DATABASE SYSTEMS

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Lecture 7

SQL

- DDL
  - Create
  - Alter
  - Drop
- DML
  - Insert
  - Update
  - Delete
  - **Select**
- DCL

Single Table
Multiple Tables

Compound Comparison Search Conditions

Customer

Fname	Lname	ID	City
Ahmed	Fahmy	111	London
Ali	Zidan	112	Paris
Mark	Antony	113	London
Amr	Moussa	114	Madrid

- List all Customer Details for customers who live in London or Paris

SELECT *
FROM Customer
WHERE City = ‘London’ **OR** City = ‘Paris’

Fname	Lname	ID	City
Ahmed	Fahmy	111	London
Ali	Zidan	112	Paris
Mark	Antony	113	London

Range Search Conditions

Product(PID, Product_name, Standard_Price)

- □ Select all Products with Standard Price between $100 and $300

```
SELECT Product_name
From Product
Where Standard_Price Between 100 and 300
```

OR

```
SELECT Product_name
From Product
Where Standard_Price >= 100 and Standard_Price < = 300
```

Using specific values for an attribute

Customer (CID, Customer_Name,City,State)

- □ List all Customer names, cities, and States for all customers who lives in the following states (Fl, Tx, Ca, Hi)
- □ Sort the results first by STATE, and within a state by CUSTOMER_NAME

```
SELECT Customer_Name, City, State
FROM Customer
WHERE State In (‘Fl’, ‘Tx’, ‘Ca’, ‘Hi’)
ORDER BY State, Customer_Name
```

Note: the IN operator in this example allows you to include rows whose STATE value is either FL, TX, CA, or HI. It is more efficient than separate OR conditions

SQL SYNTAX

```
SELECT <Column list>
FROM <table names>
[WHERE <Condition>]
[GROUP BY <Column list>]
[HAVING <Condition>]
[ORDER BY <Column list>]
```

Results by Categories

- □ Return all Order IDs and count of products in each order line.

```
SELECT OrderID, Count(ProductID) as X
FROM Orders
GROUP BY OrderID
```

orders

OrderID	ProductID	Quantity
100	1	10
100	2	17
102	2	2
100	5	9
103	3	3
103	4	4
103	5	5
103	6	6

Order ID	X
100	3
102	1
103	4

Qualifying Results by Categories Using the HAVING Clause

- Return all Order IDs that include more than 3 products in their OrderLines and their count.

```
SELECT OrderID, Count(ProductID)
FROM Orders
GROUP BY OrderID
HAVING Count(productID) > 3;
```

orders

OrderID	ProductID	Quantity
100	1	10
100	2	17
102	2	2
100	5	9
103	3	3
103	4	4
103	5	5
103	6	6

Like a WHERE clause, but it operates on groups (categories), not on individual rows. Here, only those groups with total numbers greater than 3 will be included in final result. **HAVING is considered a SECOND WHERE.**

