Question-1

Question 2

Nadim

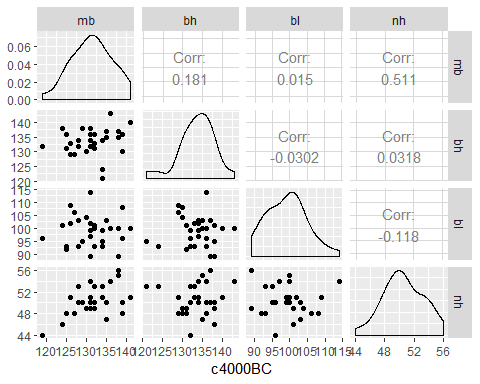
Wed Jan 23 17:46:37 2019

library(HSAUR3)

library(ggplot2)

library(GGally)

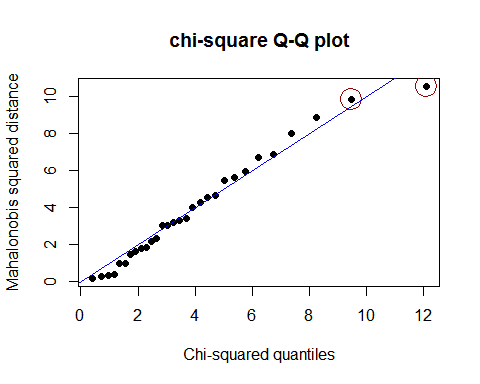
epochs<-skulls$epoch  
skull\_cov<- skulls[epochs=="c4000BC",2:5]  
ggpairs(skull\_cov,xlab="c4000BC")



chisquare.plot <- function(x,mark){  
 p <- ncol(x)  
 n<-nrow(x)  
 xbar<- colMeans(x)  
 s <- cov(x)  
   
 ###Mahalonobis Dist  
   
 x.cent <- scale(x,center =T, scale = F)  
 d2<- diag(x.cent%\*%solve(s)%\*%t(x.cent))  
   
 qchi <- qchisq((1:n-0.5)/n, df =p)  
 sortd <- sort(d2)  
   
 plot(qchi,sortd,pch=19,xlab="Chi-squared quantiles",ylab="Mahalonobis squared distance",main="chi-square Q-Q plot")  
   
 points(qchi[(n-mark+1):n],sortd[(n-mark+1):n],cex=3,col="#990000")  
   
 return((sortd[(n-mark+1):n]))  
}  
  
chisquare.plot(x=skull\_cov,mark = 2)

## 12 29   
## 9.861683 10.573099

abline(0,1,col="blue")

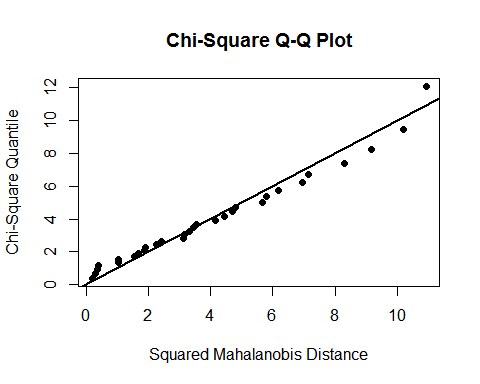


# epochs<-skulls$epoch  
# skull\_cov<- skulls[epochs=="c4000BC",2:5]  
  
z\_col<- list()  
#z\_col<-matrix(list(),nrow=length(skull\_cov$mb),ncol=4)  
for (i in 1:4){  
 z\_col[i]<- list((scale(skull\_cov[i])))  
 skull\_cov[i+4]<- z\_col[i]  
 #skull\_cov<-cbind(z\_col[-i],skull\_cov)  
  
}  
  
colnames(skull\_cov)<-c("mb","bh","bl","nh","Z\_mb","z\_bh","z\_bl","z\_nh")  
sk<-skull\_cov[,1:4]  
s<-cov(sk)  
x.cent <- scale(sk,center =T, scale = F)  
d2<- diag(x.cent%\*%solve(s)%\*%t(x.cent))  
skull\_cov<-cbind(d2=d2,skull\_cov)  
  
apply(skull\_cov[,2:5], 2, shapiro.test)

