



Universidad de Jaén

School of Engineering of Jaén

Discrete mathematics

2024-2025

Grado en Ingeniería Informática (E.P.S. Jaén)



CREA



Acceso Mayores 40

Guías docentes UJA

Horarios de tutorías

Llamamientos PAU

Movilidad (Coordinador)

P.O.D.

Solicitud bilingüismo

Syllabus 2024-25 - 13311008 - Discrete Mathematics (Matemática discreta)

Caption

- Level 1: Tutorial support sessions, materials and exams in this language
- Level 2: Tutorial support sessions, materials, exams and seminars in this language
- Level 3: Tutorial support sessions, materials, exams, seminars and regular lectures in this language

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DEGREE:

Grado en Ingeniería informática

FACULTY:

SCHOOL OF ENGINEERING OF JAÉN

ACADEMIC YEAR:

2024-25

COURSE:

Discrete Mathematics

SYLLABUS

1. COURSE BASIC INFORMATION

NAME: Discrete Mathematics

CODE: 13311008

ACADEMIC YEAR: 2024-25

LANGUAGE: English

LEVEL: 3

ECTS CREDITS: 6.0

YEAR: 1

SEMESTER: PC

2. LECTURER BASIC INFORMATION

NAME: GARCÍA MUÑOZ, MIGUEL ÁNGEL

DEPARTMENT: U124 - MATEMÁTICAS

FIELD OF STUDY: 005 - ÁLGEBRA

OFFICE NO.: B3 - 016

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P: 953212935

WEBSITE: www4.ujaen.es/~magarciaORCID: <https://orcid.org/0000-0002-6252-0592>

LANGUAGE: English

LEVEL: 3

3. CONTENT DESCRIPTION

Our goal in this course is to build skills and give you experience in areas such as Mathematical Reasoning (ability used by a computer engineer in constructing proofs and in writing programs), Discrete Structures (abstract mathematical structures used to represent discrete objects and relationships between them) and Algorithmic Thinking (some problems are solved by the specification of an algorithm that can be implemented in a program). Topics covered in the course include:

Unit 1. Fundamentals of logic.

Statements, connectives and truth tables. Normal forms. Adequate sets of connectives. Proof techniques. Arguments and validity.

Unit 2. Sets and order relations.

Basic concepts. The power set of a set. Functions. Equivalence relations. Order relations.

Unit 3. Boole algebras. Boolean functions.

Lattices. Types of lattices. Boole algebra. Boolean functions: canonical forms. Applications: boolean circuits.

Unit 4. Introduction to number theory: modular arithmetic.

Natural number: induction and first properties. Integers. Divisibility and congruences. Bezout theorem applications. Congruences and numbering systems.

Unit 5. Notions of computational complexity.

Algorithms. Growth functions. Complexity of an algorithm. The classes P and NP.

In practical classes we solve exercises and use the software Mathematica in order to solve problems related to all the topics previously develops in the course.

Practice 1: The working environment: Mathematica.

Practice 2: Basic arithmetic. Variables and functions.

Practice 3: Lists: Tables, matrices and vectors.

Practice 4: Programming in Mathematica

Practice 5: Propositional logic: Connectives and truth tables.

Practice 6: Propositional logic: Tautologies, contradictions, normal forms. Logical equivalences and implications. Arguments.

Practice 7: Sets and functions.

Practice 8: Binary relations and ordered sets.

Practice 9: Lattices and finite Boole algebras.

Practice 10: Boolean functions.

Practice 11: Natural and integer numbers. Divisibility.

Practice 12: Natural and integer numbers. Congruences and numbering systems.

Practice 13. Algorithmic complexity.

