C5b: Advanced SQLite

Outline

Advanced SQL

- Aggregate Query
- Sorting / Limiting Results

Practical SQL Queries for a Database

- Students:
  - View book and loan information
    - Where can I find the book called “Introduction to Algorithms” in the library?
    - When do I need to return my books?

- Librarians:
  - Manage user, book and loan information
  - View book and loan information
    - Who has borrowed the book called “Introduction to Algorithms”?
    - Which books have not been borrowed at all?
    - How many books has a particular student borrowed so far?
    - Which book is the most popular?

Revision

- Find the name of the student who borrowed "Introduction to Algorithms".

Loan

name	ISBN13
Jie Jie	978-0262513593
Xie Xin	978-0262033848
Jie Jie	978-0123744937

Book

title	authors	publisher	ISBN13
The Future of Learning Institutions in a Digital Age	Cathy N. Davidson, David Theo Goldberg	The MIT Press	978-0262513593
Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	The MIT Press	978-0262033848
The Digital Photography Book	Scott Kelby	Peachpit Press	978-0321474049
Computer Organization and Design	David A. Patterson, John L. Hennessy	Morgan Kaufmann	978-0123744937

Revision

- Find the name of the student who borrowed "Introduction to Algorithms".

```
SELECT loan.name FROM book, loan
WHERE book.ISBN13 = loan.ISBN13 AND
book.title = 'Introduction to Algorithms';
```

name
Xie Xin

Revision

- Find the name of the student who borrowed "Introduction to Algorithms".

```
SELECT l.name
FROM book b, loan l
WHERE b.ISBN13 = l.ISBN13 AND
b.title = 'Introduction to Algorithms';
```

  - Table names can be renamed to simplify the query

Revision

- Find the name of the student who borrowed "Introduction to Algorithms".

```
SELECT name
FROM book b, loan l
WHERE b.ISBN13 = l.ISBN13 AND
title = 'Introduction to Algorithms';
```

  - Table names can be omitted if there is no ambiguity.

Aggregate Queries: COUNT

- Find the total number of books.

```
SELECT COUNT(*) FROM book;
```

COUNT(*)
4

- Aggregate queries use aggregate functions to combine results over entire tables or columns.
  - Example: `COUNT()`, `SUM()`, `MAX()`, `MIN()`, `AVG()`

Aggregate Queries: COUNT

- Find the total number of students who have borrowed a book.

```
SELECT COUNT(name) FROM loan;
```

COUNT(name)
3

Loan

name	ISBN13
Jie Jie	978-0262513593
Xie Xin	978-0262033848
Jie Jie	978-0123744937

Aggregate Queries: COUNT

- Find the total number of different students who have borrowed a book.

Loan

name	ISBN13
Jie Jie	978-0262513593
Xie Xin	978-0262033848
Jie Jie	978-0123744937

```
SELECT COUNT(DISTINCT name) FROM loan;
```

COUNT(name)
2

```
SELECT DISTINCT name FROM loan;
```

Name
Jie Jie
Xie Xin

Aggregate Queries: Grouping

- Find the number of books borrowed by each student.

Loan

name	ISBN13
Jie Jie	978-0262513593
Xie Xin	978-0262033848
Jie Jie	978-0123744937

```
SELECT name, COUNT(ISBN13)
FROM loan GROUP BY name;
```

name	COUNT(ISBN13)
Jie Jie	2
Xie Xin	1

- The GROUP BY clause creates groups before the aggregation.

Aggregate Queries: Condition

- Find the students who borrowed more that one book.

```
SELECT name, COUNT(ISBN13)
FROM loan
GROUP BY name
HAVING COUNT(ISBN13) > 1;
```

Loan

name	ISBN13
Jie Jie	978-0262513593
Xie Xin	978-0262033848
Jie Jie	978-0123744937

name	COUNT(ISBN13)
Jie Jie	2

- The HAVING clause specifies conditions on groups.

Sorting Results

- List the loan records in ascending order of ISBN13.

Loan

name	ISBN13
Jie Jie	978-0262513593
Xie Xin	978-0262033848
Jie Jie	978-0123744937

```
SELECT name, ISBN13 FROM loan
ORDER BY ISBN13 ASC;
```

name	ISBN13
Jie Jie	978-0123744937
Xie Xin	978-0262033848
Jie Jie	978-0262513593

Sorting Results

- List the students in descending order of the number of books they have borrowed.

Loan

name	ISBN13
Jie Jie	978-0262513593
Xie Xin	978-0262033848
Jie Jie	978-0123744937

```
SELECT name, COUNT (ISBN13)
FROM loan
GROUP BY name
ORDER BY COUNT (ISBN13) DESC;
```

name	COUNT(ISBN13)
Jie Jie	2
Xie Xin	1

Limiting Results

- List the first 3 books.

```
SELECT * FROM book LIMIT 3;
```

title	authors	publisher	ISBN13
The Future of Learning Institutions in a Digital Age	Cathy N. Davidson, David Theo Goldberg	The MIT Press	978-0262513593
Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	The MIT Press	978-0262033848
The Digital Photography Book	Scott Kelby	Peachpit Press	978-0321474049

Limiting Results

- Find the student who has borrowed most books.

Loan

name	ISBN13
Jie Jie	978-0262513593
Xie Xin	978-0262033848
Jie Jie	978-0123744937

```
SELECT name, COUNT (ISBN13)
FROM loan
GROUP BY name
ORDER BY COUNT (ISBN13) DESC
LIMIT 1;
```

name	COUNT(isbn13)
Jie Jie	2

Other useful SQL constructs

- Logical Operators
  - OR / BETWEEN / ANY / ALL / LIKE
- Arithmetic Calculations
- Join
  - INNER JOIN / LEFT OUTER JOIN / RIGHT OUTER JOIN
- Set Operators
  - UNION / INTERSECT / EXCEPT