STAT 445 Assignment 1

1) Exercise 2.25 c-d

```
#find eigenvalues and eigenvectors of sigma
sig <- rbind(c(25,-2,4), c(-2,4,1), c(4,1,9))
eig <- eigen(sig)
#the eigenvalues
eig$values
```

```
## [1] 26.078452  8.495796  3.425752
```

```
#the eigenvectors in columns
eig$vectors
```

```
##             [,1]       [,2]       [,3]
## [1,]  0.97169436 -0.1914314 -0.1384345
## [2,] -0.07792066  0.2934880 -0.9527818
## [3,]  0.22302119  0.9365996  0.2702642
```

```
#d)
diagonal <- diag(sqrt(eig$values))
inv <- (eig$vectors %*% diagonal) %*% t(eig$vectors)
inv
```

```
##            [,1]       [,2]      [,3]
## [1,]  4.9639854 -0.3062868 0.5148182
## [2,] -0.3062868  1.9622841 0.2358595
## [3,]  0.5148182  0.2358595 2.9460707
```

7a)

```
#a.

fat_dat <- read.table("~/Documents/SFU/STAT445/a1/fat_dat.txt", quote="\"", comment.char="")
fat <- fat_dat[,2:3]
Mean <- colMeans(fat)
Mean
```

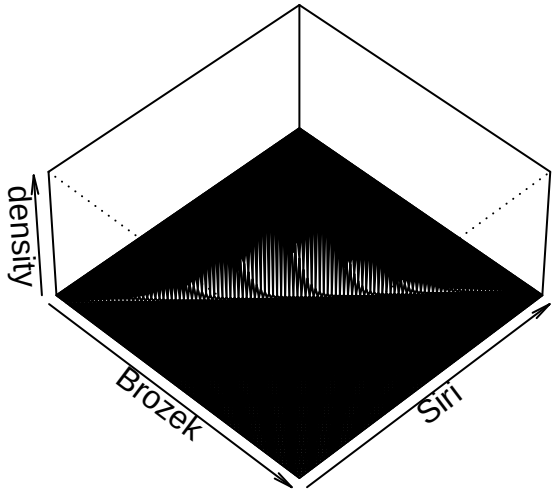
```
##       V2       V3
## 18.93849 19.15079
```

```
Covariance <- var(fat)
Covariance
```

```
##          V2       V3
## V2 60.07576 64.84832
## V3 64.84832 70.03582
```

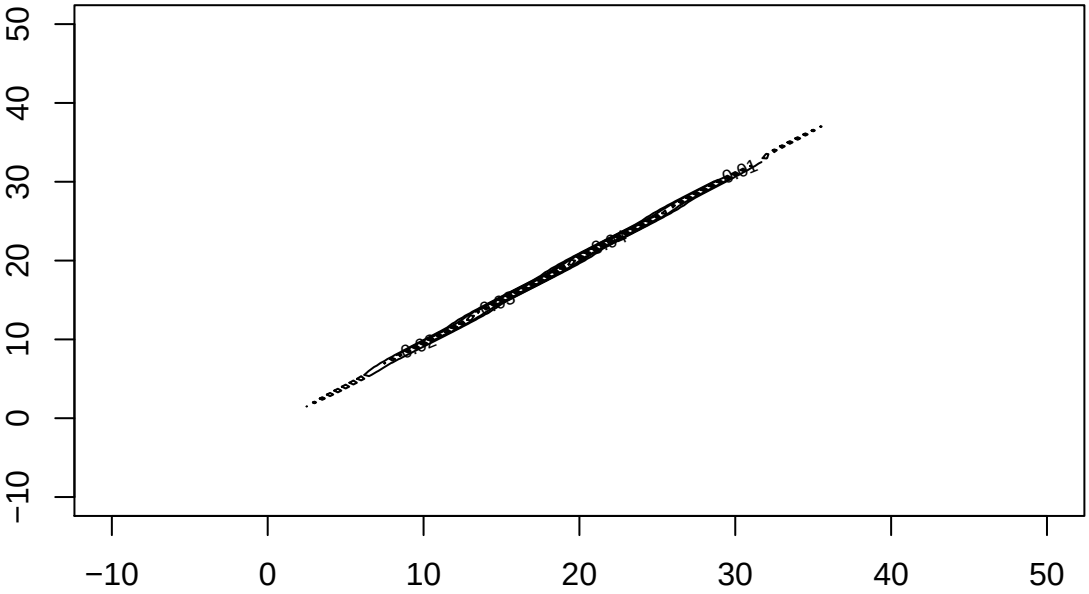
7b)

```
zxy <- cbind(x=rep((-20:100)/2, rep(121, 121)), y = rep((-20:100)/2, 121))
library(mvtnorm)
zdata <- matrix(dmvnorm(zxy, mean = c(18.93849, 19.15079), sigma = rbind(c(60.07576, 64.84832), c( 64.8
persp((-20:100)/2, (-20:100)/2, zdata, theta = 45, phi = 45, r = 20, expand = .5, xlab = "Brozek", ylab
```



