Exercise 1: Test distribution and confidence intervals

- χ^2-Distribution, t-Distribution, F-Distribution -

Group:	Surname, Given Name:	Matriculation number:	Signature*:

*** With my signature I declare that I was involved in the elaboration of this exercise.**

Deadline: 10.05.2019

Test Certificate

Received on: _____ _____ _____

Date Grade Signature

Objective

This exercise deals with the χ^2-distribution, t-Distribution and F-Distribution as well as the determination of confidence intervals. The χ^2-distribution for different degrees of freedom is depicted in Figure 1.

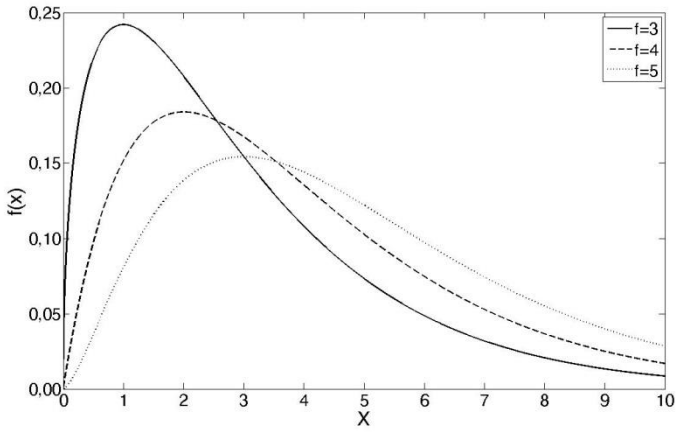

Figure 1: Graphs of the χ^2-distribution for different degrees of freedom f.

Task 1:

During a survey in 2011 and 2012 students observed the height difference between two fixed points several times using the same instrument. The raw measurements of each student for both epochs are saved in the files "*epoch2011.txt*" and "*epoch2012.txt*". The measurements are uncorrelated and were obtained with the same standard deviation. From experience a theoretical reference standard deviation $\sigma_0 = 0.0015\ \mathrm{m}$ for the instrument could be expected.

- Calculate the adjusted height difference for both epochs.
- Plot the residuals for both epochs.
- Calculate the empirical reference standard deviation for both epochs.
- Plot the F-distribution, which results from both epochs.
- Calculate the confidence limits of the F-distribution with $S = 95\ \%$.
- Are the empirical reference standard deviations of both epochs significant different from each other?
- Plot the χ^2-distribution for both epochs and compare them.
- Calculate the confidence limits of the χ^2-distribution with $S = 95\ \%$ for both epochs.
- Are the empirical reference standard deviations of both epochs significant different from the theoretical one?
- **(Homework):** Calculate the confidence limits of the F-distribution and of the χ^2-distribution for both epochs, with $S = 99\ \%$.

Task 2 (Homework):

During a previously carried out survey the students observed the distance between two fixed points and the measurements can be found in "*distances.txt*".

- Load the measurements from the "*distances.txt*".
- Calculate the mean value, the standard deviation of the mean value as well as the standard deviation of a single measurement.
- Calculate and plot the residuals.
- Calculate the confidence limits with $S = 95\ \%$ and $S = 99\ \%$ for the expectation value as well as for a single measurement.
- Comment and evaluate all results!