not have negative kurtosis"  
## [1] "pkneg"  
## [1] 0.1048715 0.6883772 0.7637927 0.3581883 0.7089166 0.5085520 0.8290571  
## [1] "H0: data do not have positive kurtosis"  
## [1] "pkpos"  
## [1] 0.8951285 0.3116228 0.2362073 0.6418117 0.2910834 0.4914480 0.1709429  
## [1] "H0: data are normally distributed"  
## [1] "Ep"  
## [,1]  
## [1,] 12.84548  
## [1] "dof"  
## [1] 14  
## [1] "sig.Ep"  
## [,1]  
## [1,] 0.5387251

#install.packages("nortest")  
library(nortest)  
attach(attitude)

## The following objects are masked from attitude (pos = 6):  
##   
## advance, complaints, critical, learning, privileges, raises, rating

ad.test(rating)

##   
## Anderson-Darling normality test  
##   
## data: rating  
## A = 0.45785, p-value = 0.2464

cvm.test(rating)

##   
## Cramer-von Mises normality test  
##   
## data: rating  
## W = 0.076108, p-value = 0.2242

lillie.test(rating)

##   
## Lilliefors (Kolmogorov-Smirnov) normality test  
##   
## data: rating  
## D = 0.14663, p-value = 0.09872

pearson.test(rating)

##   
## Pearson chi-square normality test  
##   
## data: rating  
## P = 7.3333, p-value = 0.197

sf.test(rating)

##   
## Shapiro-Francia normality test  
##   
## data: rating  
## W = 0.96524, p-value = 0.3545

### Determinant of a Matrix

mycor <- cor(attitude)  
det(mycor)

## [1] 0.02186893

mycov <- cov(attitude)  
det(mycov)

## [1] 1.327369e+13

mymatrix <- cov2cor(mycov)  
mymatrix

## rating complaints privileges learning raises critical  
## rating 1.0000000 0.8254176 0.4261169 0.6236782 0.5901390 0.1564392  
## complaints 0.8254176 1.0000000 0.5582882 0.5967358 0.6691975 0.1877143  
## privileges 0.4261169 0.5582882 1.0000000 0.4933310 0.4454779 0.1472331  
## learning 0.6236782 0.5967358 0.4933310 1.0000000 0.6403144 0.1159652  
## raises 0.5901390 0.6691975 0.4454779 0.6403144 1.0000000 0.3768830  
## critical 0.1564392 0.1877143 0.1472331 0.1159652 0.3768830 1.0000000  
## advance 0.1550863 0.2245796 0.3432934 0.5316198 0.5741862 0.2833432  
## advance  
## rating 0.1550863  
## complaints 0.2245796  
## privileges 0.3432934  
## learning 0.5316198  
## raises 0.5741862  
## critical 0.2833432  
## advance 1.0000000

mycor

## rating complaints privileges learning raises critical  
## rating 1.0000000 0.8254176 0.4261169 0.6236782 0.5901390 0.1564392  
## complaints 0.8254176 1.0000000 0.5582882 0.5967358 0.6691975 0.1877143  
## privileges 0.4261169 0.5582882 1.0000000 0.4933310 0.4454779 0.1472331  
## learning 0.6236782 0.5967358 0.4933310 1.0000000 0.6403144 0.1159652  
## raises 0.5901390 0.6691975 0.4454779 0.6403144 1.0000000 0.3768830  
## critical 0.1564392 0.1877143 0.1472331 0.1159652 0.3768830 1.0000000  
## advance 0.1550863 0.2245796 0.3432934 0.5316198 0.5741862 0.2833432  
## advance  
## rating 0.1550863  
## complaints 0.2245796  
## privileges 0.3432934  
## learning 0.5316198  
## raises 0.5741862  
## critical 0.2833432  
## advance 1.0000000

### Equality of Variance-Covariance Matrix

group <- rep(c("boy", "girl"), c(15,15))  
newdata <- data.frame(attitude,group)  
head(newdata, n=10)

## rating complaints privileges learning raises critical advance group  
## 1 43 51 30 39 61 92 45 boy  
## 2 63 64 51 54 63 73 47 boy  
## 3 71 70 68 69 76 86 48 boy  
## 4 61 63 45 47 54 84 35 boy  
## 5 81 78 56 66 71 83 47 boy  
## 6 43 55 49 44 54 49 34 boy  
## 7 58 67 42 56 66 68 35 boy  
## 8 71 75 50 55 70 66 41 boy  
## 9 72 82 72 67 71 83 31 boy  
## 10 67 61 45 47 62 80 41 boy

options(scipen = 999)  
boys <- newdata[1:15,]  
boycov <- cov(boys[,-8])  
det(boycov)

