

Databases

(Bases de Datos, BDA)

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Lab exercise book nº 3: SQL (1st part)
Data Manipulation: query and update.

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1. Introduction

The goal of the first part of this laboratory session is to learn how to make queries in SQL. For this purpose we will use the tool: Oracle SQL Worksheet (interactive SQL).

The SQL data manipulation language (DML) in Oracle is practically the SQL/92 standard. In particular, in this first part we are only using the query statement SELECT.

After the introduction of each database we will work with, we present several queries which can be performed with SQL in Oracle. The queries have been organised into three groups:

1. Queries over one single relation.

These are the simplest queries, because only a single table in the database is necessary to solve them.

2. Queries over several relations.

In this group we have included the queries that can be solved by specifying several relations in the FROM clause of the SELECT statement. The connection between these two relations must be established in the WHERE clause with suitable comparisons.

3. Queries with subqueries.

In this group we have considered queries which can be solved with a subquery in the WHERE clause.

4. Queries with universal quantification.

These are queries which have a straightforward solution using a universal quantifier. Since the SQL in ORACLE does not provide the universal quantifier operator (present in SQL3), the solution requires the conversion of the universal quantification in terms of negation and existential equation. The transformation boils down to the following: "Every element E in subset C complies with the property P" is equivalent to "There is no element E in subset C which does not comply with property P". Consequently, we propose here to find solutions to these queries by using the predicate NOT EXISTS / IS NO (...).

5. Queries with GROUP BY.

In this group we include queries whose solution uses the GROUP BY clause.

6. General queries.

Here we include queries of several kinds.

It is important to highlight that a query can be solved in many ways. Thus, a query could appear in several groups. After each query we include the result (the extension) to check whether the query is incorrect. Note that if the result is not the same, the query is wrong, but if the result is the same, the query might be right or might be wrong (a wrong query may sometimes give rise to a correct result).

2. Notation

For the different schemas, we use the following notation:

PK: Primary Key / *CP: Clave Primaria*: the set of attributes with this constraint forms the primary key.

UNI: Uniqueness constraint / *UNI: Restricción de unicidad*: the set of attributes with this constraint cannot be repeated.

FK: Foreign Key / *CAj: Clave Ajena*: the set of attributes with this constraint refers to corresponding attributes of the referred relation.

NNV: Not Null Value / *VNN: Valor no nulo*: the set of attributes with this constraint cannot be null.

3. Presentation of the CICLISMO database (CYCLE RACING)

We want to maintain some information about a cyclist race (such as the Tour de France, Il Giro di Italia, La Vuelta a España, etc.). In order to do this, we have defined a relational database whose schema is shown next:

EQUIPO(nomeq: d_eq, director: d_nom)

PK: {nomeq}

CICLISTA(dorsal: d_dor, nombre: d_nom, edad: d_edad, nomeq: d_eq)

PK: {dorsal}

FK: {nomeq} → EQUIPO

NNV: {nomeq}

NNV: {nombre}

ETAPA(netapa: d_nº, km: d_km, salida: d_ciu, llegada: d_ciu, dorsal: d_dor)

PK: {netapa}

FK: {dorsal} → CICLISTA

PUERTO(nompuerto: d_nom, altura: d_alt, categoria: d_cat, pendiente: d_pen, netapa: d_nº, dorsal: d_dor)

PK: {nompuerto}

FK: {netapa} → ETAPA

FK: {dorsal} → CICLISTA

NNV: {netapa}

MAILLOT(codigo: d_cod, tipo: d_tipo, premio: d_pre, color: d_col)

PK: {codigo}

LLEVAR(dorsal: integer, netapa: d_nº, codigo: d_cod)

PK: {netapa,codigo}

FK: {netapa} → ETAPA

FK: {dorsal} → CICLISTA

FK: {codigo} → MAILLOT

NNV: {dorsal}

Domain definition :

Name	Datatype	Name	Datatype
d_alt	integer	d_eq	varchar(25)
d_cat	char	d_km	integer
d_ciu	varchar(35)	d_nº	integer
d_cod	varchar(3)	d_nom	varchar(30)
d_col	varchar(20)	d_pen	real
d_dor	integer	d_pre	integer
d_edad	integer	d_tipo	varchar(30)

In order to clarify the schema, we describe the meaning of each attribute next.

Attribute description for each relation:**Equipo (TEAM)**

nomeq: name of the team.

director: name of the coach of the team.

Ciclista (RACING CYCLIST)

dorsal: cyclist number assigned to the cyclist during the race.

nombre: name of the cyclist.

edad: age of the cyclist.

nomeq: name of the team which the cyclist belongs to.

Etapas (STAGE)

netapa: stage number (in the race).

km: How many kilometres the stage has.

salida: name of the city where the stage starts (departure).

llegada: name of the city where the stage finish (arrival).

dorsal: number of the cyclist who has won the stage.

Puerto (MOUNTAIN PASS)

nompuerto: name of the mountain pass.

altura: maximum height in the pass.

categoria: category of the pass: 1ª/primera (first), especial (special),

pendiente: mean slope of the pass (in %).

netapa: stage number where the mountain pass is climbed.

dorsal: number of the cyclist who has won the mountain pass (“puerto”).

Maillot (JERSEY)

codigo: code of the maillot.

tipo: indicates the prize level of the maillot.

color: colour of the prize.

premio: how much money the cyclist wins if he finishes wearing this jersey.

Llevar (WEAR):

The cyclist with number *dorsal* who has worn the maillot identified by *codigo* at the stage with number *netapa*.

