STAT 151A: Lab 4

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```r
dat <- read.csv("/Users/cloverjiyoon/2017Fall/Stat 151A/Lab/Lab3/bodyfat.csv")
n <- dim(dat)[1]
p <- 4
q <- 2
fit <- lm(bodyfat ~ Weight + Height + Chest + Abdomen, data=dat)
RSS <- sum(resid(fit)^2)
```

Test for $H_0 : \beta_{weight} = \beta_{height}, \beta_{chest} = -2\beta_{abdomen}$. The model can then be rewritten as

$$\text{bodyfat} = \beta_0 + \beta_{weight}(\text{weight} + \text{height}) + \beta_{abdomen}(\text{abdomen} - 2 \cdot \text{chest})$$

Use formula

$$\frac{(\text{RSS}(m) - \text{RSS}(M))/q}{\text{RSS}(M)/(n-p-1)}.$$

```r
fit0 <- lm(bodyfat ~ I(Weight + Height) + I(-2 * Chest + Abdomen), data=dat)
RSS0 <- sum(resid(fit0)^2)
Fstat1 <- ((RSS0 - RSS) / 2) / (RSS / (n - p - 1))
```

Can write hypothesis as $H_0 : L\beta = 0$, where

$$L = \begin{bmatrix} 0 & 1 & -1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 2 \end{bmatrix}.$$

Use formula

$$\frac{(L\hat{\beta} - c)^\top [L(X^\top X)^{-1} L^\top]^{-1} (L\hat{\beta} - c)/q}{\text{RSS}(M)/(n-p-1)}.$$

```r
X <- as.matrix(cbind(1, dat[,c("Weight", "Height", "Chest", "Abdomen")]))
y <- as.numeric(dat$bodyfat)
beta_hat <- solve(t(X) %*% X, t(X) %*% y)
y_hat <- X %*% beta_hat
L <- matrix(c(0,0,1,0,-1,0,0,1,0,2), 2)
Fstat2 <- (t(L %*% beta_hat) %*% solve(L %*% solve(t(X) %*% X) %*% t(L)) %*% (L %*% beta_hat) / q) / (su
```

Check that they match.

```r
Fstat1
```

```
## [1] 172.7717
```

```r
Fstat2
```

```
##          [,1]
## [1,] 172.7717
```