Qualifying Results by Categories Using the HAVING Clause

- Return all Order IDs that include more than 3 products in their OrderLines.

```
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FROM Orders
GROUP BY OrderID
HAVING X > 3;
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orders

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103	3	3
103	4	4
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103	6	6

Order ID	X
103	4

Exercise

- Write a query to return number of students (No_of_Students) whose names ends with “Smith” and their age is Greater than 20.

Exercise

- □ Write a query to return number of students (No_of_Students) whose names ends with “Smith” and their age is Greater than 20.

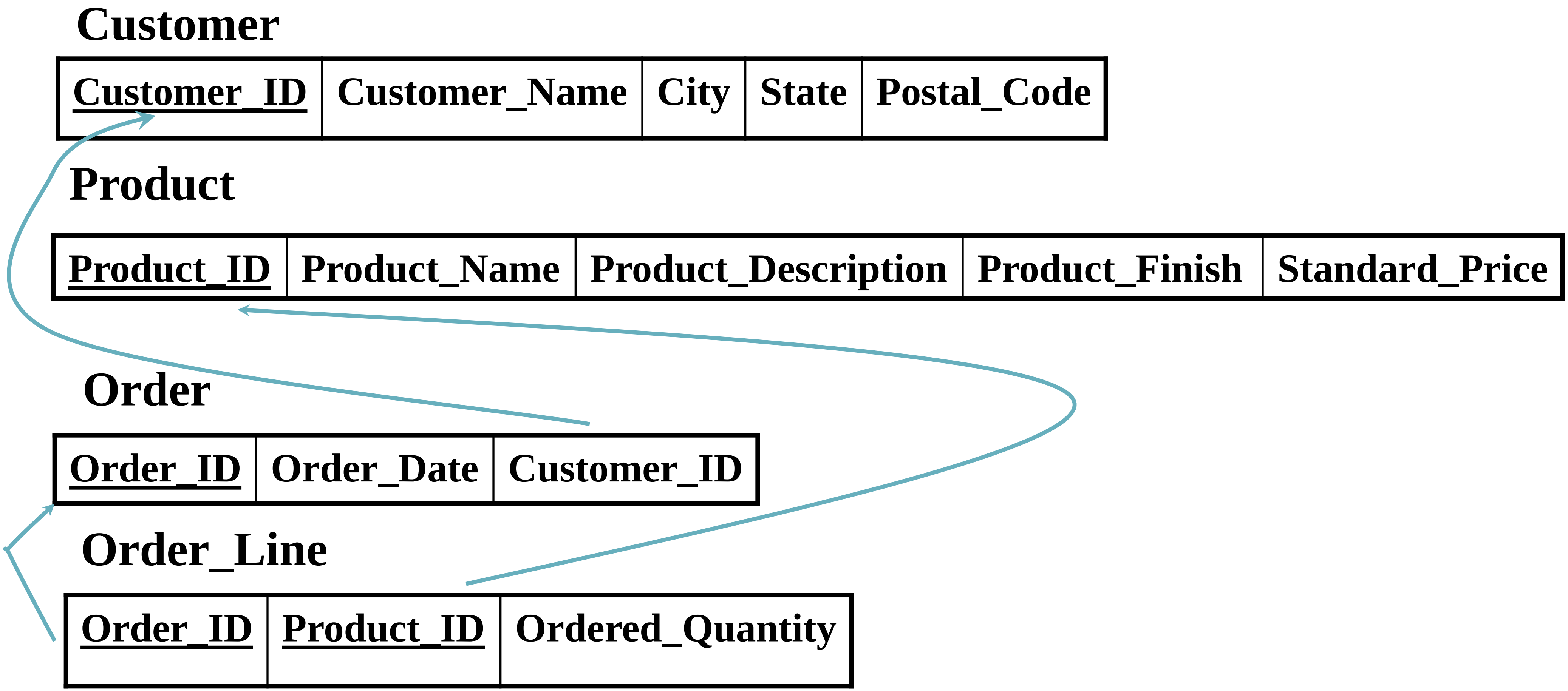
```
SELECT Count(*) as No_of_Students
FROM Student
WHERE Student_name Like ‘%Smith’ AND Age > 20
```

Notes

- You can use group by with where in the same query
- You can group by more than one attribute separated by ,
- The group by list of columns must be listed in the select statement.
- You should alias aggregate functions, so the column names are meaningful

DML
Multiple Tables

Schema



Customer