## [1] 757123067103

girls <- newdata[16:30,]  
girlcov <- cov(girls[,-8])  
det(girlcov)

## [1] 7779163547559

#install.packages("psych")  
library(psych)  
describeBy(newdata,group=group)

##   
## Descriptive statistics by group   
## group: boy  
## vars n mean sd median trimmed mad min max range skew  
## rating 1 15 65.00 10.66 67 65.46 5.93 43 81 38 -0.82  
## complaints 2 15 66.73 10.37 64 66.69 13.34 51 83 32 0.13  
## privileges 3 15 53.47 12.96 51 53.00 8.90 30 83 53 0.59  
## learning 4 15 53.33 11.18 54 53.00 14.83 39 72 33 0.28  
## raises 5 15 63.87 7.96 62 63.46 10.38 54 79 25 0.41  
## critical 6 15 74.80 10.92 77 75.46 10.38 49 92 43 -0.60  
## advance 7 15 39.00 6.89 41 39.38 8.90 25 48 23 -0.28  
## group\* 8 15 1.00 0.00 1 1.00 0.00 1 1 0 NaN  
## kurtosis se  
## rating -0.10 2.75  
## complaints -1.41 2.68  
## privileges -0.03 3.35  
## learning -1.47 2.89  
## raises -1.21 2.06  
## critical -0.22 2.82  
## advance -1.13 1.78  
## group\* NaN 0.00  
## ------------------------------------------------------------   
## group: girl  
## vars n mean sd median trimmed mad min max range skew  
## rating 1 15 64.27 13.89 65 64.54 19.27 40 85 45 -0.08  
## complaints 2 15 66.47 16.12 66 66.92 16.31 37 90 53 -0.26  
## privileges 3 15 52.80 11.91 52 52.92 14.83 33 71 38 0.05  
## learning 4 15 59.40 11.86 59 60.15 14.83 34 75 41 -0.42  
## raises 5 15 65.40 12.62 64 65.38 16.31 43 88 45 0.01  
## critical 6 15 74.73 9.14 78 75.54 2.97 54 85 31 -1.18  
## advance 7 15 46.87 11.78 46 46.00 13.34 33 72 39 0.57  
## group\* 8 15 1.00 0.00 1 1.00 0.00 1 1 0 NaN  
## kurtosis se  
## rating -1.35 3.59  
## complaints -1.12 4.16  
## privileges -1.49 3.08  
## learning -0.84 3.06  
## raises -1.08 3.26  
## critical 0.02 2.36  
## advance -0.89 3.04  
## group\* NaN 0.00

cov.list <- lapply(unique(newdata$group),function(x)cov(newdata[newdata$group==x,-8]))  
cov.list[1]

## [[1]]  
## rating complaints privileges learning raises critical  
## rating 113.71429 80.071429 75.00000 74.00000 50.28571 29.21429  
## complaints 80.07143 107.495238 96.77619 68.02381 51.60476 27.08571  
## privileges 75.00000 96.776190 167.98095 55.33333 25.78095 5.10000  
## learning 74.00000 68.023810 55.33333 124.95238 76.19048 28.00000  
## raises 50.28571 51.604762 25.78095 76.19048 63.40952 33.40000  
## critical 29.21429 27.085714 5.10000 28.00000 33.40000 119.31429  
## advance 12.35714 6.214286 -18.14286 26.78571 31.64286 36.50000  
## advance  
## rating 12.357143  
## complaints 6.214286  
## privileges -18.142857  
## learning 26.785714  
## raises 31.642857  
## critical 36.500000  
## advance 47.428571

cov.list[2]

## [[1]]  
## rating complaints privileges learning raises critical  
## rating 192.923810 196.93810 56.20000 112.9571429 105.02857 9.7904762  
## complaints 196.938095 259.69524 91.52857 126.0142857 140.51429 24.1333333  
## privileges 56.200000 91.52857 141.88571 93.5857143 92.15714 31.8000000  
## learning 112.957143 126.01429 93.58571 140.6857143 80.68571 0.1142857  
## raises 105.028571 140.51429 92.15714 80.6857143 159.25714 46.9714286  
## critical 9.790476 24.13333 31.80000 0.1142857 46.97143 83.4952381  
## advance 30.966667 58.63810 110.47143 80.6285714 89.12857 23.5333333  
## advance  
## rating 30.96667  
## complaints 58.63810  
## privileges 110.47143  
## learning 80.62857  
## raises 89.12857  
## critical 23.53333  
## advance 138.69524

boys <- newdata[1:15,]  
boycov <- cov(boys[,-8])  
boycor <- cov2cor(boycov)  
boycor

