In the Lecture Series Introduction to Database Systems

SQL

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Structured Query Language

- Originally developed in the System-R project of IBM (1974)
- Industry standard for relational databases (SQL92 is an ANSI/ISO standard)

Structured Query Language

- Data Definition Language for defining relations, views, integrity constraints, triggers
- Data Manipulation Language for updating, and querying
- Database Control Language for defining access rights, concurrency control, etc….

SQL DDL, creation example

```
CREATE TABLE book (
title VARCHAR(256) NOT NULL,
format CHAR(9) CHECK(format = 'paperback' OR format='hardcover'),
pages INT,
language VARCHAR(32),
authors VARCHAR(256),
publisher VARCHAR(64),
year DATE,
ISBN10 CHAR(10) NOT NULL UNIQUE,
ISBN13 CHAR(14) PRIMARY KEY
)
```

SQL DDL, creation example*

```
CREATE TABLE student (
name VARCHAR(32) NOT NULL,
email VARCHAR(256) PRIMARY KEY,
year DATE NOT NULL,
faculty VARCHAR(62) NOT NULL,
department VARCHAR(32) NOT NULL,
graduate DATE,
CHECK(graduate >= year)
)
```

SQL DDL, creation example

```
CREATE TABLE copy (
owner VARCHAR(256) REFERENCES student(email) ON
UPDATE CASCADE ON DELETE CASCADE,
book CHAR(14) REFERENCES book(ISBN13) ON UPDATE
CASCADE,
copy INT CHECK(copy>0),
available BIT NOT NULL DEFAULT 'TRUE',
PRIMARY KEY (owner, book, copy)
)
```

SQL DDL, creation example*

```
CREATE TABLE loan (
borrower VARCHAR(256) REFERENCES student(email),
owner VARCHAR(256)
book CHAR(14),
copy INT,
borrowed DATE,
returned DATE,
FOREIGN KEY (owner, book, copy) REFERENCES copy(owner,
book, copy) ON UPDATE CASCADE ON DELETE CASCADE,
PRIMARY KEY (borrowed, borrower, owner, book, copy),
CHECK(returned >= borrowed)
)
```

SQL DML, insertion example

```
CREATE TABLE mgh (
ISBN13 CHAR(14) PRIMARY KEY,
title VARCHAR(256) NOT NULL,
authors VARCHAR(256),
pages INT
)
```

SQL DDL, Schema update examples

DROP TABLE book

ALTER TABLE mgh DROP pages

ALTER TABLE mgh ADD price INT DEFAULT 10

SQL DML, insertion example

```
INSERT INTO mgh
VALUES ('978-0072465631',
'Database Management Systems',
'Raghu Ramakrishnan, Johannes Gehrke'),
25
)

INSERT INTO mgh (ISBN13, title, authors)
VALUES ('978-0262033848',
'Introduction to Algorithms, Third Edition',
'Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein ')
```

SQL DML, insertion example

```
INSERT INTO mgh (ISBN13, title, authors)
        SELECT ISBN13, title, authors
        FROM book
        WHERE publisher='McGraw-Hill'
```

SQL DML, update example

mgh

ISBN13	title	authors	price
978-0071508612	Schaum s Outline of Calculus	Frank Ayres, Elliott Mendelson	15
978-0071635264	Schaum s Outline of Chinese Grammar	Claudia Ross	18
978-0071639309	Practice Makes Perfect Spanish Verb Tenses	Dorothy Richmond	25

```
UPDATE mgh
SET price = price * 1.5
WHERE title LIKE '%Schaum s Outline%'
```

SQL DML, deletion example

mgh

ISBN13	title	authors	price
978-0071508612	Schaum s Outline of Calculus	Frank Ayres, Elliott Mendelson	10
978-0071635264	Schaum s Outline of Chinese Grammar	Claudia Ross	12
978-0071639309	Practice Makes Perfect Spanish Verb Tenses	Dorothy Richmond	25

```
DELETE FROM mgh
WHERE title LIKE '%Schaum s Outline%'
```

SQL DML, query

SELECT [DISTINCT] *target-list*
FROM *relation-list*
[WHERE *qualification*]

SQL DML, simple query example

Print all the information about loans

```
SELECT    *
FROM      loan
```

borrower	owner	book	copy	borrowed	returned
angjiayi1990@hotmail.com	fengmeng1990@gmail.com	978-0073381084	1	2010-01-01	2010-02-15
anniechapman1991@yahoo.com	neelamdeol2011@hotmail.com	978-1405072878	1	2010-01-01	2010-03-17
anniechapman1991@yahoo.com	yeojiahao1989@yahoo.com	978-0596007126	1	2010-01-01	2010-04-14
…					

SQL DML, simple query example

Find the students who borrowed books
and the books that they borrowed

```
SELECT    borrower, book
FROM      loan
```

borrower	book
angjiayi1990@hotmail.com	978-0073381084
anniechapman1991@yahoo.com	978-1405072878
anniechapman1991@yahoo.com	978-0596007126
…	