4. COURSE DESCRIPTION AND TEACHING METHODOLOGY

- Lecture (Theory): there will be two one-hour-long sessions each week during all the semester. These sessions will be devoted to regular lectures and problem solving, using a video projector and computer-generated slides. The lecturer makes their notes available online after a lecture through his institutional web which can help to supplement the notes you take during the class. You have to attend lectures in order to make better use of the course. The contents of the subject will be achieved and understood, relying on advanced textbooks (CB1R). Those learning skills necessary to undertake further studies with a high degree of autonomy will be developed (CB5R). Mathematical problems that may arise in engineering will be solved, knowledge of the subject will be applied, understood and mastered (learning outcomes 1, 2 and 4).
- Lecture (Practice): they will be two hours long, and will be held weekly during the semester. In these classes students will solve with the help of computer problems related to content of the subject. In these classes also will be presented in a more practical way, those theoretical contents of the subject which will not be exposed in the theory lectures. Finally, teacher will solve on the blackboard, and if it is possible, he will be used the computer, exercises of the subject that has previously been proposed to the student for the work at home. You may be asked to work individuals. In most cases, you will be asked to 'write up' your work and this will be assessed with the mark contributing to your overall exam result. You have to attend your practical classes in order to make better use of the course. The contents of the subject will be achieved and understood, relying on advanced textbooks (CB1R). The ability to understand and master the basic concepts of discrete mathematics, logic, algorithms and computational complexity, and its application to solve engineering problems, will be achieved. (CBB3R). Mathematical problems that may arise in engineering will be solved, knowledge of the subject will be applied, understood and mastered (learning outcomes 1, 2 and 4).

Students with special educational needs should contact the Student Attention Service (Servicio de Atención y Ayudas al Estudiante) in order to receive the appropriate academic support

5. ASSESSMENT METHODOLOGY

To pass the course is necessary to obtain a score of 5 out of 10 points between the weighted average of theory and practical part of the course; In order to calculate such average, it will also be essential to have obtained a minimum of 4 out of 10 points in each block (theoretical and practical part). When a student will not reach the minimum in a block, the rating which it will reflect in the minutes will be less than 4 out of 10. The positive evaluation will mean that the student has sufficiently achieved the learning results: 1, 2 y 4.

The block "Theoretical concepts of the subject" (S2) will be evaluated by means of a final exam with 60% of the weight of that block, and another 40% by continuous evaluation, attending to the interest of the student and their circumstances, provided that they are duly accredited in a timely manner. In extraordinary call 2, and as established by the regulations of the University of Jaén, 100% of the block may be evaluated.

The block "Computer Practices" (S3) will be evaluated 100% by continuous evaluation, with attendance to class, the preparation of a notebook of practice and one or more continuous evaluation tests with which will be determined the students' grade and will be verified the authorship of the notebook. In the extraordinary call, only one exam will

be carried out with 100% for students who have not passed or do not wish to maintain continuous evaluation. In each continuous assessment test and in all calls, it will be mandatory to bring, to verify its realization, all the exercises in the printed notebook.

The block "Attendance and participation" (S1) will be evaluated through active participation and the delivery of theoretical and practical exercises.

In relation to the overall weight of the course, the continuous evaluation of the three blocks (S1, S2 and S3), represents 52% of the subject.

The qualification of blocks S2 and S3, which exceed 5 out of 10 points, if the subject has not been approved, will be maintained in each of the official calls for the academic year.

Students who have done some test belong to continuous assessment will appear in the academic record of the ordinary call 1as presented, even if they do not done the final exam.

In the face-to-face exams of each call or in any class exercise which is qualifying, except for special and particular circumstances that will be specified by your teacher, electronic devices, notes, books or any other medium that allows the storage or transmission of data will not be allowed. In the event of non-compliance, it will act according to current regulations.

Competences assessed in the theoretical part: CB1R and CB5R.

Competences assessed in the practical part: CB1R and CBB3R.

