

Homework 3

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Problem 1

OLS function

First we simulate data for our LM

```
### simulate data

library(MASS)
set.seed(6886)
data = mvrnorm(
  n=100, mu=c(-2, 3),
  Sigma=matrix(c(8,3,3,2),nrow=2,ncol=2)
)
colnames(data) = c('y','x')
```

Here we create the function that calculates an OLS model manually. Comments within explain each step.

```
### create function

my_lm <- function(q, p){

  # load data

  x = as.matrix(cbind(1,p))
  y = as.matrix(q)

  # calculate b

  beta = solve( t(x) %*% x ) %*% t(x) %*% y

  # calculate vcv and se

  yhat <- x %*% beta    # predicted values

  ssr <- sum((yhat - y)^2)    # sum of squared residuals

  # set N = number of observations; k = number of variables (incl. intercept)

  N <- nrow(y)
  k <- ncol(x)

  sigma2 <- (ssr/(N-k))    # variance

  vcv <- (sigma2)*(solve( t(x) %*% x ))    # vcv
```

```

se <- sqrt(diag(vcv))

# output results

model_summary <- matrix(c(beta, se), nrow=2, ncol=2,
                        dimnames=list( c("b0", "b1"),
                                       c("Coef", "S.E."))
                        )

return(model_summary)

}

my_lm(data[, "y"], data[, "x"])

##           Coef          S.E.
## b0 -6.390654 0.4681754
## b1  1.499807 0.1309778

```

Problem 2

“Create this” matrix

Problem 3

Polity matrix and summary stats

Problem 4

Merging the other variables

Problem 5

Hadley problems