

pig feed

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reference:

- Cannon, et al., Stat2, chapter 07, example 7.3, 7.15

Import the data.

```
data <- read.csv("PigFeed.csv", header=TRUE)
head(data)
```

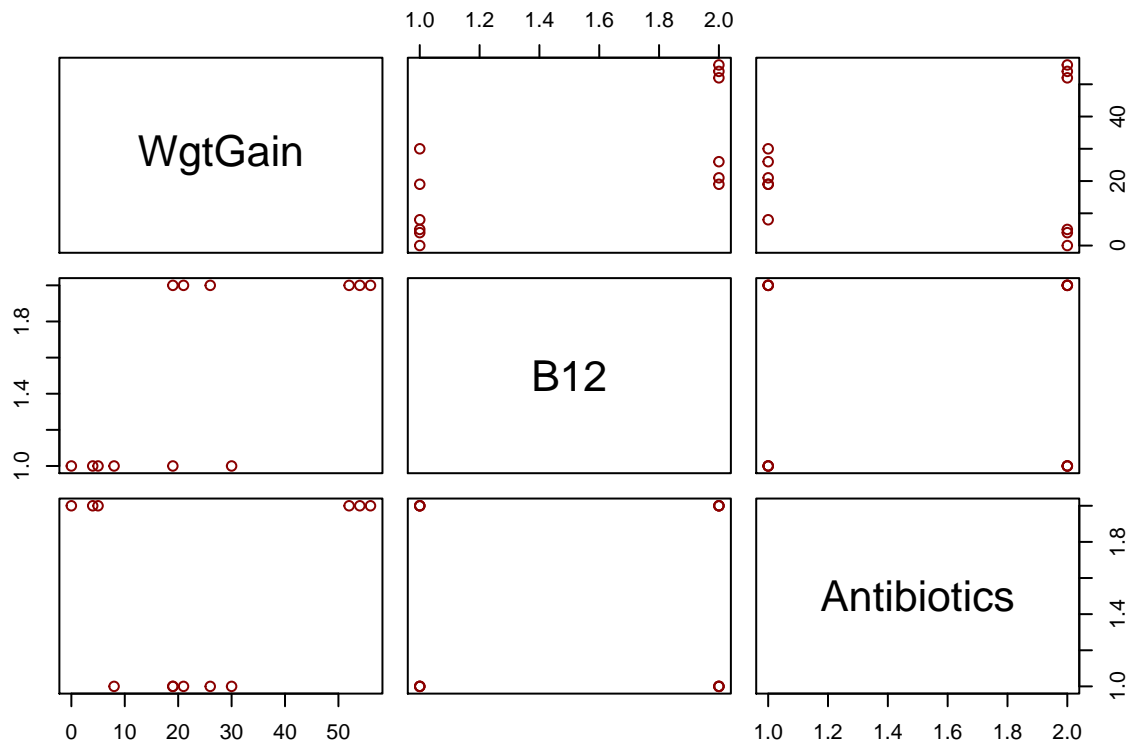
```
##   WgtGain B12 Antibiotics
## 1     30  No           No
## 2      8  No           No
## 3     19  No           No
## 4      5  No           Yes
## 5      0  No           Yes
## 6      4  No           Yes
```

```
dim(data)
```

```
## [1] 12  3
```

Scatterplot matrix.

```
pairs(~ WgtGain + B12 + Antibiotics, data=data, col="darkred")
```



Levene's test.

```
library(car)
leveneTest(WgtGain ~ B12 * Antibiotics, data=data)
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##      Df F value Pr(>F)
## group 3  1.8089 0.2235
##      8
```

Two-way ANOVA for means as regression: ANOVA

```
pigs.aov2 <- aov(WgtGain ~ Antibiotics + B12, data=data) # 2 factors
options(show.signif.stars=FALSE)
summary(pigs.aov2)
```

```
##           Df Sum Sq Mean Sq F value Pr(>F)
## Antibiotics 1     192   192.0    0.856 0.3789
## B12          1    2187  2187.0    9.754 0.0123
## Residuals   9     2018   224.2
```

