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## Inferential statistics and test theory (3ST2002)

Filières concernées	Nombre d'heures	Validation	Crédits ECTS
<b>Master en statistique</b>	<b>Cours: 4 ph</b>	<b>écrit: 2 h</b>	6

ph=période hebdomadaire, pg=période globale, j=jour, dj=demi-jour, h=heure, min=minute

### Période d'enseignement:

- Semestre Automne

### Equipe enseignante:

Professeur : Jean-Yves Dauxois  
INSA Toulouse, Dpt de Génie mathématique,  
135 av. de Ranguiel,  
31077 Toulouse Cedex 4, FRANCE  
Phone office +33 5 61 55 90 00

### Objectifs:

Introducing the theoretical background of Mathematical Statistics. Learning how to build, judge the performance, improve and compare the statistical procedures of point estimation, interval estimation and hypotheses testing.

### Contenu:

1. Statistical model
  - a. Definition, parametric and nonparametric models
  - b. Sampling models
  - c. Exponential families
  - d. Location-scale families
2. Point estimation
  - a. Statistics and estimators
  - b. Classical methods of obtaining estimators: empirical estimation, method of moments, maximum likelihood method
  - c. Criteria to judge the performance of estimators: consistency, bias, risk, Fisher information, Cramer-Rao inequality
  - d. Improving estimators: sufficient statistic, Rao-Blackwell and Lehmann-Scheffé theorems
  - e. Asymptotic behaviour: Asymptotic normality,  $\Delta$ -method, the particular cases of the empirical estimators, the maximum likelihood estimators and method of moments estimators
3. Interval estimation
  - a. Exact confidence intervals
  - b. Asymptotic confidence intervals
4. Testing statistical hypothesis
  - a. Introduction and definition : hypothesis, test statistics and critical regions, type I and type II errors, level of significance, power, p-value, bias, UMP tests, asymptotic tests
  - b. Parametric tests: Neyman-Pearson Lemma, nonrandomized and randomized tests
  - c. The particular case of gaussian samples: Hypothesis about the mean, hypothesis about the variance
  - d. Nonparametric tests: Kolmogorov test,  $\chi^2$  tests, Kolmogorov-Smirnov test, Mann-Whitney test

### Forme de l'évaluation:

2 hours written exam during the session

### Documentation:

J. Shao, Mathematical Statistics, 2nd edition, Springer, 2003  
R. Bartoszyński and M. Niewiadomska-Bugaj, Probability and Statistical Inference, Wiley series in Probability and Statistics, 1996.

### Pré-requis:

Probability Theory

### Forme de l'enseignement:

- 6 ECTS credits
- Compulsory course for master in statistics
- Autumn Semester

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- Course : 2 hours / Exercises : 2 hours