UCLouvain

linma1691

2021

Discrete mathematics - Graph theory and algorithms

5.00 credits	30.0 h + 22.5 h	Q1

Teacher(s)	Blondel Vincent ;Delvenne Jean-Charles ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	This courses assumes that the elementary notions of discrete mathematics are acquired such as taught in LEPL1108.
Main themes	Introduction to the language and theory of graphs : questions of characterization, isomorphism, existence and enumeration. Properties of directed and undirected graphs such as connectivity, planarity, k-colorability and the property of being Eulerian, perfect, etc. Modelling of practical problems : data structures and algorithms for the exploration of graphs. Basic graph algorithms and an analysis of their complexity.
Learning outcomes	**At the end of this learning unit, the student is able to :** AA1 : 1,2,3 More precisely, by the end of the course the student will be able to : 1 • model various problems in the language of graph theory • identify if a graph-theoretic problem has a known efficent algorithmic solution or not • propose and apply an algorithm to solve sucha a problem, at least for some classes of graphs • prove in a clear and rigorous fashion elementary properties related to the concepts covered in the course
Evaluation methods	The students are evaluated through small projects during the semester and through a written (or possibly oral depending on the circumstances) exam, based on the specific objectives described above. The semester projects amount to 25% of the final grade (in January and in August).
Teaching methods	The course is organised in lessons and supervised exercise sessions.
Content	Structure and characterisation of graphs - basic concepts - degree, connected components, path, cycle, cut, minor, etc. Classes of graphs and their recognition - perfect, series parallel, planar graphs, acyclic digraphs, etc. Exploration of graphs and tests of their properties - k-connected, Eulerian, etc. Flows - theorems of Menger and Hall, maximum flow and minimum cost flow algorithms and their complexity. Problems : finding optimal matchings and stable sets, the travelling salesman problem, cut, graph partitioning and graph colouring problems
Inline resources	Moodle page of the course
Bibliography	**Ouvrage de base (non obligatoire) / primary (non mandatory) reference :** Graph Theory with Applications, A. Bondy- U.S.R. Murty, Springer, téléchargement libre/free download **Aussi /also :** • Algorithmic Graph Theory, Alan Gibbons, Cambridge University Press 1985 • Introduction to Graph Theory, Douglas West, Prentice Hall 1996. • Combinatorial Optimization, W.R. Cook et al., Wiley 1998. • Network Flows, Ahuja et al., Prentice Hall 1993.
Faculty or entity in charge	MAP

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Electrical Engineering	ELEC2M	5		
Minor in Engineering Sciences: Applied Mathematics (only available for reenrolment)	MINMAP	5		
Master [120] in Computer Science and Engineering	INFO2M	5		
Additionnal module in Mathematics	APPMATH	5		
Master [120] in Computer Science	SINF2M	5		
Minor in Applied Mathematics	LMINOMAP	5		
Specialization track in Applied Mathematics	FILMAP	5		