ACADEMIC PROGRAM

LOGIC AND DISCRETE MATHEMATICS

B.F.A. IN **COMPUTER SCIENCE**

MODALITY: ON CAMPUS

ACADEMIC YEAR: 2022-2023

Name of the course:	Logic and Discrete Mathematics
Degree :	Computer Science
Location:	Centro Universitario de Tecnología y Arte Digital
Area:	Science Fundamentals
Year:	1º
Teaching period:	1
Type:	B
ECTS credits:	6
Teaching modality:	On campus
Language:	English
Lecturer / Email	Christopher Hawkins /christopher.hawkins@u-tad.com
Web page:	http://www.u-tad.com/

SUBJECT DESCRIPTION

Area description

This subject is an integral part of the area of scientific fundamentals. This material provides the student with the mathematical base that enables them to acquire the degree of abstraction necessary to solve problems that arise in the world of software engineering.

Subject description

Logic and Discrete Mathematics deals with various areas of mathematics such as sets, graphs and arithmetic, which are of interest in the training of the future engineer in relation to the processing and storage of information in computers, the design and development of algorithms and the basis of data structures and operating systems. The subject also covers aspects such as combinatorics and recurring relationships, necessary for solving practical engineering problems.

The mathematical foundation provided by Logic and Discrete Mathematics develops rigor in reasoning, the capacity for abstraction and the capacity for formalization based on the use of mathematical language, necessary skills for the future engineer.

COMPETENCIES AND LEARNING OUTCOMES

Competencies

BASIC AND GENERAL SKILLSs

CB1: Students demonstrate possession and understanding of knowledge in an area of study that is based on general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge arising from the forefront of their field of study.

CB2: Students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are typically demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

CB3: Students have the ability to gather and interpret relevant data (normally within their area of study) in order to make judgments that include a reflection on relevant issues of a social, scientific or ethical nature.

CB4: Students can transmit information, ideas, problems and solutions to both a specialized and non-specialized audience.

CB5: Students will have developed those learning skills necessary to undertake further studies with a high degree of autonomy

CG3 - Knowledge of the scientific foundations applicable to the resolution of problems in the area of computer science

CG11 – The ability to search for, analyze and manage information in order to extract knowledge from it

SPECIFIC SKILLS

CE24 – The Ability to solve mathematical problems that arise in computer engineering based on the knowledge acquired in linear algebra, differential and integral calculus and statistics

CE28 - Knowledge of the basic concepts of discrete mathematics, logic, algorithms and computational complexity and its application in solving problems in computer engineering

TRASVERSAL SKILLS

CT4 – The ability to update the knowledge acquired in the management of digital tools and technologies according to the current state of the sector and the technologies used

Learning outcomes

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- To understand and apply common demonstration strategies in mathematics (reductio ab absurdum, induction¿)

- To know and apply common numbering sets habituales (N, Z, Q, R y C).

- To know the basics of set theory.

- Basics of combinatorics in enumeration problems.

- To solve linear equation systems.

- To handle vectors, points, matrices, coordinates, distances, angles, conics, quadrics, movements, transformations, straight lines and planes in space

- To handle vector spaces and vector subspaces and linear applications.

- To apply the relation of linear applications and matrices to know the properties of a linear application according to its matrix representation.

- To apply real numbers, polynomials and expressions of inequality, absolute values, etc.

- To handle sequences and series of real number and to study their convergence.

- To understand and work intuitively and geometrically with the ideas of limits, derivative and integral.

- To know and handle common single variable functions and to find their properties (growth, maxima, minima, inflection points, concavity, convexity) and plot them.

- To be able to use elementary integration techniques of single variable functions and compute lengths, areas and volumes applying integral calculus.

- To be able to use software for symbolic computation and plotting

- To describe analytically and geometrically datasets

- To compute probabilities

- To solve elementary problems of regression, estimation and hypothesis testing

- To be able to use statistical software

CONTENTS

First Order and Propositional Logic

Combinatorics and Probability

Induction and recursivity

Graphs

Equivalence and Order relations

SUBJECT SYLLABUS

Topic 1. Logic

- 1.1. Propositional logic
- 1.2. Predicate logic
- 1.3. Boolean algebras

Topic 2. Sets

- 2.1. Naive set theory
- 2.2. Numerical sets
- 2.3. Numbering bases

Topic 3. Combinatorics

3.1. Basic counting principles

3.2. Variations, permutations and combinations

3.3. Combinatorial numbers

Topic 4. Recursion and recurring relationships

4.1. Homogeneous linear recurrence relations

4.2. Inhomogeneous linear recurrence relations

Topic 5. Relationships

5.1. Binary relationships

5.2. Equivalence relations

5.3. Order relations

Topic 6. Graphs

6.1. Basic concepts

6.2. More about graphs

6.3. Roads

Topic 7. Trees and graph algorithms

7.1. Algorithms to check the connection of a graph

7.2. Algorithms for finding minimum spanning trees

7.3. Algorithm for finding minimum paths

TRAINING ACTIVITIES AND TEACHING METHODOLOGIES

TRAINING ACTIVITIES

LEARNING ACTIVITIES	Total hours	Hours of presence
Theoretical / Expository classes	30,00	30,00
Practical classes	24,00	24,00
Tutorials	4,00	2,00
Independent study and autonomous work of the student	57,50	0,00
Elaboration of work (group or individual)	28,50	0,00
Evaluation Activities	6,00	6,00