6. BOOKLIST ([Access the bibliography in the Library catalog](#))

MAIN BOOKLIST:

- Discrete and Combinatorial Mathematics. Edition: 5ª. Author: Grimaldi, Ralph P.. Publisher: Pearson Education ([Library](#))
- Matemática discreta para la computación: nociones teóricas y problemas resueltos . Edition: -. Author: García Muñoz, Miguel Ángel. Publisher: Jaén: Universidad de Jaén, Servicio de Publicaciones, 2010 ([Library](#))
- Métodos computacionales en álgebra para informáticos: matemática discreta lógica. Edition: -. Author: García Muñoz, Miguel A.. Publisher: [Jaén]: Área de Álgebra, Universidad de Jaén, [2006] ([Library](#))
- Discrete mathematics. Edition: -. Author: Norman L. Biggs ([Library](#))
- Logic for mathematicians. Edition: Rev. ed.. Author: Hamilton, Alan G.. Publisher: Cambridge [etc] : University Press, cop. 2000 ([Library](#))
- Discrete mathematics and its applications. Edition: 6th ed. Author: Rosen, Kenneth H.. Publisher: Boston [etc.]: McGraw-Hill, cop.2007 ([Library](#))

ADDITIONAL BOOKLIST:

- Mathematica: a system for doing mathematics by computer. Edition: 2nd. ed. Author: Wolfram, Stephen. Publisher: Reading: Addison-Wesley Publishing Company, cop. 1991 ([Library](#))
- Mathematica : a practical approach. Edition: 2nd. ed. Author: Blachman, Nancy. Publisher: Upper Saddle River: Prentice Hall, 1999 ([Library](#))
- Discrete and combinatorial mathematics : an applied introduction. Edition: 5th ed., Pearson New International ed.. Author: Grimaldi, Ralph P.. Publisher: Harlow : Pearson Education, cop. 2014 ([Library](#))
- 2000 solved problems in discrete mathematics. Edition: -. Author: Lipschutz, Seymour. Publisher: New York [etc.] : Mac Graw-Hill, 2000 ([Library](#))

7. SUSTAINABLE DEVELOPMENT GOALS

Educación de calidad

DETAILED INFORMATION

Quality Education: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

8. VIRTUAL / CLASSROOM TEACHING SCENARIO

Class at the time and classroom assigned to one part of the group and retransmission by videoconference to the rest, with periodic rotation of students, as determined by the Center (*).

Attendance:

Face-to-face teaching in the multimodal or mixed scenario will be: non-rotating whenever possible for 100% of the students in the assigned time and classroom (**), and rotating when it is not possible.

Temporal planning:

The temporal planning and schedule will be the same in any scenario: if attendance is 100%, a rotating system or an exclusively online teaching system. Since, the only varying thing will be the teaching methodology.

Methodology:

If a weekly rotation system for face-to-face teaching is established, each subgroup will receive face-to-face teaching for a full week, alternating with the rest of the subgroups. The subgroup of students assigned that week will be attended in person, while the rest of the students attend the class, (according to the instructions that the Center has given), by means of videoconference retransmission (1).

- Expository classes in large groups, face-to-face/online (1) rotating 50% (or a different percentage according to the indications of the Center), where a large part of the contents of the subject will be presented, as well as typical examples.
- Classes in practical groups, face-to-face/online (1) rotating 50% (or a different percentage according to the instructions of the Center), in which problems related to the contents exposed in the classes in large groups will be solved with the help of the computer. At the same time, these classes will expose, in a more practical way, those theoretical contents of the subject not exposed in the expository classes. Finally, they will be solved on the blackboard, and whenever possible using the computer, exercises of the subject that have previously been proposed to the student to work at home.

Evaluation:

The blocks, percentages and evaluation will be the same in any scenario, only varying the evaluation methodology, and in particular the exercises or exams, which will be face-to-face or online. Whenever possible, attempts will be made to carry out the exercises or exams in person.

In the face-to-face exams of each call or in any scoring exercise of the class that is carried out, except for special and particular circumstances that will be specified by your teacher, it is not allowed electronic devices, notes, books or any other supports which allows the data storage or transmission. In case of non-compliance, the current regulations will be acted upon.

