Flipped Assignment 12

Group 5

2022/3/29

Input Data

```
setwd('G:/OneDrive - Texas Tech University/IE 5344 Statistical Data Analysis/Flipped Assignment 12')
data <- read.csv('data-table-B8.csv', header = TRUE)
colnames(data) <- c('x1', 'x2','y')
head(data)
```

```
##   x1  x2    y
## 1  0  10  7.5
## 2  0  50 15.0
## 3  0  85 22.0
## 4  0 110 28.6
## 5  0 140 31.6
## 6  0 170 34.0
```

Part a.

```
fit <- lm(y~., data)
summary(fit)
```

```
##
## Call:
## lm(formula = y ~ ., data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -9.7716 -4.1656  0.0802  3.8323  8.3349
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) 1.109e+01  1.669e+00    6.642 1.48e-07 ***
## x1          3.501e+02  3.968e+01    8.823 3.38e-10 ***
## x2          1.089e-01  9.983e-03   10.912 1.74e-12 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.782 on 33 degrees of freedom
## Multiple R-squared:  0.8415, Adjusted R-squared:  0.8319
## F-statistic:  87.6 on 2 and 33 DF,  p-value: 6.316e-14
```

```
vif(fit)
```

```
##       x1       x2
```

```
## 1.016535 1.016535
```

Part b.

```
fit1 <- lm(y~. + x1:x2, data)
summary(fit1)
```

```
##
## Call:
## lm(formula = y ~ . + x1:x2, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.0753 -3.6781  0.4395  3.1321  8.8448
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  12.50128    1.89347   6.602 1.92e-07 ***
## x1          256.73740   73.72914   3.482  0.00146 **
## x2            0.09879    0.01193   8.281 1.84e-09 ***
## x1:x2         0.76127    0.51026   1.492  0.14551
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.696 on 32 degrees of freedom
## Multiple R-squared:  0.8518, Adjusted R-squared:  0.8379
## F-statistic: 61.31 on 3 and 32 DF,  p-value: 2.318e-13
```

```
vif(fit1)
```

```
##       x1       x2    x1:x2
## 3.639435 1.505416 3.822936
```

Part c.

```
data2 <- scale(data,center=TRUE,scale=TRUE)
data2 <- as.data.frame(data2)
colnames(data2) <- c('x1','x2','y')
fit2 <- lm(y~., data2)
summary(fit2)
```

```
##
## Call:
## lm(formula = y ~ ., data = data2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.83775 -0.35713  0.00688  0.32855  0.71458
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 3.737e-17  6.833e-02    0.000        1
## x1          6.165e-01  6.987e-02    8.823 3.38e-10 ***
## x2          7.625e-01  6.987e-02   10.912 1.74e-12 ***
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.41 on 33 degrees of freedom
## Multiple R-squared:  0.8415, Adjusted R-squared:  0.8319
## F-statistic:  87.6 on 2 and 33 DF,  p-value: 6.316e-14
```

```
vif(fit2)
```

```
##       x1       x2
## 1.016535 1.016535
```

Part d.

```
fit3 <- lm(y~. + x1:x2, data2)
summary(fit3)
```

```
##
## Call:
## lm(formula = y ~ . + x1:x2, data = data2)
##
## Residuals:
##      Min      1Q   Median      3Q      Max
## -0.60658 -0.31533  0.03768  0.26852  0.75829
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.01357    0.06771   0.200    0.842
## x1           0.61207    0.06868   8.912 3.51e-10 ***
## x2           0.78767    0.07066  11.147 1.49e-12 ***
## x1:x2        0.10943    0.07335   1.492    0.146
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4026 on 32 degrees of freedom
## Multiple R-squared:  0.8518, Adjusted R-squared:  0.8379
## F-statistic: 61.31 on 3 and 32 DF,  p-value: 2.318e-13
```

```
vif(fit3)
```

```
##       x1       x2    x1:x2
## 1.018439 1.078223 1.066356
```

Part e.

In part a and part c, the VIF's for predictor variables remain the same since there are no interaction terms. However, in part b and part d, VIF's for all predictor variables decrease after standardizing which implies that the multicolinearity decreases.