

### 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 year
- Find the number items ordered by John Doe last year

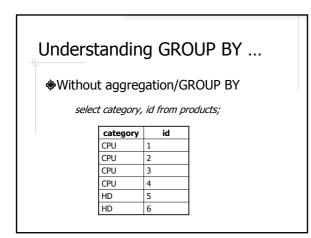
#### Be Careful with NULL inventory product\_id upc quantity price 1020301 20 100 1342193 null 200 2 null 100 null max(price)?? min(price)?? avg(price)?? count(upc)?? count(\*)?? sum(quantity) ??

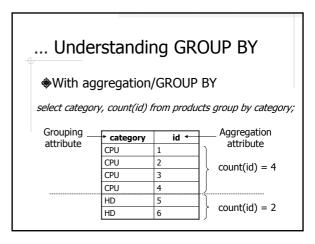
# Calculate Multiple Aggregation Values

- List the number of products <u>by product</u> <u>category</u>
- ♦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;





#### 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.

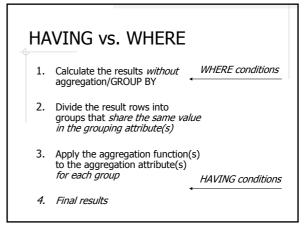
## More GROUP BY Examples

- 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;



## Top N Queries

Find the most expensive CPU product

- $\ensuremath{\circledast}\xspace$  Find the top 3 selling products
- $\ensuremath{\circledast}\xspace$  Find the top 10 spenders of last year

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# Using ORDER BY and LIMIT

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

select description, price from products where category = 'CPU' order by price desc limit 0, 3;

#### About Midterm

- 9:10-11:30, Thursday 7/24, in E&T A220
- Chapter 1-5 excluding 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