Homework_6

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```r
library(tidyverse)
```

```
## Warning: package 'tidyverse' was built under R version 4.3.2
```

```
## -- Attaching core tidyverse packages ----------------------- tidyverse 2.0.0 --
## v dplyr     1.1.2      v readr     2.1.4
## v forcats   1.0.0      v stringr   1.5.0
## v ggplot2   3.4.3      v tibble    3.2.1
## v lubridate 1.9.2      v tidyr     1.3.0
## v purrr     1.0.2
## -- Conflicts ----------------------------------------- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```r
library(broom)
```

```
## Warning: package 'broom' was built under R version 4.3.2
```

Loans

1

```r
y <- c(16, 5, 10, 15, 13, 22)
y
```

```
## [1] 16  5 10 15 13 22
```

2

```r
x <- matrix(c(1, 4,
              1, 1,
              1, 2,
              1, 3,
              1, 3,
              1, 4), nrow = 6, ncol = 2, byrow = TRUE)
x
```

```
##      [,1] [,2]
## [1,]    1    4
## [2,]    1    1
## [3,]    1    2
## [4,]    1    3
## [5,]    1    3
## [6,]    1    4
```

3

```r
batahat <- solve(t(x) %*% x) %*% t(x) %*% y
batahat
```

```
##            [,1]
## [1,] 0.4390244
## [2,] 4.6097561
```

4

```r
yhat <- x %*% batahat
resid <- y - yhat

MSE <- mean(resid^2)
MSE
```

```
## [1] 3.382114
```

5

```r
SEbetahat <- sqrt(diag(MSE * solve(t(x) %*% x)))
SEbetahat
```

```
## [1] 2.1300192 0.7035222
```

6

```r
lmloan <- lm(y ~ x[, 2])
tidy(lmloan)
```

```
## # A tibble: 2 x 5
##   term        estimate std.error statistic p.value
##   <chr>          <dbl>     <dbl>     <dbl>   <dbl>
## 1 (Intercept)    0.439      2.61     0.168 0.875
## 2 x[, 2]         4.61       0.862    5.35  0.00589
```

Other Questions

1

$$\mathbf{W} = \begin{bmatrix} 1 & -1 & 2 \\ 0 & 1 & -1 \\ 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \end{bmatrix}$$

2

```
A <- matrix(c(1, 3, 5,
              2, 4, 6), nrow = 2, ncol = 3, byrow = TRUE)

B <- matrix(c(2, -2,
              1,  -1,
              3, -3), nrow = 3, ncol = 2, byrow = TRUE)

A %*% B
```

```
##      [,1] [,2]
## [1,]   20  -20
## [2,]   26  -26
```


Solution by Hand

$$A = \begin{bmatrix} 1 & 3 & 5 \\ 2 & 4 & 6 \end{bmatrix} \qquad B = \begin{bmatrix} 2 & -2 \\ 1 & -1 \\ 3 & -3 \end{bmatrix}$$

$$AB = \begin{bmatrix} 20 & -20 \\ 26 & -26 \end{bmatrix}$$

$AB_{11} = 1 \times 2 + 3 \times 1 + 5 \times 3$
$= 2 + 3 + 15$
$= 20$

$AB_{12} = 1 \times -2 + 3 \times -1 + 5 \times -3$
$= -2 - 3 - 15$
$= -20$

$AB_{21} = 2 \times 2 + 4 \times 1 + 6 \times 3$
$= 4 + 4 + 18$
$= 26$

$AB_{22} = 2 \times -2 + 4 \times -1 + 6 \times -3$
$= -4 - 4 - 18$
$= -26$