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Faculty of Exact Sciences
Department of computer science
Level: 2 LMD
Module: DataBase

# Directed Work n° 2

**Duration: Two sessions**
**Objectives**: Identify the different types of keys and their uses in a relation.

## Exercice 1

We consider the User table filled in when registering for a website :

| nom | naissance | email | pseudo |
|---|---|---|---|
| Anna Conda | 21/01/1990 | a.conda@liberte.fr | Croc15 |
| Luc Ratif | 14/11/1995 | lratif@tropcool.com | Skyrythm |
| Amandine Aheurfix | 05/12/2001 | amandix@zone51.org | Ufologue |
| Marc Assin | 18/06/2000 | m.assin3@liberte.fr | Quileur0 |
| Béa Bas | 09/05/1998 | bbas@aloha.net | Sunnyx |
| Agathe Zeblues | 16/02/1992 | piano@musique.fr | Piano |
| Charles Magne | 23/04/1997 | cmagne2@historia.org | Durandal |
| Paul Ichinel | 12/08/2002 | paulic@tropcool.com | Flask34 |

**(1).** Indicate for each attribute whether it can be used as a primary key.

**(2).** Give the possible relational schema for the Internet user relationship.

## Exercise 2

You are given the following table:

**Table: Student**

| Student_ID | Last_Name | First_Name | Date_of_Birth | Email | National_ID |
|---|---|---|---|---|---|
| 1001 | Dupont | Jean | 2002-05-14 | jean.dupont@mail.com | AB123456 |
| 1002 | Martin | Sophie | 2001-11-20 | sophie.martin@mail.com | CD789012 |
| 1003 | Leroy | Paul | 2003-07-08 | paul.leroy@mail.com | EF345678 |

1. What are the **candidate keys** in this table?
2. Which key would you choose as the **primary key**, and why?

## Exercice 3

Consider the library database schema consisting of the following tables:

**Student** (StudentID,StudentName, StudentAddress)
**Book** (BookID, BookTitle, AuthorID, PublisherID, ThemeID, PublicationYear)
**Author** (AuthorID, AuthorName, AuthorAddress)
**Publisher** (PublisherID, PublisherName, PublisherAddress)
**Theme** (ThemeID,ThemeTitle)
**Loan** (StudentID,BookID,LoanDate, ReturnDate)

Rules & Constraints:

- A student can borrow multiple books at the same time.
- When a book is returned, the ReturnDate is updated; otherwise, its value remains null.
- For statistical purposes, all returned books are kept in the Loan (Prêt) table.
- A book cannot be borrowed on the same day it is returned.

Tasks:

1. Identify the primary keys for each table and justify your choice.
2. List all referential integrity constraints that apply to this schema.

## Exercise 4 :

Consider the Student table with the following columns:

**ID_student** (Unique integer, automatically generated)
**Email**(String, format: xxx@univ.dz )
**CNI** (National identity card number, unique)
**LastName** (String)
**FirstName** (String)
**DateOfBirth** (Date)
Questions:

**Part 1: Candidate Keys**

1. List all possible candidate keys. Explain why they qualify as candidate keys.
2. Which column would you choose as the primary key? Justify your choice.
3. If the Email column can be NULL, does it remain a candidate key? Why or why not?

**Part 2: Modifying the Table Structure**

A new column is added:

- RegistrationNumber (Unique integer, format: year + sequential number (e.g., 20240001))

**Questions**:

1. After this modification, which column would become the best primary key?
2. If the CNI is not mandatory (can be NULL), is it still a candidate key?

**Part 3: Composite Keys**

Suppose that no single column is individually unique. However, the combination of **LastName** + **FirstName** + **DateOfBirth** is unique for each student.

Questions:

1. Can this combination be used as a primary key? What are the advantages and disadvantages?
2. Suggest another possible composite candidate key.

## Exercise 5

Write the **SQL queries** to create the following tables, properly defining the primary and foreign keys.

Let be the two tables of a sale Database :

**Product**(product_code, product_name, price);

**Sale**(sale_ID, product_code,quantity, sale_date) ;

1. Define the **primary key** for each table.
2. Define the **foreign key** in the **Sale** table.
3. Write the **SQL code** to create these tables.

## Exercise 6

### Let the following relationship schema be:

```
Personne(Num-Personne, nom, prenom,sexe,adresse)
Exemplaire(Num-exemplaire, date-achat)
Emprunter(Num-Exemplaire, Num-Personne, Date, date-retour)
```

Provide the SQL statements to create the tables **Personne, Exemplaire,** and **Emprunter** while ensuring compliance with the following integrity constraints:

a) All fields must be non-empty.

b) The **Sexe** field must only take values **F** or **M**.

c) **Date-retour** must have a default value of **00/00/0000**.

d) **Date-retour** must always be strictly greater than **Date-retour**.

e) **Num-Personne** is the primary key of the **Personne** table.

f) **Num-Exemplaire** is the primary key of the **Exemplaire** table.

g) (**Num-Exemplaire, Num-Personne, Date**) is the primary key of the **Emprunter** table.