## rating complaints privileges learning raises critical  
## rating 1.0000000 0.72422823 0.54265490 0.6208003 0.5921884 0.25080809  
## complaints 0.7242282 1.00000000 0.72018470 0.5869405 0.6250545 0.23916601  
## privileges 0.5426549 0.72018470 1.00000000 0.3819307 0.2497996 0.03602417  
## learning 0.6208003 0.58694049 0.38193068 1.0000000 0.8559555 0.22931874  
## raises 0.5921884 0.62505455 0.24979957 0.8559555 1.0000000 0.38399273  
## critical 0.2508081 0.23916601 0.03602417 0.2293187 0.3839927 1.00000000  
## advance 0.1682637 0.08703152 -0.20326174 0.3479453 0.5770035 0.48520651  
## advance  
## rating 0.16826374  
## complaints 0.08703152  
## privileges -0.20326174  
## learning 0.34794527  
## raises 0.57700347  
## critical 0.48520651  
## advance 1.00000000

girls <- newdata[16:30,]  
girlcov <- cov(girls[,-8])  
girlcor <- cov2cor(girlcov)  
girlcor

## rating complaints privileges learning raises critical  
## rating 1.00000000 0.8798423 0.3396832 0.685639429 0.5991907 0.077140073  
## complaints 0.87984228 1.0000000 0.4768210 0.659269203 0.6909379 0.163890758  
## privileges 0.33968320 0.4768210 1.0000000 0.662392222 0.6130702 0.292164154  
## learning 0.68563943 0.6592692 0.6623922 1.000000000 0.5390415 0.001054475  
## raises 0.59919073 0.6909379 0.6130702 0.539041483 1.0000000 0.407336620  
## critical 0.07714007 0.1638908 0.2921642 0.001054475 0.4073366 1.000000000  
## advance 0.18930879 0.3089706 0.7874987 0.577209127 0.5997037 0.218686421  
## advance  
## rating 0.1893088  
## complaints 0.3089706  
## privileges 0.7874987  
## learning 0.5772091  
## raises 0.5997037  
## critical 0.2186864  
## advance 1.0000000

### Box M Test

#install.packages("biotools")  
library(biotools)

## Loading required package: MASS

## ---  
## biotools version 4.0

##

data(iris)  
factor(iris[,5])

## [1] setosa setosa setosa setosa setosa setosa   
## [7] setosa setosa setosa setosa setosa setosa   
## [13] setosa setosa setosa setosa setosa setosa   
## [19] setosa setosa setosa setosa setosa setosa   
## [25] setosa setosa setosa setosa setosa setosa   
## [31] setosa setosa setosa setosa setosa setosa   
## [37] setosa setosa setosa setosa setosa setosa   
## [43] setosa setosa setosa setosa setosa setosa   
## [49] setosa setosa versicolor versicolor versicolor versicolor  
## [55] versicolor versicolor versicolor versicolor versicolor versicolor  
## [61] versicolor versicolor versicolor versicolor versicolor versicolor  
## [67] versicolor versicolor versicolor versicolor versicolor versicolor  
## [73] versicolor versicolor versicolor versicolor versicolor versicolor  
## [79] versicolor versicolor versicolor versicolor versicolor versicolor  
## [85] versicolor versicolor versicolor versicolor versicolor versicolor  
## [91] versicolor versicolor versicolor versicolor versicolor versicolor  
## [97] versicolor versicolor versicolor versicolor virginica virginica   
## [103] virginica virginica virginica virginica virginica virginica   
## [109] virginica virginica virginica virginica virginica virginica   
## [115] virginica virginica virginica virginica virginica virginica   
## [121] virginica virginica virginica virginica virginica virginica   
## [127] virginica virginica virginica virginica virginica virginica   
## [133] virginica virginica virginica virginica virginica virginica   
## [139] virginica virginica virginica virginica virginica virginica   
## [145] virginica virginica virginica virginica virginica virginica   
## Levels: setosa versicolor virginica

boxM(iris[,-5],iris[,5])

##   
## Box's M-test for Homogeneity of Covariance Matrices  
##   
## data: iris[, -5]  
## Chi-Sq (approx.) = 140.94, df = 20, p-value < 0.00000000000000022

#install.packages("biotools")  
library(biotools)  
data(newdata)

## Warning in data(newdata): data set 'newdata' not found

factor(newdata[,8])

## [1] boy boy boy boy boy boy boy boy boy boy boy boy boy boy boy   
## [16] girl girl girl girl girl girl girl girl girl girl girl girl girl girl girl  
## Levels: boy girl

boxM(newdata[,-8], newdata[,8])

##   
## Box's M-test for Homogeneity of Covariance Matrices  
##   
## data: newdata[, -8]  
## Chi-Sq (approx.) = 34.069, df = 28, p-value = 0.1986