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# Tutorial 7

CSC 343  
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# Relational Algebra

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$\sigma$  is Selection

- Selection is used to specify a certain row.
- $\sigma_c(R)$  where  $c$  is a list of conditions involving the attribute(s)  $R$ .

$\pi$  is Projection

- Projection is used to specify a certain column.
- $\pi_L(R)$  where  $L$  is a list of attributes involving the attribute(s)  $R$ .

$\times$  is Cartesian Product

- Cartesian Product is the combination of two (or more) relations.
- $R := R1 \times R2$  where the tuples of  $R1$  and tuples  $R2$  are paired together to form  $R$ .



# Relational Algebra

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$\cup$  is Union

- Union is used to combine two relations into one.
- Suppose a tuple  $t$  appears in  $R1$   $m$  times, and in  $R2$   $n$  times. Then in the union,  $t$  appears  $m + n$  times.

$\cap$  is Intersection

- Intersection is used to see what overlaps in two relations.
- Suppose a tuple  $t$  appears in  $R1$   $m$  times, and in  $R2$   $n$  times. Then in the intersection,  $t$  appears  $\min(m, n)$  times.

$-$  is Difference

- Difference is basically subtraction, it is used to see what is left over in  $R1$  when  $R1 - R2$ .
- Suppose a tuple  $t$  appears in  $R1$   $m$  times, and in  $R2$   $n$  times. Then in the difference,  $t$  appears  $\max(0, m - n)$  times.



# Relational Algebra

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$\bowtie$  is Natural Join

- Connects (aka joins) two relations by equating attributes of the same name and by projecting out one copy of each pair of equated attributes.

$\bowtie_c$  is Theta Join

- Where the condition  $c$  is:
  - $a \theta b$ , where  $a$  and  $b$  are attribute names; or
  - $a \theta x$ , where  $a$  is an attribute name and  $x$  is value.

$\theta$  here represents a binary relational operator belonging to  $\{\leq, <, =, >, \geq\}$ .

- Connects (aka joins) two relations by equating attributes based on some condition
- $\bowtie_c$  is Equijoin iff  $c$ 's  $\theta$  is the equality operator (i.e.  $=$ ).



# Relational Algebra

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$\rho$  does Renaming

- $R1 := \rho_{R1(A1, \dots, An)}(R2)$ , where R1 becomes a new relation with the attributes  $A1, \dots, An$  of R2.
- $\rho_{a/b}(R)$ , where  $b$  is an attribute of  $R$  and  $a$  is the renamed attribute name.

$\delta$  does Duplicate Elimination

- This is used for duplicate elimination in bag semantics.
- $R1 := \delta(R2)$  will result in R1 containing one copy of each tuple that appears in R2 one or more times.

Check lecture slides + book for more info about RA operators.



# Task & Checkpoint

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## Task

Download *Tut\_RA\_practice.pdf* from the course site. Given those 4 relations, solve the relational algebra statements below. You may consider taking the English text, translating it into an SQL statement, and then translating that into RA (or vice versa) for added practice/clarity.

## Checkpoint

→ Complete any 3 of the 10 English to Relational Algebra translations.



# Any Questions?

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- Do you have any questions?
  1. Check piazza
  2. Post the question on piazza  
(unless it's a personal question then email one of the TAs)
- If you have any content that you would like to be added in a Tutorial, please let me know by Friday!
- Email requests to:
  - [oluwaseun.cardoso@mail.utoronto.ca](mailto:oluwaseun.cardoso@mail.utoronto.ca) OR
  - [saihiel.bakshi@mail.utoronto.ca](mailto:saihiel.bakshi@mail.utoronto.ca)