Lecture 9
Basic Queries in SQL

Basic Queries

- Basic form of the SQL SELECT statement is called a *mapping* or a *SELECT-FROM-WHERE* block

SELECT <attribute *list*>
FROM *<table list>*
WHERE *<condition>*

- <attribute list>: a list of attribute names whose values are to be retrieved by the query
- <table list>: a list of the relation names required to process the query
- <condition>: a conditional (Boolean) expression that identifies the tuples to be retrieved by the query
  - Form: attr *op* const or attr1 *op* attr2
  - Comparison Operator: =, <, <=, >, >=, and <>
  - Combined using AND, OR, and NOT

Sample Tables

Routes:

RId	RName	Grade	Rating	Height
1	Last Tango	II	12	100
2	Garden Path	I	2	60
3	The Sluice	I	8	60
4	Picnic	III	3	400

Climbers:

CId	CName	Skill	Age
123	Edmund	EXP	80
214	Arnold	BEG	25
313	Bridget	EXP	33
212	James	MED	27

Climbs:

CId	RId	Date	Duration
123	1	10/10/88	5
123	3	11/08/87	1
313	1	12/08/89	5
214	2	08/07/92	2
313	1	06/07/94	3

Sample Queries

```
SELECT *
FROM Routes
WHERE Height < 200;
```

RID	RNAME	GRADE	RATING	HEIGHT
1	Last Tango	II	12	100
2	Garden Path	I	2	60
3	The Sluice	I	8	60

```
SELECT Grade, Height
FROM Routes;
```

GRADE	HEIGHT
II	100
I	60
I	60
III	400

DISTINCT

- An SQL table is not a set of tuples; it is a multiset (bag) of tuples
- SQL doesn't automatically eliminate duplicate tuples
  - Duplicate elimination is an expensive operation
    - Sort tuples first and eliminate duplicates
  - The user may want to see duplicate tuples in the result
  - When an aggregate function is applied to tuples, we do not want to eliminate duplicates in most cases
- Need to request duplicate elimination explicitly using keyword DISTINCT in the SELECT clause

DISTINCT Example

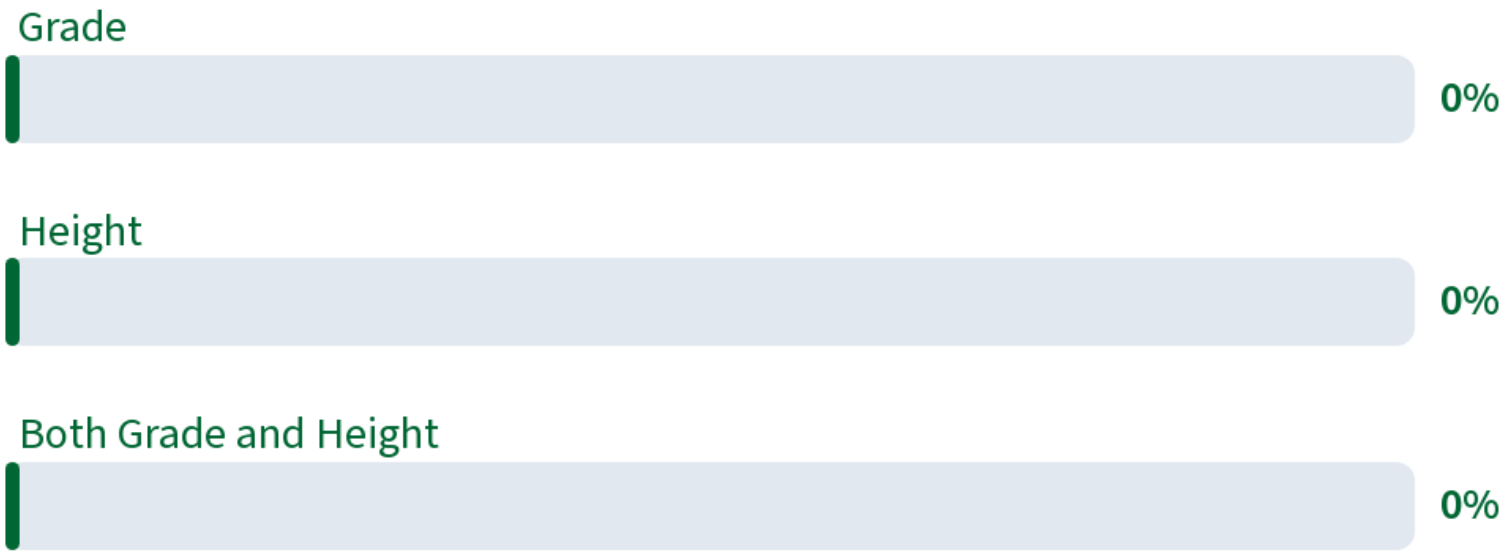
```
SELECT DISTINCT Grade, Height
FROM Routes;
```

