CS122 Using Relational Databases and SQL
Aggregations

Chengyu Sun
California State University, Los Angeles

Aggregation Functions

- Operate on multiple rows and return a single result
  - `sum`
  - `avg`
  - `count`
  - `max` and `min`

Using Aggregation Functions

- Find the highest/lowest price of the CPU products
- Find the average price of the hard drives
- Find the number of orders placed in the last week
- Find the number items ordered by Joe Doe last week

Be Careful with NULL

inventory

product_id	upc	quantity	price
1	1020301	20	100
2	1342193	null	200
3	null	100	null

max(price)?? min(price)?? avg(price)??

count(upc)?? count(*)??

sum(quantity) ??

Calculate Multiple Aggregation Values

- List the number of products by product category
- List the amount spent by each customer
- List the sales of last year by month
- …

GROUP BY

- List the number of products by product category

```
select category, count(id)
    from products
    group by category;
```

Understanding GROUP BY …

- Without aggregation/GROUP BY

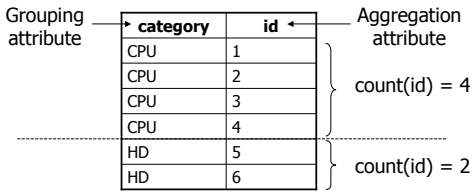
select category, id from products;

category	id
CPU	1
CPU	2
CPU	3
CPU	4
HD	5
HD	6

… Understanding GROUP BY

- With aggregation/GROUP BY

select category, count(id) from products group by category;



How GROUP BY Works

1. Calculate the results *without* aggregation/GROUP BY
2. Divide the result rows into groups that *share the same value in the grouping attribute(s)*
3. Apply the aggregation function(s) to the aggregation attribute(s) *for each group*

The result attributes must be either a group attribute or a aggregation attribute.

More GROUP BY Examples

- List the highest, lowest, and average price by product category
- List the monthly sales in the last two years in the form of <year, month, sales>.

Conditions on the Aggregated Values

- Find the categories with average product price higher than $100

```
select category, avg(price)
   from products
   group by category
   having avg(price) > 100;
```

HAVING vs. WHERE

1. Calculate the results *without* aggregation/GROUP BY ← *WHERE conditions*
2. Divide the result rows into groups that *share the same value in the grouping attribute(s)*
3. Apply the aggregation function(s) to the aggregation attribute(s) *for each group* ← *HAVING conditions*
4. *Final results*

Top N Queries

- Find the most expensive CPU product
- Find the top 3 selling products
- Find the top 10 spenders of last year
- …

Using ORDER BY and LIMIT

```
select description, price
   from products
   where category = 'CPU'
   order by price desc
   limit 1;

select description, price
   from products
   where category = 'CPU'
   order by price desc
   limit 1, 3;
```

About Midterm

- 9-11:30, Thursday 7/26, in E&T A220
- Chapter 1-5 except subqueries
- Same format as the labs
  - Open book
  - Write queries
  - Use the Human Resource Database
- Preparation
  - Read Chapter 1-5
  - Read all lecture notes and examples