Multicollinearity Example

n = 25 males; height is in inches, Rtfoot and Leftfoot are foot lengths in centimeters

Correlation matrix:

```
           Height  LeftFoot    RtFoot
Height   1.0000000 0.5466786 0.5345347
LeftFoot 0.5466786 1.0000000 0.9078141
RtFoot   0.5345347 0.9078141 1.0000000
```

Note the strong correlation between the feet

Left foot only:

```
lm(formula = Height ~ LeftFoot, data = MaleFeet)
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  44.0701     8.8493   4.980  4.9e-05 ***
LeftFoot      0.9986     0.3189   3.131  0.00469 **
Residual standard error: 2.859 on 23 degrees of freedom
Multiple R-squared: 0.2989,   Adjusted R-squared: 0.2684
F-statistic: 9.804 on 1 and 23 DF,  p-value: 0.004689
```

Clearly, knowing Left Foot helps predict height.

Right foot only:

```
lm(formula = Height ~ RtFoot, data = MaleFeet)
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  46.8408     8.2224   5.697 8.43e-06 ***
RtFoot        0.8964     0.2955   3.033  0.00591 **
Residual standard error: 2.885 on 23 degrees of freedom
Multiple R-squared: 0.2857,   Adjusted R-squared: 0.2547
F-statistic: 9.201 on 1 and 23 DF,  p-value: 0.00591
```

Clearly, knowing Right Foot helps predict height.

Both feet:

```
lm(formula = Height ~ LeftFoot + RtFoot, data = MaleFeet)
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  43.9334     8.9983   4.882 7.01e-05 ***
LeftFoot      0.6379     0.7730   0.825    0.418
RtFoot        0.3647     0.7096   0.514    0.612
---
Residual standard error: 2.905 on 22 degrees of freedom
Multiple R-squared: 0.3072,   Adjusted R-squared: 0.2442
F-statistic: 4.877 on 2 and 22 DF,  p-value: 0.01765
```

Left Foot is not significant

Right Foot is not significant

The combination *is* significant

Anova for model with both, with left foot entered first

```
Response: Height
          Df  Sum Sq Mean Sq F value   Pr(>F)
LeftFoot   1  80.106  80.106  9.4900 0.005468 **
RtFoot     1   2.230   2.230  0.2642 0.612382
Residuals 22 185.704   8.441
```

Left foot is significant alone

Right foot not significant, *given* left foot is already there.

Both feet, Anova with order of entry reversed:

```
Response: Height
          Df  Sum Sq Mean Sq F value   Pr(>F)
RtFoot     1  76.586  76.586  9.0730 0.006411 **
LeftFoot   1   5.749   5.749  0.6811 0.418060
Residuals 22 185.704   8.441
```

Right foot is significant alone

Left foot not significant, *given* right foot is already there.

Variance Inflation Factors:

```
> library(car)
> vif(Both)
LeftFoot   RtFoot
5.685903 5.685903
```