

# Domain Relational Calculus

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## 1 Administrivia

Collect assignment. Distribute next assignment.

### Announcements

### Assignment

Read 7.2, 7.5.

### From Last Time

Tuple relational calculus.

### Outline

1. Introduction to DRC.
2. Examples.
3. Practice.

## Coming Up

The “Big Merge.”

## 2 Domain Relational Calculus

1. Visual query languages (QBE, Access) are based upon this.
2. Simple example DRC query:

$$\{Pid\ Code \mid Teaching(Pid, Code, F1997)\}$$

3. General form of a TRC query:

$$\{X_1, \dots, X_n \mid Condition\}$$

where:

- (a)  $X_i$  is a *domain variable* which ranges over all possible values for that domain.
- (b) Condition is (these are similar to TRC):
  - i. Atomic:
    - A.  $P(X_1, \dots, X_n)$ , asserting that the tuple formed by the  $X_i$ s is in relation R.
    - B.  $X\ oper\ Y$  or  $X\ oper\ const.$
  - ii. Two conditions combined using AND or OR, or one condition modified by NOT.
  - iii. A condition (C), Relation (R), and domain variable (X) combined as
$$\exists X \in R.A\ (C)$$
$$\forall X \in R.A\ (C)$$
- (c) The  $X_i$ s in the target may be the only free variables.

4. The meaning of a DRC query is similar to that of a TRC query.

## 2.1 Examples

1. Retrieve names of all professors who have taught MGT123:

$$\{N \mid \exists I \in Professor.Id \exists D \in Professor.DeptId \\ (Professor(I, N, D) \text{ AND } \exists S \in Teaching.Semester \\ (Teaching(I, MGT123, S)))\}$$

This can be abbreviated:

$$\{N \mid Professor(I, N, D) \text{ AND } (Teaching(I, MGT123, S))\}$$

(Non-target free variables are implicitly existentially quantified used the universal domain.)

2. All courses that have been taken by every student:

$$\{C \mid Course(D, C, N, D) \text{ AND} \\ \forall S \in Student.Id (Transcript(S, C, SEM, G))\}$$

3. Find all students who have ever taken a course from every professor who has ever taught a course.

$$\{I \mid Transcript(I, C1, SEM1, G1) \text{ AND} \\ \forall PI \in Teaching.ProfId (Teaching(PI, C2, SEM2) \\ \text{ AND } Transcript(I, C2, SEM2, G2))\}$$

4. Retrieve IDs of students who did not take any courses in F2001:

$$\{I \mid Student(I, N, A, S) \text{ AND } NOT Transcript(I, C, F2001, G)\}$$

5. Find potential student graders for this semester's courses:

$$\{P, C, S \mid Teaching(P, C, S2002) \text{ AND } Transcript(S, C, SEM, G) \\ \text{ AND } SEM \neq S2002\}$$

## 2.2 Practice

Write DRC queries to answer the following:

1. Retrieve name of student with largest ID number.

2. Names of all professors who have taught CS318.
3. The names of all sophomores who received A's during the F2001 semester.
4. The IDs of all students who took exactly one course during the F2001 semester.
5. The IDs of all students who have taken a course with me.
6. The IDs of all students who have taken every course I've taught.