Short description of Minors and Majors in Information Sciences and Biostatistics (ISB)

Module ≠	Module title	Coordinator	Contents	ECTS #	Teaching Week/year
214	**Minor A of the Information Sciences and biostatistics "Multidimensional and Multivariate Statistical Methods"**	**Séverine Deguen**	**Minor A "Multidimensional and Multivariate Statistical Methods"** Data mining is a statistical method used in public health to analyze high-dimensional data sets. To analyze the quantitative, or qualitative variables, or both types, different methods are available. This technic is particularly adequate to synthetize variables highly correlated (eliminating colinearity problem in multiple regression, for example), to construct composite index (socioeconomic deprivation index, for example) or also to create homogeneous groups of statistical units, to prepare the sampling procedure of an epidemiological study. Each day is designed to alternate between theory and practice. ***Learning objectives**: at the end of the module, the students should be able to* 1. To be familiar with the most common methods: principal component analysis, cluster analysis .... 2. To use the statistical function implemented in STATA software 3. To interpret the results including the statistical tables (contribution of variable on each components, correlation, eigen values (….) and also correlation circle and dendogram. 4. To carry out PLS regression **Prerequisite** Advanced course in biostatistics	**3**	**45, 2018**
215	**Minor B of the Information Sciences and biostatistics "Minor 215 ISB Minor B Introduction to R"**	**Nolwen Le Meur**	**Minor Introduction to R** The course will teach students to apply basic statistical analysis and analytical epidemiologic methods using the R statistical computing. R is not only a free statistical software but also a language and environment for statistical computing and graphics. R is highly extensible and runs on a wide variety of UNIX platforms, Windows and MacOS. During this module, the emphasis will be on learning by doing. Practice material and data will be grounded on actual research questions and are intended to illustrate the kinds of issues that often arise when practicing statistics and epidemiology. Students will be encouraged to apply the material to their own research interests and epidemiological analyses. Each session is a combination of didactic lecture and hands-on practice. Students will conduct epidemiological analyses on actual data sets, and learn the importance of data preparation and cleaning, descriptive analyses, as well as how to conduct basic statistical analyses including regression analyses.	**3**	**47, 2018**

			***Learning objectives**: at the end of the module, the students should be able to:* 1. Use the R statistical computing environment to enter, read, clean, organize, index and manipulate epidemiologic data in R. 2. Analyze rate, ratio and risk data in R using using matrices, arrays and data frames. 3. Apply R functions and packages for linear models to analyze epidemiologic data. 4. Apply base graphics and ggplot2 to explore, plot, and present analyses. 5. Understand how R can be extended with function. **Prerequisite** Students are assumed to be familiar with elementary statistical methods such as regression models, analysis of variance, hypothesis testing, etc.		
229	**Major A of the Information Sciences and biostatistics «Modelling of infectious diseases»**	**Elisabeta Vergu**	**Major A « Modelling of infectious diseases »** Mathematical models contribute to the understanding of fundamental epidemiological processes or are used to predict disease spread at various spatial-temporal scales and its prevention and control. Alone or combined with economic cost-effectiveness studies, mathematical models and associated statistical techniques have become invaluable decision-making tools in public health in general and in planning mitigation strategies against any epidemic of a communicable di communicable disease in particular ***Learning objectives: at the end of the module, the students should be able to:*** *1.* Critically read and analyse research articles featuring modelling-based epidemiological studies; *2.* Provide the general ideas for constructing and analysing simple models of epidemic spread and control; *3.* Interpret models outputs as information that help guide public health decision making. The course will present the simplest models and methods used in infectious diseases modelling either conceptually or practically (through computer-based exercises and critical reading of scientific articles) and will illustrate this methodology with several developed examples.: Such as (i) main classes of epidemic models (population vs individual based, deterministic vs stochastic, spatial models), (ii) construction of SIR-like models and calculation of basic reproductive numbers (R_0); bioterrorism-related epidemics illustrated through modelling-based studies of detection and spread of smallpox, pneumonic plague, Ebola and anthrax outbreaks; control of infectious diseases illustrated with a modelling-based approach of measles vaccination in epidemic context;: last influenza a case study .	**3**	**49, 2018**
230	**Major B of the Information Sciences and biostatistics track "Multilevel Analysis"**	**Jay Kaufman**	**Major B Multilevel Analysis** "Multilevel analysis has recently emerged as a useful analytical technique in several fields, including public health and epidemiology. Multilevel analysis originally developed in the fields of education, sociology, and demography, has received increasing attention in public health and epidemiology over the past few years", especially in social epidemiology. ***Learning objectives**: at the end of the module, the students should be able to:*	**3**	**51, 2018**

			1. To identify the levels of analysis 2. To identify the principles of multilevel regression techniques 3. To recognize different concepts such as: • Different levels of variation • Intra-class correlation • Fixed and random effects • Individual & contextual factors 4. To identify multilevel structures 5. To apply different methods and use basic multilevel concepts		
231	**Major C of the Information Sciences and biostatistics track " Spatial Statistical analysis"**	**Cindy Padilla**	**Major C : Spatial Statistical analysis** Mapping is a useful and powerful tool to represent information which varies on a territory. The course will introduce students to some descriptive measures in spatial epidemiology and explore methods and important concepts commonly used to reveal risk factors of the health event It is particularly true in public health issues where health determinants are multiples and may be related to individual behavior and also to neighborhood factors which are not equally distributed in the space. Detecting clusters grouping small areas at greater health risk tends to be a appropriate method to orientate public health action. An explanatory spatial analysis can then be applied assessing the relationship between the cluster and the neighborhood characteristics in order to reveal risk factors of the health event. **Learning objectives: at the end of the module, the students should be able to:** 1. map geographic data 2. create descriptive spatial statistics 3. create environmental indicators 4. develop an awareness of some concepts to be taken into account in geographic analysis 5. carry out spatial statistical analysis using those concepts 6. Detect cluster analysis **Prerequisite** Core curriculum in Biostatistics and Epidemiology and basics in GIS : Major B EOHS GIS & Environmental Health.	**3**	**4, 2019**