

Lab 10

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Problem 3.11

Estimate the mean response and predict the future response at this new $(x_1, x_2, x_3, x_4, x_5) = (411, 22.5, 14.2, 40.3, 4.07)$. Interpret.

```
dat=read.csv("/home/david/Documents/2019 Spring/Applied Regression/Labs_HW/Data_Sets2/Data Sets/Appendi
y = dat$y
x1 = dat$x1
x2 = dat$x2
x3 = dat$x3
x4 = dat$x4
x5 = dat$x5

fit = lm(y~x1+x2+x3+x4+x5, dat)
summary(fit)

##
## Call:
## lm(formula = y ~ x1 + x2 + x3 + x4 + x5, data = dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -12.250  -4.438   0.125   5.250   9.500
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  5.208e+01  1.889e+01   2.757 0.020218 *
## x1           5.556e-02  2.987e-02   1.860 0.092544 .
## x2           2.821e-01  5.761e-02   4.897 0.000625 ***
## x3           1.250e-01  4.033e-01   0.310 0.762949
## x4           8.774e-17  2.016e-01   0.000 1.000000
## x5          -1.606e+01  1.456e+00 -11.035  6.4e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.065 on 10 degrees of freedom
## Multiple R-squared:  0.9372, Adjusted R-squared:  0.9058
## F-statistic: 29.86 on 5 and 10 DF,  p-value: 1.055e-05
err = 8.065 # the residual standard error from summary table
x0 = c(1, 411, 22.5, 14.2, 40.3, 4.07)
y0 = sum(x0*fit$coefficients)
y0

## [1] 17.65112
```

t-critical value

```
tcrit = qt(0.975, dim(dat)[1]-6)
```

$X^T T$ Matrix

```
x = cbind(1, dat[, 1:5])  
x = as.matrix(x)  
xtxi = solve(t(x) %*% x)
```

CI width for mean response

```
bm = sqrt(x0 %*% xtxi %*% x0) * tcrit * err  
bm
```

```
##           [,1]  
## [1,] 10.95428
```

95% CI for mean response

```
mean_conf = c(y0-bm, y0+bm)
```

The 95% CI for the mean response $x_1, x_2, x_3, x_4, x_5 = (411, 22.5, 14.2, 40.3, 4.07)$ is:

6.6968445, 28.6053975

PI for future response:

```
bm2 = sqrt(1+x0 %*% xtxi %*% x0) * tcrit * err  
mean_pred = c(y0-bm2, y0+bm2)
```

The 95% PI is:

-3.3944228, 38.6966648