Introdução às Bases de Dados

Course Presentation

FCUL, Departamento de Informática

Ano Letivo 2021/2022

Ana Paula Afonso

Presentation

- Presentation and available resources
- Motivation
  - why do we require databases?
  - what are database management systems?
- Purpose and course program
- Project
- Evaluation and grading
- Bibliographic information

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Presentation and communication

- Theoretical and T-Practical/Laboratory classes
  - Ana Paula Afonso
- Schedule
  - T classes: Tuesdays, **16h10** (16h00) - 18h00
    room 6.2.53
  - T-Practical/Lab classes
    Tuesdays: 13h30 – room 8.2.06 – computer lab (1.2.22)
    Tuesdays: 18h00 – room 8.2.10 – computer lab (1.2.22)

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Presentation and communication

- Communication
  - docentes-ibd@listas.di.ciencias.ulisboa.pt
  - IBD Web page: MOODLE FCUL
    https://moodle.ciencias.ulisboa.pt/course/view.php?id=3148
    Announcements
    Student Forum
  - Teacher office hours: Tuesdays, 15h00-16h00,
    Office: 6.3.44 or
    https://videoconf-colibri.zoom.us/my/apafonso

    before send an email to docentes-ibd@listas.di.ciencias.ulisboa.pt

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Schedule: rooms and labs

Horas	Segunda	Terça	Quarta	Quinta	Sexta
13:30 - 14:00		[1MSIG-TeA; 1MEIO; 1MBBC; 1PGDS; 1MI; 1PGI; 1MCD] [8_2_06] [TP] TP12 **Lab. 1.2.22**			
14:00 - 14:30					
14:30 - 15:00					
15:00 - 15:30					
15:30 - 16:00					
16:00 - 16:30		[1MSIG-TeA; 1MEIO; 1MMAEG; 2MMAEG; 1MBioEst; 1PGEABCS; 1MBBC; 1PGDS; 1MEGE; 2MEGE; 1MI; 1PGI; 1MCD] [6_2_53] [T] T11			
16:30 - 17:00					
17:00 - 17:30					
17:30 - 18:00					
18:00 - 18:30		[1MSIG-TeA; 1MMAEG; 2MMAEG; 1MBioEst; 1PGEABCS; 1MBBC; 1PGDS; 1MEGE; 2MEGE; 1MI; 1PGI; 1MCD] [8_2_10] [TP] TP11 **Lab. 1.2.22**			
18:30 - 19:00					
19:00 - 19:30					
19:30 - 20:00					

IBD Web page Plan

T/P weeks

Room or Lab

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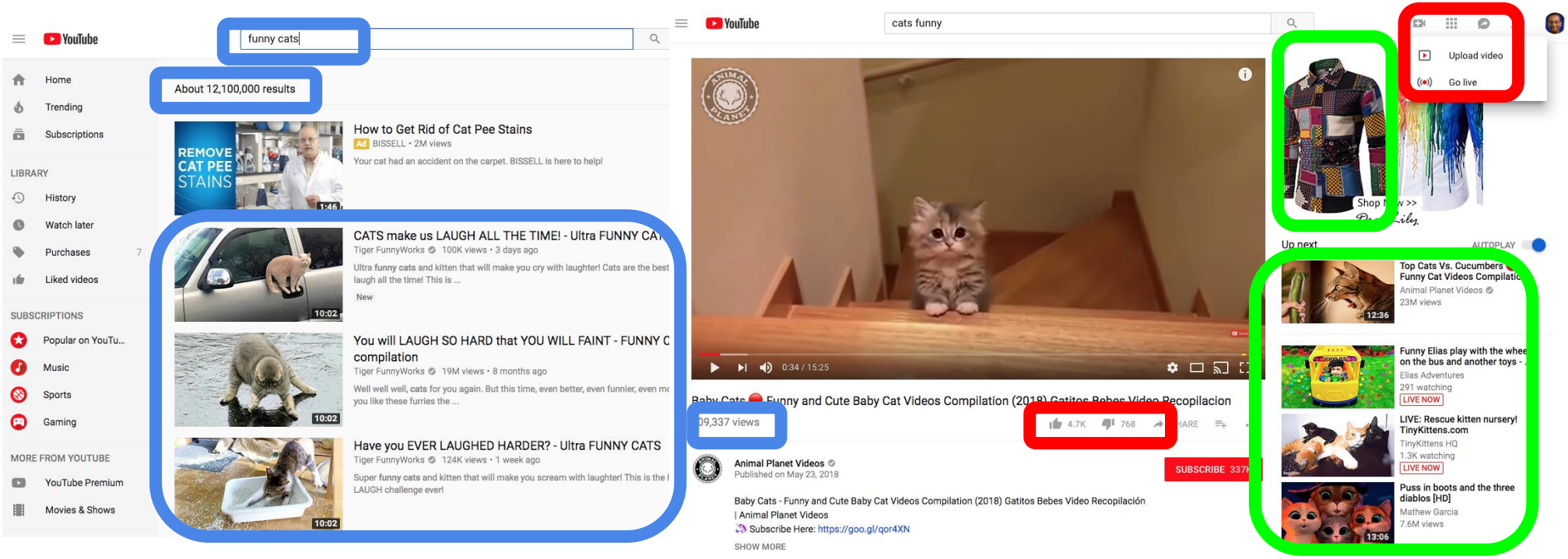
Motivation

