

Course website	http://www.stat.wisc.edu/courses/st572-larget/
TA	Xu He(Mario)
Email	hexu@stat.wisc.edu
Website of TA	www.stat.wisc.edu/~hexu
Office	1275F, MSC
Office hour	Th 11:00-12:00, 4:00-6:00
Phone	(608)334-9792

1 Problem 1

The following data is collected to study the relationship between frequency of chirps made by a ground cricket and the corresponding ground temperature. The frequency is measured as the number of wing vibrations per second.

chirps (/second)	20.0	16.0	19.8	18.4	17.1	15.5	14.7	17.1	15.4	16.2	15.0	17.2	16.0	17.0	14.1
temperature (F)	88.6	71.6	93.3	84.3	80.6	75.2	69.7	82.0	69.4	83.3	78.6	82.6	80.6	83.5	76.3

(a) Use `xyplot()` in `lattice` package to plot chirps versus temperature, including a regression line in the plot.

Is a simple linear regression model reasonable to predict the frequency of chirps from the temperature?

(b) Use `lm()` to fit this model. What are the slope and intercept of the model?

(c) Use this model to predict chirp frequency under similar conditions when the temperature is 88 F.

(d) What are the estimated standard errors for the slope and intercept?

(e) What is a typical distance for the actual chirp frequency to differ from the predicted frequency?

Answer:

```
> chirps=read.table("chirps.txt",header=T)
> xyplot(chirp~temp,data=chirps,type=c("p","r"))
>
> lm0=lm(chirp~temp,chirps)
> display(lm0)
lm(formula = chirp ~ temp, data = chirps)
      coef.est coef.se
(Intercept) -0.62    3.14
temp         0.22    0.04
---
n = 15, k = 2 residual sd = 0.98, R-Squared = 0.70
> summary(lm0)
```

```
Call: lm(formula = chirp ~ temp, data = chirps)
```

```
Residuals:
```

```
      Min       1Q   Median       3Q      Max
-1.7411 -0.5812  0.0296  0.5825  1.5061
```

```
Coefficients:
```

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  -0.6152     3.1443   -0.2  0.84790

temp           0.2157     0.0392    5.5  0.00010 ***
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 0.98 on 13 degrees of freedom Multiple
R-Squared:  0.7,      Adjusted R-squared: 0.677 F-statistic: 30.3
on 1 and 13 DF,  p-value: 0.000102
```

2 Problem 2

A study was conducted to investigate the relationship between the size of the ants and the distance at which they foraged. Ants were collected at various distance from the colony and measured. Head width is measured in mm and utilized as a good indicator of an ant's size. Distance is measured in meters and indicates how far the mound is from places where they were captured while foraging.

head width	distance	colony
1.895	1	1
1.811	1	2
1.179	4	1
1.684	4	2
1.937	7	1
1.768	7	2

Construct the matrix X for a multiple regression model to predict the ant size from colony and distance if:

- (a) Distance is treated as quantitative and colony is treated as a factor with levels 1 and 2.
- (b) Distance is treated as a factor with levels 1, 4, and 7, and colony is treated as a factor with levels 1 and 2.

