

STAT230 HW 2

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1

```
load('family.rda')
attach(family)
```

```
intercept = rep(1,length(weight))
X = cbind(intercept,height, bmi)
betahat = solve(crossprod(X,X), t(X) %*% weight)
betahat
```

```
##           [,1]
## intercept -310.346943
## height      4.675473
## bmi         6.308645
```

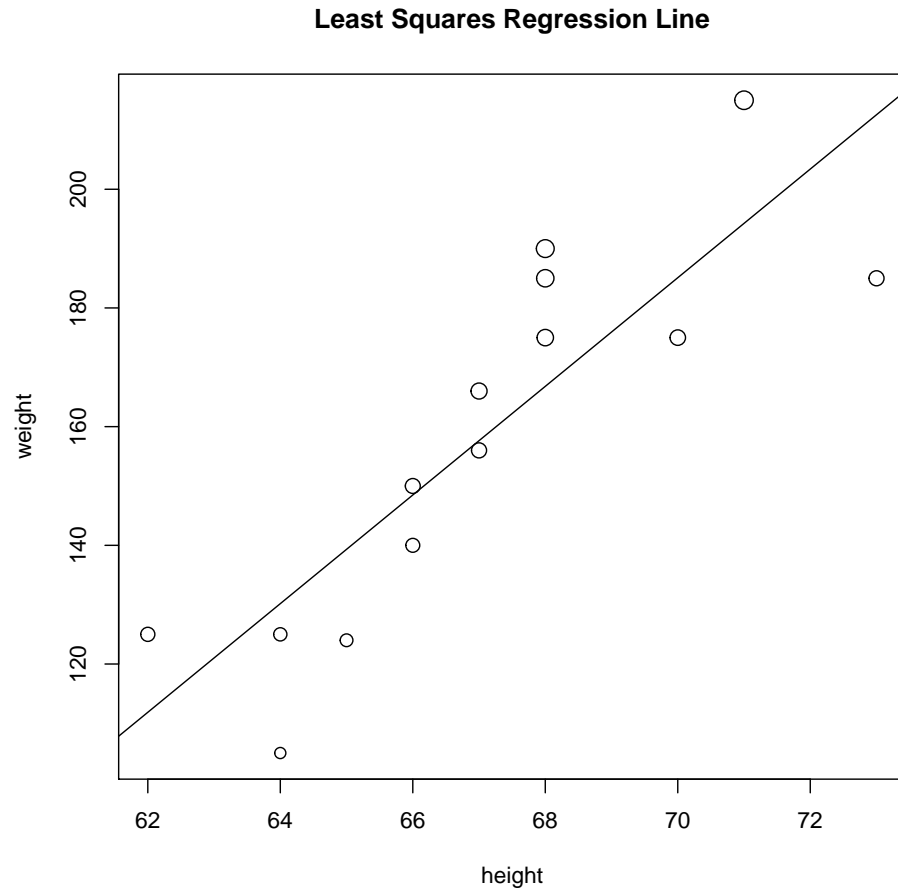
```
residuals = weight - X %*% betahat
residuals
```

```
##           [,1]
## [1,] -0.676730632
## [2,]  0.474100055
## [3,] -0.264728345
## [4,] -1.371495045
## [5,]  2.176912620
## [6,] -0.219261947
## [7,] -0.413102763
```

```
## [8,] -0.007851258
## [9,] -0.800784395
## [10,] 3.819187100
## [11,] -1.272889595
## [12,] -1.086205171
## [13,] -1.289915027
## [14,] 0.932764403
```

2

```
regcoef = function(df=family[4:5]){
  x = df[,1]
  y = df[,2]
  b = sum((y-mean(y))*(x-mean(x)))/sum((x-mean(x))^2)
  a = mean(y) - b*mean(x)
  return(c(a,b))
}
regline = function(df=family[4:5]){
  coeff = regcoef(df)
  plot(height,weight, main = "Least Squares Regression Line",
       cex = bmi*0.06)
  abline(coeff[1],coeff[2])
}
regline()
```



bmi is increasing with both weight and height.