The previous relational schema has been defined in ORACLE in the following way

```
CREATE TABLE equipo (
  nomeq VARCHAR2(25) CONSTRAINT PK_equi PRIMARY KEY,
  descripción VARCHAR2(100));
CREATE TABLE ciclista (
  dorsal NUMBER(3) CONSTRAINT PK_cicli PRIMARY KEY,
  nombre VARCHAR2(30) NOT NULL,
  edad NUMBER(2) ,
  nomeq VARCHAR(25) NOT NULL
  CONSTRAINT FK_cicli_equi REFERENCES equipo (nomeq));
CREATE TABLE etapa (
  netapa NUMBER(2) CONSTRAINT PK_eta PRIMARY KEY,
  km NUMBER(3) ,
  salida VARCHAR(35),
  llegada VARCHAR(35),
  dorsal NUMBER(3) CONSTRAINT FK_etapa_cicli REFERENCES ciclista (dorsal));
CREATE TABLE puerto (
  nompuerto VARCHAR2(35) CONSTRAINT PK_puerto PRIMARY KEY,
  altura NUMBER(4),
  categoria CHAR(1),
  pendiente NUMBER(3,2),
  netapa NUMBER(2) NOT NULL CONSTRAINT FK_puerto_eta REFERENCES etapa
  (netapa),
  dorsal NUMBER(3) CONSTRAINT FK_puerto_cicli REFERENCES ciclista (dorsal));
CREATE TABLE maillot (
  codigo CHAR(3) CONSTRAINT PK_mai PRIMARY KEY,
  tipo VARCHAR2(30),
  color VARCHAR2(20),
  premio NUMBER(7) );
CREATE TABLE llevar (
```

dorsal NUMBER(3) NOT NULL
 CONSTRAINT FK_llevar_cicli REFERENCES ciclista (dorsal),
 netapa NUMBER(2) CONSTRAINT FK_llevar_etapa REFERENCES etapa (netapa),
 codigo CHAR(3) CONSTRAINT FK_llevar_mai REFERENCES maillot (codigo),
 CONSTRAINT PK_lle PRIMARY KEY (netapa, codigo));

4. Exercises on the CICLISMO database

Queries over one single relation

- List the code, the type, the colour and the prize of all the jerseys (maillots) in the database.

COD TIPO	COLOR	PREMIO
MGE General	Amarillo	8000000
MMO Montaña	Blanco y Rojo	2000000
MMS Mas Sufrido	Estrellitas moradas	2000000
MMV Metas volantes	Rojo	2000000
MRE Regularidad	Verde	2000000
MSE Sprints especiales	Rosa	2000000

6 filas seleccionadas.

- List the cyclist number (*dorsal*) and the name of the cyclists whose age is equal or less than 25 years old.

DORSAL	NOMBRE
38	Javier Palacin
41	Rolf Aldag
46	Agustin Sagasti
49	Eugeni Berzin
66	Enrico Zaina
98	Eleuterio Anguita

6 filas seleccionadas.

- List the name and the height of all the mountain passes (“puerto”) of category ‘E’ (special).

NOMPUERTO	ALTURA
Arcalis	2230
Cerler-Circo de Ampriu	2500
Coll de Ordino	1980
Cruz de la Demanda	1850
Lagos de Covadonga	1134
Sierra Nevada	2500

6 filas seleccionadas.

- List the value of the netapa attribute for those stages with departure (“salida”) and arrival (“llegada”) in the same city.

NETAPA
1
8
18

3 filas seleccionadas.

- How many cyclists are there in the database?

```

COUNT (*)
-----
          100
1 fila seleccionada.
    
```

6. How many cyclists are there who are more than 25 years old?

```

COUNT (*)
-----
          94
1 fila seleccionada.
    
```

7. How many teams are there?

```

COUNT (*)
-----
          22
1 fila seleccionada.
    
```

8. List the average age of all the cyclists.

```

AVG (EDAD)
-----
      29,89
1 fila seleccionada.
    
```

9. List the minimum and maximum height of the mountain passes (“puerto”).

```

MIN (ALTURA)  MAX (ALTURA)
-----
          565          2500
1 fila seleccionada.
    
```

Queries over several tables

10. List the name and the category of the mountain passes (“puerto”) won by cyclists from the ‘Banesto’ team.

```

NOMPUERTO                                C
-----
Alto del Naranco                          1
Coll de la Comella                         1
Navacerrada                               1
Puerto de Alisas                          1
Puerto de la Morcuera                      2
Puerto de Navalморal                      2
Sierra Nevada                             E
7 filas seleccionadas.
    
```

11. List the name of each mountain pass, also showing the number (netapa) and the kilometres of the stage in which the mountain pass is (“puerto”).

```

NOMPUERTO                                NETAPA    KM
-----
Alto del Naranco                          10        200
Arcalis                                    10        200
Cerler-Circo de Ampriu                     11        195
Coll de la Comella                         10        200
Coll de Ordino                             10        200
Cruz de la Demanda                         11        195
Lagos de Covadonga                         16        160
Navacerrada                                19        190
Puerto de Alisas                           15        207
Puerto de la Morcuera                      19        190
    
```

Puerto de Mijares	18	195
Puerto de Naval Moral	18	195
Puerto de Pedro Bernardo	18	195
Sierra Nevada	2	180

14 filas seleccionadas.

12. List the name and the coach (director) of the teams having at least one cyclist of more than 33 years old.

NOMEQ	DIRECTOR
Amore Vita	Ricardo Padacci
Banesto	Miguel Echevarria
Bresciali-Refin	Pietro Armani
Carrera	Luigi Petroni
Gatorade	Gian Luca Pacceli
Kelme	Álvaro Pino
Mapei-Clas	Juan Fernandez
Navigare	Lonrenzo Sciacchi
TVM	Steveens Henk
Telecom	Morgan Reikcard

10 filas seleccionadas.

