Courses B0B36DBS, A7B36DBS: Database Systems

Practical Class 12:
Relational Algebra

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Exercises

• Assume the following relational database schema

  **Student**\(id, \text{name, address}\)
  **Teacher**\(id, \text{name, phone, department}\)
  \(\text{department} \subseteq \text{Department(name)}\)
  **Department**\(name, \text{chair}\)
  \(\text{chair} \subseteq \text{Teacher(id)}\)
  **Course**\(code, \text{title, annotation}\)
  **Dependency**\(\text{course, requisite}\)
  \(\text{course} \subseteq \text{Course(code)}, \text{requisite} \subseteq \text{Course(code)}\)
  **Schedule**\(\text{course, teacher, semester, day, time, room}\)
  \(\text{course} \subseteq \text{Course(code)}, \text{teacher} \subseteq \text{Teacher(id)}, \text{room} \subseteq \text{Room(number)}\)
  **Room**\(\text{number, building, capacity}\)
  **Enrollment**\(\text{student, semester, code, result}\)
  \(\text{student} \subseteq \text{Student(id)}, \text{code} \subseteq \text{Course(code)}\)
Exercise 1

• Express the following query in RA
  - Names of teachers from department *KSI*

\[
\begin{align*}
\text{Teacher}(id, \text{name, phone, department}) \\
\text{department} & \subseteq \text{Department}(\text{name}) \\
\text{Department}(\text{name, chair}) \\
\text{chair} & \subseteq \text{Teacher}(id)
\end{align*}
\]
Exercise 2

- Express the following query in RA
  - Study results of a student with identifier 4301 within the previous semester (161)
    - Return course codes, titles, and the actual results
    - Order the rows according to the actual study results and then also course names in descending order

\[
\begin{align*}
\text{Student}(\text{id, name, address}) \\
\text{Course}(\text{code, title, annotation}) \\
\text{Enrollment}(\text{student, semester, code, result}) \\
\text{student} \subseteq \text{Student}(\text{id}) \\
\text{code} \subseteq \text{Course}(\text{code})
\end{align*}
\]
Exercise 3

- Express the following query in RA
  - Names of teachers from all departments that have *Tomas Skopal* as a department chief

\[
\text{Teacher}(id, \text{name}, \text{phone}, \text{department}) \\
\text{department} \subseteq \text{Department}(\text{name})
\]

\[
\text{Department}(\text{name}, \text{chair}) \\
\text{chair} \subseteq \text{Teacher}(id)
\]
Exercise 4

• Express the following query in RA
  
  - Codes and titles of all courses that are taught on Mondays or Fridays during this semester (162)

\[
\text{Course}(\text{code, title, annotation})
\]

\[
\text{Schedule}(\text{course, teacher, semester, day, time, room})
\]

\[
\text{course} \subseteq \text{Course}(\text{code}), \text{teacher} \subseteq \text{Teacher}(\text{id}), \text{room} \subseteq \text{Room}(\text{number})
\]
Exercise 5

• Express the following query in RA

  ▪ Codes and titles of all courses that are not taught on Mondays and nor on Fridays this semester (162)

\[
\text{Course} (\text{code}, \text{title}, \text{annotation}) \\
\text{Schedule} (\text{course}, \text{teacher}, \text{semester}, \text{day}, \text{time}, \text{room})
\]
\[
\text{course} \subseteq \text{Course} (\text{code}), \text{teacher} \subseteq \text{Teacher} (\text{id}), \text{room} \subseteq \text{Room} (\text{number})
\]
Exercise 6

• Express the following query in RA
  
  ▪ Students without any enrolled course this year (semesters 161 and 162)
    – Return student names and addresses

  $\text{Student}(id, \text{name, address})$
  $\text{Enrollment}(\text{student, semester, code, result})$
  student $\subseteq \text{Student}(id)$, code $\subseteq \text{Course(code)}$
Exercise 7

- Express the following query in RA
  - Identifiers of students who have enrolled in all the courses that are taught during this semester (162)

\[
\text{Schedule}(\text{course, teacher, semester, day, time, room}) \\
\text{course} \subseteq \text{Course}(\text{code}), \text{teacher} \subseteq \text{Teacher}(\text{id}), \text{room} \subseteq \text{Room}(\text{number})
\]

\[
\text{Enrollment}(\text{student, semester, code, result}) \\
\text{student} \subseteq \text{Student}(\text{id}), \text{code} \subseteq \text{Course}(\text{code})
\]
Exercise 8

- Express the following query in RA
  - **Names of teachers who have time conflicts in their schedules for the next semester (171)**
    - Two events are in a conflict if...
      - they have overlapping times, but also
      - when there is less than 10 minutes for a break / 45 minutes for a transfer in case of events scheduled within the same / in different buildings respectively
    - Each event is 90 minutes long

**Teacher**(id, name, phone, department)
  department ⊆ Department(name)

**Schedule**(course, teacher, semester, day, time, room)
  course ⊆ Course(code), teacher ⊆ Teacher(id), room ⊆ Room(number)

**Room**(number, building, capacity)