Set

- A collection of elements
  - No ordering

\[ A_1 = \{ a, b, c, d \} \]
\[ A_2 = \{ b, c, d, a \} \]

Set Operations

- **In**
  - \( e \in A \)
  - \( A = \{ a, b, c \} \)
  - \( B = \{ c, a, d \} \)

- **Union**
  - \( A \cup B \)
  - \( A \cup B = ?? \)

- **Intersection**
  - \( A \cap B \)
  - \( A \cap B = ?? \)

- **Difference**
  - \( A - B \)
  - \( B - A = ?? \)

IN in Subquery Form

- Single column on both sides
- Return TRUE if the value of the expression equals any row in subquery result

SELECT * FROM Movie_stars m WHERE m.fname, m lname
IN (SELECT * FROM Singers);

SELECT * FROM Movie_stars m WHERE m.fname +/- m lname
IN (SELECT * FROM Singers);

More about IN

- **IN in scalar form**
  - \( expression \text{ IN} (value1, \ldots) \)

SELECT name FROM People WHERE id IN (10003, 10004);

- **NOT IN**

SELECT name FROM People WHERE id NOT IN (10003, 10004);

UNION Operation in SQL

- Combine *result sets* of multiple queries
- Syntax:

query1 UNION query2 [UNION query3 ... ];

UNION

<table>
<thead>
<tr>
<th>Raj</th>
<th>Pamela</th>
<th>Jiang</th>
<th>Guo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valentino</td>
<td>Creed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changyu</td>
<td>Sun</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
UNION vs. Cartesian Product

- **UNION**
  - Merge two tables vertically
  - Tables have to be results of subqueries

- **Cartesian product**
  - Merge two tables horizontally
  - Tables can be original database tables

Some UNION Examples

- `SELECT * FROM Movie_stars UNION SELECT * FROM Singers;`
- `SELECT fname FROM Movie_stars UNION SELECT * FROM Singers;`
- `SELECT * FROM Singers UNION SELECT fname FROM Movie_stars;`
- `SELECT "no name" FROM Singers UNION SELECT * FROM Movie_stars;`
- `SELECT NULL, fname, lname, NULL, NULL, NULL FROM Movie_stars;
UNION
SELECT * FROM People;`
- `SELECT 0, fname, lname, NULL, 0, 0 FROM Movie_stars
UNION
SELECT * FROM People;`

About UNION Operation

- Number of columns
- Column headings
- Duplicates
- Sorting
- Union compatibility
  - Numerical, Text, and Date/Time
- Place holders
  - Don’t use NULL as place holders for numerical or date types

UNION ALL

- Do not remove duplicates
- Do not sort the results

query1 UNION ALL query2 [UNION ALL query3 ... ];

Intersection and Difference in MS Access

- **Intersection**
  - \( e \in A \cap B \) iff \( e \in A \) and \( e \in B \)
- **Difference**
  - \( e \in A \ - \ B \) iff \( e \in A \) and \( e \notin B \)