Customer_ID	Customer_Name	City	State	Postal_Code

Product

Product_ID	Product_Name	Product_Description	Product_Finish	Standard_Price

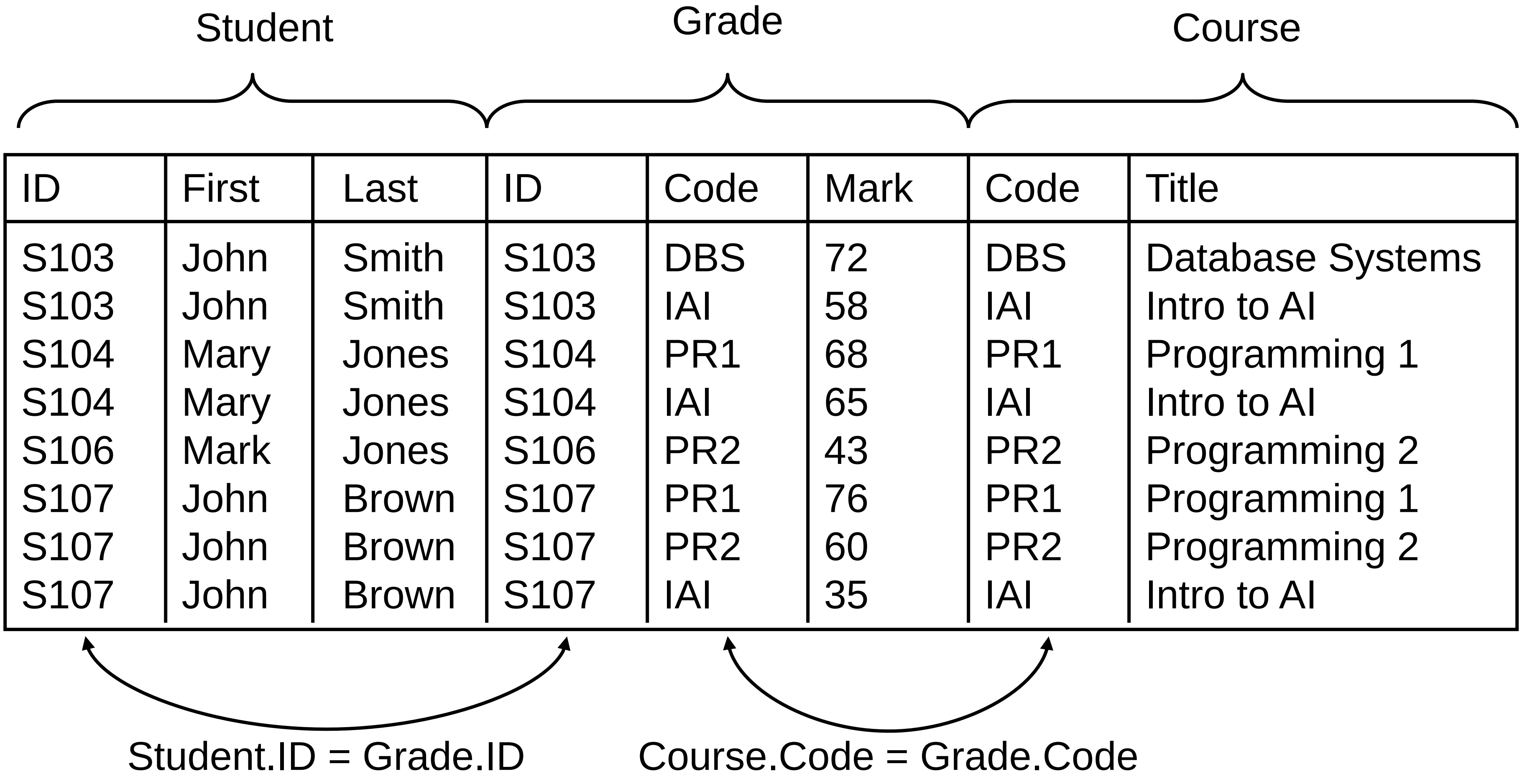
Order

Order_ID	Order_Date	Customer_ID

Order_Line

Order_ID	Product_ID	Ordered_Quantity

SELECT from Multiple Tables



Student			Grade			Course	
ID	First	Last	ID	Code	Mark	Code	Title
S103	John	Smith	S103	DBS	72	DBS	Database Systems
S103	John	Smith	S103	IAI	58	IAI	Intro to AI
S104	Mary	Jones	S104	PR1	68	PR1	Programming 1
S104	Mary	Jones	S104	IAI	65	IAI	Intro to AI
S106	Mark	Jones	S106	PR2	43	PR2	Programming 2
S107	John	Brown	S107	PR1	76	PR1	Programming 1
S107	John	Brown	S107	PR2	60	PR2	Programming 2
S107	John	Brown	S107	IAI	35	IAI	Intro to AI

Student.ID = Grade.ID

Course.Code = Grade.Code

Joins in SQL

- Connect two or more tables:

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

Company

Cname	StockPrice	Country
GizmoWorks	25	USA
Canon	65	Japan
Hitachi	15	Japan

What is the connection between them ?

Joins

Product (pname, price, category, manufacturer)
Company (cname, stockPrice, country)

Find all products under $200 manufactured in Japan;
return their names and prices.