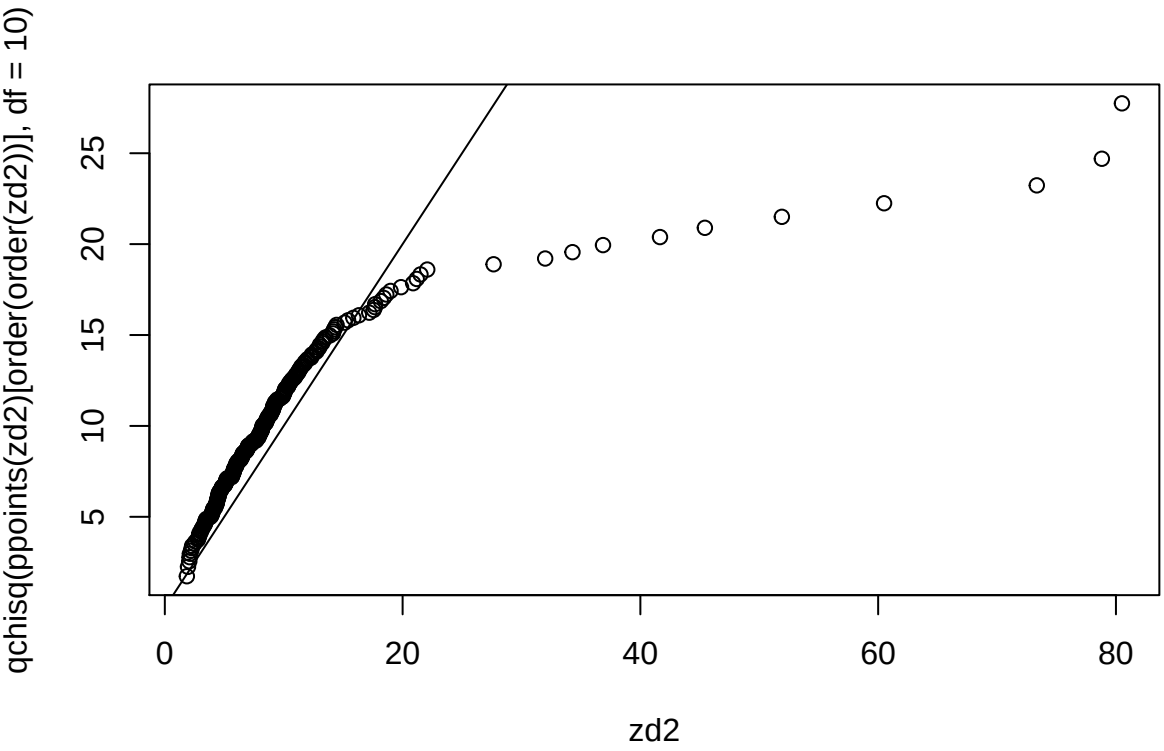
7c)

```
contour((-20:100)/2, (-20:100)/2, zdata)
```



8) By observing the qqplot below, a lot of the data points deviate from the diagonal line therefore the data does not suggest a 10-dimensional multivariate normal distribution.

```
circ <- fat_dat[,10:19]
zd2 <- apply(circ, 1,function(x, mu, sigma)(x-mu) %*% solve(sigma) %*% (x-mu),colMeans(circ), var(circ))
qqplot(zd2, qchisq(ppoints(zd2)[order(order(zd2))], df=10))
abline(0,1)
```


qchisq(ppoints(zd2)[order(order(zd2))], df = 10)
5
10
15
20
25
0
20
40
60
80
zd2