13. List the name of the cyclists with the colour of each jersey (maillot) they have worn.

NOMBRE	COLOR
Alessio Di Basco	Rosa
Alex Zulle	Amarillo
Alfonso Gutiérrez	Rojo
Alfonso Gutiérrez	Verde
Armand de las Cuevas	Estrellitas moradas
Bruno Leali	Rojo
Claudio Chiappucci	Blanco y Rojo
Davide Cassani	Rojo
Dimitri Konishev	Rojo
Eddy Seigneur	Estrellitas moradas
Gianni Bugno	Blanco y Rojo
Giorgio Furlan	Rosa
Jean Van Poppel	Rosa
Jesus Montoya	Blanco y Rojo
Laurent Jalabert	Verde
Marco Saligari	Rojo
Mario Cipollini	Rosa
Melchor Mauri	Amarillo
Melchor Mauri	Blanco y Rojo
Miguel Induráin	Amarillo
Miguel Induráin	Blanco y Rojo
Miguel Induráin	Rojo
Miguel Induráin	Rosa
Miguel Induráin	Verde
Mikel Zarrabeitia	Amarillo
Mikel Zarrabeitia	Blanco y Rojo
Pedro Delgado	Amarillo
Pedro Delgado	Blanco y Rojo
Per Pedersen	Rosa
Stefano della Santa	Rojo
Tony Rominger	Amarillo

31 filas seleccionadas.

14. List the name of a cyclist and the number of the stage such that the cyclist has won the stage and has worn the yellow jersey ('maillot' with colour = 'Amarillo') at least once.

NOMBRE	NETAPA
--------	--------

```

-----
Miguel Induráin          1
Miguel Induráin          8
Pedro Delgado            10
Pedro Delgado            19
Pedro Delgado            20
Tony Rominger            17
6 filas seleccionadas.
    
```

15. List the value of the netapa attribute of the stages which do not start in the same city where the previous stage finished.

```

NETAPA
-----
      4
      7
      8
     10
     12
     15
     17
     18
     20
9 filas seleccionadas.
    
```

Queries with subqueries

16. List the value of the attribute netapa and the departure city for those stages with no mountain passes.

```

NETAPA      SALIDA
-----
      1 Valladolid
      3 Salamanca
      4 Almedralejo
      5 Córdoba
      6 Granada
      7 Baza
      8 Benidorm
      9 Benidorm
     12 Benasque
     13 Zaragoza
     14 Pamplona
     17 Cangas de Onis
     20 Segovia
     21 Destilerias Dyc
14 filas seleccionadas.
    
```

17. List the average age of the cyclists who have won a stage.

```

AVG(EDAD)
-----
  30,5625
1 fila seleccionada.
    
```

18. Select the name of the mountain passes (“puerto”) with a height greater than the average height of all the mountain passes.

```

NOMPUERTO
-----
Arcalis
Cerler-Circo de Ampriu
    
```

Coll de Ordino
 Cruz de la Demanda
 Navacerrada
 Puerto de la Morcuera
 Sierra Nevada
 7 filas seleccionadas.

19. List the name of the departure and the arrival of the stages where the steepest mountain passes (“puerto”) are located.

SALIDA	LLEGADA
Igualada	Andorra

1 fila seleccionada.

20. List the cyclist number (dorsal) and the name of the cyclists who have won the highest mountain passes (“puerto”).

DORSAL	NOMBRE
9	Massimo Podenzana
26	Mikel Zarrabeitia

2 filas seleccionadas.

21. List the name of the youngest cyclist.

NOMBRE
Eugeni Berzin

1 fila seleccionada.

22. List the name of the youngest cyclist who has won at least one stage.

NOMBRE
Vladislav Bobrik

1 fila seleccionada.

23. List the name of the cyclists who have won more than one mountain pass.

NOMBRE
Pedro Delgado

1 fila seleccionada.

Queries with universal quantification

24. List the value of the netapa attribute for those stages such that all the mountain passes (“puerto”) in them are more than 700 metres high.

NETAPA
2
11
16
18
19

5 filas seleccionadas.

25. List the name and the coach (director) of the teams such that all their cyclists are more than 25 years old.

NOMEQ	DIRECTOR
-------	----------

Amore Vita	Ricardo Padacci
Banesto	Miguel Echevarria
Bresciali-Refin	Pietro Armani
Carrera	Luigi Petroni
Castorama	Jean Philip
Gatorade	Gian Luca Pacceli
Jolly Club	Johan Richard
Kelme	Álvaro Pino
Lotus Festina	Suarez Cuevas
Mapei-Clas	Juan Fernandez
Mercatone Uno	Ettore Romano
Motorola	John Fidwell
Navigare	Lonrenzo Sciacchi
ONCE	Manuel Sainz
Seguros Amaya	Minguez
TVM	Steveens Henk
Wordperfect	Bill Gates

17 filas seleccionadas.

26. List the cyclist number (dorsal) and the name of the cyclists such that all the stages they have won are more than 170 km long (i.e. they have only won stages longer than 170 km).

DORSAL	NOMBRE
8	Jean Van Poppel
10	Mario Cipollini
12	Alessio Di Basco
22	Giorgio Furlan
36	Gian Matteo Fagnini
65	Pascal Lino
83	Hernan Buenahora
86	Juan Martinez Oliver
93	Bo Hamburger

9 filas seleccionadas.

27. List the name of the cyclists who have won all the mountain passes (“puerto”) in one stage and have also won the stage.

NOMBRE
Pedro Delgado

1 fila seleccionada.

28. List the name of the teams such that all their cyclists have worn some jersey (‘maillot’) or have won some mountain pass.

