Course unit English denomination	Sampling Theory
SS	STAT-01/A
Teacher in charge (if defined)	Pier Francesco Perri
Teaching Hours	13
Number of ECTS credits allocated	2
Course period	02/2026
Course delivery method	☒ In presence ☐ Remotely ☐ Blended
Language of instruction	English
Mandatory attendance	☒ Yes (100% minimum of presence, apart from exceptional absences that must be justify in advance) ☐ No

Course unit contents

The problem of estimating the population mean is discussed starting from sampling with varying probabilities and emphasis will be given to the use of auxiliary variables at the estimation stage through the regression and calibration estimators. Moreover, the problem of reducing nonsampling errors due to untruthful response and nonresponse will be introduced and discussed in the context of surveys on sensitive issues.

Contents:

- First and second order inclusion probabilities
- Sampling with varying probabilities and some selection schemes
- Estimation of the population mean through the Hansen-Hurwitz estimator and the Horvitz-Thompson estimator
- Sample size determination
- Stratified and cluster samplings: design and estimation
- Estimation with auxiliary information: ratio, regression and calibration estimators
- Surveying sensitive issues by indirect questioning techniques
- The nonresponse
- Brief overview with R

Learning goals

The short course aims at providing basic notions on sampling theory and practice for finite population. At the end of the lessons, students should be able to:

- Select a representative sample of the population taking into account the aims of the survey, the information available and the budget constraints.
- Evaluate the advantages and disadvantages arising from the use of a sampling design
- Prevent and correct nonsampling errors stemming from untruthful responses and nonresponse.

Teaching methods	• Lectures
Course on transversal, interdisciplinary, transdisciplinary skills	☐ Yes ☐ No
Available for PhD students from other courses	☒ Yes ☐ No Students from other PhD courses may be admitted subject to CV evaluation and until the maximum number of students has been reached
Prerequisites (not mandatory)	max 3750 caratteri
Examination methods (in applicable)	None
Suggested readings	• Course material available from the instructor • Chaudhuri A., Chistofides T.C. (2013). Indirect Questioning in Sample Survey. Springer • Cochran W.G. (1977). Sampling Techniques. Wiley. • Conti P.L., Marrella D. (2012). Campionamento da Popolazioni Finite. Il Disegno Campionario. Springer • Heeringa S.G., West B.T., Berglund P.A. (2010). Applied Survey Data Analysis. CRC Press • Lohr S.L. (2022). Sampling: Design and Analysis. . CRC Press • Lu Y., Lohr S.L (2022). R Companion for Sampling: Design and Analysis. CRC Press • Lumley T. (2010). Complex surveys: A Guide to Analysis Using R. Wiley • Särndal C. E., Lundström S. (2005). Estimation in Surveys with Nonresponse. Wiley • Särndal C. E., Swensson B., Wretman, J. (1992). Model Assisted Survey Sampling. Springer • Tillè, Y. (2020). Sampling and Estimation from Finite Populations. Wiley • Valliant R., Dever J.A., Kreuter F. (2018). Practical Tools for Designing and Weighting Survey Samples. Springer • Wu C., Thompson M.E. (2020). Sampling: Theory and Methods. Springer
Additional information	max 3750 caratteri