Weight Loss Example

In this designed experiment (from Ott & Longnecker), we the relationship between weight loss (response) versus time and humidity (predictors). Because this is a designed experiment, the predictors (time and humidity) are uncorrelated.

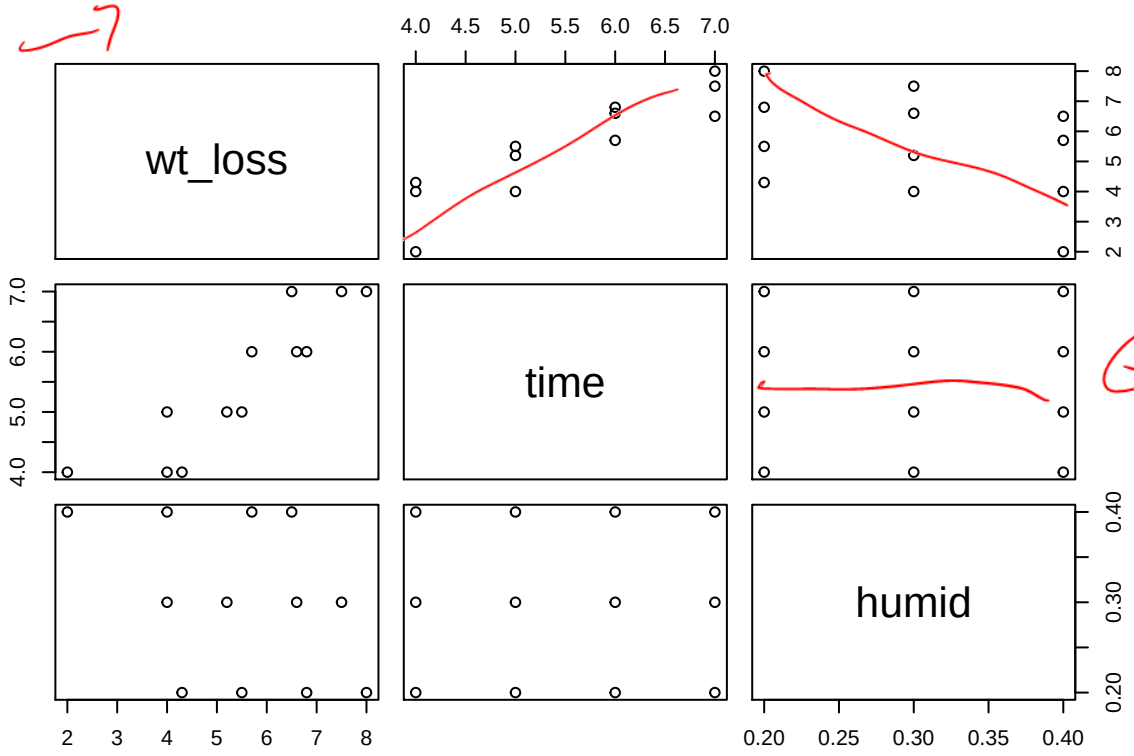
```
WtLoss <- read.csv("~/Dropbox/STAT512/Lectures/MultReg1/MR1_WtLoss.csv")
WtLoss
```

```
##    wt_loss time humid
## 1      4.3    4   0.2
## 2      5.5    5   0.2
## 3      6.8    6   0.2
## 4      8.0    7   0.2
## 5      4.0    4   0.3
## 6      5.2    5   0.3
## 7      6.6    6   0.3
## 8      7.5    7   0.3
## 9      2.0    4   0.4
## 10     4.0    5   0.4
## 11     5.7    6   0.4
## 12     6.5    7   0.4
```

```
cor(WtLoss)
```

```
##            wt_loss      time       humid
## wt_loss  1.0000000 0.8949235 -0.3970996
## time     0.8949235 1.0000000  0.0000000
## humid   -0.3970996 0.0000000  1.0000000
```

```
pairs(WtLoss)
```



```r
Model1 <- lm(wt_loss ~ time, data = WtLoss)
summary(Model1)
```

```
##
## Call:
## lm(formula = wt_loss ~ time, data = WtLoss)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1.5333 -0.5625  0.3917  0.5458  0.7667
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -1.7333     1.1652  -1.488    0.168
## time          1.3167     0.2076   6.342 8.44e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8041 on 10 degrees of freedom
## Multiple R-squared:  0.8009, Adjusted R-squared:  0.781
## F-statistic: 40.22 on 1 and 10 DF,  p-value: 8.437e-05
```

```r
Model2 <- lm(wt_loss ~ humid, data = WtLoss)
summary(Model2)
```

```
##
## Call:
## lm(formula = wt_loss ~ humid, data = WtLoss)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.70833 -0.98333  0.09167  1.24167  1.99167
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)    7.908      1.818   4.350  0.00144 **
## humid         -8.000      5.847  -1.368  0.20119
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.654 on 10 degrees of freedom
## Multiple R-squared:  0.1577, Adjusted R-squared:  0.07346
## F-statistic: 1.872 on 1 and 10 DF,  p-value: 0.2012
```

```r
Model3 <- lm(wt_loss ~ time + humid, data = WtLoss)
summary(Model3)
```

```
##
## Call:
## lm(formula = wt_loss ~ time + humid, data = WtLoss)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.73333 -0.17083 -0.04167  0.33750  0.46667
##
```

```
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.66667    0.69423   0.960 0.361994
## time         1.31667    0.09981  13.191 3.43e-07 ***
## humid       -8.00000    1.36677  -5.853 0.000243 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3866 on 9 degrees of freedom
## Multiple R-squared:  0.9586, Adjusted R-squared:  0.9494
## F-statistic: 104.1 on 2 and 9 DF,  p-value: 5.993e-07
```

```
par(mfrow = c(2, 2))
plot(Model3)
```