

Course 7	<b>Statistical Inference</b>
Program	<ol style="list-style-type: none"> <li>1. Introduction               <ol style="list-style-type: none"> <li>1.1. The general problem of statistical inference</li> <li>1.2. Likelihood</li> <li>1.3. Estimation and confidence intervals.</li> <li>1.4. Hypothesis testing</li> </ol> </li> <li>2. Some basic statistical test               <ol style="list-style-type: none"> <li>2.1. Nominal data cross tabulation tests</li> <li>2.2. Nominal by scale test</li> <li>2.3. Concordance measures</li> <li>2.4. T test for comparing means: paired and independent samples. Non-parametric versions</li> <li>2.5. One Way ANOVA. Non parametric version</li> <li>2.6. Comparing variances of two samples, the F distribution</li> <li>2.7. Correlations and partial correlations</li> <li>2.8. Distributional tests. Kolmogorov-Smirnov</li> <li>2.9. Dependence Test. Run Test</li> <li>2.10. Randomized tests</li> </ol> </li> <li>3. Multiple testing               <ol style="list-style-type: none"> <li>3.1. The family-wise error rate (FWER). Examples</li> <li>3.2. The Bonferroni and Holm's step-wise corrections</li> <li>3.3. The False Discovery Rate                   <ol style="list-style-type: none"> <li>3.3.1 Benjamini-Hochberg estimate of FDR</li> <li>3.3.2 Plug-in estimate of FDR</li> </ol> </li> </ol> </li> <li>4. Introduction to bootstrap methods               <ol style="list-style-type: none"> <li>4.1. Parametric bootstrapping</li> <li>4.2. Nonparametric bootstrapping</li> <li>4.3 Confidence intervals using bootstrapping</li> <li>4.4 Permutation tests</li> <li>4.5. Jackknife and cross-validation</li> </ol> </li> <li>5. Introduction to Robust Statistics               <ol style="list-style-type: none"> <li>4.1. Outliers</li> <li>4.2. M-estimates of location and scale</li> <li>4.3 Robust confidence intervals and tests</li> <li>4.4 Robust regression</li> </ol> </li> </ol> <p>Practical demonstrations with R (it is not necessary any previous knowledge of the software)</p>
Bibliography	<ul style="list-style-type: none"> <li>- Books, D. and Stefanski, L.A. (2013). <i>Essential Statistical Inference</i>. Springer-Verlag.</li> <li>- Davidson, A.C. (2003). <i>Statistical Models</i>. Cambridge University Press.</li> <li>- Hastie, T., Tibshirani R. and Friedman, J. (2008) <i>The Elements of Statistical Learning (2d Ed.)</i>. Springer-Verlag.</li> <li>- Held, L. and Sabanés, D. (2014). <i>Applied Statistical Inference</i>. Springer-Verlag.</li> <li>- Trosset, M. W. (2009). <i>An Introduction to Statistical Inference and Its Applications with R</i>. Chapman &amp; Hall.</li> <li>- Wood, S. (2015). <i>Core Statistics</i>. Cambridge University Press.</li> </ul>
Prerequisites	<p>The student is assumed to be familiar with the basics of probability, random variables and probability distributions (binomial, Poisson, normal, t-Student, Chi-square and F), concepts of random sampling and estimators.</p>

Readings before coming

The student will benefit more from the course if he reads before attending (the readings are not compulsory only advisable):

- Introduction to probability ([1](#), [2](#))
- [Introduction to estimation](#)