NOMEQ
Castorama

1 fila seleccionada.

29. List the code and the colour of those jerseys (‘maillots’) which have only been worn by cyclists of the same team.

COD	COLOR
MMS	Estrellitas moradas

1 fila seleccionada.

30. List the name of those teams such that their cyclists have only won mountain passes of category = 1.

NOMEQ
Carrera
Gatorade

2 filas seleccionadas.

Queries with group by

31. List the value of the ‘netapa’ attribute of those stages which have mountain passes, also indicating how many it has.

NETAPA	NUM_PUERTOS
2	1
10	4
11	2
15	1
16	1
18	3
19	2

7 filas seleccionadas.

32. List the name of the teams which have cyclists, indicating how many cyclists there are in the team.

NOMEQ	CICLISTAS
Amore Vita	3
Artiach	7
Banesto	11
Bresciali-Refin	4
Carrera	3
Castorama	2
Euskadi	2
Gatorade	4
Gewiss	8
Jolly Club	2
Kelme	7
Lotus Festina	3
Mapei-Clas	7
Mercatone Uno	8
Motorola	3
Navigare	5
ONCE	5
Seguros Amaya	3
TVM	6
Telecom	4
Wordperfect	3

21 filas seleccionadas.

33. List the name of all the teams, indicating how many cyclists there are in each team.

NOMEQ	CICLISTAS
Amore Vita	3
Artiach	7
Banesto	11
Bresciali-Refin	4
Carrera	3
Castorama	2
Euskadi	2
Gatorade	4
Gewiss	8
Jolly Club	2
Kelme	7
Lotus Festina	3
Mapei-Clas	7
Mercatone Uno	8

Motorola	3
Navigare	5
ONCE	5
PDM	0
Seguros Amaya	3
TVM	6
Telecom	4
Wordperfect	3

22 filas seleccionadas.

34. List the coach ('director') and the name of the teams which have more than 3 cyclists and with an average age lower or equal to 30.

DIRECTOR	NOMEQ
Ettore Romano	Mercatone Uno
José Pérez	Artiach
Lonrenzo Sciacchi	Navigare
Manuel Sainz	ONCE
Moreno Argentin	Gewiss
Morgan Reikcard	Telecom

6 filas seleccionadas.

35. List the name of the cyclists who belong to a team which has more than five cyclists and have also won one or more stages. Please also indicate how many stages he has won.

NOMBRE	ETAPAS
Bo Hamburger	1
Gert-Jan Theunisse	1
Gian Matteo Fagnini	1
Giorgio Furlan	1
Hernan Buenahora	1
Juan Martinez Oliver	1
Mario Cipollini	1
Miguel Induráin	2
Pedro Delgado	3
Tony Rominger	1
Vladislav Bobrik	1

11 filas seleccionadas.

36. List the name of the teams and the average age of the cyclists of those teams who have the highest average age of all the teams.

NOMEQ	MEDIA
Amore Vita	32
Gatorade	32

2 filas seleccionadas.

37. List the coach of the teams whose cyclists have worn jerseys (of any type) more days than the rest. Note: each tuple in the *Llevar* relation indicate that a cyclist has worn a jersey one day.

DIRECTOR
Miguel Echevarria

1 fila seleccionada.

General queries

38. List the code and the colour of the jersey which has been worn by some cyclist who hasn't won any stage.

```

COD COLOR
--- -----
MGE Amarillo
MMO Blanco y Rojo
MMS Estrellitas moradas
MMV Rojo
MRE Verde                (Goes on ...)
MSE Rosa
6 filas seleccionadas.
    
```

39. List the value for the 'netapa' attribute, the departure city and the arrival city of the stages longer than 190 km. and with at least two mountain passes.

```

NETAPA      SALIDA      LLEGADA
-----
          10 Igualada      Andorra
          11 Andorra      Estación de Cerler
          18 Ávila        Ávila
3 filas seleccionadas.
    
```

40. List the cyclist number (dorsal) and the name of the cyclists who have not worn all the jerseys (maillots) worn by the cyclist with number 20.

```

DORSAL      NOMBRE
-----
...          ...          /* All except 1 and 20*/
98 filas seleccionadas.
    
```

41. List the cyclist number (dorsal) and the name of the cyclists who have worn at least one of the jerseys (maillot) worn by the cyclist with number 20.

```

DORSAL      NOMBRE
-----
          1 Miguel Induráin
          16 Dimitri Konishev
          17 Bruno Leali
          27 Laurent Jalabert
          33 Stefano della Santa
          42 Davide Cassani
          48 Marco Saligari
7 filas seleccionadas.
    
```

42. List the cyclist number (dorsal) and the name of the cyclists who have not worn any of the jerseys worn by the cyclist with number 20.

```

DORSAL      NOMBRE
-----
...          ...          /*All numbers except 1,16,17,20,27,33,42 and 48*/
92 filas seleccionadas.
    
```

43. List the cyclist number (dorsal) and the name of the cyclists who have worn all the jerseys (maillots) worn by the cyclist with number 20.

```

DORSAL      NOMBRE
-----
          1 Miguel Induráin
1 fila seleccionada.
    
```

44. List the cyclist number (dorsal) and the name of the cyclists who have worn exactly the same jerseys (maillots) as the cyclist with number 20.

```
DORSAL      NOMBRE
-----
0 filas seleccionadas.
```

45. List the cyclist number (dorsal) and the name of the cyclist who has worn the same jersey during more kilometres than any other cyclist, and also indicate the colour of this jersey.

```
DORSAL      NOMBRE      COLOR
-----
          20 Alfonso Gutiérrez      Verde
1 fila seleccionada.
```