```
SELECT   pname, price
FROM     Product, Company
WHERE    manufacturer=cname AND country=‘Japan’
         AND price <= 200
```

Joins

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Company (cname, stockPrice, country)

Find all products under $200 manufactured in Japan;
return their names and prices.

```
SELECT   pname, price
FROM     Product, Company
WHERE    manufacturer=cname AND country='Japan'
         AND price <= 200
```

Join
between Product
and Company

Joins

Product (pname, price, category, manufacturer)
Company (cname, stockPrice, country)

Find all products under $200 manufactured in Japan;
return their names and prices.

```
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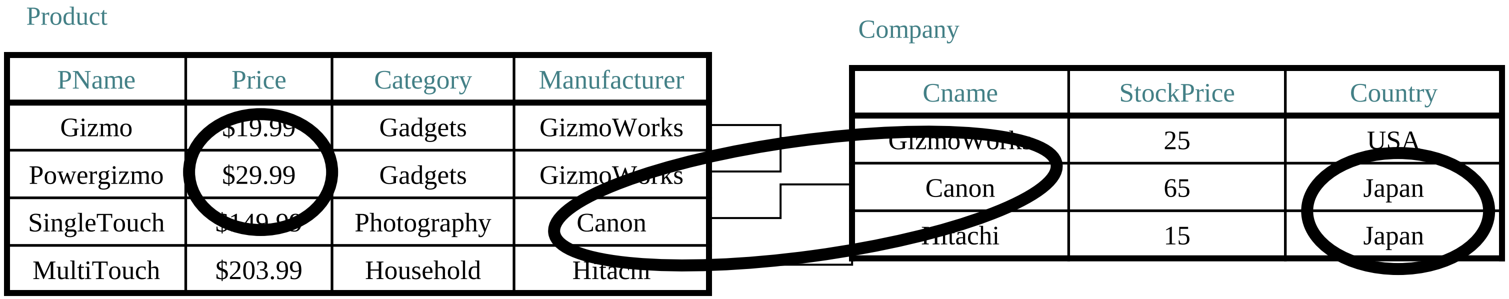
FROM     Product, Company
WHERE    manufacturer=cname AND country='Japan'
         AND price <= 200
```

Join between Product and Company

Joins in SQL



Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
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Company

Cname	StockPrice	Country
GizmoWorks	25	USA
Canon	65	Japan
Hitachi	15	Japan

```
SELECT   pname, price
FROM     Product, Company
WHERE    manufacturer=cname AND country=‘Japan’
         AND price <= 200
```

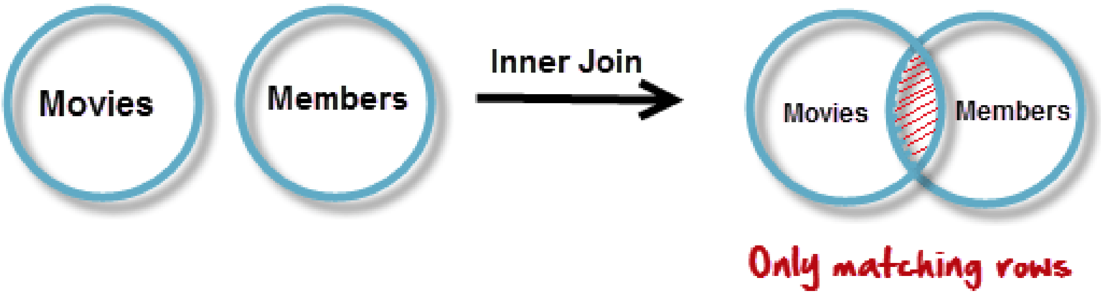
PName	Price
SingleTouch	$149.99

Join Types

- There are Four types of Joins:
  1. Inner Join
  2. Left Outer Join
  3. Right Outer Join
  4. Full Outer Join
  5. Cross Join
- To join tables, you use the cross join, inner join, left join, or right join clause for the corresponding type of join. The join clause is used in the SELECT statement appeared after the FROM clause.

INNER JOIN

- □ The inner JOIN is used to return rows from both tables that satisfy the given condition.
- □ Suppose , you want to get list of members who have rented movies together with titles of movies rented by them. You can simply use an INNER JOIN for that, which returns rows from both tables that satisfy the given conditions.



INNER JOIN

Student

ID	Name
123	John
124	Mary
125	Mark
126	Jane

Enrolment

ID	Code
123	DBS
124	PRG
124	DBS
126	PRG

```
SELECT * FROM
   Student, Enrolment
Where Student.ID=
   Enrolment.ID
```

ID	Name	ID	Code
123	John	123	DBS
124	Mary	124	PRG
124	Mary	124	DBS
126	Jane	126	PRG

INNER JOIN

Product

name	category
Gizmo	gadget
Camera	Photo
OneClick	Photo

Purchase

prodName	store
Gizmo	Wiz
Camera	Ritz
Camera	Wiz

