Medical Informatics

Lecture 6: Introduction to SQL

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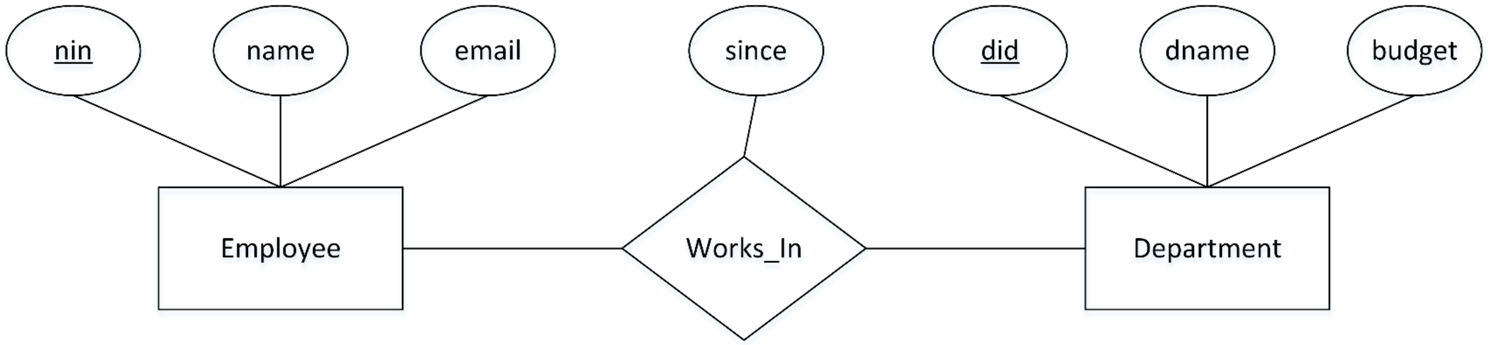
In the previous lecture

- Systematically transform an ER model into a relational one
- Transforming:
  - entity and relationship sets
  - key and participation constraints
  - weak entity sets and hierarchies

In the previous lecture



```
CREATE TABLE Employee (
    nin CHAR(9),
    name VARCHAR(20),
    email VARCHAR(35),
    PRIMARY KEY (nin) )
CREATE TABLE Department (
    did INTEGER,
    dname VARCHAR(20),
    budget INTEGER,
    PRIMARY KEY (did) )
```

```
CREATE TABLE Works_In (
    nin CHAR(9),
    did INTEGER,
    since INTEGER,
    PRIMARY KEY (nin, did),
    FOREIGN KEY (nin) REFERENCES
              Employee,
    FOREIGN KEY (did) REFERENCES
              Department )
```

In this lecture

- We’ll learn how to use the SQL Data Manipulation Language to
  - insert, delete and update rows in a table
  - query the database

Inserting rows into a table

```
CREATE TABLE Student (
    mn CHAR(8),
    name CHAR(20),
    email CHAR(25),
    age INTEGER,
    PRIMARY KEY (mn) )
```

```
INSERT
  INTO Student (mn, name, email, age)
  VALUES (‘s1253477’, ‘Jenny’, ‘jenny@sms.ed.ac.uk’, 23)
```

- The above statement adds a tuple in the Student table.
- We could omit the list of column names and simply list the values in the appropriate order, but it is good practice to include column names.

Deleting and updating rows

- We can delete tuples using the DELETE command

```
DELETE
    FROM Student
    WHERE name = ‘Alan’
```

- We can update the column values in an existing row using the UPDATE command

```
UPDATE Student
    SET name = ‘Alan’
    WHERE mn = ‘s1428571’
```

SQL queries

- SQL allows us to ask questions to the database, such as:
  - Which students are older than 19?
  - What are the names of all students taking the Medical Informatics course?
  - What is the average age of all students born in Europe who are taking the Medical Informatics course but not the Advanced Databases course?

A simple SQL query

- The following query returns all students older than 19.

```
SELECT *
FROM Student
WHERE age > 19
```

- The * means that the table returned has the same schema as Students.

mn	name	email	age
s0785212	Andrew	andrew@maths	19
s1253477	Jenny	jenny@inf	23
s1456381	Rhona	rhona@med	18
s1489673	Stuart	stuart@med	34
s1473612	Alan	alan@law	23

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SQL query syntax

```
SELECT [DISTINCT] field-list
FROM table-list
[ WHERE qualification ]
```

- Anything in [*square brackets*] is optional.
- SELECT: the columns to be retained in the result
- FROM: the tables from which to take the data
- WHERE: conditions that should hold for the records to be picked out

Variations of a simple SQL query

- Instead of using *, we can explicitly specify the list of fields to be returned. These could be in a different order than in the original table.

```
SELECT *
FROM Student
WHERE age > 19
```

```
SELECT mn, name, email, age
FROM Student
WHERE age > 19
```

Variations of a simple SQL query

- We can specify which tables the fields are from.
- This is particularly useful when the FROM-clause includes several tables.

```
SELECT *
FROM Student
WHERE age > 19
```

```
SELECT Student.mn, Student.name,
       Student.email, Student.age
FROM Student
WHERE Student.age > 19
```

Variations of a simple SQL query

- We can specify which tables the fields are from, while locally abbreviating their names.
- This is particularly useful when the FROM-clause includes several tables.

```
SELECT *           SELECT S.mn, S.name, S.email,
FROM Student                      S.age
WHERE age > 19     FROM Student S
                   WHERE S.age > 19
```

Additional SQL queries

- We may choose to select only a subset of the fields of each selected tuple.

```
SELECT S.name
FROM Student S
WHERE S.age > 19
```

- In this case, the table returned has a different schema to that in Student.

name
Jenny
Stuart
Alan

Additional SQL queries

- We may choose not to specify a condition through the WHERE-part of the query.

```
SELECT age
FROM Student
```

age
19
23
18
34
23

- By using DISTINCT, we remove any duplicates from the returned records.

```
SELECT DISTINCT age
FROM Student
```

age
19
23
18
34

Additional SQL queries

- We can include several tables in the FROM-clause.
- The following query returns the email addresses of all students taking Medical Informatics.

```
SELECT S.email
FROM Student S, Takes T, Course C
WHERE S.mn = T.mn
   AND T.cid = C.cid
   AND C.title = ‘Medical Informatics’
```

Query evaluation

```
SELECT S.email
FROM Student S, Takes T, Course C
WHERE S.mn = T.mn AND T.cid = C.cid
   AND C.title = ‘Medical Informatics’
```

1. Take all rows from the tables.

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s1473612	Alan	alan@law	23

mn	cid
s0785212	lalg
s1253477	dbs
s1253477	medinf
s1489673	medinf
s1473612	sls

cid	title	credits
dbs	Database Systems	20
inf1	Informatics 1	10
medinf	Medical Informatics	10
sls	Scottish Legal System	10
lalg	Linear Algebra	10

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1. Take all rows from the tables.
2. Keep only the row combinations that satisfy the qualification conditions.

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1. Take all rows from the tables.
2. Keep only the row combinations that satisfy the qualification conditions.
3. Return the specified columns.

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2. Keep only the row combinations that satisfy the qualification conditions.
3. Return the specified columns.

email
jenny@inf
stuart@med

Conclusions

- We’ve been introduced to the SQL Data Manipulation Language to:
  - insert, delete and update rows in a table
  - query the database
- General form of a basic SQL query:

```
SELECT [DISTINCT] field-list
FROM table-list
[ WHERE qualification ]
```

- In the next lecture we’ll learn how to formulate more complex queries in SQL.

Acknowledgements

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