data, database e database management systems

Example: YouTube



Motivation

data, database e database management systems

Other examples: Facebook …

users, friends, activities, annoucements, …

clients, consumptions, billing

clients, doctors, consultations, exams

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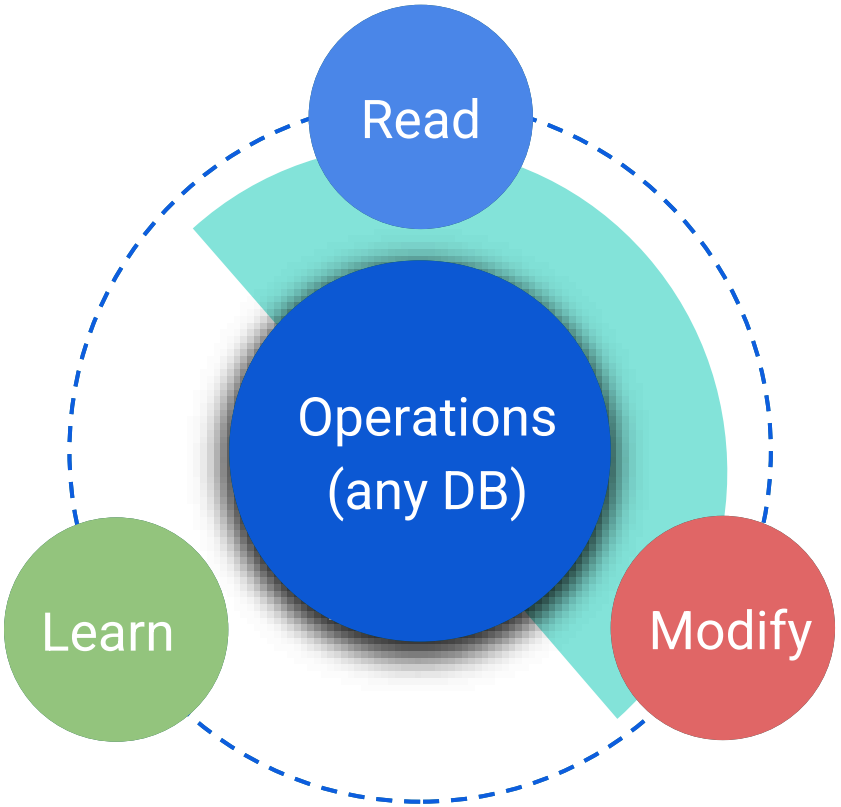
Goals of standard databases

Store and **manage** information



Supporting

- Scale
- Speed
- Stability
- Evolution
- Reliability
- Cost efficiency

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Introduction

- Since the 90's, organizations become aware that information is one of their most critical and valuable assets
- Information value depends uppon its validity, correctness and availability
- Database systems are essential tools for managing information

Data vs Information

Data are real world facts
Answers to a survey or a physical measurement are considered as "data"

Information results from data processing presented in such a way to allow interpretation and give the fundament for decision making

