

## CS34800 - PSO Solutions - Week 7

Consider the following relations for a database that keeps track of student enrollment in courses and the books adopted for each course:

STUDENT (ID, Name, Major, Bdate)

COURSE (Course\_number, Cname, Dept)

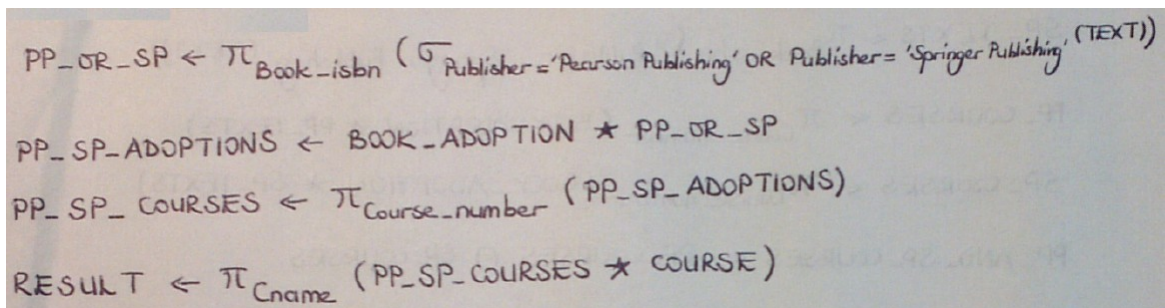
ENROLLED (ID, Course\_number, Quarter, Grade)

BOOK\_ADOPTION (Course\_number, Quarter, Book\_isbn)

TEXT (Book\_isbn, Book\_title, Publisher, Author)

Write the following queries in relational algebra:

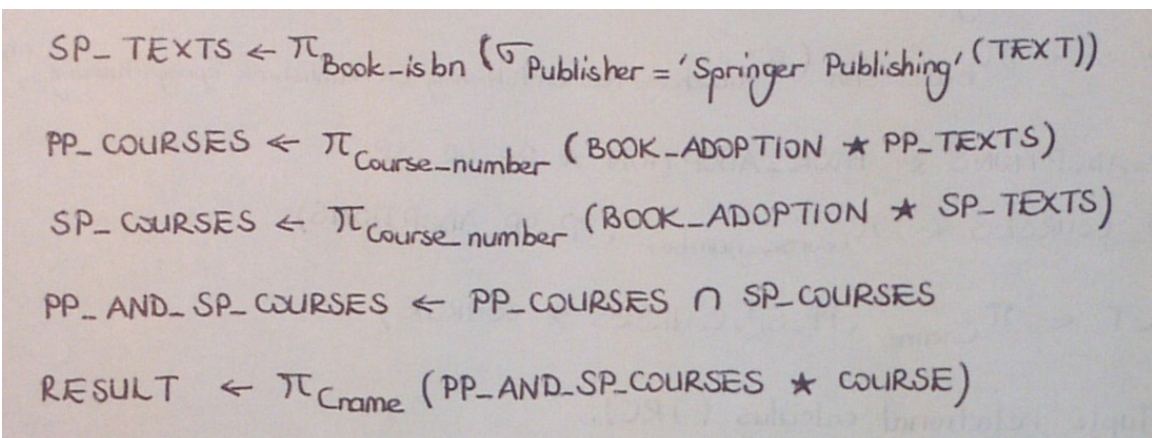
1. List the names for courses, which have used textbooks published by 'Pearson Publishing' or 'Springer Publishing'.



Handwritten relational algebra query for question 1:

$$\begin{aligned} \text{PP\_OR\_SP} &\leftarrow \pi_{\text{Book\_isbn}} (\sigma_{\text{Publisher} = \text{'Pearson Publishing'} \text{ OR } \text{Publisher} = \text{'Springer Publishing'}} (\text{TEXT})) \\ \text{PP\_SP\_ADOPTIONS} &\leftarrow \text{BOOK\_ADOPTION} \star \text{PP\_OR\_SP} \\ \text{PP\_SP\_COURSES} &\leftarrow \pi_{\text{Course\_number}} (\text{PP\_SP\_ADOPTIONS}) \\ \text{RESULT} &\leftarrow \pi_{\text{Cname}} (\text{PP\_SP\_COURSES} \star \text{COURSE}) \end{aligned}$$

