SYLLABUS

Academic year 2024-2025

Year of study I / Semester II

1. Information on academic program

1.1. University	**„1 Decembrie 1918" of Alba Iulia**
1.2. Faculty	**Faculty of Informatics and Engineering**
1.3. Department	**Informatics, Mathematics and Electronics Department**
1.4. Field of Study	**Computer Science**
1.5. Cycle of Study	**Undergraduate**
1.6. Academic programme / Qualification	**Computer Science /ESCO: 2512/ Software developers Analyst 251201 Computer System Programmer 251204 Computer System Engineer 251203**

2. Information of Course Matter

2.1. Course	***Graph algorithms***			2.2. Code		**CSE 111**	
2.3. Course Leader	Dr. Dorin Wainberg						
2.4. Seminar Tutor	Dr. Dorin Wainberg						
2.5. Academic Year	**I**	2.6. Semester	**II**	2.7. Type of Evaluation (E – final exam/ CE - colloquy examination / CA - continuous assessment)	**E**	2.8. Type of course (C– Compulsory, Op – optional, F - Facultative)	**C**

3. Course Structure (Weekly number of hours)

3.1. Weekly number of hours	**4**	3.2. course	**2**	3.3. seminar, laboratory	**2**
3.4. Total number of hours in the curriculum	**56**	3.5. course	**28**	3.6. seminar, laboratory	**28**

Allocation of time:	hours
Individual study of readers	**35**
Documentation (library)	**30**
Home assignments, Essays, Portfolios	**27**
Tutorials	**-**
Assessment (examinations)	**2**
Other activities…….	**-**

3.7 Total number of hours for individual study	94
3.8 Total number of hours in the curriculum	56
3.9 Total number of hours per semester	150
3.10 Number of ECTS	6

4. Prerequisites (where applicable)

4.1. curriculum-based	
4.2. competence-based	

5. Requisites (where applicable)

5.1. course-related	Room equipped with video projector / board
5.2. seminar/laboratory-based	Room equipped with board

6. Specific competences to be acquired

Professional competences	CP3 (2 ECTS), CP 16 (2 ECTS), CP29 (2 ECTS)
Transversal competences	Not applicable

7. Course objectives (as per the program specific competences grid)

7.1 General objectives of the course	Learning the fundamental concepts in graph theory, with a sense of some of its modern applications.

7.2 Specific objectives of the course	Our aims in this course are twofold. First, to discuss some of the major results of graph theory, and to introduce the language, methods and terminology of the subject. Second, to emphasize various approaches (algorithmic, probabilistic, etc) that have proved fruitful in modern graph theory: these modes of thinking about the subject have also proved successful in areas of informatics, and we hope that students will find the techniques learnt in this course to be useful in their future works.

8. Course contents

8.1 Course (learning units)	**Teaching methods**	**Remarks**
Preliminaries. General notions. Ways for representing a graph	***Lecture, conversation***	
Basic concepts in Graph Theory Cyclomatic number	***Lecture, conversation***	
Graph traversal Breadth First Traversal Depth First Traversal	***Lecture, conversation***	
Minimum distances in graphs	***Lecture, conversation***	
Connected components	***Lecture, conversation***	
Bipartite graphs Maximum matching problem in a bipartite graph	***Lecture, conversation***	
Hamiltonian paths and circuits Chen algorithm Foulkes algorithm Kaufmann algorithm	***Lecture, conversation***	
Flow networks Bellman-Kalaba algorithm Ford algorithm Dijkstra algorithm	***Lecture, conversation***	
Maximum flow in transport networks	***Lecture, conversation***	
Trees. Deffinitions and theorems.	***Lecture, conversation***	
Traversal of a dirrected tree	***Lecture, conversation***	
Trees of minimum values Kruskal algorithm Sollin algorithm	***Lecture, conversation***	
Binary trees	***Lecture, conversation***	
Structural trees	***Lecture, conversation***	

References

1. Behzad, M., Chartrand, G., Lesniak-Foster, L., *Graphs and digraphs*, Prindle, Weber and Schmidt, Boston, Massachusetts, 2014.
2. Bollobas, B., *Graph theory. An introductory course*, Springer-Verlag, New York, Heidelberg, Berlin, 2012.
3. Christo¯des, N., *Graph theory. An algorithmic approach*, Academic Press, 2011.
4. Ford, L., Fulkerson, D. R., *Flows in networks*, Princeton Univ. Press, 1992.
5. Wainberg, D., Breaz, D., Alb Lupaş, A., *Elemente de Algoritmica grafurilor*, Ed. Aeternitas, 2010.

Seminars-laboratories	**Teaching methods**	
Preliminaries. General notions. Ways for representing a graph	***Exercises and problems***	
Basic concepts in Graph Theory Cyclomatic number	***Exercises and problems***	
Graph traversal Breadth First Traversal Depth First Traversal	***Exercises and problems***	
Minimum distances in graphs	***Exercises and problems***	
Connected components	***Exercises and problems***	
Bipartite graphs Maximum matching problem in a bipartite graph	***Exercises and problems***	

Hamiltonian paths and circuits Chen algorithm Foulkes algorithm Kaufmann algorithm	***Exercises and problems***	
Flow networks Bellman-Kalaba algorithm Ford algorithm Dijkstra algorithm	***Exercises and problems***	
Maximum flow in transport networks	***Exercises and problems***	
Trees. Deffinitions and theorems.	***Exercises and problems***	
Traversal of a dirrected tree	***Exercises and problems***	
Trees of minimum values Kruskal algorithm Sollin algorithm	***Exercises and problems***	
Binary trees	***Exercises and problems***	
Structural trees	***Exercises and problems***	

References

1. Behzad, M., Chartrand, G., Lesniak-Foster, L., *Graphs and digraphs*, Prindle, Weber and Schmidt, Boston, Massachusetts, 2014.
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9. Corroboration of course contents with the expectations of the epistemic community's significant representatives, professional associations and employers in the field

Applying the discipline Graph algorithms in building and developing of a computer network is essential. Any company or institution that owns a computer network would need graduates who have successfully completed this subject. Also, a lot of programming techniques are based on the algorithms presented here. Therefore, we can conclude that Graph algorithms is a fundamental course of computer science.

10. Assessment

Activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of final grade
10.4 Course	*Final evaluation*	*Written paper*	50%
10.5 Seminar/laboratory	*Continuous assessment*	*Tests during the semester*	50%
10.6 Minimum performance standard: Modelling and solving some medium complexity level problems, using the mathematical and computer sciences knowledge.			

Submission date | Course leader signature | Seminar tutor signature

Date of approval by Department members | Department director signature

Date of approval by Faculty councile | Dean signature