Two-way ANOVA for means as regression: regression

```
pigs.lm2 <- lm(WgtGain ~ B12 + Antibiotics, data=data) # 2 factors
summary(pigs.lm2)
```

```
##
## Call:
## lm(formula = WgtGain ~ B12 + Antibiotics, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.0   -11.5    -3.5    12.0    23.0
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)         7.000      7.487   0.935  0.3742
## B12Yes              27.000      8.645   3.123  0.0123
## AntibioticsYes      8.000      8.645   0.925  0.3789
##
## Residual standard error: 14.97 on 9 degrees of freedom
## Multiple R-squared:  0.5411, Adjusted R-squared:  0.4391
## F-statistic: 5.305 on 2 and 9 DF, p-value: 0.03006
```

```
aov(pigs.lm2)
```

```
## Call:
## aov(formula = pigs.lm2)
##
## Terms:
##           B12 Antibiotics Residuals
```

```
## Sum of Squares 2187      192      2018
## Deg. of Freedom  1          1          9
##
## Residual standard error: 14.97405
## Estimated effects may be unbalanced
```

```
anova(pigs.lm2)
```

```
## Analysis of Variance Table
##
## Response: WgtGain
##           Df Sum Sq Mean Sq F value Pr(>F)
## B12         1  2187 2187.00  9.7537 0.01226
## Antibiotics 1   192  192.00  0.8563 0.37892
## Residuals   9  2018  224.22
```

Two-way ANOVA with interaction.

Note: Text has Antibiotics and B1 row interchanged on p.363.

```
pigs.aov3 <- aov(WgtGain ~ Antibiotics*B12, data=data)
summary(pigs.aov3)
```

```
##           Df Sum Sq Mean Sq F value Pr(>F)
## Antibiotics  1   192   192.0  5.297 0.050359
## B12          1  2187 2187.0 60.331 5.4e-05
## Antibiotics:B12 1  1728 1728.0 47.669 0.000124
## Residuals    8   290   36.3
```

Two-way ANOVA with interaction: regression.

```
pigs.lm3 <- lm(WgtGain ~ B12*Antibiotics, data=data)
summary(pigs.lm3)
```

```
##
## Call:
## lm(formula = WgtGain ~ B12 * Antibiotics, data = data)
##
## Residuals:
##   Min     1Q   Median     3Q    Max
## -11.00 -2.25  0.00   2.00  11.00
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      19.000     3.476   5.466 0.000597
## B12Yes           3.000     4.916   0.610 0.558624
## AntibioticsYes  -16.000     4.916  -3.255 0.011619
## B12Yes:AntibioticsYes  48.000     6.952   6.904 0.000124
##
## Residual standard error: 6.021 on 8 degrees of freedom
## Multiple R-squared:  0.934, Adjusted R-squared:  0.9093
## F-statistic: 37.77 on 3 and 8 DF, p-value: 4.532e-05
```

```
aov(pigs.lm3)
```

```
## Call:
##   aov(formula = pigs.lm3)
##
## Terms:
##           B12 Antibiotics B12:Antibiotics Residuals
## Sum of Squares 2187         192           1728       290
## Deg. of Freedom   1           1             1         8
##
## Residual standard error: 6.020797
## Estimated effects may be unbalanced
```

```
anova(pigs.lm3)
```

```
## Analysis of Variance Table
##
## Response: WgtGain
##           Df Sum Sq Mean Sq F value    Pr(>F)
## B12           1   2187  2187.00  60.3310 5.397e-05
## Antibiotics   1    192   192.00   5.2966 0.050359
## B12:Antibiotics 1   1728  1728.00  47.6690 0.000124
## Residuals     8    290    36.25
```