

Assignment 1

2022-10-01

Question 4

a) Using the parametrization $\mu = 0$:

```
data("iris");  
  
Y <- iris[order(iris$Species), "Sepal.Width"];  
  
X <- diag(3) %x% rep(1, 50);  
  
n = 150;  
I = 3;
```

Then we calculate the estimated $\hat{\beta} = (X^T X)^{-1} X^T Y$ as

```
beta = (t(X) %*% X) %>% solve() %*% t(X) %*% Y;
```

The residual sum of squares S_Ω and S_ω of the full and reduced models respectively are

```
s1 = norm(Y - X %*% beta)^2;  
s2 = norm(Y - matrix(rep(1, n), ncol=1) * mean(Y))^2;
```

The unbiased estimator of σ^2 are $\frac{S_\Omega}{n-1} = 1537.894656$ and $\frac{S_\omega}{n-1} = 2552.0009671$.

```
unb_est = s1/(n - 1);  
bet_ss = s2 - s1;  
bet_means = (s2 - s1)/(I);  
f_val = ((s2 - s1)/(I - 1))/(s2/(n - I));  
  
within_means = s1/(n - I);  
  
pval = pf(f_val, I-1, n-I);
```

The quantities needed to complete an ANOVA table are :

- Between groups sum of square: $S_\omega - S_\Omega = 1014.1063111$.
- Between groups mean square: $\frac{(S_\omega - S_\Omega)/(I-1)}{S_\Omega/(n-I)} = 338.035437$.
- Within groups sum of square: $S_\Omega = 1537.894656$.
- F value = 29.2072044.
- p -value = 1.