## $mb  
##   
## Shapiro-Wilk normality test  
##   
## data: newX[, i]  
## W = 0.98136, p-value = 0.8603  
##   
##   
## $bh  
##   
## Shapiro-Wilk normality test  
##   
## data: newX[, i]  
## W = 0.95664, p-value = 0.2536  
##   
##   
## $bl  
##   
## Shapiro-Wilk normality test  
##   
## data: newX[, i]  
## W = 0.97314, p-value = 0.6282  
##   
##   
## $nh  
##   
## Shapiro-Wilk normality test  
##   
## data: newX[, i]  
## W = 0.97481, p-value = 0.6772

library(MVN)

mvn(skull\_cov[, 2:5], mvnTest = "royston", multivariatePlot = "qq")



## $multivariateNormality  
## Test H p value MVN  
## 1 Royston 2.752767 0.603866 YES  
##   
## $univariateNormality  
## Test Variable Statistic p value Normality  
## 1 Shapiro-Wilk mb 0.9814 0.8603 YES   
## 2 Shapiro-Wilk bh 0.9566 0.2536 YES   
## 3 Shapiro-Wilk bl 0.9731 0.6282 YES   
## 4 Shapiro-Wilk nh 0.9748 0.6772 YES   
##   
## $Descriptives  
## n Mean Std.Dev Median Min Max 25th 75th Skew  
## mb 30 131.36667 5.129249 131 119 141 128.00 134.75 -0.16642216  
## bh 30 133.60000 4.469051 134 121 143 131.25 136.00 -0.64720446  
## bl 30 99.16667 5.884423 100 89 114 95.00 102.75 0.31717217  
## nh 30 50.53333 2.763473 50 44 56 49.00 53.00 -0.08670975  
## Kurtosis  
## mb -0.4879548  
## bh 0.8488047  
## bl -0.2756768  
## nh -0.4538837

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dat<- read.table("https://www.stat.ncsu.edu/people/maity/courses/st537-S2019/data/T4-3.DAT", header=F)  
colnames(dat) <- c("x1", "x2", "x3", "x4", "d2")  
n <- nrow(dat)  
p <- ncol(dat) - 1  
head(dat)

## x1 x2 x3 x4 d2  
## 1 1889 1651 1561 1778 0.60  
## 2 2403 2048 2087 2197 5.48  
## 3 2119 1700 1815 2222 7.62  
## 4 1645 1627 1110 1533 5.21  
## 5 1976 1916 1614 1883 1.40  
## 6 1712 1712 1439 1546 2.22

######Question 1#######  
apply(dat[,1:4], 2, shapiro.test)

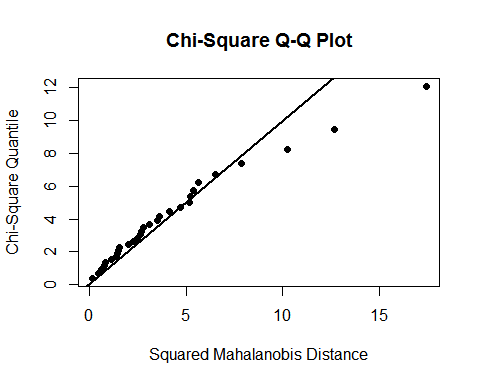
## $x1  
##   
## Shapiro-Wilk normality test  
##   
## data: newX[, i]  
## W = 0.93068, p-value = 0.05118  
##   
##   
## $x2  
##   
## Shapiro-Wilk normality test  
##   
## data: newX[, i]  
## W = 0.91274, p-value = 0.01746  
##   
##   
## $x3  
##   
## Shapiro-Wilk normality test  
##   
## data: newX[, i]  
## W = 0.93258, p-value = 0.05751  
##   
##   
## $x4  
##   
## Shapiro-Wilk normality test  
##   
## data: newX[, i]  
## W = 0.96127, p-value = 0.3337

library(MVN)