GRADE	HEIGHT
I	60
II	100
III	400

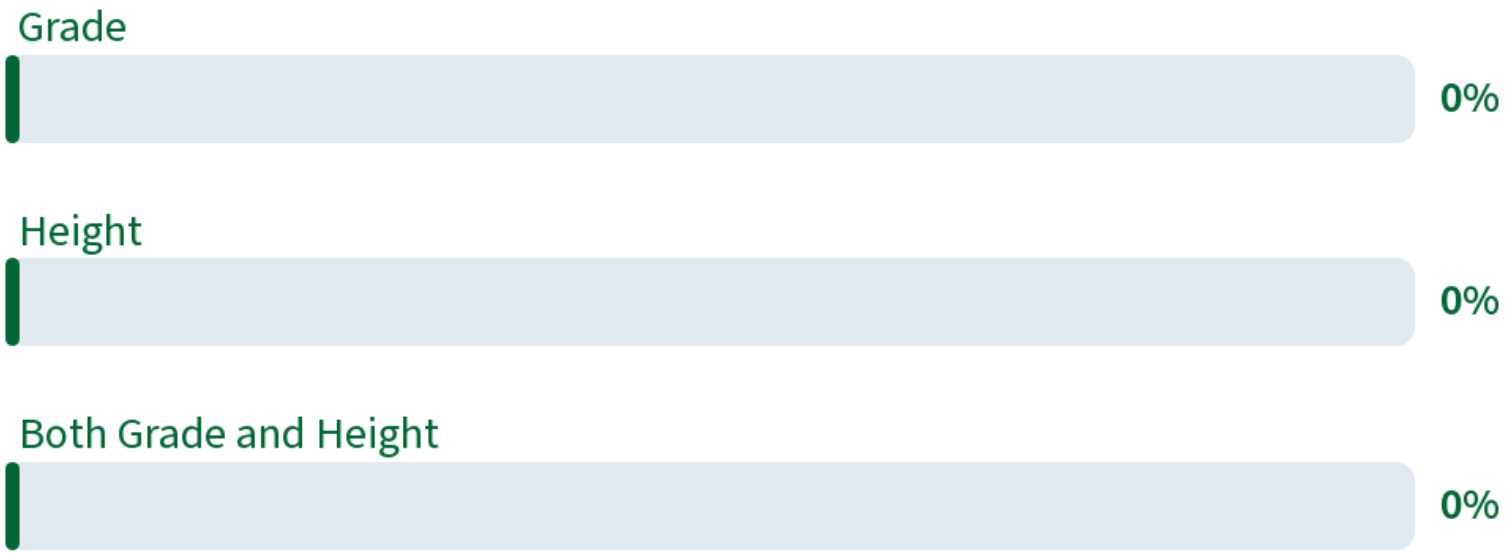
What does DISTINCT apply to?

- Grade
- Height
- Both Grade and Height

What does DISTINCT apply to?



What does DISTINCT apply to?



Aliases

- An alternative relation name (tuple variable) can be declared
- An alias can follow the keyword AS or it can directly follow the relation name
- Aliases can also be given to the relation attributes
- Example:

  EMPLOYEE AS E (B_1, B_2,…, B_n)

Example 1

- The names of climbers who have climbed route 1

```
SELECT CName
FROM Climbers, Climbs
WHERE Climbers.CId = Climbs.CId
AND RId= 1;
```

CNAME
Edmund
Bridget
Bridget

Example 2

- The names of climbers who have climbed the route named “Last Tango”

```
SELECT CName
FROM Climbers, Climbs, Routes
WHERE Climbers.CId = Climbs.CId
AND   Routes.RId = Climbs.RId
AND   RName = 'Last Tango';
```

CNAME
Edmund
Bridget
Bridget

Example 3

- The IDs of climbers who have climbed the same route at least twice

```
SELECT C1.CId
FROM Climbs C1, Climbs C2
WHERE C1.CId = C2.CId
AND   C1.RId = C2.RId
AND   (C1.Date <> C2.Date OR
       C1.DURATION <> C2.DURATION);
```

CID
313
313

- Note the use of aliases for relations

Exercise

- Department: Dname, Dnumber, MgSSN, Mgstartdate
- Employee: Name, SSN, Bdate, Address, Sex, Salary, superSSN, Dno
- Project: Pname, Pnumber, Plocation, Dno

Exercise (Cont.)

