


5.00 credits	30.0 h + 15.0 h	Q2
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Teacher(s)	Saerens Marco ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	This course assumes that the student already masters notions of algebra covered by the course LINFO1112 <i>The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.</i>
Main themes	<p><b>Set theory</b></p> <ul style="list-style-type: none"> <li>• Set notations and operations</li> <li>• Binary relations between sets: applications and link with functions in analysis</li> <li>• Cardinality of a set (finite and infinite) and notion of inclusion-exclusion</li> <li>• Equivalence, equivalence classes</li> </ul> <p><b>Logic</b></p> <ul style="list-style-type: none"> <li>• Introduction to the logic of the proposals</li> <li>• Introduction to the logic of predicates</li> <li>• Prove methods</li> <li>• Mathematical induction</li> <li>• Notions of Boolean Algebra</li> </ul> <p><b>Introduction to number theory</b></p> <ul style="list-style-type: none"> <li>• Natural integer numbers, principle of recurrence, prime numbers, etc.</li> <li>• Euclidean division, representation in a base, modulo arithmetic, representation of the integers in the computer</li> <li>• Gcd, Euclid's algorithm</li> <li>• Basic notions of cryptography</li> </ul> <p><b>Combinatorial mathematics</b></p> <ul style="list-style-type: none"> <li>• counting</li> <li>• permutations</li> <li>• arrangements</li> <li>• Recurrence relations</li> <li>• Solutions of recurrence equations</li> </ul> <p><b>Introduction to graph theory</b></p> <ul style="list-style-type: none"> <li>• Oriented and non-oriented graphs and their matrix representations</li> <li>• Bipartite graphs and matching problems</li> <li>• Paths on a graph and Eulerian / Hamiltonian circuits</li> <li>• Planar graphs and coloring</li> <li>• Problems of shorter path</li> <li>• Ranking of the nodes of a graph: PageRank</li> </ul>
Learning outcomes	<p><b>At the end of this learning unit, the student is able to :</b></p> <p>Given the learning outcomes of the "Bachelor in Engineering" program, this course contributes to the development, acquisition and evaluation of the following learning outcomes:</p> <ul style="list-style-type: none"> <li>• S1.I1, S1.G1</li> <li>• S2.2</li> </ul> <p>Students who have successfully completed this course will be able to:</p> <p>1</p> <ul style="list-style-type: none"> <li>• Use the terminology of functions, relationships and together well and perform related operations when the context requires it</li> <li>• Explain the basic structure of the main proof techniques (direct proof, counterexample, proof by the absurd, induction, recurrence)</li> <li>• Apply the various proof techniques in a convincing way by selecting the most adapted to the problem posed</li> <li>• Analyze a problem to determine the underlying recurrence relationships</li> <li>• Calculate counts, permutations, arrangements on sets as part of an application.</li> </ul>

	<ul style="list-style-type: none"> <li>• Modeling various real-world problems encountered in computer science using the appropriate forms of graphs</li> <li>• Explain the problem of the shortest path in a graph and apply classical algorithms to solve this problem</li> </ul>
Evaluation methods	<p>A mandatory project/case study that counts for 2 out of 20 points. If the project report is not done (no report submitted), the student will not be allowed to pass the exam.</p> <p>A written exam organized in session counting for 18 out of 20 points. Organized on-site or remotely, depending on the health situation.</p>
Teaching methods	<p>About 30 hours of lectures, on-site or remotely depending on the situation.</p> <p>A mandatory project/case study on the implementation of an algorithm.</p>
Inline resources	<p>On <a href="#">Moodle</a></p>
Bibliography	<p>Rosen K., Discrete mathematics and its applications, 8th edition, 2019. Mc Graw Hill.</p>
Faculty or entity in charge	<p>INFO</p>

<b>Programmes containing this learning unit (UE)</b>				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Bachelor in Computer Science	<a href="#">SINF1BA</a>	5	<a href="#">LINFO1112</a>	
Master [120] in Data Science : Statistic	<a href="#">DATS2M</a>	5		