Abstracts of the eight lectures

(I)
Presentation of the French teaching system. The University of Littoral and the Institut Universitaire de Technologie of Littoral. The programs Erasmus, Erasmus+, and DUETI. Some pictures of the four cities in which ULCO is present. Notice : four « powerpoint » files will be displayed.
[at most 40 minutes]

(II)
Three interesting paradoxical situations arising at time of vote.
IIa. The paradox of Condorcet and the non-transitivity of preference. Briefly stated, even if the individuals have transitive preorders of preference, it may happen that the whole population does not have any preorder of preferences for its preferences are not transitive.
IIb. The paradox of Simpson and the importance of the subclasses. When one divides a population in various subclasses, the frequencies of the various classes w.r.t. to other intermediate classes behave strangely. In fact this is annoying when for instance one deals with frequencies of success among various classes, say men/women, youngs/old, etc.
IIc. The paradox of Rogers and the strange behaviour of the arithmetic mean. This is an interesting example of changing the statistical indicators by modifying subclasses of the whole population.
IId. These three paradoxes may or may not appear. The connection between those three paradoxes is made via formal calculus; one may understand with only very basic undergraduate calculus. However, the relationships between the cardinalities in order that the various paradoxes happen must be found in an acute way. The basic question is therefore : depending on the size of the population, when do they happen ? Some experiments with computer algebra will be given.
[the three parts are somewhat independent each to the other, the lecture may be divided; 1h20 min is a good length]

(III)
Some interesting examples of regression of chronological series coming from geography or finance.
IIIa. In a very first part, the basics and an easy proof of the rules for obtaining a linear model of regression between two scalar series Y=aX+b+epsilon will be given.
IIIb. In a second part, first of all the rules for obtaining a general linear model of regression will be discussed. This implies to define properly the optimization problem.
Let X and Y be two statistical series, X and Y, X being vectorial and Y being scalar. Now consider a function f(X,C) depending linearly on the parameters, id est the components of C. The function f(X,C) is chosen to mimicate the series Y. Thus we may choose C in order that the total amount of residual errors f(X,C)-Y shall be minimum. The technicalities will be given.
IIIc. It will be considered remarkable examples coming from institutional sites giving

geographic and economical chronological datas eurostats (population, alcohol, drugs, ans so on) yielding quite excellent regression straight lines or curves. In these examples very cute phenomena may be revealed or at the opposite one won't be confident in the prediction given by regression tools.

IIId. The population of Bulgaria over fifty years.

IIIe. The value of the industrial production in US over a century.

IIIf. The statistics of Bulgaria provided by the World Bank.

In these examples are given the explanations and détails of calculus by using the spreadsheet Excel as well as Maple.

[Probably the longest lecture, its duration may vary from 1 to 2 hours, so that to be presented in full détails.]

(IV)

Playing with digits. Some interesting phenomenon appears when one iterate a function well defined on integers, such as the product of the digits, the sum of squares of digits, etc. However the level of complexity of the phenomena may differ and the hardness of proving may also be quite distinct. Lest us consider the two distinct functions f and g defined as follows. If x is any integer, f(x) is the sum of the squares of the digits of x and g(x) is the product of the digits of x. These two functions may be iterated on the set of integers N. However the results are very different in the previous two cases. Experiments with Maple.

[around one hour]

(V)

Uncertainty and Risk.

Va. Historical perspective on this thema, designed for students in economics, from Cantillon to Kirschner and Shannon.

Vb. Measures of uncertainty for discrete finite distribution of probability. Entropy.

Vc. Measures of risk, especially the variance.

Vd. Examples of computation. Binomial laws; Pascal's law; Poisson's law.

Ve. The case of continuous distribution of probability.

Vf. Conclusion.

[around one hour]

(VI) Evocating the works of some bulgarian mathematicians.

VIa. Sendov.

VIb. What young french students know of Sendov and why.

VIc. The beautiful conjecture of Sendov relative to location of roots of polynomials. Some very simple cases.

VId. Arrangements of roots of polynomials and their derivatives. Some examples from a paper in Serdica Math. Journal.
[around one hour]

(VII) Handling the risk.
VIIa. A preliminary part deals with quadratic optimization. It will be presented the equations for determining stationary points.
VIIb. How a young student in economics found a very simple model modelizing the investor choices of portfolios.
It will be given a precise definition of the Markowitz model, but do not enter in mathematical détails for optimization.
VIIc. Applicability of such a model with Financial series. The example uses datas from yahoo finance and starts with the computation of the vector of means and the matrix of variances and covariances of the commodities.
[between 1hour and 2hours depending on the level of détails that will be given]

(VIII) Electre.
VIIIa. How we may classify students ? Suppose that students are labelled from 1 to N according to their evaluation in maths, English, computer science, etc, but that we do not care of coefficients of those disciplines. Can some agreement on the best or the least student may be found ? A simple way to understand this question is to introduce coefficients detecting concordances and discordances. Some features of this situation will be discussed.
This applies equally well when one must choose between « actions » constrained by divergent criteria.
VIIIb. A preliminary scenario is the comparison of classification done by two persons when choosing several similar objects.This is ordinal regression. It will be presented the well-known two methods of kendall and Spearman.
VIIIb. Generalization to the case of several testers and many objects.
VIIIc. The electre method. The vocabulary : action, criteria, concordances, discordances.
VIIId. Examples of computation done with Maple.
[between 1hour and 2hours depending on the level of détails that will be given]