- Retrieve the birthday and address of the employee(s) whose name is “John Smith”.
- Retrieve the names and address of all employees who work for the research department.
- For every project located in “Stafford”, list the project #, controlling department #, the department manager’s name, address, and birthdate.
- For each employee, retrieve the employee’s name and the name of his/her immediate supervisor.

Unspecified Where Clause

- A missing WHERE clause: no condition on tuple selection
  - Only one relation specified in the FROM clause: All tuples of the relation qualify and are selected for the query result
  - More than one relation is specified in the FROM clause: Cross Product--all possible tuple combinations of these relations is selected

Use of the Asterisk

- Retrieve all the attributes of the selected tuples
- Don’t have to list the attribute names explicitly in SQL
- Specify an asterisk *, which stands for all the attributes
- Example:

```
Select    *
From      Employee
Where     Dno=5;
```

Example -- Products

```
SELECT *
FROM Climbers,Climbs;
```

CID	CNAME	SKILL	AGE	CID	RID	DAY	DURATION
123	Edmund	EXP	80	123	1	10-OCT-88	5
214	Arnold	BEG	25	123	1	10-OCT-88	5
313	Bridget	EXP	33	123	1	10-OCT-88	5
212	James	MED	27	123	1	10-OCT-88	5
123	Edmund	EXP	80	123	3	08-NOV-87	1
214	Arnold	BEG	25	123	3	08-NOV-87	1

...

- Note that the CID column name is duplicated in the output

Pattern Matching

- Only compare parts of a character string, using the LIKE comparison operator
- Can be used in WHERE clause
- Partial strings are specified using two reserved characters:
  - "_" denotes any single character
  - "%" replaces 0 or more characters

Example

```
SELECT *
FROM Routes
WHERE RName LIKE 'L_%o';
```

RId	RName	Grade	Rating	Height
1	Last Tango	II	12	100

Arithmetic

- Arithmetic can be used to compute results
- “AS” can be used to label columns in the output:

```
SELECT DISTINCT Grade, Height/10 AS H
FROM Routes;
```

Grade	H
II	10
I	6
III	40

Exercise

- Employee: Name, SSN, Address, Salary
- Project: Pname, Pnumber, Plocation, Dnum
- Works_on: ESSN, Pno, Hours

Exercise (Cont.)

- Retrieve the names of all employees whose address is in Fairfax, VA.
- Show the resulting salaries and the name of each employee working on the ‘ProductX’ project if they are given a 10% raise.

Set Operations -- UNION

```
SELECT CId
FROM Climbers
WHERE Age < 40
UNION
SELECT CId
FROM Climbs
WHERE RID = 1 ;
```

CId
123
212
214
313

- Duplicates do not occur in the union

The UNION ALL Operator Preserves Duplicates

```
SELECT CId
FROM Climbers
WHERE Age < 40
UNION ALL
SELECT CId
FROM Climbs
WHERE RID = 1 ;
```

CId
214
313
212
123
313
313

INTERSECT and EXCEPT

```
SELECT CId
FROM Climbers
WHERE Age > 40
INTERSECT
SELECT CId
FROM Climbs
WHERE RId = 1 ;
```

CID
123

```
SELECT CId
FROM Climbers
WHERE Age < 40
MINUS
SELECT CId
FROM Climbs
WHERE RId = 1 ;
```

CID
212
214

Exercise

- Sailors: sid, sname, rating, age
- Boats: bid, bname, color
- Reserves: sid, bid, day

Exercise (Cont.)

- Find the names of sailors who have reserved a red or a green boat.
- Find the sids of all sailors who have reserved both a red and a green boat.
- Find the sids of all sailors who have reserved red boats but not green boats.