TOTAL	150	62

Teaching methodologies

Expository method or master lesson

Case learning

Learning based on problem solving

Cooperative or collaborative learning

inquiry learning

Flipped classroom methodology

Gamification

Expository method or master lesson

Case method

Learning based on problem solving

Cooperative or collaborative learning

inquiry learning

Flipped classroom methodology

Gamification

TEMPORAL DEVELOPMENT

DIDACTIC UNITS / TOPICS TIME PERIOD

Logic Weeks 1 and 2

Sets Weeks 3 and 4

Combinatorial Weeks 5 and 6

Recursion and recurring relationships Weeks 7 and 8

Relationships Weeks 9 and 10

Graphs Weeks 11, 12 and 13

Trees and graph algorithms Weeks 14 and 15

EVALUATION SYSTEM

ASSESSMENT SYSTEM	MINIMUM SCORE RESPECT TO THE FINAL ASSESSMENT (%)	MAXIMUM SCORE RESPECT TO THE FINAL ASSESSMENT (%)
Assessment of participation in class, exercises or projects of the course	0	30
Assessment of assignments, projects, reports, memos	30	60
Objective test	30	60

GRADING CRITERIA

ASSESSMENT SYSTEM	ORDINARY EVALUATION	EXTRAORDINARY EVALUATION
Assessment of participation in class, exercises or projects of the course	10	10
Assessment of assignments, projects, reports, memos	30	30
Objective test	60	60

General comments on the evaluations/assessments

The evaluation of participation in class, in practices or in projects of the subject will be carried out based on attendance and active participation in class and in the rest of the activities developed during the course. This aspect will represent 10% of the final grade of the subject in the call ordinary.

- Throughout the course, activities, exercises and problems will be proposed that must be be delivered before the indicated date through the virtual platform. This work will be evaluated through the virtual platform itself and will represent 30% of the final grade of the subject in the ordinary call.

- In the middle of the semester a partial exam will be taken, which will be liberating if so. the student desires it with the condition of obtaining at least a grade of 4.0 in said exam. Those students who do not pass that grade or who decide

voluntarily discard it, they must carry out corresponding examinations to the two midterms on the date assigned for the ordinary January call. The two partial exams will represent 60% of the final grade in the ordinary call (30% each).

- To pass the subject in the ordinary call, it is essential that the final grade (including midterm exams, problems and activities to be delivery and participation) is at least 5.0 (out of 10). In addition to that requirement, It is necessary that the average of the partial exams be at least 5.0 (out of 10), allowing the individual grade of one of the two partial exams to be greater than or equal to 4.0 (out of 10). If any of these are not met requirements, the subject will be automatically considered failed regardless of the rest of the qualifications.
- If you do not get the approval in the ordinary January call, the student will be able to take the extraordinary call in July, where He will take a final exam that will represent 100% of his grade in said call, and in which the entire course will be part of the subject required of the student. subject content seen in class (including the activities delivered through the virtual classroom).
- In the exams, only scientific calculators and those forms that are permitted, for which the student must refer to the specific instructions from the teacher on this topic.
- No grades of any kind will be kept between different academic years, nor between different calls.

LIST OF REFERENCES (BOOKS, PUBLICATIONS, WEBSITES):

Bibliografía Básica:

• Matemática Discreta. F. García Merayo. Ed. Paraninfo.
• Elementos de Matemática Discreta. E. Bujalance, A. F. Costa, J. A.

Bujalance y E. Martínez. Ed. Sanz y Torres.

Bibliografía Recomendada:

• Matemática Discreta y Combinatoria. R. Grimaldi. Ed. Pearson.

• Matemática Discreta y Aplicaciones. K. H. Rosen. Ed. McGraw-Hill.

• Problemas Resueltos de Matemática Discreta. F. García Merayo, G. Hernández Peñalver, A. Nevot Luna. Ed. Paraninfo.

• Problemas de Matemática Discreta. E. Bujalance, A. F. Costa, J. A. Bujalance y E. Martínez. Ed. Sanz y Torres.

• Algorithms. R. Sedgewick y K. Wayne. Ed. Addison-Wesley

REQUIRED MATERIALS, SOFTWARE AND TOOLS

Type of classroom

Theory classroom

Board and projection system

Materials:

Personal computer.

Notebook or tablet for taking notes

Software:

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