46. List the cyclist number (dorsal) and the name of the cyclists who have worn three types of jersey less than the jerseys worn by the cyclist with number 1.

```
DORSAL      NOMBRE
-----
          20 Alfonso Gutiérrez
          30 Melchor Mauri
          26 Mikel Zarrabeitia
           2 Pedro Delgado
4 filas seleccionadas.
```

47. List the value of the netapa attribute and the length of the stages (in km) which have mountain passes.

```
NETAPA      KM
-----
          2          180
         10          200
         11          195
         15          207
         16          160
         18          195
         19          190
7 filas seleccionadas.
```

5. Presentation of the MÚSICA database (MUSIC LIBRARY)

We want to store the information of a music library: the records it has, the publishing companies, the songs recorded and who recorded them, etc.; in order to do this, the following relational database has been designed:

CANCIÓN(cod: d_can, título: d_tit, duración: d_dur)

PK: {cod}

NNV: {título}

COMPANYIA(cod: d_comp, nombre: d_nom, dir: d_dir, fax: d_tel, tfno: d_tel)

PK: {cod}

NNV: {nombre}

DISCO(cod: d_dis, nombre: d_nom, fecha: d_fecha, cod_comp: d_comp, cod_gru: d_gru)

PK: {cod}

FK: {cod_comp} → COMPANYIA

NNV: {cod_comp}

FK: {cod_gru} → GRUPO

NNV: {cod_gru}

ESTA(can: d_can, cod: d_dis)

PK: {can, cod}

FK: {can} → CANCIÓN

FK: {cod} → DISCO

GRUPO(cod: d_gru, nombre: d_nom, fecha: d_fecha, pais: d_pais)

PK: {cod}

NNV: {nombre}

ARTISTA(dni: d_dni, nombre: d_nom)

PK: {dni}

NNV: {nombre}

CLUB(cod: d_club, nombre: d_nom, sede: d_dir, num: d_num, cod_gru: d_gru)

PK: {cod}

FK: {cod_gru} → GRUPO

NNV: {cod_gru}

NNV: {nombre}

PERTENECE(dni: d_dni, cod: d_gru, funcion: f_fun)

PK: {dni, cod}

FK: {dni} → ARTISTA

FK: {cod} → GRUPO

Domain definition :

Name	Datatype	Name	Datatype
d_can	integer	d_fecha	date
d_club	varchar(3)	d_gru	varchar(3)
d_comp	varchar(3)	d_nom	varchar(30)
d_dir	varchar(30)	d_num	integer
d_dis	varchar(3)	d_pais	varchar(10)
d_dni	varchar(10)	d_tel	varchar(15)
d_dur	real	d_tit	varchar(30)

For greater clarity, next we explain the meaning of each attribute.

Attribute description for each relation:**Canción (SONG)**

cod: song code.

título: title of the song.

duración: duration of the song.

Compañía (COMPANY)

cod: code of the record company.

nombre: name of the company.

dir: address of the company.

fax: fax number of the company.

tfno: telephone number of the company.

Disco (RECORD)

cod: code which identifies each record.

nombre: name of the record.

fecha: date on which the record was edited.

cod_comp: code of the publishing company.

cod_gru: code of the group who recorded the record.

Está (IS_IN)

It maintains information about which songs are included in each record. I.e., “*can*” is the song code which is recorded in the recorded song with code “*cod*”.

Grupo (GROUP/BAND)

cod: code of the group.

nombre: name of the group.

fecha: the date on which the group was formed.

pais: the country where the group was originated.

Artista (ARTIST)

dni: the artist’s identifier (code).

nombre: name of the artist.

Club (FAN CLUB)

cod: code of the fan club.

nombre: name of the club.

sede: the 'headquarters', where the main office is located.

num: how many members (fans) the club has.

cod_gru: the code of the group which the club is fan of.

Pertenece (BELONGS TO)

It maintains information about who belongs to each group. I.e. the artist '*dni*' belongs to the group of code '*cod*' and performs a specific *función* (e.g. plays the guitar, sings, ...).

The previous relational schema has been defined in ORACLE as follows

```
CREATE TABLE artista (
  dni VARCHAR2(10) CONSTRAINT PK_arti PRIMARY KEY,
  nombre VARCHAR2(30) NOT NULL);
CREATE TABLE grupo (
  cod CHAR(3) CONSTRAINT PK_gru PRIMARY KEY,
  nombre VARCHAR2(30) NOT NULL,
  fecha DATE,
  pais VARCHAR(10) );
CREATE TABLE club (
  cod CHAR(3) CONSTRAINT PK_club PRIMARY KEY,
  nombre VARCHAR2(30) NOT NULL,
  sede VARCHAR2(30),
  num NUMBER(6),
  cod_gru CHAR(3) NOT NULL CONSTRAINT FK_club_grupo REFERENCES grupo
  (cod));
CREATE TABLE companyia (
  cod CHAR(3) CONSTRAINT PK_compa PRIMARY KEY,
  nombre VARCHAR2(30) NOT NULL,
  dir VARCHAR2(30),
  fax VARCHAR2(15),
  tfno VARCHAR2(15) );
CREATE TABLE cancion (
  cod NUMBER(3) CONSTRAINT PK_can PRIMARY KEY,
```

```

    titulo VARCHAR2(30) NOT NULL,
    duracion NUMBER(2) );
CREATE TABLE disco (
    cod CHAR(3) CONSTRAINT PK_dis PRIMARY KEY,
    nombre VARCHAR2(30),
    fecha DATE ,
    cod_comp CHAR(3) NOT NULL CONSTRAINT FK_disco_comp REFERENCES
                                                companyia (cod),
    cod_gru CHAR(3) NOT NULL CONSTRAINT FK_disco_grupo REFERENCES grupo
                                                (cod));

CREATE TABLE esta (
    can NUMBER(3) CONSTRAINT FK_esta_can REFERENCES cancion (cod),
    cod CHAR(3) CONSTRAINT FK_esta_disco REFERENCES disco (cod),
    CONSTRAINT PK_esta PRIMARY KEY (can, cod));
CREATE TABLE pertenece (
    dni VARCHAR2(10) CONSTRAINT FK_perte_arti REFERENCES artista (dni),
    cod CHAR(3) CONSTRAINT FK_perte_grupo REFERENCES grupo (cod),
    funcion VARCHAR2(15),
    CONSTRAINT PK_perte PRIMARY KEY (dni, cod));