```
SELECT Product.name, Purchase.store
FROM   Product
 INNER JOIN Purchase
            ON Product.name = Purchase.prodName
```

name	store
Gizmo	Wiz
Camera	Ritz
Camera	Wiz

Note: another equivalent way to write an INNER JOIN!

Some Queries Cont. JOIN

```
SELECT FNAME, LNAME, ADDRESS
     FROM EMPLOYEE, DEPARTMENT
     WHERE DNAME='Research' AND
     DNUMBER=DNO
```

Can be written as:

```
SELECT FNAME, LNAME, ADDRESS
     FROM (EMPLOYEE JOIN DEPARTMENT
     ON DNUMBER=DNO)
     WHERE DNAME='Research’
```

Tuple Variables

Get the person names and the address of the company they works fo

Person(pname, address, worksfor)

Company(cname, address)

```
SELECT   DISTINCT pname, address
FROM     Person, Company
WHERE    worksfor = cname
```

Which address ?

```
SELECT   DISTINCT Person.pname, Company.address
FROM     Person, Company
WHERE    Person.worksfor = Company.cname
```

```
SELECT   DISTINCT x.pname, y.address
FROM     Person AS x, Company AS y
WHERE    x.worksfor = y.cname
```

Exercise

Compute for each product, the total number of sales in ‘September’.

Get all the products

Product(pid,name, price, categoryid)

Category(Cid,Cname)

```
SELECT Product.name, count(*) as Total_sales
FROM     Product, Purchase
WHERE   Product.pid = Purchase.pid
        and  Purchase.month = ‘September’
GROUP BY Product.name
```

What’s wrong ?

Product

name	category
Gizmo	gadget
Camera	Photo
OneClick	Photo

Purchase

prodName	store
Gizmo	Wiz
Camera	Ritz
Camera	Wiz

```
SELECT Product.name, count(*) as total_sales
FROM     Product, Purchase
WHERE   Product.pid = Purchase.pid
        and  Purchase.month = ‘September’
GROUP BY Product.name
```

name	C
Gizmo	1
Camera	2

Product

name	category
Gizmo	gadget
Camera	Photo
OneClick	Photo

Purchase

prodName	store
Gizmo	Wiz
Camera	Ritz
Camera	Wiz

name	C
Gizmo	1
Camera	2
OneClick	0

Solution

Compute, for each product, the total number of sales in ‘September’

Product(name, category)

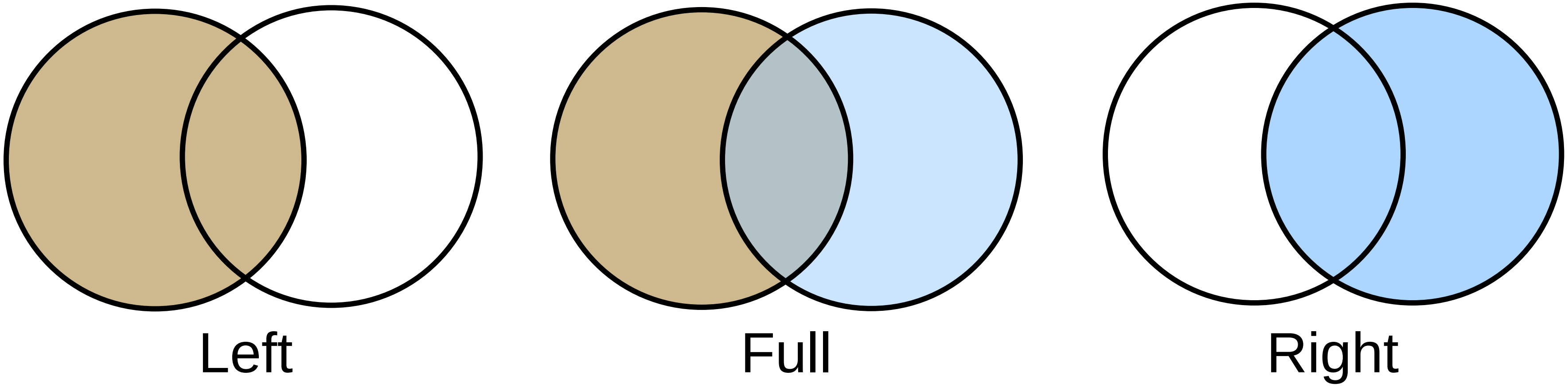
Purchase(prodName, month, store)