In case of online exams, they will be carried out according to the recommendations provided by the University of Jaén.

An online and oral evaluation will be used for those students who have technical or other difficulties (duly justified) that occur during the evaluation process, or when the teaching staff cannot verify the authorship of the tests carried out.

The mandatory instructions for taking online exams and exercises, continuous assessment or official calls, will be published well in advance in virtual teaching space of the subject. In such instructions will consider the compatibility of carrying out all the tests online, with the use of a webcam, recordings, etc. according to the guidelines given by this university.

Each student must have the necessary technical means to be able to carry out the online exams, such as a computer, webcam, microphone and the necessary software in each case. In this sense, according to instructions received from the General Secretariat of the University of Jaén, the teaching staff must comply with the duty of information contained in article 13 of the General Regulation on Data Protection (Regulation (EU) 2016/679 of the European Parliament and of the Council of April 27, 2016) and report the recording of the exam by video call, through Google's Hangouts Meet platform (2), as an essential instrument to guarantee the transparency of the process.

Competences evaluated in the theoretical part: CB1R and CB5R

Competences evaluated in the practical part: CB1R and CBB3R.

Resources and infrastructures (2):

- Those necessary, for online monitoring of classes, online tutorials, online exercises, ... (Google Meet, Google Form, YouTube, Virtual Teaching, ...).
- Tablets or tablets PC, replacing the blackboard, to teach online classes and tutoring.
- Videos of different types made for theory and practice by the teaching staff of the subject.
- Programs for self-assessment exercises carried out by the teaching staff of the subject.
- Own design software for the generation and proposal of a unique, different and random exam for each student from a large random bank of questions, and online.

(*) The Center may establish a different attendance percentage depending on the number of students and the capacity of the classroom/laboratory.

(**) The Center may establish rotating attendance depending on the number of students and capacity of the classroom/laboratory (class on the schedule and classroom/laboratory assigned to one part of the group and retransmission by videoconference to the rest, with periodic rotation of students, as determined by the Center).

(1) In the multimodal and/or non-face-to-face scenario, when appropriate, the teaching staff involved in the delivery of the teaching reserves the right not to give consent for the capture, publication, retransmission or reproduction of their speech, image, voice and explanations of the chair, in the exercise of their teaching functions, within the scope of the University of Jaén.

(2) The software or hardware that will be used to carry out the exams or exercises, classes or online tutorials, will be the one specified or any other equivalent or updated that is provided or recommended by the University of Jaén.

9. VIRTUAL TEACHING SCENARIO

Face-to-face teaching:

Teaching will be exclusively online.

Temporal planning:

The temporal planning and schedule will be the same in any scenario: if the attendance is 100%, a rotating system or an exclusively online teaching system. Since, the only varying thing will be the teaching methodology.

Methodology:

- Expository classes in large online groups (1) where a large part of the contents of the subject will be presented, as well as typical examples.
- Classes in online practice groups (1), in which problems related to the contents exposed in the classes in large groups will be solved with the help of the computer. At the same time, those theoretical contents of the subject which have not been exposed in the expository classes yet, will be presented in these classes, in a more practical way. Finally, exercises of the subject that have previously been proposed to the student to work at home will be solved on the blackboard, and whenever possible using the computer.

Evaluation:

The blocks, percentages and evaluation will be the same in any scenario, only varying the evaluation methodology, and in particular the exercises or exams, which will be face-to-face or online. Whenever possible, it will attempt to carry out the exercises or exams in person.

In case of online exams, they will be carried out according to the recommendations provided by the University of Jaén.

An online and oral evaluation will be used for those students who have technical or other difficulties (duly justified) that occur during the evaluation process, or when the teaching staff cannot verify the authorship of the tests carried out.

