Exercise 1. Retinitis pigmentosa is a disease that can follow different genetic modes of inheritance, including sex-linked and autosomal (non–sex-linked) forms. Researchers are interested in whether the **proportion of sex-linked cases** differs between two ethnic populations.

A survey identified retinitis pigmentosa cases in an English and a Swiss population. For this analysis, autosomal dominant and autosomal recessive forms are combined into a single **"non–sex-linked"** category. The data are:

- Among **125 English** cases, **46** were sex-linked and **79** were non–sex-linked.
- Among **110 Swiss** cases, **2** were sex-linked and **108** were non–sex-linked.

Use Fisher's Exact Test to determine if the proportion of sex-linked cases differs between two ethnic populations. (Adapted from Rosner Exercise 10.5)

Step 1. What hypotheses are you testing?

Null Hypothesis:

Alternative Hypothesis:

Step 2. Construct the Contingency Table.

Step 3: Compute the probability of seeing your current table?

Step 4: Construct the other more "extreme" tables and their corresponding probabilities

Step 5: Add the probabilities to get your p-value.

Step 6: State your conclusion.

Exercise 2. Two drugs (A, B) are compared for the medical treatment of duodenal ulcer. For this purpose, patients are carefully matched with regard to age, gender, and clinical condition.

The treatment results based on 200 matched pairs show that for 89 matched pairs both treatments are effective; for 90 matched pairs both treatments are ineffective; for 5 matched pairs drug A is effective, whereas drug B is ineffective; and for 16 matched pairs drug B is effective, whereas drug A is ineffective. (Adapted from Rosner Exercises 10.8-10.12)

(a) What test procedure can be used to assess the results?

(b) Perform the test in (a) and report a p-value.

Step 1. What hypotheses are you testing?

Null Hypothesis:

Alternative Hypothesis:

Step 2. Construct the Matched Pairs Table.

Step 3. What are n_A, n_B, and n_D?

Step 4. Calculate the χ^2 test statistic.

Step 5. Determine if we reject the null. What decision rule did you use?

Step 6. State your conclusion.

In the same study, if the focus is on the 100 matched pairs consisting of male patients, then the following results are obtained: for 52 matched pairs, both drugs are effective; for 35 matched pairs both drugs are ineffective; for 4 matched pairs drug A is effective whereas drug B is ineffective; and for 9 matched pairs drug B is effective, whereas drug A is ineffective.
(c) Draw the new matched pairs table.

(d) How many concordant pairs are there among the male matched pairs?

(e) How many discordant pairs are there among the male matched pairs?

(f) In McNemar's Test, can you verify that $\frac{n_D}{4} \geq 5$ or $n_D \geq 20$ is satisfied? If this is not satisfied, what should we do?

(g) Compute the p-value and state your conclusion.