```

6. Exercises on the MÚSICA database

Queries over one single relation

- How many records are there in the database?

```

COUNT (*)
-----
          18
1 fila seleccionada.

```

- List the name of the groups which are not Spanish (país <> 'España').

```

NOMBRE
-----
U2
Simple Minds
Mike + The Mechanics
Genesis
4 filas seleccionadas.

```

- List the titles of the songs which are more than 5 minutes long.

```

TITULO
-----
7 Deadly Sins
Lemon

```

So Cruel
Zooropa
4 filas seleccionadas.

4. According to the information in the database, list the different functions that may be performed in a group.

FUNCION

bajo
batería
guitarra
teclado
voz
5 filas seleccionadas.

5. List the name and the headquarters ('sede') of the fan clubs with more than 500 members.

NOMBRE	SEDE
Zoomania	33, Abbey Road
Machines	Calle 3, Lab 3
u2foryou	23, 11th Street
Troglominds	C/Lepe 22
Mentes Fuertes	Ramon and Cajal 14
The best mind	24, Homeround
Genefans	C/Visitacion 34
Fanaticgens	Av. H. Dominicos 155
Futuristas	C/Alboraya 10

9 filas seleccionadas.

Queries over several tables

6. List the name and the headquarters ('sede') of each fan club of a Spanish group, and also the name of the club which they are fans of.

NOMBRE	SEDE	NOMBRE
Jardin Botanico	203,Valencia 46004	Radio Futura
Presuntos	C/Albacete 12, bajo	Presuntos Implicados
Implicado	Torrejon de Ardoz 12	Presuntos Implicados
Los Culpables	C/Maria Cristina 67	Presuntos Implicados
Futuristas	C/Alboraya 10	Radio Futura

5 filas seleccionadas.

7. List the name of the artists which belong to a Spanish group.

NOMBRE

Carlos Torero
Enrique Sierra
J.L. Giménez
Luis Auseron
Nacho Maño
Santiago Auseron
Soledad Giménez
7 filas seleccionadas.

8. List the name of the records which contain a song which is more than 5 minutes long.

NOMBRE

Achtung baby


```

-----
7 Deadly Sins                6
Lemon                        6
So Cruel                     6
Zooropa                      6
4 filas seleccionadas.
    
```

Queries with universal quantification

15. List the name of the companies which have never worked with Spanish groups.

```

NOMBRE
-----
Island
Virgin
ATLANTIC
PoliDiscos
PoliDiscos
5 filas seleccionadas.
    
```

16. List the name of the companies which have only worked with Spanish groups.

```

NOMBRE
-----
ARIOLA
WEA
2 filas seleccionadas.
    
```

17. List the name and address of the companies which have recorded all the records of a group.

```

NOMBRE                DIR
-----
ARIOLA                Aragon 204
ATLANTIC              12, E St.
Island               67, JB St.
Virgin               2,23th St.
WEA                  L Hoyos 42
5 filas seleccionadas.
    
```

Queries with group by

18. List the name of the Spanish groups and the total number of fans they have.

```

NOMBRE                FANS
-----
Presuntos Implicados    617
Radio Futura            10207
2 filas seleccionadas.
    
```

19. For each group with more than two components, list the name and the number of components of the group.

```

NOMBRE                NUMERO
-----
Genesis                3
Mike + The Mechanics   4
Presuntos Implicados   3
Radio Futura           4
U2                     4
5 filas seleccionadas.
    
```

20. List the number of records of each group.

```

NOMBRE                DISCOS
    
```

U2	4
Simple Minds	4
Mike + The Mechanics	2
Genesis	3
Presuntos Implicados	3
Radio Futura	2
6 filas seleccionadas.	

21. List the number of songs which each company has recorded and its address.

NOMBRE	CANCIONES	DIR
ARIOLA	22	Aragon 204
ATLANTIC	54	12, E St.
Island	43	67, JB St.
PoliDiscos	0	Cami de Vera
PoliDiscos	0	Polynesia St.
Virgin	34	2,23th St.
WEA	31	L Hoyos 42
7 filas seleccionadas.		

General queries

22. List the names of the artists of groups with fan clubs with more than 500 people, such that the group is English (país = ‘Inglaterra’).

NOMBRE
Adam Clayton
Adrian Lee
Bono
C. Burchill
Edge
Jim Kerr
Larry Jr.Mullen
M. Rutherford
P. van Hooke
Paul Young
Phil Collins
Tony Banks
12 filas seleccionadas.

23. List the title of the songs of all the records of the group ‘U2’.

TITULO
4th of July
A sort of homecoming
Artitoestoy
Babyface
Bad
Daddys Goma pay for
Dirty day
Elvis Presley & USA
Even Better Than...
Fire
Fly
Gloria
I Fall Down
I Threw a Brick
Indian summer sky
Is That All
Lemon

Love is Blindness
 MLK
 Mysterious Ways
 Numb
 October
 One
 Price
 Promenade
 Rejoice
 Scarlet
 So Cruel
 Some days are better
 Stay
 Stranger in a Land
 The first time
 The unforgettable fi
 The wanderer
 Tomorrow
 Tryin to Throw...
 Ultra Violet
 Until The end...
 Whos Gonna ride...
 Wire
 With a Shout
 Zoo Station
 Zooropa
 43 filas seleccionadas.

