

## MODULE OUTLINE

### 1. GENERAL INFORMATION

<b>SCHOOL</b>	SCHOOL OF SCIENCE AND TECHNOLOGY		
<b>PROGRAM COURSE</b>	DATA SCIENCE AND MACHINE LEARNING		
<b>LEVEL OF STUDY</b>	POSTGRADUATE		
<b>MODULE CODE</b>	DAMA-51	<b>YEAR OF STUDY</b>	1 <sup>st</sup>
<b>MODULE TITLE</b>	Foundations in Computer Science		
<b>INDEPENDENT TEACHING ACTIVITIES</b> <i>in case credits are awarded for separate components/parts of the course, e.g. in lectures, laboratory exercises, etc. If credits are awarded for the entire course, give the weekly teaching hours and the total credits</i>		<b>HOURS</b>	<b>CREDIS</b>
Weekly teaching hours: 21-25 x 32 weeks		840	30 ECTS
<b>COURSE TYPE</b> Compulsory, Optional, Optional mandatory	Compulsory		
<b>PREREQUISITE MODULES:</b>	The selection of DAMA51 does not require the simultaneous selection or completion of any other DAMA module.		
<b>LANGUAGE OF INSTRUCTION AND EXAMS</b>	ENGLISH		
<b>THE MODULE IS OFFERED TO ERASMUS STUDENTS</b>	No (due to annual duration of the module)		
<b>MODULE WEBSITE (URL)</b>	<a href="https://www.eap.gr/education/postgraduate/annual/data-science-and-machine-learning/topics/#dama51">https://www.eap.gr/education/postgraduate/annual/data-science-and-machine-learning/topics/#dama51</a>  Each module has its own space in the Learning Management System of EAP ( <a href="http://study.eap.gr">http://study.eap.gr</a> ), with controlled access (use of code) for students and teaching staff.		

### 2. LEARNING OUTCOMES

<p><b>Learning Outcomes</b></p> <ul style="list-style-type: none"> <li>• <i>The course learning outcomes, specific knowledge, skills and competences of an appropriate (certain) level, which students will acquire upon successful completion of the course, are described in detail. It is necessary to consult:</i></li> </ul>
<ul style="list-style-type: none"> <li>• Identify what data science is, and how it is related to statistics</li> <li>• List basic statistical analysis techniques</li> <li>• Indicate the roles and the skills of a data scientist</li> <li>• Name and recognize the steps of the data science process</li> <li>• Appraise the quality of input data</li> <li>• Accept that data science must be applied as an iterative process</li> <li>• Code \simple algorithms in a high level programming language</li> </ul>

- Apply scraping and data munging
- Use different data science software packages
- Use appropriate methods of analysis to build highly understandable and accurate models
- Assess the fit of a model to the data
- Investigate potential issues in data and models
- Interpret and communicate findings to an audience
- Derive insights from the results of data analysis
- Perform Principal Component Analysis
- Identify outliers
- Perform Dimensionality Reduction methods
- Perform Hypothesis Testing
- Select an optimal subset of attributes
- Define single-linkage and complete-linkage clustering approaches
- Distinguish between prototype-based, density-based and hierarchical clustering techniques
- Explain the notion of (dis)similarity between records for different kind of attributes
- Compute the value of different distance metrics
- Apply the K-means algorithm for clustering purposes
- Apply clustering techniques to various data sets using R
- Evaluate Clustering algorithms
- Apply Association Rules to various data sets using R
- Solve the frequent item set mining problem
- Apply linear regression models to various data sets using R
- Describe the terminology of the decision trees domain
- Apply decision tree learning to various data sets using the WEKA software
- Analyze a data set identifying features/attributes and classes, towards applying a machine learning algorithm
- Evaluate the performance of a model

### **General Competences**

*Taking into consideration the general competences that students/graduates must acquire (as those are described in the Diploma Supplement and are mentioned below), at which of the following does the course attendance aim?*

*Search for, analysis and synthesis of data and information by the use of appropriate technologies,*

*Adapting to new situations*

*Decision-making*

*Individual/Independent work*

*Group/Team work*

*Working in an international environment*

*Working in an interdisciplinary environment (Other.....citizenship, spiritual freedom, social*

*Introduction of innovative research*

*Project planning and management*

*Respect for diversity and multiculturalism*

*Environmental awareness*

*Social, professional and ethical responsibility and sensitivity to gender issues*

*Critical thinking*

*Development of free, creative and inductive thinking*

*.....*

*awareness, altruism etc.) .....*

Search for, analysis and synthesis of data and information by the use of appropriate technologies,

Adapting to new situations

Decision-making

Individual/Independent work

Project planning and management  
 Critical thinking  
 Development of free, creative and inductive thinking

### 3. MODULE CONTENT

The students will acquire a strong background as far as the algorithmic aspects and the computational requirements of data science and machine learning approaches are concerned. They will also develop an in depth understanding of the key technologies in data science and data analytics. After they will be presented with the fundamental concepts and principles that underlie the techniques for extracting knowledge from data, they will become acquainted with a number of practical considerations regarding the analysis and the interpretation of the data as well as assessing the quality of the input data and deriving insights from the results of mining the data. By the time the students will complete this module, they will be able to apply theory, languages algorithms and tools to solve real world problems while they will be proficient in interpreting and communicating findings to any kind of audience.