2. List the names for courses, which have used textbooks published by 'Pearson Publishing' and 'Springer Publishing'.



Handwritten relational algebra query for question 2:

$$\begin{aligned} \text{SP\_TEXTS} &\leftarrow \pi_{\text{Book\_isbn}} (\sigma_{\text{Publisher} = \text{'Springer Publishing'}} (\text{TEXT})) \\ \text{PP\_COURSES} &\leftarrow \pi_{\text{Course\_number}} (\text{BOOK\_ADOPTION} \star \text{PP\_TEXTS}) \\ \text{SP\_COURSES} &\leftarrow \pi_{\text{Course\_number}} (\text{BOOK\_ADOPTION} \star \text{SP\_TEXTS}) \\ \text{PP\_AND\_SP\_COURSES} &\leftarrow \text{PP\_COURSES} \cap \text{SP\_COURSES} \\ \text{RESULT} &\leftarrow \pi_{\text{Cname}} (\text{PP\_AND\_SP\_COURSES} \star \text{COURSE}) \end{aligned}$$

3. List the departments, which have all of their adopted books published by 'Pearson Publishing'.

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PP_BOOKS ←  $\pi_{\text{Book\_isbn}} (\sigma_{\text{Publisher} = \text{'Pearson Publishing'}} (\text{TEXT}))$ 
NON_PP_BOOKS ←  $\pi_{\text{Book\_isbn}} (\sigma_{\text{Publisher} \neq \text{'Pearson Publishing'}} (\text{TEXT}))$ 
PP_COURSES ← (BOOK_ADOPTION  $\star$  PP_BOOKS)
NON_PP_COURSES ← (BOOK_ADOPTION  $\star$  NON_PP_BOOKS)
PP_DEPTS ←  $\pi_{\text{Dept}} (\text{PP\_COURSES} \star \text{COURSE})$ 
NON_PP_DEPTS ←  $\pi_{\text{Dept}} (\text{NON\_PP\_COURSES} \star \text{COURSE})$ 
RESULT ← PP_DEPTS - NON_PP_DEPTS

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4. Provide a list of textbooks (include Course\_number, Book\_isbn, Book\_title) for courses offered by the 'CS' department that have used more than one book.

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CS_COURSES ←  $\pi_{\text{Course\_number}} (\sigma_{\text{Dept} = \text{'CS'}} (\text{COURSE}))$ 
CS_BOOK_ADOPTIONS ← CS_COURSES  $\star$  BOOK_ADOPTION
CS_BA_2 (Course_number2, Book_isbn2) ←  $\pi_{\text{Course\_number}, \text{Book\_isbn}} (\text{CS\_BOOK\_ADOPTIONS})$ 
DIFF_BOOKS ← CS_BOOK_ADOPTIONS  $\bowtie_{\substack{\text{Course\_number} = \text{Course\_number2} \\ \text{AND Book\_isbn} \neq \text{Book\_isbn2}}} \text{CS\_BA\_2}$ 
RES_BOOKS ← TEXT  $\star$  DIFF_BOOKS
RESULT ←  $\pi_{\text{Course\_number}, \text{Book\_isbn}, \text{Book\_title}} (\text{RES\_BOOKS})$ 

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5. List the names of students who have not been enrolled in any courses that use textbooks published by 'Springer Publishing'.

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SPRINGER_BOOKS ←  $\pi_{\text{Book\_isbn}}$  ( $\sigma_{\text{Publisher} = \text{'Springer Publishing'}}(\text{TEXT})$ )
SPR_ENR ← (ENROLLED  $\star$  BOOK_ADOPTION)  $\star$  SPRINGER_BOOKS
SPR_ENR_IDS ←  $\pi_{\text{ID}}$  (SPR_ENR)
NO_SPR_IDS ← ( $\pi_{\text{ID}}$  (STUDENT)) - SPR_ENR_IDS
RESULT ←  $\pi_{\text{Name}}$  (NO_SPR_IDS  $\star$  STUDENT)

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6. List the names of students who are enrolled in all courses offered by the 'Math' department in the quarter 'Fall 2014', which use a textbook published by 'McGraw-Hill'.

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MATHCRS ←  $\pi_{\text{Course\_number}}$  ( $\sigma_{\text{Dept} = \text{'Math'}}(\text{COURSE})$ )
F14_ADOPTIONS ←  $\sigma_{\text{Quarter} = \text{'Fall 14'}}(\text{MATHCRS} \star \text{BOOK\_ADOPTION})$ 
F14_TEXTS ← F14_ADOPTIONS  $\star$  TEXT
MCGRAWTEXTS ←  $\sigma_{\text{Publisher} = \text{'McGraw-Hill'}}(\text{F14\_TEXTS})$ 
MCGRAWCRS ←  $\pi_{\text{Course\_number}, \text{Quarter}}$  (MCGRAWTEXTS)
STU_ENRS ←  $\pi_{\text{ID}, \text{Course\_number}, \text{Quarter}}$  (ENROLLED)
STU_IDS ← STU_ENRS  $\div$  MCGRAWCRS
RESULT ←  $\pi_{\text{Name}}$  (STUDENT  $\star$  STU_IDS)

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