



MINISTERUL EDUCAȚIEI  
UNIVERSITATEA „AUREL VLAICU” DIN ARAD  
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## SYLLABUS

### 1. Study programme

|                                      |  |
|--------------------------------------|--|
| 1.1. Higher education institution    | „Aurel Vlaicu” University of Arad              |
| 1.2. Faculty                         | of Exact Sciences                              |
| 1.3. Department                      | Department of Mathematics and Computer Science |
| 1.4. Field of study                  | Informatics                                    |
| 1.5. Study level                     | 2024-2025                                      |
| 1.6. Ciclul de studii                | Bachelor                                       |
| 1.7. Study programme / Qualification | Computer Science                               |
| 1.8. Form of education               | Full – Time study                              |

### 2. Course details

|   |                          |
|---|--------------------------|
| 2.1. Name of the course                     | GIAF2011 Data Structures |
| 2.2. Course coordinator                     | dr. Bejan Crina-Anina    |
| 2.3. Seminar/laboratory/project coordinator | specialist Țerei Carmen  |
| 2.4. Study year                             | 1                        |
| 2.5. Semester                               | 2                        |
| 2.6. Evaluation type                        | ES                       |
| 2.7. Course type                            | Ob                       |

### 3. Estimated total time (hours per semester)

|   |     |
|---|-----|
| 3.1. Hours per week   | 3   |
| 3.2. Lecture hours per week   | 2   |
| 3.3. Seminar/laboratory/project hours per week  | 1   |
| 3.4. Total hours per curriculum   | 42  |
| 3.5. Lecture hours per semester   | 28  |
| 3.6. Seminar/laboratory/project hours per semester  | 14  |
| Time division [hrs]   |     |
| 3.4.1. Independent study from textbooks, course support, bibliography and notes             | 30  |
| 3.4.2. Additional reading (libraries, specialized electronic platforms and field research)  | 30  |
| 3.4.3. Preparing of seminars/laboratories/projects, homework, papers, portfolios and essays | 30  |
| 3.4.4. Tutorial coaching  | 0   |
| 3.4.5. Examinations   | 4   |
| 3.4.6. Other activities   | 0   |
| 3.7. Total individual study hours   | 94  |
| 3.8. Total hours per semester   | 150 |
| 3.9. Number of ECTS credits   | 6   |

### 4. Prerequisites (if applicable)

|                         |  |
|-------------------------|--|
| 4.1. Curriculum related |  |
| 4.2. Competence related |  |

**5. Conditions** (if applicable)

|                         |  |
|-------------------------|--|
| 5.1. for the lecture    | Lecture room, equipped with laptop, video projector and appropriate software.                      |
| 5.2. for the seminar    |  |
| 5.3. for the laboratory | Laboratory room, properly equipped: computers, network, Internet connection, appropriate software. |
| 5.4. for the project    |  |

**6. Specific educational objectives** (competences to be acquired)

|                              |  |
|------------------------------|--|
| 6.1. Competențe profesionale | <p><b>C1. Programming in high-level languages.</b><br/> <b>C2. Development and maintenance of software applications.</b><br/> <b>C3. Using IT tools in an interdisciplinary context.</b><br/> <b>C4. Using the theoretical foundations of computer science and formal models.</b></p>  |
| 6.2. Competențe transversale | <p><b>CT1. Applying rules of organized and efficient work, demonstrating responsible attitudes towards the educational-scientific field to creatively harness one's potential, while respecting the principles and norms of professional ethics.</b><br/> <b>CT2. Efficiently conducting activities organized within an interdisciplinary group and developing empathetic interpersonal communication skills, as well as the ability to relate to and collaborate with diverse groups.</b><br/> <b>CT3. Using effective methods and techniques for learning, research, and developing the ability to apply knowledge, adapt to the demands of a dynamic society, and communicate in an international language.</b></p> |

**7. Course outcomes** (resulting from the specific educational objectives to be acquired)

|                        |   |
|------------------------|---|
| 7.1. General outcomes  | <p>Students learn the concepts of procedural programming problems and algorithm design and analysis.<br/>         To develop students' ability to apply correctly the knowledge acquired and to develop their analytical skills.</p>  |
| 7.2. Specific outcomes | <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>- Identify the appropriate algorithm for a given problem;</li> <li>- Design, implement and optimize an algorithm as a solution to a given problem;</li> <li>- Perform complexity calculations for a given algorithm.</li> </ul> |