SQL DML, simple query example

Find the books and their owners that student anniechapman1991@yahoo.com borrowed after 4th March 2010

```
SELECT    book, owner
FROM      loan
WHERE     returned  > '2010-03-04'
          AND borrower = 'anniechapman1991@yahoo.com'
```

book	owner
978-1405072878	neelamdeol2011@hotmail.com
978-0596007126	yeojiahao1989@yahoo.com
978-0547167022	dennisbeckham1989@msn.com
…	

SQL DML, operators and connectives

- Operators
  - <, >, <=, <>, >=, LIKE, BETWEEN
- Connectives
  - AND, OR, NOT

```
SELECT    book, owner
FROM      loan
WHERE     returned  > '2010-03-04'
          AND  (borrower = 'anniechapman1991@yahoo.com'
          OR     borrower = 'xuhuajun1990@msn.com')
```

Can combine with arithmetic and functions

SQL DML, joining two tables

loan

borrower	owner	book	copy	borrowed	returned
…					
anniechapman1991@yahoo.com	neelamdeol2011@hotmail.com	978-1405072878	1	2010-01-01	2010-03-17
anniechapman1991@yahoo.com	yeojiahao1989@yahoo.com	978-0596007126	1	2010-01-01	2010-04-14
angjiayi1990@hotmail.com	dennisbeckham1989@msn.com	978-1418843410	1	2010-01-17	2010-02-03
huangran1991@yahoo.com	dennisbeckham1989@msn.com	978-0073529288	1	2010-01-17	2010-04-02
…					

SQL DML, two tables example

student

name	email	year	faculty	department	graduated
…					
DENNIS BECKHAM	dennisbeckham1989@msn.com	2010-08-01	School of Computing	IS	NULL
NEELAM DEOL	neelamdeol2011@hotmail.com	2008-01-01	Faculty of Arts and Social Science	Language	NULL
YEO JIA HAO	yeojiahao1989@yahoo.com	2010-01-01	School of Computing	CS	NULL
…					

SQL DML, two tables example

```
SELECT    book, name
FROM      loan, student
WHERE     email=owner
          AND returned  > '2010-03-04'
          AND borrower = 'anniechapman1991@yahoo.com'
```

book	name
978-1405072878	NEELAM DEOL
978-0596007126	YEO JIA HAO
978-0547167022	DENNIS BECKHAM
…	

SQL DML, t-uple variables example

```
SELECT      loan.book , student.name
FROM        loan , student
WHERE       student.email=loan.owner
            AND loan.returned  > '2010-03-04'
            AND loan.borrower = 'anniechapman1991@yahoo.com'
```

```
SELECT      l.book , s.name
FROM        loan l, student s
WHERE       s.email=l.owner
            AND l.returned  > '2010-03-04'
            AND l.borrower = 'anniechapman1991@yahoo.com'
```

SQL DML, renaming example

```
SELECT    l.book , s.name AS owner
FROM      loan l, student s
WHERE     s.email=l.owner
          AND l.returned  > '2010-03-04'
          AND l.borrower = 'anniechapman1991@yahoo.com'
```

book	owner
978-1405072878	NEELAM DEOL
978-0596007126	YEO JIA HAO
978-0547167022	DENNIS BECKHAM
…	

SQL DML, duplicates example

```
SELECT    s.name AS owner
FROM      loan l, student s
WHERE     s.email=l.owner
          AND l.returned  > '2010-03-04'
          AND l.borrower = 'anniechapman1991@yahoo.com'
```

owner
NEELAM DEOL
YEO JIA HAO
DENNIS BECKHAM
TSO HUI LIN
GE DUO
YEO JIA HAO
GE DUO
TSO HUI LIN
…

SQL DML, duplicates example

```
SELECT    DISTINCT s.name AS owner
FROM      loan l, student s
WHERE     s.email=l.owner
          AND l.returned  > '2010-03-04'
          AND l.borrower = 'anniechapman1991@yahoo.com'
```

owner
DENNIS BECKHAM
GE DUO
NEELAM DEOL
TSO HUI LIN
YEO JIA HAO
…

SQL DML, ordering example

```
SELECT    s.name AS owner
FROM      loan l, student s
WHERE     s.email=l.owner
          AND l.returned  > '2010-03-04'
          AND l.borrower = 'anniechapman1991@yahoo.com'
          ORDER BY name DESC
```

owner
ZHOU XIALIN
ZHENG ZHEMIN
ZHANG HONG
ZENG YIHUI
YEO JIA HAO
YEO JIA HAO
TSO HUI LIN
…

SQL DML, ordering example

```
SELECT    book, borrowed, returned
FROM      loan
WHERE     borrower='anniechapman1991@yahoo.com'
ORDER BY borrowed, returned
```

book	borrowed	returned
978-1405072878	2010-01-01	2010-03-17
978-0596007126	2010-01-01	2010-04-14
978-9562913621	2010-01-02	2010-01-03
978-0470526705	2010-01-04	2010-01-11
…		

Credits

The content of this lecture is based on chapter 5 of the book "Introduction to database Systems"
By
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