24. List all the pairs of artists from two different Spanish groups such that the first one is a singer (funcion = 'voz') and the second one plays the guitar (funcion = 'guitarra').

VOZ	GUITARRA
Soledad Giménez	Enrique Sierra
Santiago Auseron	J.L. Giménez

2 filas seleccionadas.

25. List the name of the artists who belong to more than one group.

NOMBRE

M. Rutherford
 1 fila seleccionada.

26. List the title of the longest song, only if it is unique.

TITULO	DURACION
--------	----------

0 filas seleccionadas.

27. List the tenth (i.e. there must only be 9 above it) club with greatest number of fans. Do also indicate this number.

NOMBRE	NUM
Jardin Botanico	357

1 fila seleccionada.

28. List the name of the artists who play the bass (funcion = 'bajo') in only one group and also that this group has more than two members.

NOMBRE

Adam Clayton

Luis Auseron
Nacho Maño
3 filas seleccionadas.

29. Which is the company which has recorded more songs than the rest?

NOMBRE	CANCIONES
ATLANTIC	54
1 fila seleccionada.	

7. Presentation of the BIBLIOTECA database (BOOK LIBRARY)

We want to maintain information of a home library; in order to do this, we have defined a relational database whose schema is shown next:

AUTOR(autor_id: varchar(4), nombre: varchar(35), nacionalidad: varchar(20))
 PK: {autor_id}
 NNV: {nombre}

LIBRO(id_lib: varchar(10), titulo: varchar(80), año: integer, num_obras: integer)
 PK: {id_lib}

TEMA(tematica: varchar(20), descripcion: varchar(50))
 PK: {tematica}

OBRA(cod_ob: integer, titulo: varchar(80), año: d_cat, tematica: varchar(20))
 PK: {cod_ob}
 FK: {tematica} → TEMA
 NNV: {titulo}

AMIGO(num: integer, nombre: varchar(60), telefono: varchar(10))
 PK: {num}
 NNV: {nombre}

PRESTAMO(num: integer, id_lib: varchar(10))
 PK: {num, id_lib}
 FK: {num} → AMIGO
 FK: {id_lib} → LIBRO

ESTA_EN(cod_ob: integer, id_lib: varchar(10))
 PK: {cod_ob, id_lib}
 FK: {cod_ob} → OBRA
 FK: {id_lib} → LIBRO

ESCRIBIR(cod_ob: integer, autor_id: varchar(4))
 PK: {cod_ob, autor_id}
 FK: {cod_ob} → OBRA
 FK: {autor_id} → AUTOR

For clarity, next we explain the meaning of the tables and attributes.

Autor (AUTHOR): for each author we store his/her identifier (autor_id), his/her name (nombre) and his/her country (nacionalidad).

Libro (BOOK): for each book we store its identifier (id_lib), its title (titulo), if it has one, the year (año) in which it was bought, and the number (num_obras) of works it contains.

Tema (TOPIC): for each topic we store its identifier (tematica) and a short description (descripcion).

Obra (WORK): for each work we store its identifier (cod_ob), the title (titulo), the year (año) in which it was written, and its topic (tematica).

Amigo (FRIEND): for each friend we store an identifier number (num), his/her name (nombre) and his/her phone (telefono).

Préstamo (LOAN): each tuple of this relation represents that a book (*id_lib*) has been lent to a friend (*num*). We assume that the friend reads the works that are in this book.

Esta_en (IS_IN): each tuple of this relation represents that a work (*cod_ob*) is included in a book (*id_lib*).

Escribir (HAS_WRITTEN): each tuple of this relation represents that an author (*autor_id*) has written a book (*cod_ob*).

Additionally, the data must comply with the following properties:

- The value of the attribute *num_obras* in the “libro” (book) relation must always be equal to the number of tuples in *Esta_en* for the book.
- Each book contains at least one work.
- If a book has a title and only contains one work, the book’s title matches the work’s title.

The previous relational schema has been defined in ORACLE as follows

```
CREATE TABLE autor (
  autor_id CHAR(4),
  nombre VARCHAR2(35) NOT NULL,
  nacionalidad VARCHAR2(20),
  CONSTRAINT cp_autor PRIMARY KEY (autor_id) ;
CREATE TABLE libro (
  id_lib VARCHAR2(10),
  titulo VARCHAR2(80),
  año NUMBER(5,0),
  num_obras NUMBER(5,0),
  CONSTRAINT cp_lib PRIMARY KEY (id_lib)) ;
CREATE TABLE tema (
  tematica VARCHAR2(20),
  descripcion VARCHAR2(50),
  CONSTRAINT cp_tema PRIMARY KEY (tematica)) ;
CREATE TABLE obra (
  cod_ob NUMBER(10,0),
  titulo VARCHAR2(80) NOT NULL,
  tematica VARCHAR2(20),
  CONSTRAINT cp_obra PRIMARY KEY (cod_ob),
  CONSTRAINT ca_obra_tema FOREIGN KEY (tematica) REFERENCES tema(tematica)) ;
CREATE TABLE amigo (
  num NUMBER(5),
```

```

nombre VARCHAR2(60) NOT NULL,
telefono VARCHAR2(10),
CONSTRAINT cp_amigo PRIMARY KEY (num)) ;

