



**Academia de Studii Economice**  
**Departamentul de Informatică și Cibernetică Economică**

Calea Dorobanți, 15-17, Sector 1, București, 010552 (camera 2314)  
Tel.: +40 21 319 19 00, ext. 319, 336, Fax: +40 21 311 20 66  
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**Contest topics for Associate Professor,  
position 54, 2020-2021, semester 1**

**Disciplines: Software for Statistics and Data Science (R, Python, SAS);  
Multiparadigm Programming - Java; Data Analysis**

**Software for Statistics and Data Science (R, Python, SAS)**

1. Python Language Basics. Applications structure. Operators. Objects and variables.
2. Control Structures and Functions in Python.
3. Types and data structures in Python.
4. File Handling in Python.
5. NumPy Basics: Arrays and
6. Data structures in Pandas. Series and DataFrame classes.
7. Using Pandas library. Exploring data - selection, summary, filtering, data aggregation.
8. Scientific computing in Python. Scipy library
9. Data analysis in Python. Scikit-learn library. Factor analysis, regression, principal component analysis
10. Data analysis in Python. Scikit-learn library. Discriminant analysis and cluster analysis
11. Data visualization in Python matplotlib library. Line plots, bar plots, histograms and density plots, scatterplots.
12. Spatial data visualization in Python. Geopandas, Bokeh and Pysal libraries.
13. R Basics. R scripts. Functions and objects. Sessions and the workspace. Data structures in R - Vectors, attributes, arrays and lists, data frames, factors. Data subsetting.
14. Import and export data from/to R. Read / write from / to CSV and Excel files. Access to databases from R. Interoperability with Python
15. Efficient processing of statistical data. Using dplyr and tidyverse packages. Data exploration operations using dplyr and tidyverse functions: selection, filtering, aggregation.
16. Scientific graphics and spatial data visualization in R. Graphics package. Basics statistical charts. Spatial packages sp, sf and gdal.
17. SAS - Architecture, components, features. Introduction to SAS programming.

**Bibliography:**

1. Wes McKinney, Python for Data Analysis, O'Reilly Media, 2018, Statele Unite ale Americii
2. Wes McKinney & PyData Development Team, Pandas: powerful Python data analysis toolkit, 2017, <https://pandas.pydata.org/pandasdocs>
3. Robert I. Kabacoff, R in Action. Data analysis and graphics with R, Manning Publications Co., 2015, Statele Unite ale Americii
4. Furtună Titus, Software pentru statistică și data science, <https://online.ase.ro>, România



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## **Multiparadigm Programming - Java**

1. Basic concepts of the Java language: JDK, JVM, JRE.
2. Data types, variables, memory usage in Java language.
3. The packing / unpacking mechanism in Java.
4. Control structures, enumerations, methods in Java.
5. Vectors and matrices, Shallow copy / Deep copy in Java.
6. Implementation in Java language of working with files, the serialization mechanism.
7. Implementation of the principles of Object Oriented Programming in Java: classes, interfaces, inheritance, polymorphism.
8. Peculiarities of the Java language. String, immutable, wrapper class.
9. Advanced Java language concepts: Singleton, Java Generics, Annotations, Threads, callback mechanism, events.
10. Collections in Java.
11. Exception management in Java.
12. Working with Java databases, JDBC architecture, stored procedures.
13. JavaDoc, internationalization in Java.

## **Bibliography**

1. Herbert Schildt, "Java: The Complete Reference, Eleventh Edition, 11th Edition", Publisher McGraw-Hill, (Dec, 2018), Language: English, ISBN: 9781260440249
2. Joshua Bloch, "Effective Java 3rd Edition", Publisher Addison-Wesley (Dec 27, 2017), ISBN: 978-0-9780134686097
3. Bruce Eckel, "Thinking in Java", Publisher: Prentice Hall; 4 edition (February 20, 2006) , ISBN-10: 0131872486, ISBN-13: 978-0131872486
4. James Gosling, Bill Joy, Guy Steele, Gilad Bracha, Alex Buckley - "The Java Language Specification, Java SE 7 Edition": <http://docs.oracle.com/javase/specs/jls/se7/jls7.pdf>
5. B. Bates, K. Sierra, Head First Java, Your Brain on Java - A Learner's Guide, O'Reilly Media, 2003
6. Java Platform Standard Edition 8 Documentation, <https://docs.oracle.com/javase/8/docs/>
7. Irina Athanasiu – Programarea practica in limbajul Java, ALL, 2001.

## **Data Analysis**

1. Preliminary Data Analysis. Fundamentals. Statistical Distributions.
2. Goodness of fit tests for distributions. Types of data. measures of similarity and dissimilarity in data analysis.
3. Principal component analysis: concept definition, principal components computation, mathematical model.
4. Principal component analysis: model evaluation and data visualization.
5. Principal component analysis: applying model on supplementary data sets, model generalization.
6. Factor analysis: concept definition, model assumptions, factorability.
7. Factor analysis: factor extraction, determining number of factors - Bartlett's test, factor rotation



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8. Canonical analysis
9. Generalized canonical correlation analysis
10. Discriminant analysis: variability indicators, model significance
11. Linear discriminant analysis
12. Bayesian discriminant analysis
13. Hierarchical cluster analysis
14. Correspondence analysis
15. Multiple correspondence analysis

**Bibliography:**

1. Murtagh, F., Heck, A., Multivariate data analysis, Dordrecht, 1987, Olanda
2. Benzecri J. P., L'analyse des donnees. L'analyse des correspondances, Dunod, Paris, 1979, Franța
3. Ruxanda Gh., Analiza datelor, Editura ASE, Bucuresti, 2001, România
4. Jiawei Han, Micheline Kamber, Data Mining. Concepts and Techniques, Morgan Kaufman Publishers, 2006, Statele Unite ale Americii