

Databases: Part 2

Alex Galakatos

December 1st 2015

Review

- Insert a new records
 - **INSERT INTO table VALUES (v1, v2, ..)**
- Retrieve records from a table
 - **SELECT * FROM table [WHERE ?]**
- Modify records in a table
 - **UPDATE table set c1=x [WHERE ?]**
- Delete records from a table
 - **DELETE FROM table [WHERE ?]**

Aggregation

- Aggregation functions
 - **AVG**
 - **SUM**
 - **MIN**
 - **MAX**
 - **COUNT**
- Use during **SELECT** clause
 - **SELECT FUNCTION(COLUMN) FROM TABLE**
- Each aggregate operates only on a single column

Aggregation

```
SELECT *  
FROM student
```

id	name	age	GPA
1	Matt	20	3.45
2	Henry	19	3.89
3	Ally	21	3.95
4	John	21	2.85
5	Liz	18	3.45

```
SELECT MAX(age)  
FROM student
```

MAX(age)

21

```
SELECT AVG(GPA)  
FROM student  
WHERE age > 20
```

AVG(GPA)

3.4

Aggregation

```
SELECT *  
FROM student
```

id	name	age	GPA
1	Matt	20	3.45
2	Henry	19	3.89
3	Ally	21	3.95
4	John	21	2.85
5	Liz	18	3.45

```
SELECT MIN(age), MAX(age),  
        MIN(GPA), MAX(GPA)  
FROM student
```

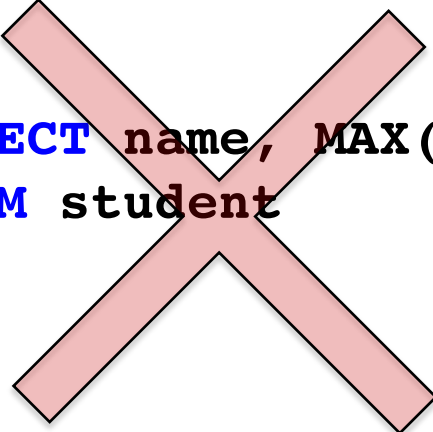
MIN(age)	MAX(age)	MIN(GPA)	MAX(GPA)
18	21	2.85	3.95

Warning!

```
SELECT *  
FROM student
```

id	name	age	GPA
1	Matt	20	3.45
2	Henry	19	3.89
3	Ally	21	3.95
4	John	21	2.85
5	Liz	18	3.45

```
SELECT name, MAX(age)  
FROM student
```



name	MAX(age)
Ally	21

Activity: Task 1

Grouping

- Group == all records with the same value for a column
- Example
 - Sex
 - Graduation year
 - Date
 - Region

name	sex
Matt	M
Henry	M
Ally	F
John	M
Liz	F

Base Table

name	sex	
Matt	M	Group 1
Henry	M	
John	M	
name	sex	
Ally	F	Group 2
Liz	F	

Group-by

- Perform aggregation on each group individually
- Example
 - Average age for males/females
 - Max GPA for each graduation year
 - Count of orders per day
 - Sum of sales per region
- Comes after **WHERE** clause
- Can only “select” grouped by columns or aggregates

Group-by

```
SELECT *  
FROM student
```

i d	name	ag e	sex	GPA
1	Matt	20	M	3.45
2	Henry	19	M	3.89
3	Ally	21	F	3.95
4	John	21	M	2.85
5	Liz	18	F	3.45

```
SELECT sex, MIN(age)  
FROM student  
GROUP BY sex
```

name	age
M	19
F	18

Group-by

```
SELECT *  
FROM student
```

i d	name	ag e	sex	GPA
1	Matt	20	M	3.45
2	Henry	19	M	3.89
3	Ally	21	F	3.95
4	John	21	M	2.85
5	Liz	18	F	3.45

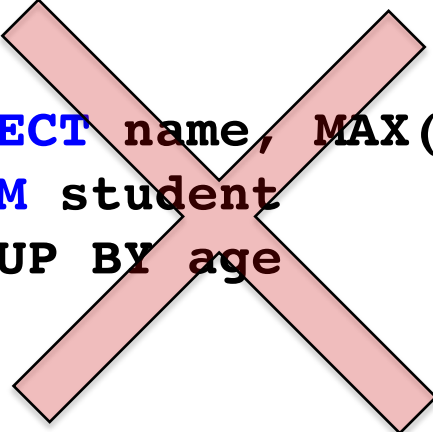
```
SELECT age, MAX(GPA)  
FROM student  
GROUP BY age
```

age	MAX(GPA)
18	3.45
19	3.89
20	3.45
21	3.95

Group-by

```
SELECT *  
FROM student
```

```
SELECT name, MAX(GPA)  
FROM student  
GROUP BY age
```



i d	name	ag e	sex	GPA
1	Matt	20	M	3.45
2	Henry	19	M	3.89
3	Ally	21	F	3.95
4	John	21	M	2.85
5	Liz	18	F	3.45

Activity: Task 2

Joins

Inside a database



Students

Name	Age	Major	GPA
John	19	Math	3.4
Jason	20	English	3.2
Sarah	21	History	3.8
Sam	18	Math	2.8

Employees

Name	Age	Salary
Ethan	49	\$40k
Kyle	37	\$20k
Andrew	33	\$60k
Tim	45	\$25k

Courses

Name	Room	Capacity
CS 101	351	120
Math 205	220	80
HIST 170	301	80
ENG 405	110	30

Joining Tables

student

student_id	name	age	sex	major_id
1	Matt	20	M	2
2	Henry	19	M	2
3	Ally	21	F	1
4	John	21	M	4
5	Liz	18	F	3

major

major_id	desc	building
1	Math	Smith
2	History	Johnson
3	English	Davis
4	CS	Wilson

What is each student's major?

Joining Tables

student

student_id	name	age	sex	major_id
1	Matt	20	M	2
2	Henry	19	M	2
3	Ally	21	F	1
4	John	21	M	4

major

major_id	desc	building
1	Math	Smith
2	History	Johnson
3	English	Davis
4	CS	Wilson

5	student_id	name	age	sex	major_id	desc	building
	1	Matt	20	M	2	History	Johnson
	2	Henry	19	M	2	History	Johnson
	3	Ally	21	F	1	Math	Smith
	4	John	21	M	4	CS	Wilson

Join

student

student_id	name	age	GPA	major_id
------------	------	-----	-----	----------

major

major_id	desc	building
----------	------	----------

```
SELECT name, desc  
FROM student join major  
on student.major_id = major.major_id
```

name	desc
Matt	History
Henry	History
Ally	Math
John	CS
Liz	English

Activity: Task 3 & 4

Questions?