PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
COLLEGE OF ENGINERING
DEPARTAMENT OF COMPUTER SCIENCE
ABET COURSE SYLLABI

IIC1253 DISCRETE MATHEMATICS

Credits and contact hours:	10 credits / 3 h. Lectures; 1,5 h. Assistantship; 5,5 h. Independent learning experiences
Instructor's name:	Gabriel Diéguez Franzani
Course coordinator's name	Marcelo Arenas Saavedra
Textbook:	- Discrete Mathematics with Applications. Epp, S. (2010) - Discrete Mathematics and Its Applications. Rosen, K. (2011)
Course Catalog Description:	The goal of the course is to introduce the basic concepts and mathematical models needed for the study of Computer Science. The course covers both theoretical and practical aspects of discrete mathematics and its applications to various computer science fields. During the course, students are expected to develop the capacity to abstract, formulate and formally solve mathematical problems related to computer science, to domain fundamental concepts of graph theory and analysis of algorithms, and to determine, in a basic way, the difficulty of computational problems with respect to its practical solutions.
Prerequisite Courses:	MAT1203 Linear Algebra
Co-requisite Courses:	None
Status in the Curriculum:	Required
Course Learning Outcomes:	1. Formulate formal mathematical statements (such as definitions and theorems) using logic, set theory, relations, functions, cardinality and other tools, as well as prove these statements using various techniques. 2. Prove properties of discrete sets and formally define discrete objects using mathematical induction. 3. Formally model a problem using sets, relations and their properties, and prove properties about proposed models. 4. Formally model a discrete problem using graphs, and prove properties about proposed models. 5. Formally prove the correctness of simple algorithms, and determine the computational complexity of algorithms using asymptotic notation to estimate their running time. 6. Determine the relative difficulty of algorithms, using basic complexity

theory notions.

Relation of Course to ABET Criteria:

a. Knowledge of mathematics, science and engineering
e. Identify, formulate, and solve engineering problems
k. Techniques, skills, and modern tools for engineering practice.

Topics covered:

1. Mathematical induction: well-ordering principle, induction principle, strong induction, inductive definitions, structural induction, applications to data structures.
2. Propositional logic: syntax, semantics, truth tables, functional completeness, satisfiability, normal forms, logical consequence, resolution technique.
3. Elementary Set theory: axioms, operations, set definitions.
4. Relations and functions: tuples, general definition, binary relations and their properties, equivalence relations, order relations.
5. Functions and Cardinality: functions and their properties, pigeonhole principle, cardinality of finite, countable and uncountable sets.
6. First order logic: syntax, semantics, satisfiability, logical consequence.
7. Introduction to graph theory: basic definitions, isomorphism, paths, cycles, complete and bipartite graphs, adjacency and incidence matrices, connectivity, Eulerian and Hamiltonian paths and cycles, trees.
8. Introduction to number theory: modular arithmetic, Fermat's little theorem, greatest common divisor, inverses, applications to cryptography, RSA protocol.
9. Algorithm analysis: asymptotic notation, correctness and complexity of iterative and recursive algorithms.
10. Introduction to computational complexity theory.