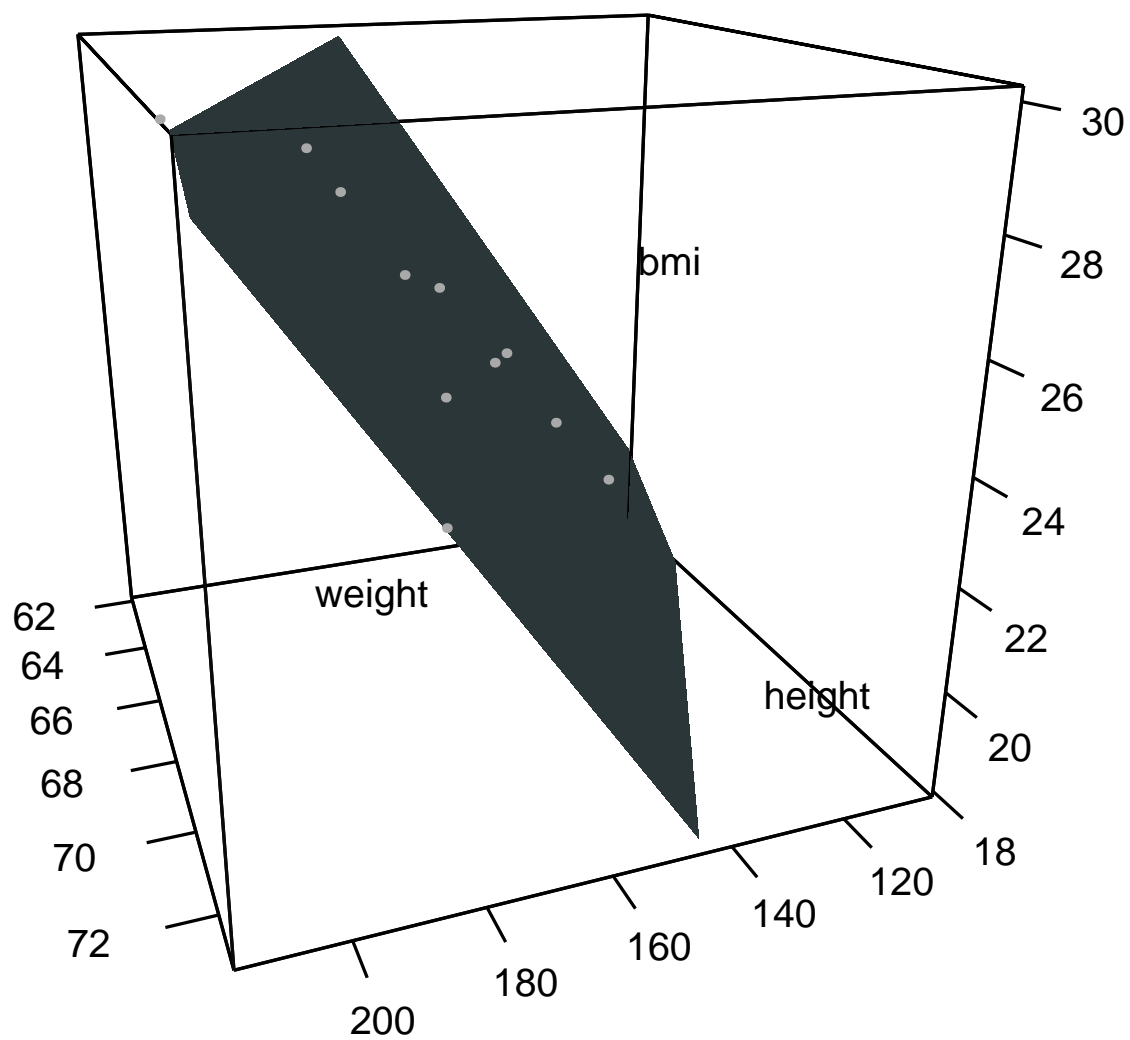
3

```
library(rgl)

par3d(params=list(
  windowRect=c(100,100,600,600))
view3d( theta = 70, phi = 20)

plot3d(X[,2],X[,3],weight,"height","bmi","weight",
  col='darkgray')
```

```
planes3d(betahat[2],betahat[3],c=-1,betahat[1],add=TRUE,  
         alpha=.5,col="lightblue")  
  
# Save pdf  
rgl.postscript("plot.pdf","pdf")
```



4

```
M = X[,1:2]
N = X[,3]
Y = weight

# step 1
gamma_1 = solve(crossprod(M,M), crossprod(M,Y))
gamma_1

##                [,1]
## intercept -455.6660
## height      9.1537

f = Y - M %*% gamma_1

# step 2
gamma_2 = solve(crossprod(M,M), crossprod(M,N))
gamma_2

##                [,1]
## intercept -23.0349135
## height      0.7098557

g = N - M %*% gamma_2

# step 3
gamma_3 = sum(f*g)/sum(g*g)
gamma_3

## [1] 6.308645

e = f-g*gamma_3

# step 4
betahatBis = c(gamma_1-gamma_2*gamma_3,gamma_3)
betahatBis

## [1] -310.346943    4.675473    6.308645
```

```
# Check validity
abs(betahat-betahatBis)

##           [,1]
## intercept 6.082246e-12
## height    1.803002e-13
## bmi       2.522427e-13
```