Join Operations

Cartesian Product

- Goal: get a relation that associates Dept Name with Employee
- 1st Step: associate EVERY dept with EVERY employee
Cartesian Product

Now we can pick out the ones where DNO and DNUM are the same.

Select + Cartesian Product

\[ \sigma_{dno=dnum} (TMP) \]
JOINS

- This sequence -- CARTESIAN PRODUCT then SELECTION is called a JOIN.
- Frequently used in DATABASE
- Two types:
  - THETA (θ) JOIN,
  - NATURAL JOIN
- In this course, you can almost always use NATURAL.
- But θ-join is more general.

<table>
<thead>
<tr>
<th>FNAME</th>
<th>LNAME</th>
<th>SSN</th>
<th>DNO</th>
<th>DNAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>John</td>
<td>Smith</td>
<td>123456789</td>
<td>5</td>
<td>Rsch</td>
</tr>
<tr>
<td>Frank</td>
<td>Wong</td>
<td>333445555</td>
<td>5</td>
<td>Rsch</td>
</tr>
<tr>
<td>Alice</td>
<td>Zelaya</td>
<td>999877777</td>
<td>4</td>
<td>Admin</td>
</tr>
<tr>
<td>Jenny</td>
<td>Wallace</td>
<td>987654321</td>
<td>4</td>
<td>Admin</td>
</tr>
<tr>
<td>James</td>
<td>Borg</td>
<td>888665555</td>
<td>1</td>
<td>HQ</td>
</tr>
</tbody>
</table>

THETA JOIN

- Here θ is ‘=’ (equality)
- Note equality makes 2 identical columns (DNO & DNUM)
NATURAL JOIN

- Eliminates extra column
- Can only JOIN on EQUALITY (99% of joins are on equality)

DIFFERENCES

- Syntax of θ-JOIN subscript is
  - fieldA = fieldB (or fieldA >= fieldB, etc.)
- Syntax of NATURAL JOIN subscript is
  - (fieldA),(fieldB)
More than ONE CONDITION

• $\theta$-JOIN subscript, like $\sigma$ subscript:
  - fieldA = fieldB AND fieldC > fieldD
  - Each condition must involve one field from each relation so
  - fieldA = fieldB AND fieldC = 5 is not allowed
• NATURAL JOIN subscript uses 2 lists:
  - (fieldA, fieldC, fieldE), (fieldB, fieldD, fieldF)