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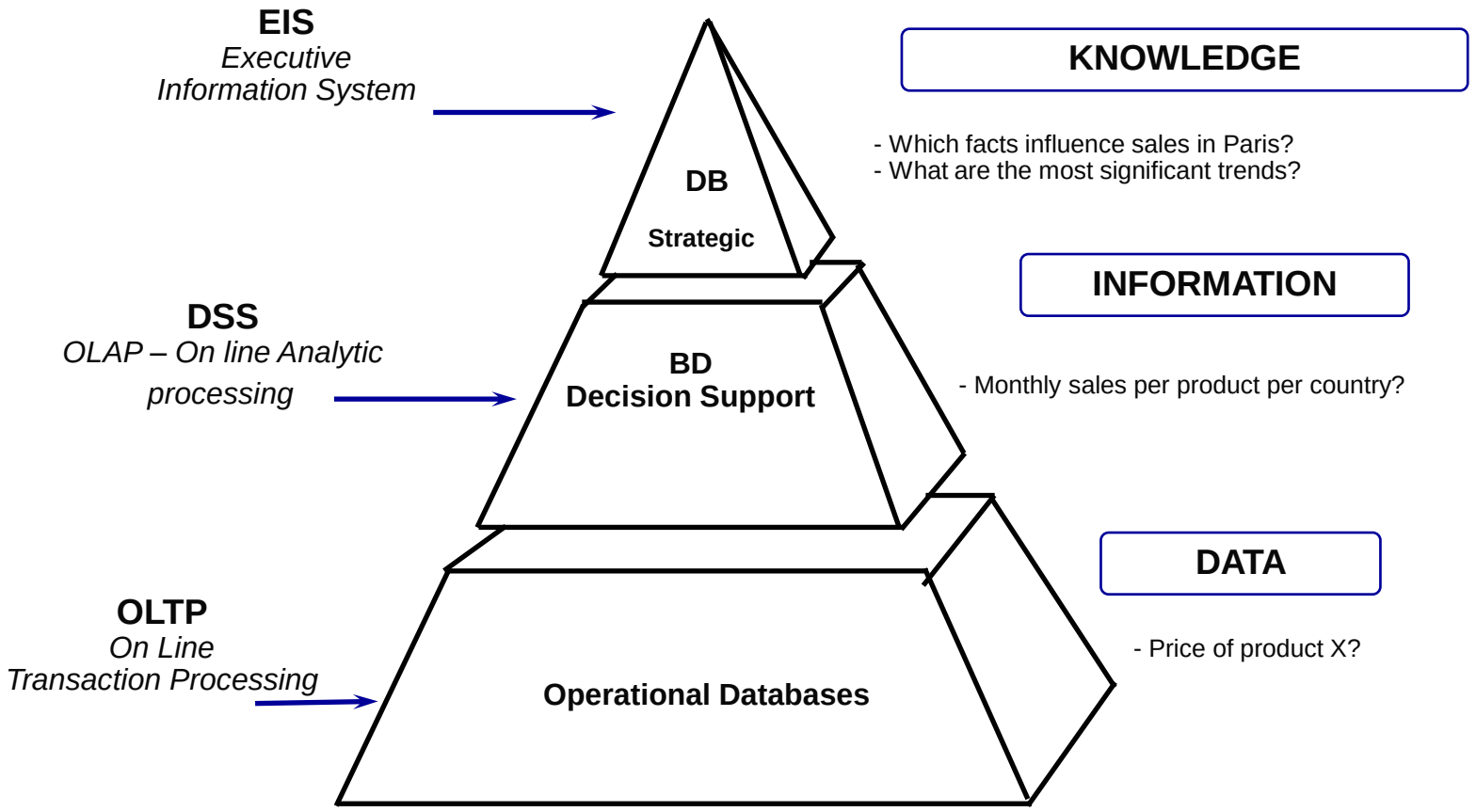
Information Systems



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10

Database Management Systems (DBMS)

- What is a Database?
  - A large collection of integrated data
  - Model the intrinsic characteristics of the universe it tries to encompass:

    Entities (e.g., Students, Courses)

    Relationships (e.g., Ana is enrolled in IDB)

- What is a DBMS?
  - It is a software package designed to store and manage large amounts of data and coordinate user access

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Advantages and disadvantages of using a DBMS

- **Advantages of using a DBMS**
  - Data independence
  - Efficient access
  - Reduced time for developping and maintaing applications
  - Easy and centralized **data integrity** mechanisms and **increased security**
  - Uniform and simplified administration
  - Allows for concurrent access and easy fault recovery
- **Disadvantages**
  - Data sharing creates conflict
  - It is harder to maintain than simple file systems
  - Requires specialized training
  - Typically larger investment in software and hardware
  - They may not be as performant as some file based systems