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Each student must have the necessary technical means to be able to carry out the online exams, such as a computer, webcam, microphone and the necessary software in each case. In this sense, according to instructions received from the General Secretariat of the University of Jaén, the teaching staff must comply with the duty of information contained in article 13 of the General Regulation on Data Protection (Regulation (EU) 2016/679 of the European Parliament and of the Council of April 27, 2016) and report the recording of the exam by video call, through Google's Hangouts Meet platform (2), as an essential instrument to guarantee the transparency of the process.

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- Programs for self-assessment exercises carried out by the teaching staff of the subject.
- Own design software for the generation and proposal of a unique, different and random exam for each student from a large random bank of questions, and online.

(1) In the multimodal and/or non-face-to-face scenario, when appropriate, the teaching staff involved in the delivery of the teaching reserves the right not to give consent for the capture, publication, retransmission or reproduction of their speech, image, voice and explanations of the chair, in the exercise of their teaching functions, within the scope of the University of Jaén.

(2) The software or hardware that will be used to carry out the exams or exercises, classes or online tutorials, will be the one specified or any other equivalent or updated that is provided or recommended by the University of Jaén.

DATA PROTECTION CLAUSE (on line exams)

Institution in charge of data processing: Universidad de Jaén, Campus Las Lagunillas, s/n, 23071 Jaén

Data Protection Delegate: dpo@ujaen.es

Purpose: In accordance with the Universities Law and other national and regional regulations in force, carrying out exams and assessment tests corresponding to the courses students are registered in. In order to avoid frauds while sitting the exam, the exam will be answered using a videoconference system, being able the academic staff of the University of Jaén to compare and contrast the image of the person who is answering the exam with the student's photographic files. Likewise, in order to provide the exam with evidential content for revisions or claims, in accordance with current regulation frameworks, the exam will be recorded and stored.

Legitimacy: compliance with legal obligations (Universities Law) and other national and regional regulations currently in force.

Addressees: service providers who are the owners of the platforms where the exams are carried out and with whom the University of Jaén has signed the corresponding data access contracts.

Storage periods: those established in current in force regulations. In the specific case of exam videoconference recordings, not before the examination records and transcripts are closed or the exam can still be reviewed or challenged.

Rights: you can exercise your right of access, amendment, cancellation, opposition, suppression, limitation and portability by sending a letter to the postal or electronic address indicated above. In the event that you consider that your rights have been violated, you may submit a complaint to the Andalusian Council for Transparency and Data Protection www.ctpdandalucia.es

CLASS RECORDING CLAUSE PERSONAL DATA PROTECTION

Person in charge: Universidad de Jaén, Paraje Las Lagunillas, s/n; Tel.953 212121; www.ujaen.es

Data protection delegate (DPO): TELEFÓNICA, S.A.U. ; Email: dpo@ujaen.es

Procedure aim: To manage proper recordings of teaching sessions with the aim of facilitating learning process under a multimodal and/or online teaching

Period for record storage: Images will be kept during legal term according to regulations in force

Legitimacy: Data will be managed according to legal regulations (Organic Law 6/2001, December 21, on Universities) and given consent provided by selecting corresponding box in legal admission documents

Data recipients (transfers or assignments): Any person allowed to get access to every teaching modality

Rights: You may exercise your rights of access, rectification, cancellation, portability, limitation of processing, deletion or, where appropriate, opposition. To exercise these rights, you must submit a written request to the Information, Registration and Electronic Administration Service of the University of Jaen at the address above, or by e-mail to the address above. You must specify which of these rights you are requesting to be satisfied and, at the same time, you must attach a photocopy of your ID card or equivalent identification document. In case you act through a representative, legal or voluntary, you must also provide a document that proves this representation and identification. Likewise, if you consider that your right to personal data protection has been violated, you may file a complaint with the Andalusian Data Protection and Transparency Council www.ctpdandalucia.es

Campus Las Lagunillas s/n | 23071 - Jaén

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