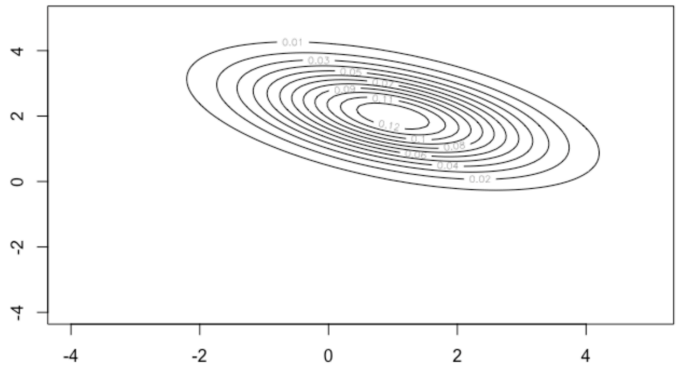
In-Class Assignment 9

1. Open the pizza dataset.
    a. Calculate the covariance and correlation between moisture and cal using cov and cor
        i. cor(pizza$mois, pizza$cal) = 0.7644405
        ii. cov(pizza$mois, pizza$cal) = -4.527918
    b. Verify the cov value by calculating E(XY) – E(X)E(Y) (will not be exact)
        i. mean(pizza$mois*pizza$cal) - (mean(pizza$mois)*mean(pizza$cal))
        ii. [1] -4.512825
    c. Verify the cor value by diving the covariance by the product of standard deviations
        i. cov(pizza$mois, pizza$cal)/(sd(pizza$cal)* sd(pizza$mois))
        ii. -0.7644405
    d. Examine the entire correlation matrix. Which variable has the strongest correlation with cal?
        i. cor(pizza$cal, pizza$mois) = -0.7644405
        ii. cor(pizza$cal, pizza$prot) = 0.0702581
        iii. cor(pizza$cal, pizza$fat) = 0.7645671
        iv. cor(pizza$cal, pizza$ash) = 0.3264685
        v. cor(pizza$cal, pizza$sodium) = 0.6719575
        vi. cor(pizza$cal, pizza$carb) = -0.02348458
        vii. calorie and fat have the strongest correlation.

2. For a multivariate normal definition, define the mean value to be (1, 2), with Var(X) = 2, Var(Y) = 1, and the Corr(X, Y) = -0.5.
    a. Create a contour plot for this distribution.




```r
library(mvtnorm)
min <- -4
max <- 5
var_x <- 2.0
var_y <- 1.0
cor_xy <- -0.5
Sigma <- cbind(c(var_x,cor_xy*sqrt(var_x)*sqrt(var_y)),c(cor_xy*sqrt(var_x)*sqrt(var_y),var_y))
x <- seq(min, max, by = 0.1)
y <- seq(min, max, by = 0.1)
z <- matrix(nrow=length(x), ncol=length(y))
co_df <- data.frame('x', 'y', 'z')
for (i in 1:length(x)){
  for (j in 1:length(y)){
    z[i,j] <- dmvnorm(c(x[i],y[j]),c(1,2),Sigma)
  }
}
contour(x, y, z)

co_df <- data.frame('x' = x, 'y' = y)
df.grad <- expand.grid(x = seq(-4,4, by = 0.1),y = seq(-4,4, by = 0.1))
dens <- cbind(df.grad, z = dmvnorm(df.grad,c(0,0), Sigma))
```

b. Create 1,000 simulations of the distribution and create a scatterplot for those simulations.

   i. library(MASS)

   ii. plot(mvrnorm(1000, mu = c(0,0), Sigma))