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Objectives

- To acquaint students with the fundamental principles of **data centered information systems** and information organization independent of any program language that manipulates it
- Explain and illustrate the full process of **database construction and management**. From conceptual modeling to logical models and actual implementation
  - Entity-relationship (ER) modeling
  - Relational modeling
- Explain how to manipulate data and extract data from databases using the Structured Query Language (SQL)
- Explain the principles of database interaction via a programming language with SQL

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Course summary - goals

We'll learn how to…

Design "good" databases

conceptual design, logical design, schema normalization

Query over small-med-large data sets with SQL

On relational engines

Update data sets

Writes, transactions, logging, ACID properties

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Course planning (tentative)

Semana	Data	Teóricas	Teórica Prática	Local	Entregas
1	14-Sep	Apresentação da disciplina. Métodos de Avaliação. Programa da Disciplina; Bibliografia. Introdução aos Sistemas de Gestão de Bases de Dados (capítulo 1)			Formação grupos
2	21-Sep	Desenho Conceptual de BD: Construtores do modelo EA - entidades, associações, participação e multiplicidade nas associações, entidades fracas, generalizações e agregações (capítulo 2)	Apresentação das aulas TP. Exercícios de modelação concetual	sala	Formação grupos
3	28-Sep	Desenho Conceptual de BD: Decisões no Desenho Conceptual de BD. Erros comuns, projetos complexos e verificação (capítulo 2)	Exercícios de modelação concetual	sala	Formação grupos
4	05-Oct	FERIADO	FERIADO		Formação grupos (data limite: 10 out)
5	12-Oct	Modelo Relacional: história, relação, BD relacional, SQL. Conceitos de Chaves: Chaves primárias, chaves candidatas chaves estrangeiras. Integridade de Chave, Entidade e Referencial (capítulo 3 e 5)	Exercícios de modelação concetual	sala	E1 - Simple E/R (17 out, 23:59)
6	19-Oct	Desenho Lógico de BD: Passagem do EA para relacional, entidades, associações, RI, ent. Fracas, generalizações e agregações (capítulo 3)	Introdução ao SGBD Mysql. SQL/DDL: criação tabelas, inserção de dados e regras de integridade	lab	
7	26-Oct	Desenho Lógico de BD: Vistas; Apagar e alterar tabelas e vistas (capítulo 3) Project - E1: Uma solução e erros comuns.	Passagem do diagrama EA para um esquema relacional	sala	
8	02-Nov	Introdução ao SQL/DML: Interrogações (capítulo 5) SQL/DML: Operadores de Agregação (capítulo 5)	Passagem do diagrama EA para um esquema relacional	sala	E2 - E/R, SQL/DDL (7 nov, 23:59)
9	09-Nov	SQL: Valores Nulos e Joins. Restrições de Integridade (capítulo 5)	Discussão de projetos: E2	sala	
10	16-Nov	Introdução à normalização no modelo relacional (capítulo 19)	SQL/DML - Interrogações	sala	
11	23-Nov	Conceitos de Gestão de Bases de Dados: Planeamento da Base de Dados, gestão de transações (capítulo 16)	SQL/DML - Interrogações	lab	
12	30-Nov	Conceitos de Gestão de Bases de Dados: Segurança e gestão de utilizadores (capítulo 21)	SQL/DML - Interrogações	lab	
13	07-Dec	Desenvolvimento de Aplicações com Bases de Dados (capítulo 6). Bases de dados não relacionais	SQL/DML - Interrogações	lab	E3 - SQL/DML (12 dec, 23:59)
14	14-Dec	Discussão de projetos	Discussão de projetos: E3	lab	

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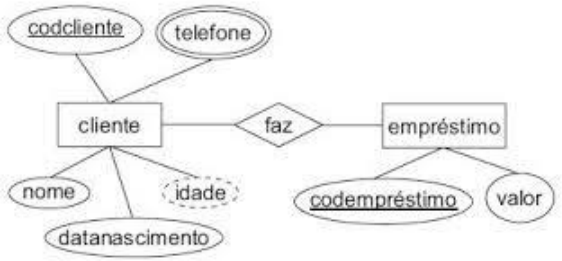
Detailed



