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# Relational Calculus

Asst. Prof. Lipyeow Lim

Information & Computer Science Department

University of Hawaii at Manoa

# Relational Calculus (RC)

- RC is an alternative to RA
- RC is non-procedural, or declarative: describe what the results of a query should be without specifying how to get the results
- Two variants:
  - Tuple Relational Calculus
  - Domain Relational Calculus (not covered in ICS321)

# Tuple Relational Calculus (TRC)

- Uses **tuple variables** : a variable that takes on tuples of a particular relation schema as values.
- A TRC query is specified using set-theoretic first order logic expressions of the form

$$\{ T \mid p(T) \}$$

- T is a tuple variable and is the only free variable in p
- p(T) is a formula that describes T
  - Any atomic formula
    - $R \in Rel$
    - R.a $\{<>.=,\neq,\geq,\leq\}$ S.b
    - R.a $\{<>.=,\neq,\geq,\leq\}$ constant, or constant $\{<>.=,\neq,\geq,\leq\}$ R.a
  - $\neg p$, $p \wedge q$, $p \vee q$, $p \rightarrow q$
  - $\exists R( p(R) )$, where R is a tuple variable
  - $\forall R( p(R) )$, where R is a tuple variable

# Q11: Find all sailors with rating above 7

- The TRC expression for this query is

$$\{ S \mid S \in \text{Sailors} \wedge S.\text{rating} > 7 \}$$

- Reads: the set of S tuples, such that S is a member of the Sailors relation instance AND S's rating is greater than 7.

# Q12: Find the names and ages of sailors with a rating above 7

- The TRC expression for this query is

$$\{ P \mid \exists S \in \text{Sailors} (S.\text{rating} > 7 \wedge P.\text{name}=S.\text{name} \wedge P.\text{age}=S.\text{age} ) \}$$