

## **Syllabus for Admission to the PhD School in Statistics, University of Padova**

Candidates for the PhD School in Statistics (Doctorate in Statistical Sciences) are required to be sufficiently well trained to be able to benefit from the research and study activities planned for the programme. At the start of the programme, it will be assumed that students have a level of preparation equivalent to at least 5 university courses of: mathematics (including linear algebra), probability and statistics. Furthermore, a working knowledge of English will be required.

The necessary prerequisites required at the start of the programme are fundamental mathematical skills and basic knowledge in probability and statistics as described below.

### **Mathematics**

For instance at the level of

Adams, R.A.. *Calculus*. Pearson.

Rudin, W. *Principles of Mathematical Analysis*, Third Edition, Chapters 1 to 9.

In particular:

Set theory. Sequences of real numbers: limit of a sequence, Cauchy sequences, subsequences. Series of real numbers: convergence and convergence criteria. Differential and Integral Calculus in  $\mathbb{R}$  and in  $\mathbb{R}^n$ .

### **Basic Probability**

For instance at the level of

Ross, S.M. (2005). *A First Course in Probability*. Prentice Hall.

In particular:

Probability Spaces. Random variables and vectors. Moments and quantiles. Marginal and conditional distributions. The binomial, hypergeometric, Poisson, normal, uniform, gamma, exponential, beta, Cauchy, multinomial, multivariate normal, chi-squared, t and F distributions. Transformations of random variables and vectors. Convergence of sequences of random variables, laws of large numbers and the central limit theorem.

### **Basic Statistics**

For instance at the level of

Freedman D., Pisani R., Purves R. (2007). *Statistics*, 4-th ed. W W Norton & Co Inc.

Mood A.M., Graybill F.A., Boes D.C. (2006). *Introduction to the Theory of Statistics*.

Third ed. McGraw Hill.

In particular:

Frequency distributions. Measures of location, variability and shape. Correlation and regression. Population and sample. Parametric and nonparametric statistical models. Point estimation: methods of estimation, sampling distribution of an estimator. Confidence intervals and regions. Hypothesis testing: test statistic, p-value, power function. The likelihood function and related quantities. Estimation, tests and confidence intervals based on the likelihood function. Standard examples: inference on normal model parameters (including linear regression), binomial models, multinomial models.