- **Theoretical classes**
  - Overview of database managment systems
  - Conceptual database design: Entity-Relationship model and UML
  - Logical database design: Relational model, SQL DDL, and normalization
  - DBMS queries: SQL DML
  - Overview of transaction management
  - Database application development
  - NoSQL databases

- **Theoretical-pratical classes** (start next week)
  - Exercises about the subjects given in the theoretical component
  - Use of a programming language to access the database management system

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Project

Elaboration of a project, where is requested the development of relational database. Components of the project:

1. A simple Universe of Discourse (UoD) is presented to students to make a conceptual model (E/R)
2. A more complex UoD is provided and new models are built, conceptual (E/R) and logical models (SQL/DDL) are built and implemented in SQL
3. A series of query problems is given to solve in SQL/DML to a solution of Phase 2

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Evaluation method

- **Project** – **50%**
  - Project with 3 deliverables / 2 individual discussions (presential)
  - Teamwork

    group size: 3 - 4 students per group

    use the course moodle activity to create the groups (deadline: October 10)

- **Final exam** – **50%**
  - Examination calendar available at: www.fc.ul.pt/

All components must score at least 9.5 for course approval

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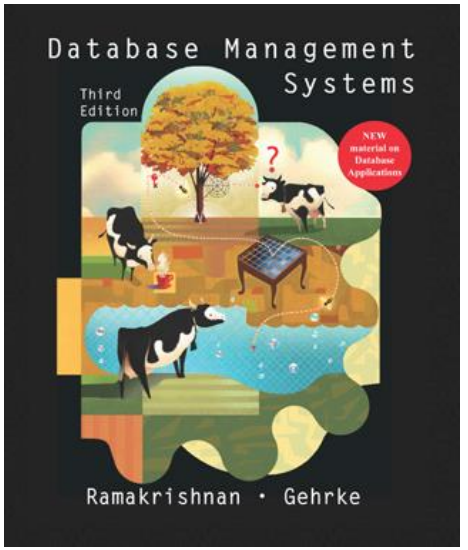
Bibliographic references



- **Essential**
  - Ramakrishnan R. and Gehrke J.
    Database Management Systems (3rd ed.), McGraw-Hill

  Also important for specific topics
  - Elmasri and Navathe - Fundamentals of Database Systems (7th ed.), Pearson

- **Course material at the FCUL's Moodle**
  - Slides of the theoretical classes (in Portuguese)
  - Lab class materials and datasets
  - Tutorials of SQL and MySQL

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Honor code rules

Any work submitted for grading should not be derived from or influenced by the work of others. All submissions are subject to plagiarism detection tools.

Examples of honor code violations include (but are not limited to):

- reusing your own or another student's assignment work from previous years
- sharing your responses/answers/code/design with other students nor publicly
- joint design/development/debugging
- use of web or public resources for public solutions
- copying code or answers
- posting up/dispersing your solutions or code on public repos

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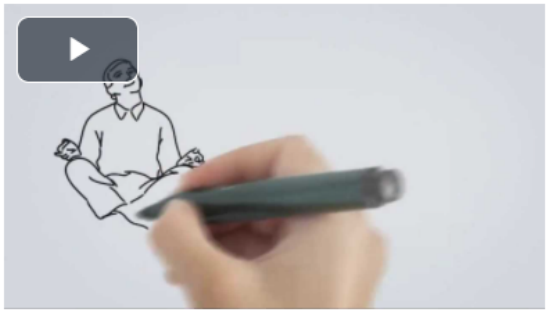
IBD Moodle web page

Introduction to Database Systems 2021-2022

(Introdução às Bases de Dados)



The main objective is to know the principles of relational database management systems, in order to develop and manage a real-world relational databases.

Contents: Overview of DataBase Managment Systems; Conceptual Database Design; Logical Database Design; DBMS queries; Database Application Development and Overview of Transaction Management

Teachers

- Ana Paula Afonso, Regente - Theoretical and T/P

  Office hours: Tuesdays, 15h00-16h00, 6.3.44 or Zoom (students must send an email before)

Schedule

Theoretical Classes

- Tuesday, 16h00-18h00, room 6.2.53

T/Practical and Labs Classes

- TP11: Tuesday, 18h00-19h30, room 8.2.10/lab 1.2.22 (see plan)
- TP12: Tuesday, 13h30-15h00, room 8.2.06/lab 1.2.22 (see plan)

Communication

E-mail: docentes-ibd@listas.di.ciencias.ulisboa.pt