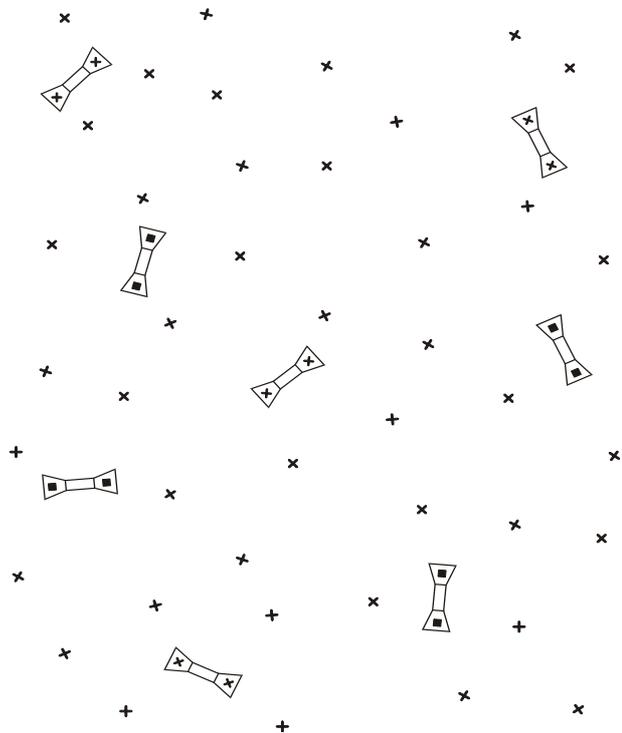


Test Exercise 1 (R)

1. Read the data in **Aposematic.txt** into a data frame. The file contains the number of "cryptic" and "aposematic" artificial prey attacked by ten different birds (great tits) in an experiment performed at the Tovetorp research station. The artificial prey consisted of short pieces of straw filled with animal fat with 12% chloroquine added, making the prey very bitter and distasteful to the birds. Half of the prey were "aposematic", signalling their distastefulness by having "paper wings" with a conspicuous filled square, and the other half were "cryptic", with crosses similar to markings on the floor on their "wings" (see figure). Each bird spent 20 minutes in a room with a total of 32 artificial prey spread out on the floor, and the number of prey of the two kinds the bird attacked was counted. Your job is to determine if there was a relation between the numbers of each kind of prey attacked. (a) First test the null hypothesis of zero correlation between Cryptic and Aposematic and report the result of the test. (b) Then perform a linear regression of Cryptic on Aposematic, give the regression equation, and report the result of a test of the null hypothesis of zero slope of the regression. (c) Finally perform a linear regression of Aposematic on Cryptic, give that regression equation, and report the result of a test of the null hypothesis of zero slope of the regression. Which, if any, of these three alternatives do you prefer?



2. Read the data in **Mcinxia2.txt** into a data frame. The file contains pupal weights (in grams) of 765 *Melitaea cinxia* butterflies that were reared on the roof of the biology lab (some of these individuals are in the **Mcinxia1.txt** data file from the exercises). (a) Compare the skewness and kurtosis of the distribution of pupal weight with their standard errors. In case you need it, you will find the file **SkewKurt.R** with code to compute these things in the same directory as the data file (you may have used it in the first exercise this week). What do you conclude about the shape of the distribution? (Hint: you can use 1.96 times the standard error as a critical value for a test.) (b) Repeat the previous, but now do it separately for each sex. Also, obtain the mean pupal weights for each sex. What is now your explanation for the result with the sexes pooled? Look at histograms of the data grouped by sex. One possibility is to use the plots found in the so-called lattice package. Try the following commands

```
library(lattice)

histogram( ~ PupW | Sex, data=dat, layout=c(1,2))
```

To learn about the command, write `?histogram`. If you make more lattice plots, you do not have to repeat the `library(lattice)` command, since the package is already loaded. The lattice package is a bit complex, but can be used for very "advanced" plots.

3. Continue using the data in **Mcinxia2.txt**. (a) Construct a test of whether the variance in pupal weight is the same in two sexes (see p. 38 in Q&K). First you can the command

```
var.test(PupW[Sex=="f"], PupW[Sex=="m"])
```

but validate the result by calculating it "manually". What do you conclude about the variances? (b) Do the same test for the variances of the logarithm of pupal weight. What do you conclude in this case? (c) Use a t-test to investigate if there is sexual size dimorphism in *M. cinxia*. Which variables will you use and what do you conclude?

BONUS QUESTION: *Why would a geeky statistician think this comic is funny?* (Comic taken from www.xkcd.com)

