# Statistical Inference

## Program

1. **Introduction**
   - 1.1. The general problem of Statistical inference
   - 1.2. Deduction vs induction
   - 1.3. Statistics and Probability
   - 1.4. Estimation
   - 1.5. Hypothesis Testing
   - 1.6. Examples

2. **Some basic statistical test**
   - 2.1. Cross tabulation
   - 2.2. Chi Square test
   - 2.3. Nominal data cross tabulation tests
   - 2.4. Ordinal data cross tabulation tests
   - 2.5. Nominal by scale test
   - 2.6. Concordance measures
   - 2.7. T test for comparing means: paired and independent samples
   - 2.8. Non-parametric versions
   - 2.9. One Way ANOVA, Non parametric version
   - 2.10. Comparing variances of two samples, the F distribution
   - 2.11. Correlations and partial correlations
   - 2.12. Regression and non-linear regression
   - 2.13. Kolmogorov-Smirnov test
   - 2.14. Run Test
   - 2.15. Randomized tests

3. **Multiple testing**
   - 3.1. The family-wise error rate (FWER). Examples
   - 3.2. The Bonferroni and Holm's step-wise corrections
   - 3.3. The False Discovery Rate
     - 3.3.1 Benjamini-Hochberg estimate of FDR
     - 3.3.2 Plug-in estimate of FDR

4. **Introduction to bootstrap methods**
   - 4.1. Parametric bootstrapping
   - 4.2. Nonparametric bootstrapping
   - 4.3. Confidence intervals using bootstrapping
   - 4.4. Permutation tests
   - 4.5. Jacknife and cross-validation

5. **Introduction to Robust Statistics**
   - 4.1. Outliers
   - 4.2. M-estimates of location and scale
   - 4.3. Robust confidence intervals and tests
   - 4.4. Robust regression

**Practical demonstration:** R and R-Commander (it is not necessary any previous knowledge of the software)

## Bibliography

<table>
<thead>
<tr>
<th><strong>Prerequisites</strong></th>
<th>The student is assumed to be familiar with the basics of probability, random variables and probability distributions (binomial, Poisson, normal, t-Student, Chis square and F), concepts of random sampling and estimators.</th>
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</thead>
<tbody>
<tr>
<td><strong>Readings before coming</strong></td>
<td>The student will benefit more from the course if he reads before attending (the readings are not compulsory only advisable):</td>
</tr>
<tr>
<td></td>
<td>• Introduction to probability (<a href="#">1, 2</a>)</td>
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<td></td>
<td>• <a href="#">Introduction to estimation</a></td>
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