```

```

CREATE TABLE prestamo (
  num NUMBER(5),
  id_lib VARCHAR2(10),
  CONSTRAINT cp_pres PRIMARY KEY (num, id_lib),
  CONSTRAINT ca_pres_obra FOREIGN KEY (num) REFERENCES amigo(num),
  CONSTRAINT ca_pres_libro FOREIGN KEY (id_lib) REFERENCES libro(id_lib)) ;

```

```

CREATE TABLE esta_en (
  cod_ob NUMBER(10,0),
  id_lib VARCHAR2(10),
  CONSTRAINT cp_esta_en PRIMARY KEY (cod_ob, id_lib),
  CONSTRAINT ca_estaen_obra FOREIGN KEY (COD_OB) REFERENCES obra(cod_ob),
  CONSTRAINT ca_estaen_libro FOREIGN KEY (ID_LIB) REFERENCES libro(id_lib)) ;

```

```

CREATE TABLE escribir (
  autor_id CHAR(4),
  cod_ob NUMBER(10,0),
  CONSTRAINT cp_escribir PRIMARY KEY (autor_id, cod_ob),
  CONSTRAINT ca_esc_obra FOREIGN KEY (cod_ob) REFERENCES obra(cod_ob),
  CONSTRAINT ca_esc_autor FOREIGN KEY (autor_id) REFERENCES autor(autor_id)) ;

```

8. Interpretation of the relational schema BIBLIOTECA

In order to understand the reality represented by the previous relational schema, answer the following questions:

- Justify the existence of the relations *Libro* and *Obra*. Would it be the same with only one of the two?
- How many authors can write a work? How many works can be written by one author? Can there be authors who haven't written any work? And works without author?
- Can there be friends who haven't borrowed any book? How would you store the information of a friend having borrowed the same book several times?

9. Exercises over the BIBLIOTECA database

1. How many books are there such that we know the year in which they were bought?

```

LIB_AÑO
-----
 92
1 fila seleccionada.

```

2. How many books have more than one work? Solve this exercise using the *num_obras* attributes and without using it.

```
MÁS_1_OB
-----
 30
1 fila seleccionada.
```

3. How many authors are there in the database such that they haven't written any work?

```
SIN_OBRA
-----
 3
1 fila seleccionada.
```

4. List the name of the authors counted on the previous query.

```
NOMBRE
-----
Peris Rossi, Cristina
Apollinaire, Guillaume
García Hortelano, Juan
3 filas seleccionadas.
```

5. List the title of the works written by only one author who, additionally, must be French (*nacionalidad* = "Francesa"). Also list the name of the author.

TITULO	NOMBRE
Bella del señor	Cohen, Albert
El método Montignac	Montignac, Michel
Madame Bovary	Flaubert, Gustave
La hierba roja	Vian, Boris
Con las mujeres no hay quien pueda	Vian, Boris
Que se mueran los feos	Vian, Boris
Escupiré sobre vuestras tumbas	Vian, Boris
El lobo hombre	Vian, Boris
El extranjero	Camús, Albert
Bosquejo de una teoría de las emociones	Sartre, Jean-Paul
El amante	Duras, Marguerite
Ana, soror...	Yourcenar, Marguerite
Opus nigrum	Yourcenar, Marguerite
Los amotinados de la "Bounty"	Verne, Jules

14 filas seleccionadas.

6. List the title and the identifier of the books which have more than two works, showing the number of works.

```
ID_LIB  TITULO  OBRAS
-----
...
20 filas seleccionadas.
```

7. List the name of authors with the Spanish nationality (*nacionalidad* "Española") who have written two or more works.

```
NOMBRE
-----
...
```



```
-----
Isabel Peiró García
    1 fila seleccionada.
```

16. List the name of the friends who have read all the works of the author with identifier 'JAGR'.

```
NOMBRE
-----
0 filas seleccionadas.
```

17. List the name of the friends who have read all the works of some author.

```
NOMBRE
-----
Isabel Peiró García
Yolanda Milanés Cuba
2 filas seleccionadas.
```

18. Solve the previous query also showing the name of the author for which they have read all their works.

```
NOMBRE_AMIGO          NOMBRE_AUTOR
-----
Isabel Peiró García    Maalouf, Amin
Yolanda Milanés Cuba   Vian, Boris
Isabel Peiró García    Kipling, Rudyard
3 filas seleccionadas.
```

19. List the name of the friends who have read a work of the author with identifier 'CAMA'.

```
NOMBRE
-----
Pepe Pérez Pérez
Isabel Peiró García
Isidro Catalá Ferrer
3 filas seleccionadas.
```

20. List the name of the friends who have only read works of the author with identifier 'CAMA'.

```
NOMBRE
-----
Pepe Pérez Pérez
Isidro Catalá Ferrer
2 filas seleccionadas.
```

21. List the name of the friends who have only read works of one author.

```
NOMBRE
-----
Pepe Pérez Pérez
Eloy Prim Gros
Yolanda Milanés Cuba
Isidro Catalá Ferrer
4 filas seleccionadas.
```

22. Solve the previous query also showing the name of the author.

```
NOMBRE_AMIGO          NOMBRE_AUTOR
-----
Eloy Prim Gros        Kipling, Rudyard
Isidro Catalá Ferrer  Martín Gaité, Carmen
Pepe Pérez Pérez      Martín Gaité, Carmen
```

```
Yolanda Milanés Cuba      Vian, Boris
4 filas seleccionadas.
```

23. List the name of the friends who have read all the works of some author but have read nothing of another author, showing the name of the latter author.

```
NOMBRE                      NOMBRE
-----
Yolanda Milanés Cuba      Vian, Boris
1 fila seleccionada.
```