The key subjects of the module are:

- A. Data Structures, Algorithms and Databases
- B. Data Science Fundamentals
- C. Artificial Intelligence

### 4. TEACHING METHODS--ASSESSMENT

<p><b>MODES OF DELIVERY</b>  <i>Face-to-face, in-class lecturing, distance teaching and distance learning etc.</i></p>	<p>Distance education with five Group Counseling Meetings (OSS) during the academic year on weekends.</p>							
<p><b>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY</b>  <i>Use of ICT in teaching, Laboratory Education, Communication with students</i></p>	<p>We use :          Remote meetings tools (cisco webex),          Presentation software (e.g. power point),          Specialized software in the subjects under study (R, WEKA, etc.).</p> <p>Additionally, the students use office automation tools, web browsers and e-reader for digital books.</p>							
<p><b>MODULE DESIGN</b>  <i>Description of teaching techniques, practices and methods: Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, Internship, Art Workshop, Interactive teaching,</i></p>	<table border="1"> <thead> <tr> <th data-bbox="695 1654 1019 1696"><b>Activity</b></th> <th data-bbox="1027 1654 1344 1696"><b>Annual Workload</b></th> </tr> </thead> <tbody> <tr> <td data-bbox="695 1696 1019 1766">5 Tutorial Meetings (x 4 hours)</td> <td data-bbox="1027 1696 1344 1766">20</td> </tr> <tr> <td data-bbox="695 1766 1019 1835">Multiple Choice Exercises (5 x 2 hours)</td> <td data-bbox="1027 1766 1344 1835">10</td> </tr> </tbody> </table>		<b>Activity</b>	<b>Annual Workload</b>	5 Tutorial Meetings (x 4 hours)	20	Multiple Choice Exercises (5 x 2 hours)	10
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<p><i>Educational visits, projects, Essay writing, Artistic creativity, etc</i></p> <p><i>The study hours for each learning activity as well as the hours of selfdirected study are given following the principles of the ECTS.</i></p>	Preparation of Assignments (5 assignments x 10 hours)	50
	Examination	3
	Individual study	672-800
	<b>Total module workload (hours)</b>	<b>755-883</b>
<p><b>STUDENT PERFORMANCE EVALUATION/ASSESSMENT METHODS</b></p> <p><i>Detailed description of the evaluation procedures.</i></p> <p><i>Language of evaluation, assessment methods, formative or summative (conclusive), multiple choice tests, short- answer questions, open-ended questions, problem solving, written work, essay/report, oral exam, presentation, laboratory work, other.....etc.</i></p> <p><i>Specifically defined evaluation criteria are stated, as well as if and where they are accessible by the students</i></p>	<p>Elaboration of written assignments during the academic year, the average of the grades of which participates in the formation of the final grade of module by 30%, if there is a passable in the final or repetitive examinations. In the final written exams the grade of the written assignments participates in the formation of the final grade of module by 70%.</p> <p>All the criteria are posted, both in each written assignment (in the LMS study.eap.gr), as well as in the general regulation of HOU at:  <a href="https://www.eap.gr/education/study-regulations/">https://www.eap.gr/education/study-regulations/</a></p>	

## (5) SUGGESTED BIBLIOGRAPHY

<p>- <i>Suggested bibliography:</i></p> <ul style="list-style-type: none"> <li>• Michael R. Berthold, Christian Borgelt, Frank Höppner and Frank Klawonn. (2010). Guide to Intelligent Data Analysis. How to Intelligently Make Sense of Real Data. Springer. <ul style="list-style-type: none"> <li>○ <a href="https://link-springer-com.proxy.eap.gr/book/10.1007/978-1-84882-260-3">https://link-springer-com.proxy.eap.gr/book/10.1007/978-1-84882-260-3</a>.</li> </ul> </li> <li>• EMC, E. S., &amp; EMC, E. S. (Eds.). (2015). Data science and big data analytics : Discovering, analyzing, visualizing and presenting data. Wiley. <ul style="list-style-type: none"> <li>○ <a href="https://onlinelibrary-wiley-com.proxy.eap.gr/doi/book/10.1002/9781119183686">https://onlinelibrary-wiley-com.proxy.eap.gr/doi/book/10.1002/9781119183686</a>.</li> </ul> </li> </ul> <p>Additional digital (and multimedia) material is available within the “study” platform</p> <p>- <i>Related scientific Journals:</i></p> <ol style="list-style-type: none"> <li>1) Journal of Machine Learning Research (<a href="http://www.jmlr.org">http://www.jmlr.org</a>)</li> <li>2) Machine Learning (<a href="https://www.springer.com/journal/10994">https://www.springer.com/journal/10994</a>)</li> </ol>
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