Week 3

LeftOver Relational Algebra

First lab

- Today (Monday Sept 27th) – 4:30 – 5:20pm – on zoom
- Link on Courselink

- Select
- Project
- Join
  - Cartesian product
  - Natural join
  - Theta join
  - Outer joins
- Divide by
- Set operators

Movies:

mID	title	director	year	length
1	Shining	Kubrick	1980	146
3	Chinatown	Polaski	1974	131
5	Star Wars IV	Lucas	1977	126
6	American Graffiti	Lucas	1973	110

Note that I have changed the instance of table movies to demo the next operator we learn.

List all actors who play a role in every movie listed in the database.

Artists:

aID	aName	nationality
1	Nicholson	American
2	Ford	American
3	Stone	British
4	Fisher	American
5	Bachchan	Indian

Roles:

mID	aID	character
1	1	Jack Torrance
3	1	Jake 'J.J.' Gittes
1	3	Delbert Grady
5	1	Han Solo
6	1	Bob Falfa
5	4	Princess Leia Organa

Division operator

- Division is a binary operator which returns a relation
  - with all the attributes of R that are not attributes of S
  - with all the tuples from R that “match” every tuple in S
- Notation: R ÷ S
  - every attribute of S must be an attribute of R

Division

Note that to divide R1 by R2, every attribute in R2 must be an attribute in R1

- Example

R1

Col1	Col2
A	1
A	2
B	1
B	2
C	1

R2

Col2
1
2

R1 ÷ R2

Col1
A
B

Movies:

mID	title	director	year	length
1	Shining	Kubrick	1980	146
3	Chinatown	Polaski	1974	131
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Set operations

- Because relations are sets, we can use set intersection, union and difference.
- Relations must be Union Compatible: Two relations R(A1,….An) and S(B1,…Bn) are said to be ***Union Compatible*** if they have the same degree n and Domain(Ai) = Domain(Bi) where $1 \leq i \leq n$
- You can make 2 relations union compatible by projecting ($\prod$) the desired attributes, before applying any set operator.

Set operators

R ∪S: is a relation that includes all tuples that are either in R or in S or in both R and S, duplicate tuples being eliminated.

R ∩S: is a relation that includes all tuples that are in both R and in S.

R – S: is a relation that includes all tuples that are in R but not in S.

Movies:

mID	title	director	year	length
1	Shining	Kubrick	1980	146
2	Player	Altman	1992	146
3	Chinatown	Polaski	1974	131
4	Repulsion	Polaski	1965	143
5	Star Wars IV	Lucas	1977	126
6	American Graffiti	Lucas	1973	110
7	Full Metal Jacket	Kubrick	1987	156

names of actors who do not work in a movie with mID = 1

Roles

-

<1, 2>

Artists:

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1	Nicholson	American
2	Ford	American
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4	Fisher	American

Roles:

mID	aID	character
1	1	Jack Torrance
3	1	Jake 'J.J.' Gittes
1	3	Delbert Grady
5	2	Han Solo
6	2	Bob Falfa
5	4	Princess Leia Organa

Relational algebra wrap-up

- Approaching the problem:
  - Ask yourself which relations need to be involved.
  - If an instance is given, use it to get results – that tells you a lot – the relations involved, operators required to get results etc.
  - Is there an intermediate relation that would help you get the final answer?
    - Draw it out with actual data in it.
    - Use assignment to define those intermediate relations.
  - Every time you combine relations, confirm that
    - attributes with same name will be made to match, unless otherwise stated in the design
    - Mostly, natural join will suffice when you join relations
    - If a self join is required, use cartesian product
    - Look for ‘for all’ or ‘every’ clause in the query – that should give you a hint that you might need to use divideBy (÷)

Relational Calculus

- Another abstract query language for the relational model.
- Based on first-order logic.
- RC is “declarative”: the query describes what you want, but not how to get it.
- Queries look like this:
  $\{ t \mid t \in Movies \wedge t[director] = \text{“Scott”} \}$
- Expressive power (when limited to queries that generate finite results) is the same as RA. It is “relationally complete.”

We will focus ONLY on RA for 3530 this term