## Warning: package 'MVN' was built under R version 3.5.2

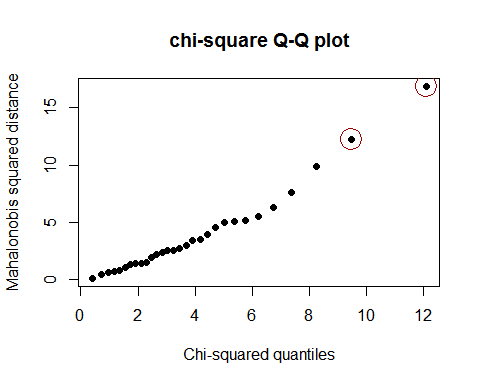
## sROC 0.1-2 loaded

mvn(dat[, 1:4], mvnTest = "royston", multivariatePlot = "qq")



## $multivariateNormality  
## Test H p value MVN  
## 1 Royston 9.823858 0.009534665 NO  
##   
## $univariateNormality  
## Test Variable Statistic p value Normality  
## 1 Shapiro-Wilk x1 0.9307 0.0512 YES   
## 2 Shapiro-Wilk x2 0.9127 0.0175 NO   
## 3 Shapiro-Wilk x3 0.9326 0.0575 YES   
## 4 Shapiro-Wilk x4 0.9613 0.3337 YES   
##   
## $Descriptives  
## n Mean Std.Dev Median Min Max 25th 75th Skew  
## x1 30 1906.100 324.9866 1863.0 1325 2983 1715.25 2057.25 1.0380842  
## x2 30 1749.533 318.6065 1680.0 1170 2794 1595.50 1888.75 1.1435912  
## x3 30 1509.133 303.1783 1466.0 1002 2412 1295.75 1623.75 0.9800274  
## x4 30 1724.967 322.8436 1674.5 1176 2581 1520.25 1880.75 0.5978431  
## Kurtosis  
## x1 2.03586397  
## x2 1.94986381  
## x3 0.99683699  
## x4 -0.04626509

chisquare.plot <- function(x,mark){  
 p <- ncol(x)  
 n<-nrow(x)  
 xbar<- colMeans(x)  
 s <- cov(x)  
   
 ###Mahalonobis Dist  
   
 x.cent <- scale(x,center =T, scale = F)  
 d2<- diag(x.cent%\*%solve(s)%\*%t(x.cent))  
   
 qchi <- qchisq((1:n-0.5)/n, df =p)  
 sortd <- sort(d2)  
   
 plot(qchi,sortd,pch=19,xlab="Chi-squared quantiles",ylab="Mahalonobis squared distance",main="chi-square Q-Q plot")  
   
 points(qchi[(n-mark+1):n],sortd[(n-mark+1):n],cex=3,col="#990000")  
   
 return((sortd[(n-mark+1):n]))  
 }  
  
 a<-chisquare.plot(x=dat[,1:4],mark = 2)



a[1]

## [1] 12.26475

a[2]

## [1] 16.84741

# # plot(dat$x1,dat$x2 ,  
 # xlim = c(1000, 3500), ylim = c(800, 3000),   
 # pch=19, col = c("steelblue"))  
 # abline(0,1,col="blue")  
   
 i<-which(dat$d2==max(dat$d2))  
 dat <- dat[-c(i),]  
 j<-which(dat$d2==max(dat$d2))  
 dat<- dat[-c(j),]  
 dat$d2

## [1] 0.60 5.48 7.62 5.21 1.40 2.22 4.99 1.49 0.77 1.93 0.46 2.70 0.13 1.08  
## [15] 3.50 3.99 1.36 1.46 9.90 5.06 0.80 2.54 4.58 3.40 2.38 3.00 6.28 2.58

max(dat$d2)

## [1] 9.9

length(dat$d2)

## [1] 28