Mandatory Exercise 1

IN3020&IN4020 (2026)

Deadline: 23 February 2026, 23:59 (Devilry)

Question 1.

Consider the following relations:

MathStudents:

SID	SName	Age
1	Peter	40
2	Peter	20
3	Anna	20

CSStudents:

SID	SName	Age
1	Julia	30
2	Peter	20
2	Peter	40

Takes:

SID	Course
1	Databases
2	Astronomy
2	Databases

Part a.

Evaluate the following (set) RA expression over these relations:

$$\pi_{\mathsf{SName,Course}}(\sigma_{\mathsf{Age}\geq 30 \vee \mathsf{SName}\neq \text{`Peter'}}(\mathsf{MathStudents} \cup \mathsf{CSStudents}) \bowtie \mathsf{Takes}).$$

Part b.

Evaluate the following (bag) RA expression over these relations:

$$\gamma_{\mathsf{COUNT(SID)}\rightarrow\mathsf{CountSID,SName}}((\mathsf{MathStudents} \cup^{\mathsf{b}} \delta(\mathsf{CSStudents})) \bowtie \pi^{\mathsf{b}}_{\mathsf{SID}}(\mathsf{Takes})).$$

Question 2.

Part a.

Can renaming be pushed through equi-join—that is, does the following algebraic law hold, for θ in the form specified in the lectures for equi-join?

$$\rho_N(R \bowtie_\theta S) = \rho_N(R) \bowtie_\theta \rho_N(S)$$

Support your answer by an example (i.e., give relations and parameters so that the expressions on the two sides of $=$ are equal or non-equal). If your answer is no, additionally impose restrictions on the parameter (i.e., N) so that the law holds.

Part b.

Is right anti-join associative? Commutative? Idempotent? Support your answers by examples as in Part a.

Question 3.

Show that right outer join (over sets) is expressible via union, difference, selection, generalised projection, and natural join (i.e., the core RA+generalised projection).