**8. Outline** (if applicable)

| 8.1 Lecture Outline  | Teaching methods  | Remarks |
|--|---|---------|
| Introduction, general notions  | interactive exposition, heuristic conversation, exemplification | 2 hrs   |
| Linked lists – linked data structures  | interactive exposition, heuristic conversation, exemplification | 4 hrs   |
| Queues. Stacks.  | interactive exposition, heuristic conversation, exemplification | 8 hrs   |
| Trees – hierarchical data structures   | interactive exposition, heuristic conversation, exemplification | 4 hrs   |
| Graphs – relational data structures.   | interactive exposition, heuristic conversation, exemplification | 4 hrs   |
| Specific Algorithms: Dynamic Programming, Divide and Conquer, Greedy, Backtracking, Branch & Bound   | interactive exposition, heuristic conversation, exemplification | 4 hrs   |
| Search and sorting methods.  | interactive exposition, heuristic conversation, exemplification | 2 hrs   |
| <p>8.2 Lecture References</p> <ol style="list-style-type: none"> <li>1. T. Cormen, C. Leiserson, R. Rivest, and C. Stein. Introduction to Algorithms. 2nd ed. Cambridge, MA: MIT Press, 2001. ISBN:9780262032933 2;</li> <li>2. D. Knuth, Arta Programarii Calculatoarelor, Vol.1: Algoritmi Fundamentali, Teora, 2000</li> <li>3. K.Jamsa, L. Klander, Totul despre C și C++, Manual fundamental de programare în C și C++, Ed. Teora, 2004;</li> <li>4. V. Jordan, Algoritmi și programare în C, Ed.Eurostampa, 2007</li> <li>5. D. Galățchi, S. Zoican, R. Zoican, Limbajul C. Structuri de date și algoritmi, Editura POLITEHNICA Press, 2004, ISBN 973-8449-39-1</li> <li>6. Siddhartha Rao, C++ in One Hour a Day, Sams Teach Yourself, Pearson Education (US), 2016</li> <li>7. Subrata Saha, Subhodip Mukherjee, Basic Computation and Programming with C, Cambridge University Press, 2017</li> <li>8. Joseph Bergin, Data Structure Programming: With the Standard Template Library in C++, SPRINGER NEW YORK, 2012</li> </ol> |   |         |
| 8.3 Seminar Outline  | Teaching methods  | Remarks |
|  |   |         |
| 8.4 Seminar References   |   |         |
| 8.5 Laboratory Outline   | Teaching methods  | Remarks |
| Introduction to dynamic memory allocation  | debate, problem-solving, exercise, application                  | 2 hrs   |
| Linked lists   | debate, problem-solving, exercise, application                  | 2 hrs   |

|  |  |         |
|--|--|---------|
| Queues. Stacks.  | debate, problem-solving, exercise, application | 2 hrs   |
| Trees  | debate, problem-solving, exercise, application | 2 hrs   |
| Graphs   | debate, problem-solving, exercise, application | 2 hrs   |
| Specific Algorithms applications.  | debate, problem-solving, exercise, application | 2 hrs   |
| Search and sorting methods applications.   | debate, problem-solving, exercise, application | 2 hrs   |
| 8.6 Laboratory References<br>1. T. Cormen, C. Leiserson, R. Rivest, and C. Stein. <i>Introduction to Algorithms</i> . 2nd ed. Cambridge, MA: MIT Press, 2001. ISBN:9780262032933 2;<br>2. D. Knuth, <i>Arta Programarii Calculatoarelor, Vol.1: Algoritmi Fundamentali, Teora, 2000</i><br>3. K.Jamsa, L. Klander, <i>Totul despre C și C++, Manual fundamental de programare in C și C++, Ed. Teora, 2004;</i><br>4. V. Jordan, <i>Algoritmi si programare in C, Ed.Eurostampa, 2007</i><br>5. D. Galațchi, S. Zoican, R. Zoican, Limbajul C. <i>Structuri de date și algoritmi, Editura POLITEHNICA Press, 2004, ISBN 973-8449-39-1</i><br>6. Siddhartha Rao, <i>C++ in One Hour a Day, Sams Teach Yourself, Pearson Education (US), 2016</i><br>7. Subrata Saha, Subhodip Mukherjee, <i>Basic Computation and Programming with C, Cambridge University Press, 2017</i><br>8. Joseph Bergin, <i>Data Structure Programming: With the Standard Template Library in C++, SPRINGER NEW YORK, 2012</i> |  |         |
| 8.7 Project Outline  | Teaching methods                               | Remarks |
| 8.8 Project Outline  |  |         |

9. Correlation of course outline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

The content of the subject is in line with the content of similar subjects in other universities in the country and abroad. In order to better adapt the content of the subject to the requirements of the labour market, meetings were held with employers - representatives of the business environment and with mathematics and computer science teachers from the preuniversity education in Arad.

**10. Evaluation / Grading (if applicable)**

| Activity type  | Evaluation criteria   | Evaluation methods  | Percentage of the final grade |
|--|---|---|-------------------------------|
| 10.1. Lecture  | Accuracy and completeness of knowledge. Logical consistency. Degree of assimilation of specialist language. | Oral assessment (final in the exam session): -Presentation of a final project - Free student presentation - Evaluation conversation - Oral questionnaire. | 50%                           |
| 10.2. Seminar  |   |   |                               |
| 10.3. Laboratory   | Ability to operate with assimilated knowledge. Ability to apply in practice.                                | Oral assessment (final in the examination session): -Completion and presentation of the final project   | 30%                           |
| 10.4. Project  | Homeworks.  | Oral evaluation.  | 20%                           |
| 10.5 Minimal performance standard<br><b>Learning fundamental concepts, using specialist language, making a simple application.</b> |   |   |                               |

Course coordinator  
Conf. univ. dr. Crina Anina Bejan

Seminar/laboratory/project coordinator  
**specialist** Carmen Țerei

Head of the Department  
Lector Popa Lorena

Dean  
Prof.univ.dr. Sorin Florin Nădăban