```
SELECT Product.name, count(*)
FROM     Product LEFT OUTER JOIN Purchase ON
                   Product.pid = Purchase.pid
              and  Purchase.month = ‘September’
GROUP BY Product.name
```

Now we also get the products who sold in 0 quantity

Types of Joins

- **Outer joins**
  - return all matching rows, plus nonmatching rows from one or both tables
  - can be performed on only two tables at a time.



Outer Joins

- Left outer join:
  - Include the left tuple even if there’s no match
- Right outer join:
  - Include the right tuple even if there’s no match
- Full outer join:
  - Include the both left and right tuples even if there’s no match

Table One

X	A
1	a
4	d
2	b

Table Two

X	B
2	x
3	y
5	v

```
select *
    from one left join two
      on one.x = two.x;
```

X	A	X	B
1	a	.	
2	b	2	x
4	d	.	

Right Join

Table Two

X	B
2	x
3	y
5	v

Table One

X	A
1	a
4	d
2	b

```
select *
    from two right join one
       on one.x = two.x;
```

X	B	X	A
.		1	a
2	x	2	b
.		4	d

Full Join

Table One

X	A
1	a
4	d
2	b

Table Two

X	B
2	x
3	y
5	v

```
select *
    from one full join two
       on one.x = two.x;
```

X	A	X	B
1	a	.	
2	b	2	x
.		3	y
4	d	.	
.		5	v

LEFT OUTER JOIN

Product

name	category
Gizmo	gadget
Camera	Photo
OneClick	Photo

Purchase

prodName	store
Gizmo	Wiz
Camera	Ritz
Camera	Wiz

```
SELECT Product.name, Purchase.store
FROM   Product
 LEFT OUTER JOIN Purchase
          ON Product.name = Purchase.prodName
```

name	store
Gizmo	Wiz
Camera	Ritz
Camera	Wiz
OneClick	NULL

Right Outer Join

List all the employees and any orders they might have placed

Employee

Name	ID	Salary
Nancy	1	1000
Mark	2	1500
Ali	3	2000

Orders

OID	CID	EID	Odate
10308	1024	1	18/9/2016
10857	1055	2	3/5/2017
10698	1022	1	5/1/2017

SELECT Orders.OrderID, Employees.Name
FROM Orders **RIGHT JOIN** Employees
ON Orders.EmployeeID = Employees.EmployeeID
ORDER BY Orders.OrderID;

OID	Name
	Ali
10308	Nancy
10698	Nancy
10857	Mark

Full Outer Join

List all the employees and any orders they might have placed

Employee

Name	ID	Salary
Nancy	1	1000
Mark	2	1500
Ali	3	2000

Orders

OID	CID	EID	Odate
10308	1024	1	18/9/2016
10857	1055	2	3/5/2017
10698	1022	8	5/1/2017

SELECT Orders.OrderID, Employees.Name
FROM Orders **Full Outer JOIN** Employees
ON Orders.EmployeeID = Employees.EmployeeID
ORDER BY Orders.OrderID;

OID	Name
10308	Nancy
10857	Mark
10698	
	Ali

CROSS JOIN

Attributes n+m
Cardinality n*m

Student

ID	Name
123	John
124	Mary
125	Mark
126	Jane

Enrolment

ID	Code
123	DBS
124	PRG
124	DBS
126	PRG

```
SELECT * FROM
Student CROSS JOIN
Enrolment
```

ID	Name	ID	Code
123	John	123	DBS
124	Mary	123	DBS
125	Mark	123	DBS
126	Jane	123	DBS
123	John	124	PRG
124	Mary	124	PRG
125	Mark	124	PRG
126	Jane	124	PRG
123	John	124	DBS
124	Mar		DBS

Solution

Compute, for each product, the total number of sales in ‘September’

Product(name, category)

Purchase(prodName, month, store)

```
SELECT Product.name, count(*)
FROM     Product LEFT OUTER JOIN Purchase ON
                 Product.pid = Purchase.pid
           and  Purchase.month = ‘September’
GROUP BY Product.name
```

Now we also get the products who sold in 0 quantity